

정답과 풀이

빠른 정답	002
01 다항식의 덧셈과 뺄셈	010
02 다항식의 곱셈	017
03 다항식의 나눗셈	028
04 항등식	036
05 나머지정리	042
06 인수분해	050

1. 다항식의 덧셈과 뺄셈 6쪽~19쪽

STEP 1

- 01-1** (1) 삼차식 (2) -1
- 01-2** (1) x : 이차식, y : 일차식 (2) $2y-1$
(3) x^2+2x-3 (4) $-3y-5$
- 02-1** (1) $-2x^2-3x+1$ (2) $2+5x-x^2$
- 02-2** (1) $x: 2x^2-x-y^2+2y+1, y: -y^2+2y+2x^2-x+1$
(2) $x: x^3+2x^2+xy+y^2+4y, y: y^2+(x+4)y+x^3+2x^2$
- 03-1** (1) 2, 8 (2) 7, 2
- 03-2** (1) $9x+3$ (2) $-3x+4$ (3) $7x+8y$ (4) $x+4y$
- 04-1** (1) 2, 2 (2) $3x, 3$
- 04-2** (1) $-2x+7$ (2) $-13x+3y$ (3) $2x+6$
(4) $-4x-3y$
- 05-1** (1) -, + (2) -, 2 (3) $3x-5y$ (4) $-x+2y$
(5) $3x-2$ (6) $6x-6$ (7) $7x-3$ (8) $8x+2$
(9) $7y$ (10) $4x+y$
- 06-1** (1) 2, 4 (2) 9, 1 (3) $\frac{7x-1}{6}$ (4) $\frac{11x-1}{12}$
(5) $\frac{-x+7}{20}$ (6) $\frac{10x+2}{3}$ (7) $\frac{x+1}{6}$ (8) $\frac{4x-29}{15}$
(9) $\frac{-2x-5}{24}$ (10) $\frac{-4x-19}{5}$
- 07-1** (1) $3, x$ (2) $4, 5x^2$ (3) $x, 3y$ (4) $5x-1$
(5) $-x^2+4x-5$ (6) $-x^2y-3xy+4xy^2$
(7) $2x+3y+3$ (8) $4x^2-2x-2$
(9) $x^3+2x^2-6x-10$ (10) $-x^2-2xy+2y^2$
(11) $-3y+1$
- 08-1** (1) 4, 2 (2) 3, 8
- 08-2** (1) $-11x+11$ (2) $2x^2-14x+12$
(3) $4x^2+5x-9$ (4) $-17x^2-2x+19$
- 08-3** (1) $2A, 3xy$ (2) $6y^2, -7x^2$
(3) $8x^2-xy+17y^2$ (4) $-11x^2+10xy-9y^2$
(5) $-12x^2+9xy-13y^2$ (6) $-7x^2-7xy-28y^2$
- 09-1** (1) $6y^2, 3xy$ (2) $6x^2, y^2$ (3) +, $-2x^2$
- 09-2** (1) $3x^2+2xy-4y^2$ (2) $5x^2-5xy-2y^2$
(3) $7x^2-5y^2$ (4) $-4x^2+6xy-8y^2$
(5) $12x^2-10xy-6y^2$
- 09-3** (1) $6x^2, 2x^2$ (2) $6x^2, 3x^2$ (3) $-2x^2+xy+y^2$
(4) $4x^2+3y^2$ (5) $-5x^2+8xy-y^2$
(6) $x^2-xy+2y^2$ (7) $2x^2-xy+3y^2$
(8) $x^2-xy-2y^2$ (9) $-2x^2-3xy+y^2$

STEP 2

- 1-1** (1) $6x+5$ (2) $5x+5y$ (3) $6x+9$ (4) $6x-4$
(5) $7x-4$ (6) $-12x+6$

002 빅터 연산 - 다항식

- 1-2** (1) $4x-1$ (2) $3x+2y$ (3) $7x+2$ (4) $-12x+1$
(5) $-3x-5$ (6) 3

- 2-1** (1) $14x-1$ (2) $7x-9$ (3) $\frac{8x+1}{6}$
(4) $\frac{-2x+14y}{15}$ (5) $\frac{8x+7}{3}$ (6) $3x-1$

- 2-2** (1) $2x-11$ (2) $-x+3$ (3) $\frac{7x+7}{18}$ (4) $\frac{x-13}{10}$
(5) $\frac{5x+1}{3}$ (6) $\frac{x+6}{4}$

- 3-1** (1) $2x^2-x+1$ (2) $3x^3+x^2-5x+2$

- 3-2** (1) $-3x^2+2x+3$
(2) $-x^2+(3y+1)x+2y^2-5$

- 4-1** (1) $3+x-x^2$ (2) $5-4x+4x^2$

- 4-2** (1) $1+x-2x^2+2x^3$
(2) $-y+3x+(2y+1)x^2-x^3$

- 5-1** (1) $4x+2y-5$ (2) $2x+3y-1$
(3) $-2x+8y-2$ (4) $3x^2-3x-6$

- 5-2** (1) $4x^2-x+1$ (2) $5x^3-3x^2+3x+3$
(3) $3x^2+4xy-4y^2$ (4) $-x^3+4x^2+x-2$

- 6-1** (1) x^2+11 (2) $x^2-2x-21$
(3) $4x^2-x+28$

- 6-2** (1) $5x^2+3x-5$ (2) $3x^2+x-3$
(3) $-3x^2-x+3$

- 7-1** (1) $2x^2-x+2$ (2) $x^2+2xy+3y^2$

- 7-2** (1) $3x^2-xy+y^2$ (2) $-3x^2-2x+2$

STEP 3

- 01** $x^2+(-2y+1)x+y^2$ **02** $y+xy+2x^2-x^3$
- 03** $6x-5y+6$ **04** $2x+3y-3$
- 05** $-x^2+5xy+4y^2$ **06** $2x^3-x^2+4x-2$
- 07** $-3x+3$ **08** ㉠
- 09** $\frac{-7x^2+7x-5}{6}$ **10** $\frac{-2x^2+3xy-7y^2}{6}$
- 11** $3A, 2xy$ **12** $-2x^2-7y^2$
- 13** x^3-16x^2-5x+4 **14** $-x^2-8xy+y^2$
- 15** $x^2+6xy-10y^2$

2. 다항식의 곱셈 22쪽~51쪽

STEP 1

- 01-1** (1) 24 (2) x^{10} (3) $4x^2y^2, -108$
(4) $8x^6y^3$ (5) $-\frac{1}{27}$

01-2 (1) x^7 (2) $8x^7$ (3) $4x^8$ (4) $72x^{14}$
 (5) $144x^{16}$ (6) $-16x^9y^{11}$ (7) $2a^7b^{12}$ (8) $-\frac{9}{8}a^7b^{11}$

02-1 (1) $2x^3y^5$ (2) $3x^4y^3$ (3) $6xy, 2xy$ (4) $2x^2, 7x$

02-2 (1) $-6x^3y^3-3x^4y^4$ (2) $3x^4y^4-x^5y^3+2x^5y^4$
 (3) $6x^2-7xy+2y^2$ (4) $2x^3+5x^2-18x+9$
 (5) x^3-4x^2+7x-6 (6) $6x^3-7x^2+11x-6$

03-1 (1) 3 (2) -8

03-2 (1) -5 (2) 0 (3) 3

03-3 (1) -12 (2) 10 (3) -4

03-4 (1) -6 (2) -11 (3) 4

04-1 (1) 2, 9 (2) $2x, 4x^2$ (3) 4 (4) 4, $6x$
 (5) 15, x

04-2 (1) $4x^2+4xy+y^2$ (2) $9x^2+12xy+4y^2$
 (3) $16x^2-8x+1$ (4) $4x^2-20xy+25y^2$
 (5) $4x^2-9$ (6) $-9x^2+y^2$
 (7) $x^2+2x-15$ (8) $x^2-xy-6y^2$
 (9) $6x^2-7xy+2y^2$

05-1 (1) $x^2, 12x$ (2) $2x, 12x^2$
 (3) $8x^3+36x^2+54x+27$
 (4) $x^3+9x^2y+27xy^2+27y^3$
 (5) $64x^3+48x^2y+12xy^2+y^3$
 (6) $8x^3+4x^2y+\frac{2}{3}xy^2+\frac{1}{27}y^3$
 (7) $64x^3+24x^2y+3xy^2+\frac{1}{8}y^3$

05-2 (1) $2^3, 12x$ (2) $3, 8x^3$
 (3) $x^3-9x^2y+27xy^2-27y^3$
 (4) $27x^3-27x^2y+9xy^2-y^3$
 (5) $8x^3-60x^2y+150xy^2-125y^3$
 (6) $27x^3-108x^2y+144xy^2-64y^3$
 (7) $64x^3-16x^2y+\frac{4}{3}xy^2-\frac{1}{27}y^3$
 (8) $27x^3-\frac{54}{5}x^2y+\frac{36}{25}xy^2-\frac{8}{125}y^3$

06-1 (1) 1, 1 (2) 2, 8 (3) $8x^3+1$ (4) x^3+8y^3
 (5) $27a^3+b^3$ (6) $8a^3+27b^3$

06-2 (1) 4, 64 (2) 2, 8 (3) $8x^3-1$ (4) x^3-27y^3
 (5) $27a^3-b^3$ (6) $8a^3-27b^3$

07-1 (1) $4b^2, 2ca$ (2) x, y^2
 (3) $a^2+b^2+4c^2+2ab-4bc-4ca$
 (4) $x^2+9y^2+z^2-6xy-6yz+2zx$
 (5) $4x^2+y^2+4z^2-4xy-4yz+8zx$
 (6) $x^2+25y^2+4z^2-10xy+20yz-4zx$

07-2 (1) $3a, (3a)^3$ (2) $2^3, 6xy$
 (3) $a^3-b^3+c^3+3abc$ (4) $8x^3+y^3+6xy-1$
 (5) $8x^3-27y^3+z^3+18xyz$

08-1 (1) $t, 2y$ (2) $x^2+2xy+y^2-9$
 (3) $x^2-2xy+y^2-x+y-2$ (4) $x^2-2xy+y^2-z^2$
 (5) $x^2+4x+4-y^2$ (6) $-x^2+2xy-y^2-2x+2y+3$
 (7) $x^2-y^2-z^2+2yz$

08-2 (1) 1, x^2 (2) $x^4+4x^3+x^2-6x$
 (3) $x^4-2x^3-x^2+2x-3$ (4) x^4+3x^2+4

08-3 (1) $2x^3, 13x^2$ (2) $x^4+2x^3-5x^2-6x$
 (3) $x^4-4x^3-34x^2+76x+105$
 (4) $x^4+4x^3-52x^2-112x+384$

08-4 (1) $x+2, 7x^2$ (2) $x^4-6x^3+x^2+24x-20$
 (3) $x^4-2x^3-17x^2+18x+72$
 (4) $x^4-4x^3-14x^2+36x+45$

08-5 (1) $x+4, 50x$ (2) $x^4+6x^3+11x^2+6x$
 (3) $x^4+12x^3+44x^2+48x$ (4) $x^4-6x^3+11x^2-6x$

09-1 (1) $2ab, 3^2$ (2) $a^2+b^2=14, (a-b)^2=12$
 (3) $a^2+b^2=8, (a-b)^2=12$
 (4) $a^2+b^2=13, (a-b)^2=25$
 (5) $a^2+b^2=5, (a-b)^2=1$

09-2 (1) -1, $a-b$
 (2) $a^2+b^2=13, (a+b)^2=25$
 (3) $a^2+b^2=10, (a+b)^2=4$
 (4) $a^2+b^2=5, (a+b)^2=9$
 (5) $a^2+b^2=8, (a+b)^2=12$

10-1 (1) 3, 18 (2) $ab, 28$ (3) 20 (4) 40
 (5) $10\sqrt{2}$ (6) 74

10-2 (1) 3 (2) 3, 18 (3) 10 (4) 20
 (5) $16\sqrt{5}$ (6) 52

10-3 (1) $2xy, 14$ (2) $x+y, -9$ (3) 37
 (4) -20 (5) 10

10-4 (1) $2xy, 7$ (2) $x-y, -88$ (3) 18
 (4) -14 (5) -13

11-1 (1) 2 (2) 6 (3) 2 (4) 14
 (5) 27

11-2 (1) 4, 29 (2) $a-\frac{1}{a}$ (3) 20 (4) 8
 (5) 13 (6) 40

11-3 (1) 4 (2) $a+\frac{1}{a}, 5$ (3) 32
 (4) 21 (5) 12 (6) 45

12-1 (1) 2 (2) $a+\frac{1}{a}, -18$ (3) -52
 (4) -2 (5) 110

12-2 (1) 3 (2) -4, -76 (3) -36
 (4) 14 (5) -140

12-3 (1) 2, 3, 18 (2) 2 (3) 52 (4) 110

12-4 (1) -3 , -3 (2) -14 (3) -76 (4) -140

12-5 (1) 4 , 52 (2) $x^2 + \frac{1}{x^2} = 23$, $x^3 + \frac{1}{x^3} = 110$

(3) $x^2 + \frac{1}{x^2} = 7$, $x^3 + \frac{1}{x^3} = -18$

(4) $x^2 + \frac{1}{x^2} = 14$, $x^3 + \frac{1}{x^3} = -52$

12-6 (1) -1 , 3 (2) $x^2 + \frac{1}{x^2} = 6$, $x^3 - \frac{1}{x^3} = 14$

(3) $x^2 + \frac{1}{x^2} = 27$, $x^3 - \frac{1}{x^3} = -140$

(4) $x^2 + \frac{1}{x^2} = 11$, $x^3 - \frac{1}{x^3} = -36$

13-1 (1) $a+b+c$, 7 (2) 5 (3) 12
(4) 12 (5) 7

13-2 (1) $ab+bc+ca$, -1 (2) 7 (3) 7
(4) 2 (5) -4

13-3 (1) 5 , 5 , 3 (2) -4 (3) 28 (4) 1

14-1 (1) 2 , 10201 (2) -1 (3) 1000001 (4) 999999

14-2 (1) 2^4 , 2^8 , 255 (2) $\frac{3^8-1}{2}$ (3) $\frac{5^{16}-1}{4}$
(4) $\frac{2^{32}-1}{3}$

STEP 2

1-1 (1) $9x^2+6x+1$ (2) $x^2-4xy+4y^2$
(3) x^2-4 (4) x^2-25y^2
(5) $x^2-4x-21$ (6) $x^2-xy-20y^2$
(7) $6x^2+13xy+5y^2$ (8) $6x^2+xy-15y^2$

1-2 (1) $x^2+xy+\frac{1}{4}y^2$ (2) $9x^2-12xy+4y^2$
(3) $16x^2-y^2$ (4) $-x^2+9y^2$
(5) $x^2+3x-10$ (6) $x^2-5xy+6y^2$
(7) $6x^2+11xy-10y^2$ (8) $8x^2-6xy-9y^2$

2-1 (1) $a^2+b^2=28$, $(a-b)^2=20$
(2) $a^2+b^2=2$, $(a-b)^2=0$
(3) $a^2+b^2=12$, $(a+b)^2=20$
(4) $a^2+b^2=7$, $(a+b)^2=13$
(5) $a^2+\frac{1}{a^2}=34$, $\left(a-\frac{1}{a}\right)^2=32$
(6) $a^2+\frac{1}{a^2}=18$, $\left(a+\frac{1}{a}\right)^2=20$

2-2 (1) $a^2+b^2=27$, $(a-b)^2=29$
(2) $a^2+b^2=10$, $(a-b)^2=4$
(3) $a^2+b^2=17$, $(a+b)^2=25$
(4) $a^2+b^2=19$, $(a+b)^2=13$
(5) $a^2+\frac{1}{a^2}=23$, $\left(a-\frac{1}{a}\right)^2=21$
(6) $a^2+\frac{1}{a^2}=6$, $\left(a+\frac{1}{a}\right)^2=8$

3-1 (1) -3 (2) 3 (3) -7 (4) 7

3-2 (1) -4 (2) 11 (3) -7 (4) -12

4-1 (1) $27x^3+27x^2+9x+1$ (2) $8x^3+6x^2y+\frac{3}{2}xy^2+\frac{1}{8}y^3$
(3) $x^3-9x^2+27x-27$ (4) $64x^3-48x^2y+12xy^2-y^3$

4-2 (1) $x^3+15x^2+75x+125$
(2) $8x^3+60x^2y+150xy^2+125y^3$
(3) $27x^3-9x^2+x-\frac{1}{27}$ (4) $27x^3-54x^2y+36xy^2-8y^3$

5-1 (1) x^3+27 (2) x^3+64y^3
(3) x^3-1 (4) $64x^3-y^3$
(5) $x^2+25y^2+z^2+10xy+10yz+2zx$
(6) $9x^2+4y^2-12xy+12x-8y+4$
(7) $x^3+y^3-9xy+27$

5-2 (1) $125x^3+y^3$ (2) $27x^3+8y^3$
(3) x^3-8y^3 (4) $27x^3-64y^3$
(5) $9x^2+y^2+z^2+6xy-2yz-6zx$
(6) $4x^2+y^2+4xy-12x-6y+9$
(7) $x^3-y^3-6xy-8$

6-1 (1) $x^4-4x^3+8x^2-8x$ (2) x^2+8x-y^2+16
(3) $x^4+4x^3-4x^2-16x$
(4) $x^4+8x^3-10x^2-104x+105$

6-2 (1) $4x^4-4x^3+17x^2-8x+15$
(2) $-x^2-2xy-y^2+4$
(3) $x^4-2x^3-7x^2+8x+12$ (4) $x^4+8x^3-x^2-68x+60$

7-1 (1) -2 (2) 3 (3) 9 (4) -15

7-2 (1) 3 (2) 4 (3) 28 (4) 80

8-1 (1) 14 (2) 12 (3) 52

8-2 (1) 6 (2) 8 (3) -14

9-1 (1) 22 (2) 8

9-2 (1) -5 (2) 20

10-1 (1) 39999 (2) $2^{32}-1$

10-2 (1) 30301 (2) $\frac{3^{32}-1}{8}$

STEP 3

01 $24a^9b^8$ 02 3 03 $-\frac{3}{2}$ 04 ③

05 $8x^3+36x^2y+54xy^2+27y^3$

06 $x^3-12x^2y+48xy^2-64y^3$

07 $64x^3+27y^3$ 08 x^3-125y^3

09 $4x^2+9y^2+z^2-12xy+6yz-4zx$

10 $x^3+8y^3-z^3+6xyz$

11 $-4x^2+4xy-y^2+9$ 12 $x^4+4x^3-7x^2-22x+24$

13 15 14 ① 15 ① 16 ①

17 ③ 18 ⑤ 19 ⑤ 20 $10\sqrt{2}$

21 ② 22 ① 23 $\sqrt{13}$ 24 ②

25 ④ 26 $7\sqrt{10}$ 27 ① 28 ①

29 30 30 ③ 31 ③ 32 $2^{16}-3^8$

3. 다항식의 나눗셈 54쪽~69쪽

STEP 1

- 01-1** (1) $5a$ (2) $-4x^2$ (3) $3a^3b^3$ (4) $\frac{6y^2}{x}$
(5) $-18a^5b^5$
- 02-1** (1) $2b^2$ (2) $2x^3$ (3) $-b^2+2ab-3b$
(4) $10x^2-6xy+4y^2$ (5) $6a^4b^2-9a^3b^3+12a^3b^2$
(6) $-8x^3y^4-6x^2y^6+4x^3y^5$
- 03-1** (1) $x-3, 2$ (2) 몫 : $2x-1$, 나머지 : -1
(3) 몫 : $2x$, 나머지 : -7
(4) 몫 : $2x-2$, 나머지 : 0
(5) $x^2+x-4, -2$ (6) 몫 : $2x^2+3x+5$, 나머지 : 13
(7) 몫 : $3x^2-7x+20$, 나머지 : -62
(8) 몫 : $2x^2-2x-1$, 나머지 : -4
(9) $x+1, -x+4$ (10) 몫 : $x+1$, 나머지 : $5x-5$
(11) 몫 : $2x+1$, 나머지 : $2x+6$
(12) 몫 : $3x+3$, 나머지 : $-8x-4$
- 04-1** (1) $2x-7$
(2) $x^3-2x^2-5x+2=(x-3)(x^2+x-2)-4$
(3) $6x^3-7x^2-8x-9=(2x-5)(3x^2+4x+6)+21$
(4) $4x^3-x+5=(2x^2+x-3)(2x-1)+6x+2$
- 04-2** (1) $2x+1, 6x$ (2) $10x^2-19x+4$
(3) $x^3-3x^2-3x+13$ (4) $3x^3+x^2-20x+23$
- 04-3** (1) $x-1, x^2+2x-1$ (2) $3x-4$
(3) x^2+x-3 (4) $2x-3$
- 05-1** (1) $2, x^2-x-1, 3$ (2) $-2, x^2-4x+3, -3$
(3) 몫 : $x^2+4x+11$, 나머지 : 37
(4) 몫 : $2x^2-5x+1$, 나머지 : 0
(5) 몫 : $2x^2-x+1$, 나머지 : 3
(6) 몫 : $3x^2-5x+3$, 나머지 : -10
(7) $1, x^3+3x^2-x+1, 2$
(8) 몫 : x^3-4x^2+5x-6 , 나머지 : 17
(9) 몫 : $2x^3-5x^2+4x-1$, 나머지 : -3
(10) 몫 : $3x^3+7x^2+9x+11$, 나머지 : 19
- 05-2** (1) $0, x^2-x-2, 4$ (2) $0, x^2+2x-1, 1$
(3) 몫 : x^2 , 나머지 : -4
(4) 몫 : x^2-x+2 , 나머지 : 4
(5) 몫 : $2x^2-2x+6$, 나머지 : -11
(6) 몫 : $x^2-6x+12$, 나머지 : -24
(7) 몫 : $2x^2-2x+1$, 나머지 : -1
(8) 몫 : $3x^2+6x+12$, 나머지 : 19
(9) $0, x^3-3x^2+6x-11, 20$
(10) 몫 : x^3+x^2-2x+2 , 나머지 : -5
(11) 몫 : x^3+x^2+2x+4 , 나머지 : 11
(12) 몫 : $x^3+3x^2+9x+22$, 나머지 : 66

- 06-1** (1) $R, \frac{1}{2}Q(x), \frac{1}{2}Q(x), R$ (2) $\frac{1}{3}Q(x), \frac{1}{3}Q(x), R$
(3) 몫 : $\frac{1}{4}Q(x)$, 나머지 : R (4) 몫 : $\frac{1}{3}Q(x)$, 나머지 : R
(5) 몫 : $\frac{1}{4}Q(x)$, 나머지 : R (6) 몫 : $\frac{1}{5}Q(x)$, 나머지 : R
(7) 몫 : $3Q(x)$, 나머지 : R (8) 몫 : $4Q(x)$, 나머지 : R
(9) 몫 : $2Q(x)$, 나머지 : R (10) 몫 : $7Q(x)$, 나머지 : R

- 06-2** (1) $\frac{1}{2}, x^2+2x-1, -6$ (2) $\frac{1}{2}, 1, x^2-x+2, 1$
(3) 몫 : $2x^2-x-1$, 나머지 : 3
(4) 몫 : x^2-x-2 , 나머지 : -1
(5) 몫 : $2x^2-x+2$, 나머지 : -3
(6) 몫 : x^2+x-1 , 나머지 : -3
(7) 몫 : x^2+3x+2 , 나머지 : 9
(8) 몫 : $2x^2+x-1$, 나머지 : 1
(9) 몫 : $2x^2-x+1$, 나머지 : -5
(10) 몫 : x^2-2x+3 , 나머지 : -7
(11) 몫 : x^2-2x+3 , 나머지 : -11

STEP 2

- 1-1** (1) $\frac{4b}{a}$ (2) $\frac{b^3}{2a^2}$ (3) $\frac{2x}{y^2}$ (4) $8x^4y^5$
- 1-2** (1) $\frac{1}{2}a^2b$ (2) $-\frac{2}{3a^2b^5}$ (3) $9xy$ (4) $-16x^4y^9$
- 2-1** (1) $3b^2+2a^2b$ (2) $\frac{3b^2}{a}-\frac{2a}{b}$ (3) $\frac{a^2}{3bc}+\frac{2ab}{3c^2}$
- 2-2** (1) $\frac{x^2}{2y}+2xy$ (2) $\frac{4x^2z^4}{y}-\frac{2xz^3}{y^2}$ (3) $\frac{2}{5}z+\frac{3xy^2}{5z}$
- 3-1** (1) $\frac{3b}{a^2}+\frac{4b^2}{a^3}-\frac{2}{ab}$ (2) $2a^2b-a+\frac{1}{2}b^2$
(3) $\frac{b^2c}{3a}+\frac{c^4}{2a^2}-\frac{2c^2}{3a^2b}$
- 3-2** (1) $3y^2+\frac{9}{2}x^2y-6y$ (2) $\frac{5y}{2xz}-\frac{3}{2x}+\frac{2y^2}{x^2z^2}$
(3) $-\frac{1}{3xy}+\frac{2x}{3y^2}+2x^2y^2$
- 4-1** (1) $3x^2-8x-1=(x-2)(3x-2)-5$
(2) $3x^3-2x^2+x+1=(x-1)(3x^2+x+2)+3$
(3) $x^4-3x^3+2x-1=(x^2+1)(x^2-3x-1)+5x$
- 4-2** (1) $8x^2-6x-2=(2x-1)(4x-1)-3$
(2) $6x^3-5x^2+3x-2=(2x^2-x+3)(3x-1)-7x+1$
(3) $2x^4+3x^2-2x-1=(x^2+x-1)(2x^2-2x+7)-11x+6$
- 5-1** (1) 몫 : $3x-8$, 나머지 : 19
(2) 몫 : x^2+4x+9 , 나머지 : 32
(3) 몫 : $x-1$, 나머지 : $3x$
- 5-2** (1) 몫 : $x-4$, 나머지 : 7
(2) 몫 : x^2+2x-1 , 나머지 : 1
(3) 몫 : $3x-1$, 나머지 : $8x+1$

- 6-1** (1) x^3+x^2-x+4 (2) x^2+x+2
6-2 (1) $6x^3+x^2+4x$ (2) $2x-1$
7-1 (1) 몫: x^2-2x+3 , 나머지: -4
 (2) 몫: x^3+x^2+4x+4 , 나머지: 5
 (3) 몫: x^2+2x-1 , 나머지: 2
7-2 (1) 몫: x^2-3x , 나머지: 4
 (2) 몫: x^3-2x+7 , 나머지: -17
 (3) 몫: x^2-x-1 , 나머지: 2
8-1 (1) 몫: $\frac{1}{3}Q(x)$, 나머지: R (2) 몫: $4Q(x)$, 나머지: R
8-2 (1) 몫: $\frac{1}{5}Q(x)$, 나머지: R (2) 몫: $5Q(x)$, 나머지: R

STEP 3

- 01** ③ **02** ④
03 몫: $x-4$, 나머지: 6 **04** 몫: x^2+x-2 , 나머지: -4
05 몫: $x+3$, 나머지: $x+10$
06 10 **07** ②
08 $3x^3-4x^2-7x-1$ **09** $2x^3-7x^2+17x-10$
10 $2x^2+x-2$ **11** x^2+3x+3
12 16 **13** -3
14 몫: $\frac{1}{3}Q(x)$, 나머지: R **15** 몫: $2Q(x)$, 나머지: R

4. 항등식 72쪽~85쪽

STEP 1

- 01-1** (1) 방정식 (2) 항등식
01-2 (1) 항 (2) 방 (3) 방 (4) 항
02-1 (1) 0 (2) 1 (3) 6, 4 (4) 2, 5
02-2 (1) $a=0, b=3$ (2) $a=3, b=-1$
 (3) $a=1, b=4$ (4) $a=3, b=1$
 (5) $a=3, b=1$ (6) $a=-2, b=1$
 (7) $a=3, b=3$ (8) $a=-2, b=6$
03-1 (1) 0, 3 (2) 5, 1
 (3) $a=1, b=0, c=2$ (4) $a=4, b=-4, c=-1$
 (5) $a=5, b=-2, c=-2$
03-2 (1) 1, 4 (2) $a=2, b=-5, c=-1$
 (3) $a=1, b=3, c=-9$ (4) $a=-2, b=1, c=-3$
 (5) $a=2, b=3, c=-1$
03-3 (1) $2c, 1$ (2) $a=1, b=4, c=-4$
 (3) $a=2, b=-3, c=3$ (4) $a=1, b=-1, c=1$
 (5) $a=2, b=-3, c=5$
04-1 (1) $7x, 6$ (2) $12x^2, 6$
 (3) $a=27, b=0, c=0, d=-8$
 (4) $a=1, b=4, c=-2, d=-12$

(5) $a=-10, b=35, c=-50, d=24$

- 05-1** (1) $2x+3, 9x, 12$ (2) $a=2, b=-9$
 (3) $a=6, b=11$ (4) $a=3, b=-8$
05-2 (1) $x^2+4x-2, 10x, -5$ (2) $a=-3, b=-2, c=-3$
 (3) $a=-5, b=-1, c=-1$ (4) $a=2, b=-7, c=2$
05-3 (1) $x^2+1, 3, -2$ (2) $a=-1, b=-2, c=-4$
 (3) $a=-1, b=-4, c=3$ (4) $a=6, b=-1, c=-5$
06-1 (1) 0, 0, -1 (2) 0, 0, 2
 (3) $x=1, y=-1$ (4) $x=2, y=2$
 (5) $x=5, y=3$ (6) $x=1, y=-2$
 (7) $x=2, y=1$ (8) $x=-2, y=5$
07-1 (1) 0 (2) 1 (3) -1 (4) 50, 25
 (5) 48, 24
07-2 (1) 27 (2) 216 (3) 8
07-3 (1) 1 (2) 1024 (3) 0
07-4 (1) 1, 1 (2) $-1, 5^4$ (3) 313
07-5 (1) 32 (2) 0 (3) 16
07-6 (1) 1, 16 (2) $-1, 0$ (3) 16, 8
07-7 (1) 0 (2) 1024 (3) -512

STEP 2

- 1-1** (1) 방정식 (2) 항등식
1-2 (1) 방정식 (2) 항등식
2-1 (1) $a=-2, b=1$ (2) $a=4, b=-2$
 (3) $a=6, b=3$ (4) $a=3, b=-4$
2-2 (1) $a=1, b=0$ (2) $a=3, b=-3$
 (3) $a=-1, b=-2$ (4) $a=5, b=4$
3-1 (1) $a=4, b=-3$ (2) $a=2, b=3$
 (3) $a=2, b=5$ (4) $a=4, b=-2$
3-2 (1) $a=-1, b=3$ (2) $a=4, b=1$
 (3) $a=-3, b=1$ (4) $a=2, b=3$
4-1 (1) $a=1, b=7, c=12$ (2) $a=1, b=0, c=-4$
 (3) $a=6, b=1, c=-2$
4-2 (1) $a=1, b=4, c=-5$ (2) $a=9, b=0, c=-25$
 (3) $a=12, b=5, c=-2$
5-1 (1) $a=3, b=-1, c=1$ (2) $a=2, b=5, c=-2$
 (3) $a=1, b=-1, c=-2$ (4) $a=2, b=1, c=0$
 (5) $a=1, b=-9, c=27, d=-27$
 (6) $a=4, b=4, c=-3, d=-2$
5-2 (1) $a=-2, b=3, c=-4$ (2) $a=9, b=-4, c=2$
 (3) $a=2, b=2, c=2$ (4) $a=3, b=1, c=-2$
 (5) $a=8, b=0, c=0, d=1$ (6) $a=1, b=-6, c=3, d=18$
6-1 (1) $a=3, b=-7$ (2) $a=-4, b=7, c=-17$
6-2 (1) $a=3, b=-7, c=14$ (2) $a=4, b=2, c=-5$
7-1 (1) $x=3, y=-3$ (2) $x=1, y=-2$

7-2 (1) $x=1, y=1$ (2) $x=1, y=3$

8-1 (1) 25 (2) -24

8-2 (1) 32 (2) -32

STEP 3

01 ⑤ 02 6 03 4 04 -3

05 6 06 -6 07 -4 08 7

09 $-\frac{25}{4}$ 10 24 11 -3 12 13

13 $1, -1, \frac{3^{10}-1}{2}$ 14 7

5. 나머지정리 88쪽~103쪽

STEP 1

01-1 (1) $-1, -5, x+1$ (2) $2, 1, x^2-x-1$

(3) $1, 3, x^3+3x^2-x+2$

01-2 (1) $Q(x)=x-2, R=-2$ (2) $Q(x)=3x-2, R=-2$

(3) $Q(x)=x^2-1, R=5$ (4) $Q(x)=x^2+2x+2, R=6$

(5) $Q(x)=x^3+2x+6, R=4$

(6) $Q(x)=x^3-2x^2-4x-10, R=-19$

02-1 (1) 1, 3 (2) -1, 1 (3) 28 (4) 0

(5) $-\frac{5}{4}$ (6) $-\frac{3}{4}$

02-2 (1) 4 (2) -23 (3) $\frac{58}{27}$ (4) $-\frac{16}{27}$

02-3 (1) 4 (2) 1 (3) $-\frac{8}{27}$ (4) $\frac{62}{27}$

03-1 (1) $\frac{1}{2}, \frac{13}{8}$ (2) $-\frac{1}{2}, -\frac{21}{8}$ (3) $\frac{16}{27}$

(4) $-\frac{58}{27}$ (5) $\frac{77}{27}$ (6) $-\frac{47}{8}$

03-2 (1) $-\frac{11}{8}$ (2) $\frac{59}{8}$ (3) -4 (4) $-\frac{113}{64}$

03-3 (1) $\frac{23}{8}$ (2) $\frac{71}{27}$ (3) $\frac{59}{64}$ (4) $\frac{158}{125}$

04-1 (1) 1, -3 (2) 2, -4 (3) -3 (4) -1

(5) 1 (6) $\frac{1}{2}$ (7) 2 (8) 18

04-2 (1) -4, 2, -3 (2) 4, 1, 2

(3) $a=-2, b=4$ (4) $a=-1, b=-1$

(5) $a=-3, b=1$ (6) $a=-4, b=3$

(7) $a=-3, b=-2$ (8) $a=-1, b=4$

(9) $a=-3, b=1$

05-1 (1) $4x^2-4x+4, -x-3$ (2) $15x-10$

(3) $-12x+2$

05-2 (1) $-x^3-x^2-2x, 5$ (2) -4

(3) 11 (4) -8

05-3 (1) $ax+b, a+b, 1$ (2) $x-2$

(3) $4x+1$ (4) $-2x+2$ (5) $2x+1$

05-4 (1) $x-2, 1, 4, x+4$ (2) $-3x+2$

(3) $-2x+5$ (4) $x+5$ (5) $-x+3$

06-1 (1) 0, 2 (2) $0, -\frac{17}{2}$ (3) -6 (4) $-\frac{58}{3}$

(5) 9 (6) $\frac{130}{9}$

06-2 (1) 0, -3 (2) $0, -\frac{17}{4}$ (3) $-\frac{33}{2}$ (4) $\frac{127}{16}$

(5) $\frac{53}{9}$ (6) $-\frac{11}{12}$

07-1 (1) 0, 3, -1, 2 (2) $a=-4, b=-4$

(3) $a=4, b=1$ (4) $a=-1, b=3$

(5) $a=-1, b=-8$ (6) $a=11, b=-6$

(7) $a=1, b=15$

07-2 (1) 0, -16, -6, 8 (2) $a=-1, b=-4$

(3) $a=-1, b=3$ (4) $a=1, b=-2$

(5) $a=-9, b=-9$ (6) $a=-5, b=6$

(7) $a=6, b=6$

STEP 2

1-1 (1) -2 (2) -32 (3) $-\frac{52}{27}$ (4) $-\frac{1}{2}$

(5) -2 (6) $-\frac{79}{32}$

1-2 (1) -1 (2) 55 (3) -1 (4) $-\frac{67}{27}$

(5) $-\frac{5}{2}$ (6) $-\frac{25}{32}$

2-1 (1) -2 (2) 6

2-2 (1) 3 (2) 12

3-1 (1) $a=2, b=-6$ (2) $a=-3, b=1$

3-2 (1) $a=-2, b=4$ (2) $a=1, b=-3$

4-1 (1) $4x+2$ (2) $x+3$ (3) $x+1$

4-2 (1) $-x+2$ (2) $x-2$ (3) $-2x+1$

5-1 (1) -4 (2) $-\frac{8}{3}$ (3) $-\frac{7}{6}$

5-2 (1) 7 (2) $\frac{119}{9}$ (3) $-\frac{41}{4}$

6-1 (1) $a=2, b=-13$ (2) $a=-6, b=-8$

(3) $a=-9, b=-18$ (4) $a=0, b=-7$

6-2 (1) $a=3, b=-4$ (2) $a=8, b=0$

(3) $a=-8, b=12$ (4) $a=1, b=0$

STEP 3

01 $f(1)$ 02 3 03 $\frac{21}{8}$ 04 -5

05 -14 06 -9 07 22

08 $ax+b, -1, -x+2$ 09 $4x+3$ 10 $3x+2$

11 $-\frac{2}{9}$ 12 -1 13 48

14 11, 11, -4, -4, $3x+5$

6. 인수분해 106쪽~133쪽

STEP 1

- 01-1** (1) $xy(x+y+1)$ (2) $x+1$
 (3) $4xy(x+2)$ (4) $(x+y)(x+y+3)$
 (5) $(x-y)(y+z)$ (6) $(a+b)(x-y)$
- 01-2** (1) $x+1$ (2) $3x-1$ (3) $(x+2)^2$ (4) $(4x+y)^2$
 (5) $\left(2x+\frac{1}{3}\right)^2$ (6) $(x-5)^2$ (7) $(2x-5)^2$ (8) $\left(x-\frac{1}{x}\right)^2$
- 01-3** (1) $x+2$ (2) $x-3y$
 (3) $(3x+y)(3x-y)$ (4) $\left(x+\frac{1}{5}y\right)\left(x-\frac{1}{5}y\right)$
 (5) $-(4x+1)(4x-1)$ (6) $(x+y-z)(x-y+z)$
 (7) $(x^2+y^2)(x+y)(x-y)$ (8) $xy(x+y)(x-y)$
- 01-4** (1) $x+3$ (2) $x+2$
 (3) $(x-1)(x-3)$ (4) $(x-2)(x-4)$
 (5) $(x-3y)(x-7y)$ (6) $(x-4y)(x+5y)$
 (7) $(x+3y)(x-8y)$ (8) $(x-2y)(x-5y)$
- 01-5** (1) $2x+3$ (2) $x-3$
 (3) $(2x+1)(2x+3)$ (4) $(x+3)(3x+2)$
 (5) $(x+5y)(2x+y)$ (6) $(2x-1)(2x-5)$
 (7) $(x-y)(5x-3y)$ (8) $(2x-1)(3x-2)$
- 01-6** (1) $3x+7$ (2) $3x-y$
 (3) $(x+3)(2x-3)$ (4) $(x-2)(5x+3)$
 (5) $(x-y)(2x+7y)$ (6) $(x+1)(2x-3)$
 (7) $(x-3y)(7x+y)$ (8) $(2x+3)(2x-5)$
- 02-1** (1) $x^2, x+2$ (2) $3^2, x+3$ (3) $(2x+1)^3$ (4) $(x+4)^3$
 (5) $(x+y)^3$ (6) $(3x+y)^3$ (7) $(x+5)^3$
- 02-2** (1) $3^2, x-3$ (2) $2x, 2x-y$ (3) $(x-1)^3$ (4) $(x-4)^3$
 (5) $(3x-y)^3$ (6) $(x-5y)^3$ (7) $(4x-y)^3$ (8) $(3x-2y)^3$
- 02-3** (1) $x+1, x^2-x+1$ (2) $2y, x^2-2xy+4y^2$
 (3) $(x+3)(x^2-3x+9)$ (4) $(2x+1)(4x^2-2x+1)$
 (5) $2(x+5)(x^2-5x+25)$ (6) $(x+4y)(x^2-4xy+16y^2)$
 (7) $(3x+2y)(9x^2-6xy+4y^2)$
 (8) $x(4x+y)(16x^2-4xy+y^2)$
- 02-4** (1) $2, x^2+2x+4$ (2) $4x^2+6xy+9y^2$
 (3) $(x-3)(x^2+3x+9)$ (4) $(4x-1)(16x^2+4x+1)$
 (5) $(3x-2)(9x^2+6x+4)$ (6) $(x-5y)(x^2+5xy+25y^2)$
 (7) $(3x-y)(9x^2+3xy+y^2)$
 (8) $2x^2y(2x-y)(4x^2+2xy+y^2)$
- 03-1** (1) $2z, x+y+2z$ (2) $-z, x-y-z$
 (3) $(x+3y+z)^2$ (4) $(2x+y+3z)^2$
 (5) $(x+y-z)^2$ (6) $(2x-2y+z)^2$
- 03-2** (1) $1, 1, x+y+1$ (2) $-3, x+y-3$
 (3) $(5x+y+1)^2$ (4) $(x+2y+2)^2$
 (5) $(x-4y+1)^2$ (6) $(2x-y-5)^2$

- 03-3** (1) $2y, 3z$ (2) $3, x, x+y-z$
 (3) $(x+2y+z)(x^2+4y^2+z^2-2xy-2yz-zx)$
 (4) $(x+y+4z)(x^2+y^2+16z^2-xy-4yz-4zx)$
 (5) $(x-y-z)(x^2+y^2+z^2+xy-yz+zx)$
 (6) $(3x+y-z)(9x^2+y^2+z^2-3xy+yz+3zx)$
- 03-4** (1) $3, y^2, x+y+1$ (2) $-2, xy, xy$
 (3) $(x+2y+1)(x^2+4y^2-2xy-x-2y+1)$
 (4) $(x+y-3)(x^2+y^2-xy+3x+3y+9)$
 (5) $(x-y+4)(x^2+y^2+xy-4x+4y+16)$
 (6) $(x-3y+2)(x^2+9y^2+3xy-2x+6y+4)$
- 04-1** (1) $t+1, 1$ (2) $4, 4$ (3) $(x+y-1)(x+y-4)$
 (4) $(3x+y-2)(3x+y+4)$ (5) $(x-2y-3)(x-2y-5)$
- 04-2** (1) $2, x^2+5x$ (2) $x^2-2x, x^2-2x, x-3$
 (3) $(x^2+8x-4)(x+1)(x+7)$ (4) $(x+1)(x+2)(x-1)(x+4)$
 (5) $(x^2+4x+1)(x-1)(x+5)$
- 05-1** (1) $t-6, x^2+x, x+4$ (2) $x-5, t-3, x^2-2x$
 (3) $x^2+3x, t+6, x+4$ (4) $(x^2-2x-5)(x^2-2x-33)$
 (5) $(x-2)(x+3)(x^2+x-8)$ (6) $(x^2-x+4)(x+3)(x-4)$
 (7) $(x^2+6x+3)(x+1)(x+5)$
- 06-1** (1) $X+3, x+1$ (2) $9X, x^2, x-2$
 (3) $(x+1)(x-1)(x+2)(x-2)$
 (4) $(x+1)(x-1)(x+3)(x-3)$
 (5) $(x+1)(x-1)(x^2+2)$ (6) $(x+3)(x-3)(2x^2+1)$
 (7) $(x+2)(x-2)(3x^2-2)$ (8) $(x^2+4)(x+2)(x-2)$
- 06-2** (1) $2x, 2x, 2x$ (2) x^2, x, x
 (3) $(x^2+4x+8)(x^2-4x+8)$ (4) $(x^2+3x+5)(x^2-3x+5)$
 (5) $(x^2+x+3)(x^2-x+3)$
- 06-3** (1) $9x^2, x^2-3, 3x$ (2) $10x^2, 5x, 5x$
 (3) $(x^2+3x-1)(x^2-3x-1)$ (4) $(x^2+2x-4)(x^2-2x-4)$
 (5) $(x^2+2x-5)(x^2-2x-5)$
- 07-1** (1) $2x+y-1$ (2) $x+y, x-yz$
 (3) y^3, x^2-y^2 (4) $(-3x+y+1)(y-2)$
 (5) $(3x-2)(x-4y+1)$ (6) $(x+y)(x-y+z)$
 (7) $(y+z)(2x+y-z)$ (8) $(x+2z)(x-3y-2z)$
 (9) $(y+z)(y-z)(x+y)$ (10) $(x+z)(x-z)(y+z)$
- 07-2** (1) $-2y+3, (-2y+3)x, x-2y+3$
 (2) $3y+1, x+3y+1$ (3) $(x+2y+1)(x+2y-5)$
 (4) $(x+2y+3)(2x+y+4)$ (5) $(x-3y-2)(x-4y+1)$
 (6) $(x-y+2)(x-3y-1)$ (7) $(x-y-1)(x-2y-5)$
 (8) $(x-y-4)(3x-2y+1)$
- 08-1** (1) $x-1, 1, x^2-2x+2$ (2) $x+1, -1, x-3$
 (3) $(x-1)(x+2)^2$ (4) $(x+2)(x-3)(x-5)$
 (5) $(x-1)(x+2)(x-4)$ (6) $(2x-1)(x^2+3x-2)$
- 08-2** (1) $-2, x+2, x-1$
 (2) $(x-1)(x+2)(x-2)(x+3)$

- (3) $(x+1)^2(x+2)(x-3)$
 (4) $(x-1)(x+1)(2x^2-2x+1)$
 (5) $(x+2)(x-3)(x^2+3)$
 (6) $(x+1)(x-2)(3x^2+2)$ (7) $(x-1)(x+2)(x+3)(x-4)$

- 09-1** (1) a^2-b^2, b^2 , 직각삼각형 (2) $b-c, c-a$, 정삼각형
 (3) $b=c$ 인 이등변삼각형 (4) $a=b$ 인 이등변삼각형
 (5) $b=c$ 인 이등변삼각형
 (6) 빗변의 길이가 c 인 직각삼각형 (7) 정삼각형

- 10-1** (1) $3ab, 9$ (2) 91 (3) 21 (4) 10
 (5) $b-c, a-c, 5, 30$ (6) 6
 (7) 20 (8) -30

- 11-1** (1) $a+1, 9800$ (2) $a^2+ab+b^2, a-b, 10$
 (3) 49, 100, 800 (4) 80 (5) 10000
 (6) 1000 (7) $\frac{1}{40}$ (8) $\frac{1}{60}$

STEP 2

- 1-1** (1) $-2ab(a^2b-6a-2)$ (2) $(a+b)(a+b-1)$
 (3) $(x+z)(x-y)$

- 1-2** (1) $-3ab(3ab^2+2a-b-5)$
 (2) $(a+b)(a-b)^2$ (3) $(b-c)(c+a)$

- 2-1** (1) $(x+3)^2$ (2) $(a-10)^2$ (3) $\left(x+\frac{1}{5}\right)^2$ (4) $\left(x-\frac{3}{4}\right)^2$
 (5) $(3a+5b)(3a-5b)$

- 2-2** (1) $(3x+4y)^2$ (2) $(2a-7b)^2$ (3) $\left(\frac{1}{2}x+y\right)^2$ (4) $\left(3x-\frac{2}{3}\right)^2$
 (5) $(2x+y+z)(2x-y-z)$

- 3-1** (1) $(x+2)(x+8)$ (2) $(x-y)(x+5y)$
 (3) $(a+3b)(5a+b)$ (4) $(3x-y)(4x+3y)$

- 3-2** (1) $(a-3b)(a-5b)$ (2) $(x+4)(x-8)$
 (3) $(a-6)(3a-5)$ (4) $(2x-3y)(4x+5y)$

- 4-1** (1) $(x-2y-2)^2$ (2) $(a+b-2)(a+b-3)$
 (3) $(x-1)(x-2)(x+1)(x-4)$
 (4) $(x-1)(x+3)(x^2+2x+6)$

- 4-2** (1) $(x-y-2)(x-y-7)$ (2) $(a-3b+2)(a-3b-6)$
 (3) $(x^2-x-3)(x+3)(x-4)$ (4) $(x^2+x+5)(x-2)(x+3)$

- 5-1** (1) $(5x+y)^3$ (2) $\left(x+\frac{1}{3}\right)^3$ (3) $(x-2y)^3$ (4) $\left(a-\frac{1}{4}\right)^3$
 (5) $(2x+5)(4x^2-10x+25)$ (6) $3xy^2(x+3y)(x^2-3xy+9y^2)$
 (7) $(2x-1)(4x^2+2x+1)$
 (8) $2xy(2x-3y)(4x^2+6xy+9y^2)$

- 5-2** (1) $(3a+2)^3$ (2) $\left(2x+\frac{1}{2}\right)^3$ (3) $(2x-3y)^3$ (4) $\left(3x-\frac{1}{2}\right)^3$
 (5) $(4a+3b)(16a^2-12ab+9b^2)$
 (6) $5abc^3(a+2b)(a^2-2ab+4b^2)$
 (7) $\left(a-\frac{1}{3}\right)\left(a^2+\frac{1}{3}a+\frac{1}{9}\right)$
 (8) $2c^2(5a-2b)(25a^2+10ab+4b^2)$

- 6-1** (1) $(x-y+4z)^2$ (2) $(2a+b-5c)^2$
 (3) $(x+y+6)^2$ (4) $(x-4y+3)^2$
 (5) $(x+y+3z)(x^2+y^2+9z^2-xy-3yz-3zx)$
 (6) $(x-y+2z)(x^2+y^2+4z^2+xy+2yz-2zx)$
 (7) $(x+y+3)(x^2+y^2-xy-3x-3y+9)$
 (8) $(2x-y-1)(4x^2+y^2+2xy+2x-y+1)$

- 6-2** (1) $(3x+y-z)^2$ (2) $(x-2y+3z)^2$
 (3) $(a-b+2)^2$ (4) $(3x+y+2)^2$
 (5) $(2x+4y+z)(4x^2+16y^2+z^2-8xy-4yz-2zx)$
 (6) $(2x-y-z)(4x^2+y^2+z^2+2xy-yz+2zx)$
 (7) $(x+2y+4)(x^2+4y^2-2xy-4x-8y+16)$
 (8) $(x-2y+2)(x^2+4y^2+2xy-2x+4y+4)$

- 7-1** (1) $(x+2)(x-5)(x^2-3x+12)$
 (2) $(x^2+1)(2x+1)(2x-1)$
 (3) $(x^2+4x+2)(x^2-4x+2)$ (4) $(x^2+5x+3)(x^2-5x+3)$
 (5) $(x^2+x-1)(x^2-x-1)$ (6) $(x^2+x-3)(x^2-x-3)$

- 7-2** (1) $(x-1)^2(x^2-2x-12)$ (2) $(x^2-2)(x+3)(x-3)$
 (3) $(x^2+2x+5)(x^2-2x+5)$ (4) $(x^2+2x+4)(x^2-2x+4)$
 (5) $(x^2+3x-2)(x^2-3x-2)$ (6) $(x^2+3x-6)(x^2-3x-6)$

- 8-1** (1) $(2x-1)(x+y-3)$ (2) $(x+2y)(x+y+z)$
 (3) $(x+2y+3)(x+3y+4)$

- 8-2** (1) $(y-3)(x+5y-1)$ (2) $(x+z)(x-z)(x+y)$
 (3) $(x+y-1)(2x-y+3)$

- 9-1** (1) $(x-2)(x-3)^2$ (2) $(x-1)(x-2)(x^2-3)$

- 9-2** (1) $(2x-1)(2x^2-x+2)$ (2) $(x-2)(x+3)(x^2-x-1)$

STEP 3

01 x^2+3x 를 치환

02 $x+2$

03 ③

04 $(2x+3)^3$

05 $(3x-5y)^3$

06 $5(a+2)(a^2-2a+4)$

07 $\left(x-\frac{y}{2}\right)\left(x^2+\frac{xy}{2}+\frac{y^2}{4}\right)$

08 $(4x+y-2z)^2$

09 $(a-b+4)^2$

10 $(x+2y-2z)(x^2+4y^2+4z^2-2xy+4yz+2zx)$

11 $\left(x+2y+\frac{1}{2}\right)\left(x^2+4y^2-2xy-\frac{1}{2}x-y+\frac{1}{4}\right)$

12 $(x+y+1)(x+y+2)$ **13** $(x-1)(x-4)(x-2)(x-3)$

14 $x+4, t+2, x^2+3x-6$ **15** $(x^2+4x-3)(x^2+4x-6)$

16 $(3x+1)(3x-1)(x^2+1)$ **17** $(x^2+3x+8)(x^2-3x+8)$

18 $(x-1)(x+4)(x+1)(x-4)$

19 0 **20** $(a-b)(a+b+c)$

21 $(x+y)(x-y)(x-z)$ **22** $3b+1, b+2, a+b+2$

23 $(x-2)(x+3)(x+4)$ **24** $(x-1)(x+2)(x-3)(2x-1)$

25 $(x-1)^2(x+1)(x+2)$ **26** ②

27 $a=c$ 인 이등변삼각형 **28** 21

29 6

30 45

31 80

STEP 1

6쪽~13쪽

01-1 (1) x 에 대한 삼차식이다.(2) $-x^2$ 이므로 x^2 의 계수는 -1 이다.**01-2** (1) x 에 대한 이차식, y 에 대한 일차식이다.(2) x 에 대하여 정리하면 $x^2y + (2y-1)x - 3y - 5$ 이므로 x 의 계수는 $2y-1$ (3) y 에 대하여 정리하면 $(x^2+2x-3)y - x - 5$ 이므로 y 의 계수는 x^2+2x-3 (4) x 에 대한 상수항은 x 를 포함하지 않는 항이므로 $-3y-5$ **02-1** (1) $-2x^2-3x+1$ (2) $2+5x-x^2$ **02-2** (1) $x : 2x^2 - x - y^2 + 2y + 1$ $y : -y^2 + 2y + 2x^2 - x + 1$ (2) $x : x^3 + 2x^2 + xy + y^2 + 4y$ $y : y^2 + (x+4)y + x^3 + 2x^2$ **03-1** (1) $3x+2+5x+4=(3+5)x+\boxed{2}+4$ $=\boxed{8}x+6$ (2) $5x-3x+2y-7y=(5-3)x+(2-\boxed{7})y$ $=\boxed{2}x-5y$ **03-2** (1) $5x+2+4x+1=(5+4)x+2+1$ $=9x+3$ (2) $x-5-4x+9=(1-4)x-5+9$ $=-3x+4$ (3) $5x+2x+6y+2y=(5+2)x+(6+2)y$ $=7x+8y$ (4) $3x-2x+6y-2y=(3-2)x+(6-2)y$ $=x+4y$ **04-1** (1) $(3x+1)+(2x-1)=3x+1+\boxed{2}x-1$ $=(3+\boxed{2})x+1-1$ $=5x$ (2) $(5x-1)-(5-3x)=5x-1-5+\boxed{3}x$ $=(5+\boxed{3})x-1-5$ $=8x-6$ **04-2** (1) $2(2x+1)+(5-6x)=4x+2+5-6x$ $=-2x+7$ (2) $(2x-3y)+3(2y-5x)=2x-3y+6y-15x$ $=-13x+3y$ (3) $(4x+7)-\frac{1}{3}(6x+3)=4x+7-2x-1$ $=2x+6$ (4) $(2x+y)-2(3x+2y)=2x+y-6x-4y$ $=-4x-3y$ **05-1** (1) $3x-\{x+2(3x-1)\}$ $=3x-(x+6x-\boxed{2})$ $=3x-(7x-2)$ $=3x-7x+2$ $=-4x+\boxed{2}$ (2) $x-3[x-\{2x-2(x+1)\}]$ $=x-3\{x-(2x-2x+\boxed{2})\}$ $=x-3(x+\boxed{2})$ $=x-3x-6$ $=-2x-6$ (3) $(2x-3y)-\{x-2(x-y)\}$ $=2x-3y-(x-2x+2y)$ $=2x-3y-(-x+2y)$ $=2x-3y+x-2y$ $=3x-5y$ (4) $2x-\{3(x+y)-5y\}=2x-(3x+3y-5y)$ $=2x-(3x-2y)$ $=2x-3x+2y$ $=-x+2y$ (5) $x+2\{2x-(x+1)\}=x+2(2x-x-1)$ $=x+2(x-1)$ $=x+2x-2$ $=3x-2$ (6) $4x-\{x-3(x-2)\}=4x-(x-3x+6)$ $=4x-(-2x+6)$ $=4x+2x-6$ $=6x-6$ (7) $2x-[x-\{2x+4(x-1)+1\}]$ $=2x-\{x-(2x+4x-4+1)\}$ $=2x-\{x-(6x-3)\}$ $=2x-(x-6x+3)$ $=2x-(-5x+3)$ $=2x+5x-3$ $=7x-3$

$$\begin{aligned}
(8) \quad & 4x+3-[x+2-\{3x+(2x+1)\}] \\
&= 4x+3-\{x+2-(5x+1)\} \\
&= 4x+3-(x+2-5x-1) \\
&= 4x+3-(-4x+1) \\
&= 4x+3+4x-1 \\
&= 8x+2 \\
(9) \quad & 3y-[2x-\{(-x+2y)+(3x+2y)\}] \\
&= 3y-\{2x-(-x+2y+3x+2y)\} \\
&= 3y-\{2x-(2x+4y)\} \\
&= 3y-(2x-2x-4y) \\
&= 3y+4y \\
&= 7y \\
(10) \quad & 6x-[3x-2y-\{2x-(x+y)\}] \\
&= 6x-\{3x-2y-(2x-x-y)\} \\
&= 6x-\{3x-2y-(x-y)\} \\
&= 6x-(3x-2y-x+y) \\
&= 6x-(2x-y) \\
&= 6x-2x+y \\
&= 4x+y
\end{aligned}$$

06-1 (1) $\frac{x+2}{2} + \frac{5-x}{4} = \frac{\boxed{2}(x+2) + (5-x)}{4}$

$$\begin{aligned}
&= \frac{2x+4+5-x}{4} \\
&= \frac{x+9}{\boxed{4}}
\end{aligned}$$

(2) $\frac{2x+1}{3} - \frac{4x+2}{9} = \frac{3(2x+1) - (4x+2)}{\boxed{9}}$

$$\begin{aligned}
&= \frac{6x+3-4x-2}{9} \\
&= \frac{2x+\boxed{1}}{9}
\end{aligned}$$

(3) $\frac{x-1}{2} + \frac{2x+1}{3} = \frac{3(x-1) + 2(2x+1)}{6}$

$$\begin{aligned}
&= \frac{3x-3+4x+2}{6} \\
&= \frac{7x-1}{6}
\end{aligned}$$

(4) $\frac{3x-1}{4} + \frac{x+1}{6} = \frac{3(3x-1) + 2(x+1)}{12}$

$$\begin{aligned}
&= \frac{9x-3+2x+2}{12} \\
&= \frac{11x-1}{12}
\end{aligned}$$

(5) $\frac{x-2}{5} + \frac{3-x}{4} = \frac{4(x-2) + 5(3-x)}{20}$

$$\begin{aligned}
&= \frac{4x-8+15-5x}{20} \\
&= \frac{-x+7}{20}
\end{aligned}$$

(6) $\frac{4x+5}{3} + 2x-1 = \frac{(4x+5)+3(2x-1)}{3}$

$$\begin{aligned}
&= \frac{4x+5+6x-3}{3} \\
&= \frac{10x+2}{3}
\end{aligned}$$

(7) $\frac{2x-1}{3} - \frac{x-1}{2} = \frac{2(2x-1)-3(x-1)}{6}$

$$\begin{aligned}
&= \frac{4x-2-3x+3}{6} \\
&= \frac{x+1}{6}
\end{aligned}$$

(8) $\frac{2x-4}{3} - \frac{2x+3}{5} = \frac{5(2x-4)-3(2x+3)}{15}$

$$\begin{aligned}
&= \frac{10x-20-6x-9}{15} \\
&= \frac{4x-29}{15}
\end{aligned}$$

(9) $\frac{x+1}{6} - \frac{2x+3}{8} = \frac{4(x+1)-3(2x+3)}{24}$

$$\begin{aligned}
&= \frac{4x+4-6x-9}{24} \\
&= \frac{-2x-5}{24}
\end{aligned}$$

(10) $\frac{x-4}{5} - (x+3) = \frac{(x-4)-5(x+3)}{5}$

$$\begin{aligned}
&= \frac{x-4-5x-15}{5} \\
&= \frac{-4x-19}{5}
\end{aligned}$$

07-1 (1) $2x+y+5-3y-3x-6$

$$\begin{aligned}
&= (2-3)x + (1-\boxed{3})y + 5-6 \\
&= -\boxed{x} - 2y - 1
\end{aligned}$$

(2) $2x^2-x-3-5x+3x^2+4$

$$\begin{aligned}
&= (2+3)x^2 + (-1-5)x + (-3+\boxed{4}) \\
&= \boxed{5x^2} - 6x + 1
\end{aligned}$$

(3) $(3x+4y-2)-(y+x-1)$

$$\begin{aligned}
&= 3x+4y-2-y-\boxed{x}+1 \\
&= 2x+\boxed{3y}-1
\end{aligned}$$

(4) $3x+2x+3-4=(3+2)x+3-4$

$$= 5x-1$$

(5) $x^2+7x+2-2x^2-3x-7$

$$\begin{aligned}
&= x^2-2x^2+7x-3x+2-7 \\
&= -x^2+4x-5
\end{aligned}$$

(6) $x^2y-2xy+3xy^2-2x^2y+xy^2-xy$

$$\begin{aligned}
&= x^2y-2x^2y-2xy-xy+3xy^2+xy^2 \\
&= -x^2y-3xy+4xy^2
\end{aligned}$$

$$\begin{aligned}(7) & (5x+y+1)+(2y-3x+2) \\ &= 5x-3x+y+2y+1+2 \\ &= 2x+3y+3\end{aligned}$$

$$\begin{aligned}(8) & (x^2-3x+2)+(3x^2+x-4) \\ &= x^2+3x^2-3x+x+2-4 \\ &= 4x^2-2x-2\end{aligned}$$

$$\begin{aligned}(9) & (x^3-2x^2+4)+2(2x^2-3x-7) \\ &= x^3-2x^2+4x^2-6x+4-14 \\ &= x^3+2x^2-6x-10\end{aligned}$$

$$\begin{aligned}(10) & (x^2-xy+y^2)-(2x^2+xy-y^2) \\ &= x^2-xy+y^2-2x^2-xy+y^2 \\ &= -x^2-2xy+2y^2\end{aligned}$$

$$\begin{aligned}(11) & (2x+y+3)-2(x+2y+1) \\ &= 2x+y+3-2x-4y-2 \\ &= -3y+1\end{aligned}$$

08-1 $A=3x^2+4x-1$, $B=x^2-x+2$ 에 의해

$$\begin{aligned}(1) & A+2B=(3x^2+4x-1)+2(x^2-x+2) \\ &= 3x^2+4x-1+2x^2-2x+4 \\ &= 5x^2+2x+3\end{aligned}$$

$$\begin{aligned}(2) & 2A-3B=2(3x^2+4x-1)-3(x^2-x+2) \\ &= 6x^2+8x-2-3x^2+3x-6 \\ &= 3x^2+11x-8\end{aligned}$$

08-2 $A=2x^2-3x+1$, $B=3x^2+x-4$ 에 의해

$$\begin{aligned}(1) & 3A-2B=3(2x^2-3x+1)-2(3x^2+x-4) \\ &= 6x^2-9x+3-6x^2-2x+8 \\ &= -11x+11\end{aligned}$$

$$\begin{aligned}(2) & 4A-2B=4(2x^2-3x+1)-2(3x^2+x-4) \\ &= 8x^2-12x+4-6x^2-2x+8 \\ &= 2x^2-14x+12\end{aligned}$$

$$\begin{aligned}(3) & -A+2B=-(2x^2-3x+1)+2(3x^2+x-4) \\ &= -2x^2+3x-1+6x^2+2x-8 \\ &= 4x^2+5x-9\end{aligned}$$

$$\begin{aligned}(4) & -A-5B=-(2x^2-3x+1)-5(3x^2+x-4) \\ &= -2x^2+3x-1-15x^2-5x+20 \\ &= -17x^2-2x+19\end{aligned}$$

08-3 $A=-x^2+2xy+y^2$, $B=2x^2-xy+3y^2$ 에 의해

$$\begin{aligned}(1) & (3A+B)-A \\ &= 2A+B \\ &= 2(-x^2+2xy+y^2)+(2x^2-xy+3y^2) \\ &= -2x^2+4xy+2y^2+2x^2-xy+3y^2 \\ &= 3xy+5y^2\end{aligned}$$

$$\begin{aligned}(2) & 2A+(A-2B) \\ &= 3A-2B \\ &= 3(-x^2+2xy+y^2)-2(2x^2-xy+3y^2) \\ &= -3x^2+6xy+3y^2-4x^2+2xy-6y^2 \\ &= -7x^2+8xy-3y^2\end{aligned}$$

$$\begin{aligned}(3) & B+2(A+2B) \\ &= B+2A+4B \\ &= 2A+5B \\ &= 2(-x^2+2xy+y^2)+5(2x^2-xy+3y^2) \\ &= -2x^2+4xy+2y^2+10x^2-5xy+15y^2 \\ &= 8x^2-xy+17y^2\end{aligned}$$

$$\begin{aligned}(4) & 3(A-2B)+2B \\ &= 3A-6B+2B \\ &= 3A-4B \\ &= 3(-x^2+2xy+y^2)-4(2x^2-xy+3y^2) \\ &= -3x^2+6xy+3y^2-8x^2+4xy-12y^2 \\ &= -11x^2+10xy-9y^2\end{aligned}$$

$$\begin{aligned}(5) & -(2B+A)+3(A-B) \\ &= -2B-A+3A-3B \\ &= 2A-5B \\ &= 2(-x^2+2xy+y^2)-5(2x^2-xy+3y^2) \\ &= -2x^2+4xy+2y^2-10x^2+5xy-15y^2 \\ &= -12x^2+9xy-13y^2\end{aligned}$$

$$\begin{aligned}(6) & 2(A-2B)-3(3A+B) \\ &= 2A-4B-9A-3B \\ &= -7A-7B \\ &= -7(-x^2+2xy+y^2)-7(2x^2-xy+3y^2) \\ &= 7x^2-14xy-7y^2-14x^2+7xy-21y^2 \\ &= -7x^2-7xy-28y^2\end{aligned}$$

09-1 $A=x^2+xy-3y^2$, $B=3x^2-5xy+y^2$ 에 의해

$$\begin{aligned}(1) & X-2A=B에서 \\ & X=2A+B \\ &= 2(x^2+xy-3y^2)+(3x^2-5xy+y^2) \\ &= 2x^2+2xy-6y^2+3x^2-5xy+y^2 \\ &= 5x^2-3xy-5y^2\end{aligned}$$

$$\begin{aligned}(2) & X-2B=A에서 \\ & X=A+2B \\ &= (x^2+xy-3y^2)+2(3x^2-5xy+y^2) \\ &= x^2+xy-3y^2+6x^2-10xy+2y^2 \\ &= 7x^2-9xy-y^2\end{aligned}$$

$$\begin{aligned}(3) & A+X=B+2X에서 \\ & X=A-B \\ &= (x^2+xy-3y^2)-(3x^2-5xy+y^2) \\ &= x^2+xy-3y^2-3x^2+5xy-y^2 \\ &= -2x^2+6xy-4y^2\end{aligned}$$

09-2 (1) $X - A = 2B$ 에서

$$\begin{aligned} X &= A + 2B \\ &= (-x^2 + 4xy + 2y^2) + 2(2x^2 - xy - 3y^2) \\ &= -x^2 + 4xy + 2y^2 + 4x^2 - 2xy - 6y^2 \\ &= 3x^2 + 2xy - 4y^2 \end{aligned}$$

(2) $X + A = 3B$ 에서

$$\begin{aligned} X &= -A + 3B \\ &= -(x^2 + 2xy - y^2) + 3(2x^2 - xy - y^2) \\ &= -x^2 - 2xy + y^2 + 6x^2 - 3xy - 3y^2 \\ &= 5x^2 - 5xy - 2y^2 \end{aligned}$$

(3) $2A - X = B$ 에서

$$\begin{aligned} X &= 2A - B \\ &= 2(3x^2 - xy - 2y^2) - (-x^2 - 2xy + y^2) \\ &= 6x^2 - 2xy - 4y^2 + x^2 + 2xy - y^2 \\ &= 7x^2 - 5y^2 \end{aligned}$$

(4) $2X + A = 3(X - B)$, 즉 $2X + A = 3X - 3B$ 에서

$$\begin{aligned} X &= A + 3B \\ &= (2x^2 + 3xy + y^2) + 3(-2x^2 + xy - 3y^2) \\ &= 2x^2 + 3xy + y^2 - 6x^2 + 3xy - 9y^2 \\ &= -4x^2 + 6xy - 8y^2 \end{aligned}$$

(5) $2A - X = 2(B - X)$, 즉 $2A - X = 2B - 2X$ 에서

$$\begin{aligned} X &= -2A + 2B \\ &= -2(-5x^2 + 2xy + y^2) + 2(x^2 - 3xy - 2y^2) \\ &= 10x^2 - 4xy - 2y^2 + 2x^2 - 6xy - 4y^2 \\ &= 12x^2 - 10xy - 6y^2 \end{aligned}$$

09-3 (1) $3X + A = -2B$ 에서

$$\begin{aligned} 3X &= -A - 2B \\ &= -(-2x^2 - xy + 5y^2) - 2(-2x^2 - 4xy - y^2) \\ &= 2x^2 + xy - 5y^2 + 4x^2 + 8xy + 2y^2 \\ &= \boxed{6x^2} + 9xy - 3y^2 \\ \therefore X &= \boxed{2x^2} + 3xy - y^2 \end{aligned}$$

(2) $2(X + 2A) = B$, 즉 $2X + 4A = B$ 에서

$$\begin{aligned} 2X &= -4A + B \\ &= -4(-x^2 + xy + 2y^2) + (2x^2 - 4xy + 10y^2) \\ &= 4x^2 - 4xy - 8y^2 + 2x^2 - 4xy + 10y^2 \\ &= \boxed{6x^2} - 8xy + 2y^2 \\ \therefore X &= \boxed{3x^2} - 4xy + y^2 \end{aligned}$$

(3) $B - 2X = X - 2A$ 에서

$$\begin{aligned} 3X &= 2A + B \\ &= 2(-x^2 + 2xy + 2y^2) + (-4x^2 - xy - y^2) \\ &= -2x^2 + 4xy + 4y^2 - 4x^2 - xy - y^2 \\ &= -6x^2 + 3xy + 3y^2 \\ \therefore X &= -2x^2 + xy + y^2 \end{aligned}$$

(4) $X + 2A = 3X + B$ 에서

$$\begin{aligned} 2X &= 2A - B \\ &= 2(3x^2 - 2xy + y^2) - (-2x^2 - 4xy - 4y^2) \\ &= 6x^2 - 4xy + 2y^2 + 2x^2 + 4xy + 4y^2 \\ &= 8x^2 + 6y^2 \\ \therefore X &= 4x^2 + 3y^2 \end{aligned}$$

(5) $A - 2(X + B) = B$, 즉

$$\begin{aligned} A - 2X - 2B &= B \text{에서} \\ 2X &= A - 3B \\ &= (-x^2 + xy + 4y^2) - 3(3x^2 - 5xy + 2y^2) \\ &= -x^2 + xy + 4y^2 - 9x^2 + 15xy - 6y^2 \\ &= -10x^2 + 16xy - 2y^2 \\ \therefore X &= -5x^2 + 8xy - y^2 \end{aligned}$$

(6) $X - A = 2(B - 2X)$, 즉

$$\begin{aligned} X - A &= 2B - 4X \text{에서} \\ 5X &= A + 2B \\ &= (3x^2 - 3xy + 2y^2) + 2(x^2 - xy + 4y^2) \\ &= 3x^2 - 3xy + 2y^2 + 2x^2 - 2xy + 8y^2 \\ &= 5x^2 - 5xy + 10y^2 \\ \therefore X &= x^2 - xy + 2y^2 \end{aligned}$$

(7) $4A - X = 3(A + B + X)$, 즉

$$\begin{aligned} 4A - X &= 3A + 3B + 3X \text{에서} \\ 4X &= A - 3B \\ &= (5x^2 + 2xy + 3y^2) - 3(-x^2 + 2xy - 3y^2) \\ &= 5x^2 + 2xy + 3y^2 + 3x^2 - 6xy + 9y^2 \\ &= 8x^2 - 4xy + 12y^2 \\ \therefore X &= 2x^2 - xy + 3y^2 \end{aligned}$$

(8) $A + 4(X + 2B) = 3A + 2B$, 즉

$$\begin{aligned} A + 4X + 8B &= 3A + 2B \text{에서} \\ 2X &= A - 3B \\ &= (-x^2 - 5xy + 2y^2) - 3(-x^2 - xy + 2y^2) \\ &= -x^2 - 5xy + 2y^2 + 3x^2 + 3xy - 6y^2 \\ &= 2x^2 - 2xy - 4y^2 \\ \therefore X &= x^2 - xy - 2y^2 \end{aligned}$$

(9) $A + 2(X - B) = 4X + 2A$, 즉

$$\begin{aligned} A + 2X - 2B &= 4X + 2A \text{에서} \\ 2X &= -A - 2B \\ &= -(-2x^2 + 2xy + 2y^2) - 2(3x^2 + 2xy - 2y^2) \\ &= 2x^2 - 2xy - 2y^2 - 6x^2 - 4xy + 4y^2 \\ &= -4x^2 - 6xy + 2y^2 \\ \therefore X &= -2x^2 - 3xy + y^2 \end{aligned}$$

1-1 (1) $6x+5$

(2) $5x+5y$

(3) $(2x+6)+(4x+3)=2x+6+4x+3=6x+9$

(4) $(x-1)-(3-5x)=x-1-3+5x=6x-4$

$$(5) 2x+\{3x+2(x-2)\}=2x+(3x+2x-4) \\ =2x+5x-4 \\ =7x-4$$

$$(6) (5-3x)-\{5x-(-4x+1)\} \\ =5-3x-(5x+4x-1) \\ =5-3x-9x+1 \\ =-12x+6$$

1-2 (1) $4x-1$

(2) $3x+2y$

$$(3) (2x+3)+(5x-1)=2x+3+5x-1 \\ =7x+2$$

$$(4) 2(-3x+2)-3(2x+1)=-6x+4-6x-3 \\ =-12x+1$$

$$(5) (x-3)+2\{-3x+(x-1)\} \\ =x-3+2(-2x-1) \\ =x-3-4x-2 \\ =-3x-5$$

$$(6) 3x-\{4x-(x+3)\}=3x-(3x-3) \\ =3x-3x+3 \\ =3$$

2-1 (1) $3+2[2x+\{x-(2-4x)\}]$

$$=3+2\{2x+(x-2+4x)\} \\ =3+2(7x-2)=14x-1$$

$$(2) -2x-3[x-\{4(x-1)+1\}] \\ =-2x-3\{x-(4x-4+1)\} \\ =-2x-3\{x-(4x-3)\} \\ =-2x-3(x-4x+3) \\ =-2x-3(-3x+3) \\ =-2x+9x-9=7x-9$$

$$(3) \frac{2x-3}{2}+\frac{x+5}{3}=\frac{3(2x-3)+2(x+5)}{6} \\ =\frac{6x-9+2x+10}{6} \\ =\frac{8x+1}{6}$$

$$(4) \frac{x-2y}{5}-\frac{x-4y}{3}=\frac{3(x-2y)-5(x-4y)}{15} \\ =\frac{3x-6y-5x+20y}{15} \\ =\frac{-2x+14y}{15}$$

$$(5) 2(x+2)+\frac{2x-5}{3}=\frac{6(x+2)+(2x-5)}{3} \\ =\frac{6x+12+2x-5}{3} \\ =\frac{8x+7}{3}$$

$$(6) 4(x-1)-\frac{1}{2}(2x-6)=4x-4-x+3 \\ =3x-1$$

2-2 (1) $3x-2+[2x-3\{-x+2+(2x+1)\}]$

$$=3x-2+\{2x-3(x+3)\} \\ =3x-2+(2x-3x-9) \\ =3x-2-x-9 \\ =2x-11$$

$$(2) 4x+1-[x-2\{-4x+(2x+1)\}] \\ =4x+1-\{x-2(-2x+1)\} \\ =4x+1-(x+4x-2) \\ =4x+1-5x+2 \\ =-x+3$$

$$(3) \frac{2x-1}{9}+\frac{x+3}{6}=\frac{2(2x-1)+3(x+3)}{18} \\ =\frac{4x-2+3x+9}{18} \\ =\frac{7x+7}{18}$$

$$(4) \frac{3x-4}{5}-\frac{x+1}{2}=\frac{2(3x-4)-5(x+1)}{10} \\ =\frac{6x-8-5x-5}{10} \\ =\frac{x-13}{10}$$

$$(5) 2x+1+\frac{-x-2}{3}=\frac{3(2x+1)+(-x-2)}{3} \\ =\frac{6x+3-x-2}{3} \\ =\frac{5x+1}{3}$$

$$(6) \frac{5x-2}{4}-(x-2)=\frac{(5x-2)-4(x-2)}{4} \\ =\frac{5x-2-4x+8}{4} \\ =\frac{x+6}{4}$$

3-1 (1) $2x^2-x+1$

(2) $3x^3+x^2-5x+2$

3-2 (1) $-3x^2+2x+3$

(2) $-x^2+(3y+1)x+2y^2-5$

4-1 (1) $3+x-x^2$

(2) $5-4x+4x^2$

4-2 (1) $1+x-2x^2+2x^3$

(2) $-y+3x+(2y+1)x^2-x^3$

5-1 (1) $4x+2y-5$

(2) $(4x+2y+1)+(-2x+y-2)$

$=4x+2y+1-2x+y-2$

$=2x+3y-1$

(3) $2x+7y+3-(4x-y+5)$

$=2x+7y+3-4x+y-5$

$=-2x+8y-2$

(4) $(4x^2-x-2)-(x^2+2x+4)$

$=4x^2-x-2-x^2-2x-4$

$=3x^2-3x-6$

5-2 (1) $(2x^2-3x)+(2x^2+2x+1)$

$=2x^2-3x+2x^2+2x+1$

$=4x^2-x+1$

(2) $(x^3-x^2+1)+(4x^3-2x^2+3x+2)$

$=x^3-x^2+1+4x^3-2x^2+3x+2$

$=5x^3-3x^2+3x+3$

(3) $(2x^2+xy-3y^2)-(-x^2-3xy+y^2)$

$=2x^2+xy-3y^2+x^2+3xy-y^2$

$=3x^2+4xy-4y^2$

(4) $(2x^3-x^2+2)-(3x^3-5x^2-x+4)$

$=2x^3-x^2+2-3x^3+5x^2+x-4$

$=-x^3+4x^2+x-2$

6-1 $A=x^2-x-5, B=2x^2-x+6$ |므로

(1) $-A+B$

$=(x^2-x-5)+(2x^2-x+6)$

$=-x^2+x+5+2x^2-x+6$

$=x^2+11$

(2) $A+(2A-B)$

$=A+2A-B$

$=3A-B$

$=3(x^2-x-5)-(2x^2-x+6)$

$=3x^2-3x-15-2x^2+x+6$

$=x^2-2x-9$

(3) $(A+2B)-(3A-B)$

$=A+2B-3A+B$

$=-2A+3B$

$=-2(x^2-x-5)+3(2x^2-x+6)$

$=-2x^2+2x+10+6x^2-3x+18$

$=4x^2-x+28$

6-2 $A=x^2+3x-1, B=x^2-x-1$ |므로

(1) $2A+3B$

$=2(x^2+3x-1)+3(x^2-x-1)$

$=2x^2+6x-2+3x^2-3x-3$

$=5x^2+3x-5$

(2) $3A-2(A-B)$

$=3A-2A+2B$

$=A+2B$

$=(x^2+3x-1)+2(x^2-x-1)$

$=x^2+3x-1+2x^2-2x-2$

$=3x^2+x-3$

(3) $(A-3B)-(2A-B)$

$=A-3B-2A+B$

$=-A-2B$

$=(x^2+3x-1)-2(x^2-x-1)$

$=x^2+3x-1-2x^2+2x+2$

$=-x^2-3x+3$

7-1 (1) $A-3X=2B$ |에서

$3X=A-2B$

$=(2x^2-x+8)-2(-2x^2+x+1)$

$=2x^2-x+8+4x^2-2x-2$

$=6x^2-3x+6$

$\therefore X=2x^2-x+2$

(2) $3(X+A)=B, \text{ 즉 } 3X+3A=B$ |에서

$3X=-3A+B$

$=-3(-2x^2-3xy+y^2)+(-3x^2-3xy+12y^2)$

$=6x^2+9xy-3y^2-3x^2-3xy+12y^2$

$=3x^2+6xy+9y^2$

$\therefore X=x^2+2xy+3y^2$

7-2 (1) $2(X+3A)=A+B, \text{ 즉 } 2X+6A=A+B$ |에서

$2X=-5A+B$

$=-5(-x^2+xy-y^2)+(x^2+3xy-3y^2)$

$=5x^2-5xy+5y^2+x^2+3xy-3y^2$

$=6x^2-2xy+2y^2$

$\therefore X=3x^2-xy+y^2$

(2) $A+2(X+B)=-2B, \text{ 즉 } A+2X+2B=-2B$ |에서

$2X=-A-4B$

$=(x^2+12x-8)-4(x^2-2x+1)$

$=x^2+12x-8-4x^2+8x-4$

$=-3x^2+20x-12$

$\therefore X=-3x^2+10x-6$

01 $x^2 + (-2y+1)x + y^2$

02 $y + xy + 2x^2 - x^3$

03 $2x - 3y + 1 - 2y + x + 5 + 3x$
 $= 2x + x + 3x - 3y - 2y + 1 + 5$
 $= 6x - 5y + 6$

04 $(4x - y - 1) - 2(x - 2y + 1)$
 $= 4x - y - 1 - 2x + 4y - 2$
 $= 2x + 3y - 3$

05 $(-2x^2 + xy + 3y^2) + (x^2 + 4xy + y^2)$
 $= -2x^2 + xy + 3y^2 + x^2 + 4xy + y^2$
 $= -x^2 + 5xy + 4y^2$

06 $(3x^3 - 2x^2 + x) + (-x^3 + x^2 + 3x - 2)$
 $= 3x^3 - 2x^2 + x - x^3 + x^2 + 3x - 2$
 $= 2x^3 - x^2 + 4x - 2$

07 $\{x + 2 - 3(2x - 1)\} - \{x - 3(x - 2) - 4\}$
 $= (x + 2 - 6x + 3) - (x - 3x + 6 - 4)$
 $= (-5x + 5) - (-2x + 2)$
 $= -5x + 5 + 2x - 2$
 $= -3x + 3$

08 $5x + 2 - [x - 3 + \{x - 3(x - 2) - 4\}]$
 $= 5x + 2 - \{x - 3 + (x - 3x + 6 - 4)\}$
 $= 5x + 2 - \{x - 3 + (-2x + 2)\}$
 $= 5x + 2 - (x - 3 - 2x + 2)$
 $= 5x + 2 - (-x - 1)$
 $= 5x + 2 + x + 1$
 $= 6x + 3$

따라서 처음으로 틀린 부분은 ㉠이다.

09 $\frac{x^2 + 2x - 1}{3} - \frac{3x^2 - x + 1}{2}$
 $= \frac{2(x^2 + 2x - 1) - 3(3x^2 - x + 1)}{6}$
 $= \frac{2x^2 + 4x - 2 - 9x^2 + 3x - 3}{6}$
 $= \frac{-7x^2 + 7x - 5}{6}$

10 $\frac{2x^2 + xy - y^2}{6} - \frac{2x^2 - xy + 3y^2}{3}$
 $= \frac{(2x^2 + xy - y^2) - 2(2x^2 - xy + 3y^2)}{6}$
 $= \frac{2x^2 + xy - y^2 - 4x^2 + 2xy - 6y^2}{6}$
 $= \frac{-2x^2 + 3xy - 7y^2}{6}$

11 $A = x^2 - 2xy + y^2, B = 3x^2 - xy - y^2$ 이므로
 $5A - 2(A + B)$
 $= 5A - 2A - 2B$
 $= 3A - 2B$
 $= 3(x^2 - 2xy + y^2) - 2(3x^2 - xy - y^2)$
 $= 3x^2 - 6xy + 3y^2 - 6x^2 + 2xy + 2y^2$
 $= -3x^2 - 4xy + 5y^2$

12 $A = x^2 - xy + 2y^2, B = x^2 - 3xy - y^2$ 이므로
 $-2A - (A - B)$
 $= -2A - A + B$
 $= -3A + B$
 $= -3(x^2 - xy + 2y^2) + (x^2 - 3xy - y^2)$
 $= -3x^2 + 3xy - 6y^2 + x^2 - 3xy - y^2$
 $= -2x^2 - 7y^2$

13 $A = 2x^3 - 4x^2 + 6, B = 5x^3 - 2x + 1,$
 $C = 3x^3 - 4x^2 - 3x$ 이므로
 $A - 2B + 3C$
 $= (2x^3 - 4x^2 + 6) - 2(5x^3 - 2x + 1) + 3(3x^3 - 4x^2 - 3x)$
 $= 2x^3 - 4x^2 + 6 - 10x^3 + 4x - 2 + 9x^3 - 12x^2 - 9x$
 $= x^3 - 16x^2 - 5x + 4$

14 $A = x^2 - 2xy - y^2, B = 2x^2 + xy - 2y^2$ 이므로
 $3A - (X + B) = B$, 즉 $3A - X - B = B$ 에서
 $X = 3A - 2B$
 $= 3(x^2 - 2xy - y^2) - 2(2x^2 + xy - 2y^2)$
 $= 3x^2 - 6xy - 3y^2 - 4x^2 - 2xy + 4y^2$
 $= -x^2 - 8xy + y^2$

15 $A = 2x^2 - 6xy + 8y^2, B = 2x^2 + 3xy - 6y^2$ 이므로
 $2A - 2(X - B) = 3A$, 즉 $2A - 2X + 2B = 3A$ 에서
 $2X = -A + 2B$
 $= -(2x^2 - 6xy + 8y^2) + 2(2x^2 + 3xy - 6y^2)$
 $= -2x^2 + 6xy - 8y^2 + 4x^2 + 6xy - 12y^2$
 $= 2x^2 + 12xy - 20y^2$
 $\therefore X = x^2 + 6xy - 10y^2$

STEP 1

22쪽~41쪽

01-1 (1) $3x^2 \times 8x^7 = \boxed{24} x^{2+7} = 24x^9$
 (2) $(x^3)^4 \times (x^5)^2 = x^{12} \times \boxed{x^{10}}$
 $= x^{12+10} = x^{22}$
 (3) $(-3xy)^3 \times (2xy)^2 = -27x^3y^3 \times \boxed{4x^2y^2}$
 $= \boxed{-108} x^5y^5$
 (4) $(2x^2y)^3 \times (-2xy)^2 = \boxed{8x^6y^3} \times 4x^2y^2$
 $= 32x^8y^5$
 (5) $(2a^3b)^2 \times \left(-\frac{1}{3}a^2b^3\right)^3 = 4a^6b^2 \times \left(\boxed{-\frac{1}{27}} a^6b^9\right)$
 $= -\frac{4}{27} a^{12}b^{11}$

01-2 (1) x^7
 (2) $8x^7$
 (3) $(2x)^2 \times (x^3)^2 = 4x^2 \times x^6 = 4x^8$
 (4) $(2x^2)^3 \times (3x^4)^2 = 8x^6 \times 9x^8 = 72x^{14}$
 (5) $(-3x^2)^2 \times (2x^3)^4 = 9x^4 \times 16x^{12}$
 $= 144x^{16}$
 (6) $(-4x^3y)^2 \times (-xy^3)^3 = 16x^6y^2 \times (-x^3y^9)$
 $= -16x^9y^{11}$
 (7) $\left(-\frac{1}{2}a^2b^3\right)^2 \times (2ab^2)^3 = \frac{1}{4}a^4b^6 \times 8a^3b^6$
 $= 2a^7b^{12}$
 (8) $(3a^2b)^2 \times \left(-\frac{1}{2}ab^3\right)^3 = 9a^4b^2 \times \left(-\frac{1}{8}a^3b^9\right)$
 $= -\frac{9}{8}a^7b^{11}$

02-1 (1) $x^2y^3(x^3y - 2xy^2) = x^5y^4 - \boxed{2x^3y^5}$
 (2) $x^2y(2x^3y + 3x^2y^2 - xy^2)$
 $= 2x^5y^2 + \boxed{3x^4y^3} - x^3y^3$
 (3) $(x+2y)(3x-4y)$
 $= 3x^2 - 4xy + \boxed{6xy} - 8y^2$
 $= 3x^2 + \boxed{2xy} - 8y^2$
 (4) $(x-2)(x^2-2x+3)$
 $= x^3 - 2x^2 + 3x - \boxed{2x^2} + 4x - 6$
 $= x^3 - 4x^2 + \boxed{7x} - 6$

02-2 (1) $-6x^3y^3 - 3x^4y^4$
 (2) $3x^4y^4 - x^5y^3 + 2x^5y^4$
 (3) $(2x-y)(3x-2y)$
 $= 6x^2 - 4xy - 3xy + 2y^2$
 $= 6x^2 - 7xy + 2y^2$

(4) $(2x-3)(x^2+4x-3)$
 $= 2x^3 + 8x^2 - 6x - 3x^2 - 12x + 9$
 $= 2x^3 + 5x^2 - 18x + 9$
 (5) $(x^2-2x+3)(x-2)$
 $= x^3 - 2x^2 - 2x^2 + 4x + 3x - 6$
 $= x^3 - 4x^2 + 7x - 6$
 (6) $(2x^2-x+3)(3x-2)$
 $= 6x^3 - 4x^2 - 3x^2 + 2x + 9x - 6$
 $= 6x^3 - 7x^2 + 11x - 6$

03-1 $(x+2y-5)(2x-y+2)$ 의 전개식에서
 (1) $-xy + 4xy = 3xy$ 이므로 xy 의 계수는 3
 (2) $2x - 10x = -8x$ 이므로 x 의 계수는 -8

03-2 $(x^2+x-3)(x^2+2x+1)$ 의 전개식에서
 (1) $x - 6x = -5x$ 이므로 x 의 계수는 -5
 (2) $x^2 + 2x^2 - 3x^2 = 0$ 이므로 x^2 의 계수는 0
 (3) $2x^3 + x^3 = 3x^3$ 이므로 x^3 의 계수는 3

03-3 $(x^2-2x+3)^2 = (x^2-2x+3)(x^2-2x+3)$ 에서
 (1) $-6x - 6x = -12x$ 이므로 x 의 계수는 -12
 (2) $3x^2 + 4x^2 + 3x^2 = 10x^2$ 이므로 x^2 의 계수는 10
 (3) $-2x^3 - 2x^3 = -4x^3$ 이므로 x^3 의 계수는 -4

03-4 $(2x^2+x-3)^2 = (2x^2+x-3)(2x^2+x-3)$ 에서
 (1) $-3x - 3x = -6x$ 이므로 x 의 계수는 -6
 (2) $-6x^2 + x^2 - 6x^2 = -11x^2$ 이므로 x^2 의 계수는 -11
 (3) $2x^3 + 2x^3 = 4x^3$ 이므로 x^3 의 계수는 4

04-1 (1) $(x+3)^2 = x^2 + \boxed{2} \cdot x \cdot 3 + 3^2$
 $= x^2 + 6x + \boxed{9}$
 (2) $(2x-y)^2 = (2x)^2 - 2 \cdot \boxed{2x} \cdot y + y^2$
 $= \boxed{4x^2} - 4xy + y^2$
 (3) $(x+4)(x-4) = x^2 - \boxed{4}^2$
 $= x^2 - 16$
 (4) $(x+2)(x+4) = x^2 + (2+4)x + 2 \cdot \boxed{4}$
 $= x^2 + \boxed{6x} + 8$
 (5) $(2x+3)(3x-5) = 6x^2 + (-10+9)x - \boxed{15}$
 $= 6x^2 - \boxed{x} - 15$

04-2 (1) $4x^2 + 4xy + y^2$
 (2) $9x^2 + 12xy + 4y^2$
 (3) $16x^2 - 8x + 1$
 (4) $4x^2 - 20xy + 25y^2$
 (5) $4x^2 - 9$

$$\begin{aligned}
 (6) \quad & (3x+y)(-3x+y) = -(3x+y)(3x-y) \\
 & = -(9x^2 - y^2) \\
 & = -9x^2 + y^2 \\
 (7) \quad & x^2 + 2x - 15 \\
 (8) \quad & x^2 - xy - 6y^2 \\
 (9) \quad & 6x^2 - 7xy + 2y^2
 \end{aligned}$$

05-1

$$\begin{aligned}
 (1) \quad & (x+2)^3 = x^3 + 3 \cdot \boxed{x^2} \cdot 2 + 3 \cdot x \cdot 2^2 + 2^3 \\
 & = x^3 + 6x^2 + \boxed{12x} + 8 \\
 (2) \quad & (2x+1)^3 = (\boxed{2x})^3 + 3 \cdot (2x)^2 \cdot 1 + 3 \cdot 2x \cdot 1^2 + 1^3 \\
 & = 8x^3 + \boxed{12x^2} + 6x + 1 \\
 (3) \quad & (2x+3)^3 = (2x)^3 + 3 \cdot (2x)^2 \cdot 3 + 3 \cdot 2x \cdot 3^2 + 3^3 \\
 & = 8x^3 + 36x^2 + 54x + 27 \\
 (4) \quad & x^3 + 9x^2y + 27xy^2 + 27y^3 \\
 (5) \quad & 64x^3 + 48x^2y + 12xy^2 + y^3 \\
 (6) \quad & 8x^3 + 4x^2y + \frac{2}{3}xy^2 + \frac{1}{27}y^3 \\
 (7) \quad & 64x^3 + 24x^2y + 3xy^2 + \frac{1}{8}y^3
 \end{aligned}$$

05-2

$$\begin{aligned}
 (1) \quad & (x-2)^3 = x^3 - 3 \cdot x^2 \cdot 2 + 3 \cdot x \cdot 2^2 - \boxed{2^3} \\
 & = x^3 - 6x^2 + \boxed{12x} - 8 \\
 (2) \quad & (2x-3)^3 = (2x)^3 - 3 \cdot (2x)^2 \cdot 3 + \boxed{3} \cdot 2x \cdot 3^2 - 3^3 \\
 & = \boxed{8x^3} - 36x^2 + 54x - 27 \\
 (3) \quad & (x-3y)^3 = x^3 - 3 \cdot x^2 \cdot 3y + 3 \cdot x \cdot (3y)^2 - (3y)^3 \\
 & = x^3 - 9x^2y + 27xy^2 - 27y^3 \\
 (4) \quad & (3x-y)^3 = (3x)^3 - 3 \cdot (3x)^2 \cdot y + 3 \cdot 3x \cdot y^2 - y^3 \\
 & = 27x^3 - 27x^2y + 9xy^2 - y^3 \\
 (5) \quad & 8x^3 - 60x^2y + 150xy^2 - 125y^3 \\
 (6) \quad & 27x^3 - 108x^2y + 144xy^2 - 64y^3 \\
 (7) \quad & 64x^3 - 16x^2y + \frac{4}{3}xy^2 - \frac{1}{27}y^3 \\
 (8) \quad & 27x^3 - \frac{54}{5}x^2y + \frac{36}{25}xy^2 - \frac{8}{125}y^3
 \end{aligned}$$

06-1

$$\begin{aligned}
 (1) \quad & (x+1)(x^2-x+1) \\
 & = (x+1)(x^2-x \cdot \boxed{1} + 1^2) \\
 & = x^3 + 1^3 = x^3 + \boxed{1} \\
 (2) \quad & (x+2)(x^2-2x+4) \\
 & = (x+2)(x^2-x \cdot 2 + \boxed{2}^2) \\
 & = x^3 + 2^3 = x^3 + \boxed{8} \\
 (3) \quad & (2x+1)(4x^2-2x+1) \\
 & = (2x+1)\{(2x)^2-2x \cdot 1+1^2\} \\
 & = (2x)^3+1^3=8x^3+1 \\
 (4) \quad & (x+2y)(x^2-2xy+4y^2) \\
 & = (x+2y)\{x^2-x \cdot 2y+(2y)^2\} \\
 & = x^3+(2y)^3=x^3+8y^3
 \end{aligned}$$

$$\begin{aligned}
 (5) \quad & (3a+b)(9a^2-3ab+b^2) \\
 & = (3a)^3+b^3=27a^3+b^3 \\
 (6) \quad & (2a+3b)(4a^2-6ab+9b^2) \\
 & = (2a)^3+(3b)^3=8a^3+27b^3
 \end{aligned}$$

06-2

$$\begin{aligned}
 (1) \quad & (x-4)(x^2+4x+16) \\
 & = (x-4)(x^2+x \cdot 4 + \boxed{4}^2) \\
 & = x^3-4^3=x^3-\boxed{64} \\
 (2) \quad & (x-2)(x^2+2x+4) \\
 & = (x-2)(x^2+x \cdot \boxed{2} + 2^2) \\
 & = x^3-2^3=x^3-\boxed{8} \\
 (3) \quad & (2x-1)(4x^2+2x+1) \\
 & = (2x-1)\{(2x)^2+2x \cdot 1+1^2\} \\
 & = (2x)^3-1^3=8x^3-1 \\
 (4) \quad & (x-3y)(x^2+3xy+9y^2) \\
 & = x^3-(3y)^3=x^3-27y^3 \\
 (5) \quad & (3a-b)(9a^2+3ab+b^2) \\
 & = (3a)^3-b^3=27a^3-b^3 \\
 (6) \quad & (2a-3b)(4a^2+6ab+9b^2) \\
 & = (2a)^3-(3b)^3=8a^3-27b^3
 \end{aligned}$$

07-1

$$\begin{aligned}
 (1) \quad & (a+2b+c)^2 \\
 & = a^2 + (2b)^2 + c^2 + 2 \cdot a \cdot 2b + 2 \cdot 2b \cdot c + 2 \cdot c \cdot a \\
 & = a^2 + \boxed{4b^2} + c^2 + 4ab + 4bc + \boxed{2ca} \\
 (2) \quad & (x+y-1)^2 \\
 & = x^2 + y^2 + (-1)^2 + 2 \cdot x \cdot y + 2 \cdot y \cdot (-1) + 2 \cdot (-1) \cdot \boxed{x} \\
 & = x^2 + \boxed{y^2} + 2xy - 2x - 2y + 1 \\
 (3) \quad & (a+b-2c)^2 \\
 & = a^2 + b^2 + (-2c)^2 + 2 \cdot a \cdot b + 2 \cdot b \cdot (-2c) + 2 \cdot (-2c) \cdot a \\
 & = a^2 + b^2 + 4c^2 + 2ab - 4bc - 4ca \\
 (4) \quad & (x-3y+z)^2 \\
 & = x^2 + (-3y)^2 + z^2 \\
 & \quad + 2 \cdot x \cdot (-3y) + 2 \cdot (-3y) \cdot z + 2 \cdot z \cdot x \\
 & = x^2 + 9y^2 + z^2 - 6xy - 6yz + 2zx \\
 (5) \quad & 4x^2 + y^2 + 4z^2 - 4xy - 4yz + 8zx \\
 (6) \quad & x^2 + 25y^2 + 4z^2 - 10xy + 20yz - 4zx
 \end{aligned}$$

07-2

$$\begin{aligned}
 (1) \quad & (3a+b+c)(9a^2+b^2+c^2-3ab-bc-3ca) \\
 & = (3a+b+c)\{(3a)^2+b^2+c^2-3a \cdot b-b \cdot c-c \cdot \boxed{3a}\} \\
 & = \boxed{(3a)^3} + b^3 + c^3 - 3 \cdot 3a \cdot b \cdot c \\
 & = 27a^3 + b^3 + c^3 - 9abc \\
 (2) \quad & (x+y+2)(x^2+y^2-xy-2x-2y+4) \\
 & = (x+y+2)(x^2+y^2+4-xy-2y-2x) \\
 & = (x+y+2)(x^2+y^2+2^2-x \cdot y-y \cdot 2-2 \cdot x) \\
 & = x^3+y^3+\boxed{2^3}-3 \cdot x \cdot y \cdot 2 \\
 & = x^3+y^3+8-6xy \\
 & = x^3+y^3-\boxed{6xy}+8
 \end{aligned}$$

$$\begin{aligned}
(3) & (a-b+c)(a^2+b^2+c^2+ab+bc-ca) \\
&= (a-b+c)\{a^2+(-b)^2+c^2-a\cdot(-b) \\
&\quad -(-b)\cdot c-c\cdot a\} \\
&= a^3+(-b)^3+c^3-3\cdot a\cdot(-b)\cdot c \\
&= a^3-b^3+c^3+3abc \\
(4) & (2x+y-1)(4x^2+y^2-2xy+2x+y+1) \\
&= (2x+y-1)(4x^2+y^2+1-2xy+y+2x) \\
&= (2x)^3+y^3+(-1)^3-3\cdot 2x\cdot y\cdot(-1) \\
&= 8x^3+y^3-1+6xy \\
&= 8x^3+y^3+6xy-1 \\
(5) & (2x-3y+z)(4x^2+9y^2+z^2+6xy+3yz-2zx) \\
&= (2x)^3+(-3y)^3+z^3-3\cdot 2x\cdot(-3y)\cdot z \\
&= 8x^3-27y^3+z^3+18xyz
\end{aligned}$$

08-1 (1) $(x+y)(x+y-2)$

$$\begin{aligned}
&= t(\boxed{t}-2) \quad \leftarrow x+y=t \text{로 치환} \\
&= t^2-2t \\
&= (x+y)^2-2(x+y) \quad \leftarrow t=x+y \text{ 대입} \\
&= x^2+2xy+y^2-2x-\boxed{2y}
\end{aligned}$$

$$\begin{aligned}
(2) & (x+y-3)(x+y+3) \\
&= (t-3)(t+3) \quad \leftarrow x+y=t \text{로 치환} \\
&= t^2-9
\end{aligned}$$

$$\begin{aligned}
&= (x+y)^2-9 \quad \leftarrow t=x+y \text{ 대입} \\
&= x^2+2xy+y^2-9
\end{aligned}$$

$$\begin{aligned}
(3) & (x-y+1)(x-y-2) \\
&= (t+1)(t-2) \quad \leftarrow x-y=t \text{로 치환} \\
&= t^2-t-2 \\
&= (x-y)^2-(x-y)-2 \quad \leftarrow t=x-y \text{ 대입} \\
&= x^2-2xy+y^2-x+y-2
\end{aligned}$$

$$\begin{aligned}
(4) & (x-y+z)(x-y-z) \\
&= (t+z)(t-z) \quad \leftarrow x-y=t \text{로 치환} \\
&= t^2-z^2
\end{aligned}$$

$$\begin{aligned}
&= (x-y)^2-z^2 \quad \leftarrow t=x-y \text{ 대입} \\
&= x^2-2xy+y^2-z^2
\end{aligned}$$

$$\begin{aligned}
(5) & (x-y+2)(x+y+2) \\
&= \{(x+2)-y\}\{(x+2)+y\} \\
&= (t-y)(t+y) \quad \leftarrow x+2=t \text{로 치환} \\
&= t^2-y^2 \\
&= (x+2)^2-y^2 \quad \leftarrow t=x+2 \text{ 대입} \\
&= x^2+4x+4-y^2
\end{aligned}$$

$$\begin{aligned}
(6) & (-x+y+1)(x-y+3) \\
&= -(x-y-1)(x-y+3) \\
&= -(t-1)(t+3) \quad \leftarrow x-y=t \text{로 치환} \\
&= -t^2-2t+3 \\
&= -(x-y)^2-2(x-y)+3 \quad \leftarrow t=x-y \text{ 대입} \\
&= -x^2+2xy-y^2-2x+2y+3
\end{aligned}$$

$$\begin{aligned}
(7) & (x+y-z)(x-y+z) \\
&= \{x+(y-z)\}\{x-(y-z)\} \\
&= (x+t)(x-t) \quad \leftarrow y-z=t \text{로 치환} \\
&= x^2-t^2 \\
&= x^2-(y-z)^2 \quad \leftarrow t=y-z \text{ 대입} \\
&= x^2-(y^2-2yz+z^2) \\
&= x^2-y^2-z^2+2yz
\end{aligned}$$

08-2 (1) $(x^2+x-2)(x^2+x+1)$

$$\begin{aligned}
&= (t-2)(t+\boxed{1}) \quad \leftarrow x^2+x=t \text{로 치환} \\
&= t^2-t-2
\end{aligned}$$

$$\begin{aligned}
&= (x^2+x)^2-(x^2+x)-2 \quad \leftarrow t=x^2+x \text{ 대입} \\
&= x^4+2x^3+\boxed{x^2}-x^2-x-2 \\
&= x^4+2x^3-x-2
\end{aligned}$$

$$\begin{aligned}
(2) & (x^2+2x)(x^2+2x-3) \\
&= t(t-3) \quad \leftarrow x^2+2x=t \text{로 치환} \\
&= t^2-3t
\end{aligned}$$

$$\begin{aligned}
&= (x^2+2x)^2-3(x^2+2x) \quad \leftarrow t=x^2+2x \text{ 대입} \\
&= x^4+4x^3+4x^2-3x^2-6x \\
&= x^4+4x^3+x^2-6x
\end{aligned}$$

$$\begin{aligned}
(3) & (x^2-x+1)(x^2-x-3) \\
&= (t+1)(t-3) \quad \leftarrow x^2-x=t \text{로 치환} \\
&= t^2-2t-3
\end{aligned}$$

$$\begin{aligned}
&= (x^2-x)^2-2(x^2-x)-3 \quad \leftarrow t=x^2-x \text{ 대입} \\
&= x^4-2x^3+x^2-2x^2+2x-3 \\
&= x^4-2x^3-x^2+2x-3
\end{aligned}$$

$$\begin{aligned}
(4) & (x^2-x+2)(x^2+x+2) \\
&= \{(x^2+2)-x\}\{(x^2+2)+x\} \\
&= (t-x)(t+x) \quad \leftarrow x^2+2=t \text{로 치환} \\
&= t^2-x^2 \\
&= (x^2+2)^2-x^2 \quad \leftarrow t=x^2+2 \text{ 대입} \\
&= x^4+4x^2+4-x^2 \\
&= x^4+3x^2+4
\end{aligned}$$

08-3 (1) $(x-1)(x+2)(x-3)(x+4)$

$$\begin{aligned}
&= (x^2+x-2)(x^2+x-12) \\
&= (t-2)(t-12) \quad \leftarrow x^2+x=t \text{로 치환} \\
&= t^2-14t+24
\end{aligned}$$

$$\begin{aligned}
&= (x^2+x)^2-14(x^2+x)+24 \quad \leftarrow t=x^2+x \text{ 대입} \\
&= x^4+\boxed{2x^3}+x^2-14x^2-14x+24 \\
&= x^4+2x^3-\boxed{13x^2}-14x+24
\end{aligned}$$

$$\begin{aligned}
(2) & x(x+1)(x-2)(x+3) \\
&= (x^2+x)(x^2+x-6) \\
&= t(t-6) \quad \leftarrow x^2+x=t \text{로 치환} \\
&= t^2-6t
\end{aligned}$$

$$\begin{aligned}
&= (x^2+x)^2-6(x^2+x) \quad \leftarrow t=x^2+x \text{ 대입} \\
&= x^4+2x^3+x^2-6x^2-6x \\
&= x^4+2x^3-5x^2-6x
\end{aligned}$$

$$\begin{aligned}
(3) & (x+1)(x-3)(x+5)(x-7) \\
&= (x^2-2x-3)(x^2-2x-35) \\
&= (t-3)(t-35) \quad \leftarrow x^2-2x=t \text{로 치환} \\
&= t^2-38t+105 \\
&= (x^2-2x)^2-38(x^2-2x)+105 \quad \leftarrow t=x^2-2x \text{ 대입} \\
&= x^4-4x^3+4x^2-38x^2+76x+105 \\
&= x^4-4x^3-34x^2+76x+105 \\
(4) & (x-2)(x+4)(x-6)(x+8) \\
&= (x^2+2x-8)(x^2+2x-48) \\
&= (t-8)(t-48) \quad \leftarrow x^2+2x=t \text{로 치환} \\
&= t^2-56t+384 \\
&= (x^2+2x)^2-56(x^2+2x)+384 \quad \leftarrow t=x^2+2x \text{ 대입} \\
&= x^4+4x^3+4x^2-56x^2-112x+384 \\
&= x^4+4x^3-52x^2-112x+384
\end{aligned}$$

08-4 (1) $(x+1)(x+2)(x-3)(x-4)$

$$\begin{aligned}
&= \{(x+1)(x-3)\} \{(\boxed{x+2})(x-4)\} \\
&= (x^2-2x-3)(x^2-2x-8) \\
&= (t-3)(t-8) \quad \leftarrow x^2-2x=t \text{로 치환} \\
&= t^2-11t+24 \\
&= (x^2-2x)^2-11(x^2-2x)+24 \quad \leftarrow t=x^2-2x \text{ 대입} \\
&= x^4-4x^3+4x^2-11x^2+22x+24 \\
&= x^4-4x^3-\boxed{7x^2}+22x+24 \\
(2) & (x-1)(x+2)(x-2)(x-5) \\
&= \{(x-1)(x-2)\} \{(x+2)(x-5)\} \\
&= (x^2-3x+2)(x^2-3x-10) \\
&= (t+2)(t-10) \quad \leftarrow x^2-3x=t \text{로 치환} \\
&= t^2-8t-20 \\
&= (x^2-3x)^2-8(x^2-3x)-20 \quad \leftarrow t=x^2-3x \text{ 대입} \\
&= x^4-6x^3+9x^2-8x^2+24x-20 \\
&= x^4-6x^3+x^2+24x-20 \\
(3) & (x+2)(x+3)(x-3)(x-4) \\
&= \{(x+2)(x-3)\} \{(x+3)(x-4)\} \\
&= (x^2-x-6)(x^2-x-12) \\
&= (t-6)(t-12) \quad \leftarrow x^2-x=t \text{로 치환} \\
&= t^2-18t+72 \\
&= (x^2-x)^2-18(x^2-x)+72 \quad \leftarrow t=x^2-x \text{ 대입} \\
&= x^4-2x^3+x^2-18x^2+18x+72 \\
&= x^4-2x^3-17x^2+18x+72 \\
(4) & (x+1)(x+3)(x-3)(x-5) \\
&= \{(x+1)(x-3)\} \{(x+3)(x-5)\} \\
&= (x^2-2x-3)(x^2-2x-15) \\
&= (t-3)(t-15) \quad \leftarrow x^2-2x=t \text{로 치환} \\
&= t^2-18t+45 \\
&= (x^2-2x)^2-18(x^2-2x)+45 \quad \leftarrow t=x^2-2x \text{ 대입} \\
&= x^4-4x^3+4x^2-18x^2+36x+45 \\
&= x^4-4x^3-14x^2+36x+45
\end{aligned}$$

08-5 (1) $(x+1)(x+2)(x+3)(x+4)$

$$\begin{aligned}
&= \{(x+1)(\boxed{x+4})\} \{(x+2)(x+3)\} \\
&= (x^2+5x+4)(x^2+5x+6) \\
&= (t+4)(t+6) \quad \leftarrow x^2+5x=t \text{로 치환} \\
&= t^2+10t+24 \\
&= (x^2+5x)^2+10(x^2+5x)+24 \quad \leftarrow t=x^2+5x \text{ 대입} \\
&= x^4+10x^3+25x^2+10x^2+50x+24 \\
&= x^4+10x^3+35x^2+\boxed{50x}+24 \\
(2) & x(x+1)(x+2)(x+3) \\
&= \{x(x+3)\} \{(x+1)(x+2)\} \\
&= (x^2+3x)(x^2+3x+2) \\
&= t(t+2) \quad \leftarrow x^2+3x=t \text{로 치환} \\
&= t^2+2t \\
&= (x^2+3x)^2+2(x^2+3x) \quad \leftarrow t=x^2+3x \text{ 대입} \\
&= x^4+6x^3+9x^2+2x^2+6x \\
&= x^4+6x^3+11x^2+6x \\
(3) & x(x+2)(x+4)(x+6) \\
&= \{x(x+6)\} \{(x+2)(x+4)\} \\
&= (x^2+6x)(x^2+6x+8) \\
&= t(t+8) \quad \leftarrow x^2+6x=t \text{로 치환} \\
&= t^2+8t \\
&= (x^2+6x)^2+8(x^2+6x) \quad \leftarrow t=x^2+6x \text{ 대입} \\
&= x^4+12x^3+36x^2+8x^2+48x \\
&= x^4+12x^3+44x^2+48x \\
(4) & x(x-1)(x-2)(x-3) \\
&= \{x(x-3)\} \{(x-1)(x-2)\} \\
&= (x^2-3x)(x^2-3x+2) \\
&= t(t+2) \quad \leftarrow x^2-3x=t \text{로 치환} \\
&= t^2+2t \\
&= (x^2-3x)^2+2(x^2-3x) \quad \leftarrow t=x^2-3x \text{ 대입} \\
&= x^4-6x^3+9x^2+2x^2-6x \\
&= x^4-6x^3+11x^2-6x
\end{aligned}$$

09-1 (1) $a^2+b^2=(a+b)^2-\boxed{2ab}$

$$\begin{aligned}
&= 3^2-2 \cdot (-2)=13 \\
(a-b)^2 &= (a+b)^2-4ab \\
&= \boxed{3^2}-4 \cdot (-2)=17 \\
(2) & a^2+b^2=(a+b)^2-2ab \\
&= (-4)^2-2 \cdot 1=14 \\
(a-b)^2 &= (a+b)^2-4ab \\
&= (-4)^2-4 \cdot 1=12 \\
(3) & a^2+b^2=2^2-2 \cdot (-2)=8 \\
(a-b)^2 &= 2^2-4 \cdot (-2)=12 \\
(4) & a^2+b^2=1^2-2 \cdot (-6)=13 \\
(a-b)^2 &= 1^2-4 \cdot (-6)=25 \\
(5) & a^2+b^2=3^2-2 \cdot 2=5 \\
(a-b)^2 &= 3^2-4 \cdot 2=1
\end{aligned}$$

09-2 (1) $a^2+b^2=(a-b)^2+2ab$
 $=2^2+2\cdot(\boxed{-1})=2$
 $(a+b)^2=(\boxed{a-b})^2+4ab$
 $=2^2+4\cdot(-1)=0$

(2) $a^2+b^2=(a-b)^2+2ab$
 $=1^2+2\cdot6=13$
 $(a+b)^2=(a-b)^2+4ab$
 $=1^2+4\cdot6=25$
(3) $a^2+b^2=(-4)^2+2\cdot(-3)=10$
 $(a+b)^2=(-4)^2+4\cdot(-3)=4$
(4) $a^2+b^2=1^2+2\cdot2=5$
 $(a+b)^2=1^2+4\cdot2=9$
(5) $a^2+b^2=2^2+2\cdot2=8$
 $(a+b)^2=2^2+4\cdot2=12$

10-1 (1) $a^3+b^3=(a+b)^3-3ab(a+b)$
 $=3^3-3\cdot1\cdot\boxed{3}=\boxed{18}$
(2) $a^3+b^3=(a+b)^3-3\cdot\boxed{ab}\cdot(a+b)$
 $=4^3-3\cdot3\cdot4=\boxed{28}$
(3) $a^3+b^3=(a+b)^3-3ab(a+b)$
 $=2^3-3\cdot(-2)\cdot2=20$
(4) $a+b=4, ab=2\circ\text{므로}$
 $a^3+b^3=4^3-3\cdot2\cdot4=40$
(5) $a+b=2\sqrt{2}, ab=1\circ\text{므로}$
 $a^3+b^3=(2\sqrt{2})^3-3\cdot1\cdot2\sqrt{2}=10\sqrt{2}$
(6) $a+b=2, ab=-11\circ\text{므로}$
 $a^3+b^3=2^3-3\cdot(-11)\cdot2=74$

10-2 (1) $a^3-b^3=(a-b)^3+3ab(a-b)$
 $=2^3+\boxed{3}\cdot4\cdot2=32$
(2) $a^3-b^3=(a-b)^3+3ab(a-b)$
 $=(\boxed{3})^3+3\cdot(-1)\cdot3=\boxed{18}$
(3) $a^3-b^3=(a-b)^3+3ab(a-b)$
 $=1^3+3\cdot3\cdot1=10$
(4) $a-b=2, ab=2\circ\text{므로}$
 $a^3-b^3=2^3+3\cdot2\cdot2=20$
(5) $a-b=2\sqrt{5}, ab=-4\circ\text{므로}$
 $a^3-b^3=(2\sqrt{5})^3+3\cdot(-4)\cdot2\sqrt{5}=16\sqrt{5}$
(6) $a-b=4, ab=-1\circ\text{므로}$
 $a^3-b^3=4^3+3\cdot(-1)\cdot4=52$

10-3 (1) $x^2+y^2=(x+y)^2-\boxed{2xy}\circ\text{에서}$
 $6=2^2-2xy \quad \therefore xy=-1$
 $\therefore x^3+y^3=2^3-3\cdot(-1)\cdot2=\boxed{14}$
(2) $x^2+y^2=(\boxed{x+y})^2-2xy\circ\text{에서}$
 $5=(-3)^2-2xy \quad \therefore xy=2$
 $\therefore x^3+y^3=(-3)^3-3\cdot2\cdot(-3)=\boxed{-9}$

(3) $25=1^2-2xy \quad \therefore xy=-12$
 $\therefore x^3+y^3=1^3-3\cdot(-12)\cdot1=37$
(4) $8=(-2)^2-2xy \quad \therefore xy=-2$
 $\therefore x^3+y^3=(-2)^3-3\cdot(-2)\cdot(-2)=-20$
(5) $7=1^2-2xy \quad \therefore xy=-3$
 $\therefore x^3+y^3=1^3-3\cdot(-3)\cdot1=10$

10-4 (1) $x^2+y^2=(x-y)^2+\boxed{2xy}\circ\text{에서}$
 $5=1^2+2xy \quad \therefore xy=2$
 $\therefore x^3-y^3=1^3+3\cdot2\cdot1=\boxed{7}$
(2) $x^2+y^2=(\boxed{x-y})^2+2xy\circ\text{에서}$
 $20=(-4)^2+2xy \quad \therefore xy=2$
 $\therefore x^3-y^3=(-4)^3+3\cdot2\cdot(-4)=\boxed{-88}$
(3) $7=3^2+2xy \quad \therefore xy=-1$
 $\therefore x^3-y^3=3^3+3\cdot(-1)\cdot3=18$
(4) $6=(-2)^2+2xy \quad \therefore xy=1$
 $\therefore x^3-y^3=(-2)^3+3\cdot1\cdot(-2)=-14$
(5) $9=(-1)^2+2xy \quad \therefore xy=4$
 $\therefore x^3-y^3=(-1)^3+3\cdot4\cdot(-1)=-13$

11-1 (1) $a^2+\frac{1}{a^2}=\left(a+\frac{1}{a}\right)^2-\boxed{2}=3^2-2=7$
(2) $a^2+\frac{1}{a^2}=\left(a-\frac{1}{a}\right)^2+2=2^2+2=\boxed{6}$
(3) $a^2+\frac{1}{a^2}=\left(a+\frac{1}{a}\right)^2-2=(-2)^2-2=2$
(4) $a^2+\frac{1}{a^2}=\left(a+\frac{1}{a}\right)^2-2=(-4)^2-2=14$
(5) $a^2+\frac{1}{a^2}=\left(a-\frac{1}{a}\right)^2+2=(-5)^2+2=27$

11-2 (1) $\left(a+\frac{1}{a}\right)^2=\left(a-\frac{1}{a}\right)^2+\boxed{4}=5^2+4=\boxed{29}$
(2) $\left(a+\frac{1}{a}\right)^2=\left(a-\frac{1}{a}\right)^2+4=(-1)^2+4=5$
(3) $\left(a+\frac{1}{a}\right)^2=\left(a-\frac{1}{a}\right)^2+4=(-4)^2+4=20$
(4) $\left(a+\frac{1}{a}\right)^2=(-2)^2+4=8$
(5) $\left(a+\frac{1}{a}\right)^2=3^2+4=13$
(6) $\left(a+\frac{1}{a}\right)^2=6^2+4=40$

11-3 (1) $\left(a-\frac{1}{a}\right)^2=\left(a+\frac{1}{a}\right)^2-\boxed{4}=2^2-4=0$
(2) $\left(a-\frac{1}{a}\right)^2=\left(a+\frac{1}{a}\right)^2-4=(-3)^2-4=\boxed{5}$
(3) $\left(a-\frac{1}{a}\right)^2=\left(a+\frac{1}{a}\right)^2-4=6^2-4=32$
(4) $\left(a-\frac{1}{a}\right)^2=(-5)^2-4=21$

$$(5) \left(a - \frac{1}{a}\right)^2 = 4^2 - 4 = 12$$

$$(6) \left(a - \frac{1}{a}\right)^2 = 7^2 - 4 = 45$$

$$\mathbf{12-1} \quad (1) a^3 + \frac{1}{a^3} = \left(a + \frac{1}{a}\right)^3 - 3\left(a + \frac{1}{a}\right) \\ = 2^3 - 3 \cdot 2 = 2$$

$$(2) a^3 + \frac{1}{a^3} = \left(a + \frac{1}{a}\right)^3 - 3\left(a + \frac{1}{a}\right) \\ = (-3)^3 - 3 \cdot (-3) = \boxed{-18}$$

$$(3) a^3 + \frac{1}{a^3} = \left(a + \frac{1}{a}\right)^3 - 3\left(a + \frac{1}{a}\right) \\ = (-4)^3 - 3 \cdot (-4) = -52$$

$$(4) a^3 + \frac{1}{a^3} = 1^3 - 3 \cdot 1 = -2$$

$$(5) a^3 + \frac{1}{a^3} = 5^3 - 3 \cdot 5 = 110$$

$$\mathbf{12-2} \quad (1) a^3 - \frac{1}{a^3} = \left(a - \frac{1}{a}\right)^3 + \boxed{3} \cdot \left(a - \frac{1}{a}\right) \\ = 1^3 + 3 \cdot 1 = 4$$

$$(2) a^3 - \frac{1}{a^3} = \left(a - \frac{1}{a}\right)^3 + 3\left(a - \frac{1}{a}\right) \\ = (-4)^3 + 3 \cdot (-4) = \boxed{-76}$$

$$(3) a^3 - \frac{1}{a^3} = \left(a - \frac{1}{a}\right)^3 + 3\left(a - \frac{1}{a}\right) \\ = (-3)^3 + 3 \cdot (-3) = -36$$

$$(4) a^3 - \frac{1}{a^3} = 2^3 + 3 \cdot 2 = 14$$

$$(5) a^3 - \frac{1}{a^3} = (-5)^3 + 3 \cdot (-5) = -140$$

$$\mathbf{12-3} \quad (1) \left(a + \frac{1}{a}\right)^2 = a^2 + \frac{1}{a^2} + \boxed{2} = 9 \text{에서}$$

$$a + \frac{1}{a} = \boxed{3} \quad (\because a > 0) \\ \therefore a^3 + \frac{1}{a^3} = \left(a + \frac{1}{a}\right)^3 - 3\left(a + \frac{1}{a}\right) = 3^3 - 3 \cdot 3 = \boxed{18}$$

$$(2) \left(a + \frac{1}{a}\right)^2 = a^2 + \frac{1}{a^2} + 2 = 4 \text{에서}$$

$$a + \frac{1}{a} = 2 \quad (\because a > 0) \\ \therefore a^3 + \frac{1}{a^3} = 2^3 - 3 \cdot 2 = 2$$

$$(3) \left(a + \frac{1}{a}\right)^2 = a^2 + \frac{1}{a^2} + 2 = 16 \text{에서}$$

$$a + \frac{1}{a} = 4 \quad (\because a > 0) \\ \therefore a^3 + \frac{1}{a^3} = 4^3 - 3 \cdot 4 = 52$$

$$(4) \left(a + \frac{1}{a}\right)^2 = a^2 + \frac{1}{a^2} + 2 = 25 \text{에서}$$

$$a + \frac{1}{a} = 5 \quad (\because a > 0) \\ \therefore a^3 + \frac{1}{a^3} = 5^3 - 3 \cdot 5 = 110$$

$$\mathbf{12-4} \quad (1) \left(a - \frac{1}{a}\right)^2 = a^2 + \frac{1}{a^2} - 2 = 9 \text{에서}$$

$$a - \frac{1}{a} = \boxed{-3} \quad (\because 0 < a < 1 \text{이면 } a < \frac{1}{a}) \\ \therefore a^3 - \frac{1}{a^3} = \left(a - \frac{1}{a}\right)^3 + 3\left(a - \frac{1}{a}\right) \\ = (-3)^3 + 3 \cdot (-3) = -36$$

$$(2) \left(a - \frac{1}{a}\right)^2 = a^2 + \frac{1}{a^2} - 2 = 4 \text{에서}$$

$$a - \frac{1}{a} = -2 \quad (\because 0 < a < 1) \\ \therefore a^3 - \frac{1}{a^3} = (-2)^3 + 3 \cdot (-2) = -14$$

$$(3) \left(a - \frac{1}{a}\right)^2 = a^2 + \frac{1}{a^2} - 2 = 16 \text{에서}$$

$$a - \frac{1}{a} = -4 \quad (\because 0 < a < 1) \\ \therefore a^3 - \frac{1}{a^3} = (-4)^3 + 3 \cdot (-4) = -76$$

$$(4) \left(a - \frac{1}{a}\right)^2 = a^2 + \frac{1}{a^2} - 2 = 25 \text{에서}$$

$$a - \frac{1}{a} = -5 \quad (\because 0 < a < 1) \\ \therefore a^3 - \frac{1}{a^3} = (-5)^3 + 3 \cdot (-5) = -140$$

$$\mathbf{12-5} \quad (1) x \neq 0 \text{이므로 } x^2 - 4x + 1 = 0 \text{의 양변을 } x \text{로 나누면}$$

$$x - 4 + \frac{1}{x} = 0 \quad \therefore x + \frac{1}{x} = \boxed{4}$$

$$\therefore x^2 + \frac{1}{x^2} = \left(x + \frac{1}{x}\right)^2 - 2 \\ = 4^2 - 2 = 14$$

$$x^3 + \frac{1}{x^3} = \left(x + \frac{1}{x}\right)^3 - 3\left(x + \frac{1}{x}\right) \\ = 4^3 - 3 \cdot 4 = \boxed{52}$$

$$(2) x \neq 0 \text{이므로 } x^2 - 5x + 1 = 0 \text{의 양변을 } x \text{로 나누면}$$

$$x - 5 + \frac{1}{x} = 0 \quad \therefore x + \frac{1}{x} = 5$$

$$\therefore x^2 + \frac{1}{x^2} = 5^2 - 2 = 23$$

$$x^3 + \frac{1}{x^3} = 5^3 - 3 \cdot 5 = 110$$

$$(3) x \neq 0 \text{이므로 } x^2 + 3x + 1 = 0 \text{의 양변을 } x \text{로 나누면}$$

$$x + 3 + \frac{1}{x} = 0 \quad \therefore x + \frac{1}{x} = -3$$

$$\therefore x^2 + \frac{1}{x^2} = (-3)^2 - 2 = 7$$

$$x^3 + \frac{1}{x^3} = (-3)^3 - 3 \cdot (-3) = -18$$

$$(4) x \neq 0 \text{이므로 } x^2 + 4x + 1 = 0 \text{의 양변을 } x \text{로 나누면}$$

$$x + 4 + \frac{1}{x} = 0 \quad \therefore x + \frac{1}{x} = -4$$

$$\therefore x^2 + \frac{1}{x^2} = (-4)^2 - 2 = 14$$

$$x^3 + \frac{1}{x^3} = (-4)^3 - 3 \cdot (-4) = -52$$

12-6 (1) $x \neq 0$ 이므로 $x^2 + x - 1 = 0$ 의 양변을 x 로 나누면

$$x + 1 - \frac{1}{x} = 0 \quad \therefore x - \frac{1}{x} = \boxed{-1}$$

$$\therefore x^2 + \frac{1}{x^2} = \left(x - \frac{1}{x}\right)^2 + 2 \\ = (-1)^2 + 2 = \boxed{3}$$

$$x^3 - \frac{1}{x^3} = \left(x - \frac{1}{x}\right)^3 + 3\left(x - \frac{1}{x}\right) \\ = (-1)^3 + 3 \cdot (-1) = -4$$

(2) $x \neq 0$ 이므로 $x^2 - 2x - 1 = 0$ 의 양변을 x 로 나누면

$$x - 2 - \frac{1}{x} = 0 \quad \therefore x - \frac{1}{x} = 2$$

$$\therefore x^2 + \frac{1}{x^2} = 2^2 + 2 = 6$$

$$x^3 - \frac{1}{x^3} = 2^3 + 3 \cdot 2 = 14$$

(3) $x \neq 0$ 이므로 $x^2 + 5x - 1 = 0$ 의 양변을 x 로 나누면

$$x + 5 - \frac{1}{x} = 0 \quad \therefore x - \frac{1}{x} = -5$$

$$\therefore x^2 + \frac{1}{x^2} = (-5)^2 + 2 = 27$$

$$x^3 - \frac{1}{x^3} = (-5)^3 + 3 \cdot (-5) = -140$$

(4) $x \neq 0$ 이므로 $x^2 + 3x - 1 = 0$ 의 양변을 x 로 나누면

$$x + 3 - \frac{1}{x} = 0 \quad \therefore x - \frac{1}{x} = -3$$

$$\therefore x^2 + \frac{1}{x^2} = (-3)^2 + 2 = 11$$

$$x^3 - \frac{1}{x^3} = (-3)^3 + 3 \cdot (-3) = -36$$

13-1 (1) $a^2 + b^2 + c^2 = (\boxed{a+b+c})^2 - 2(ab+bc+ca)$

$$= 1^2 - 2 \cdot (-3) = \boxed{7}$$

(2) $a^2 + b^2 + c^2 = (a+b+c)^2 - 2(ab+bc+ca)$

$$= (-1)^2 - 2 \cdot (-2) = 5$$

(3) $a^2 + b^2 + c^2 = (a+b+c)^2 - 2(ab+bc+ca)$

$$= 2^2 - 2 \cdot (-4) = 12$$

(4) $a^2 + b^2 + c^2 = 4^2 - 2 \cdot 2 = 12$

(5) $a^2 + b^2 + c^2 = 3^2 - 2 \cdot 1 = 7$

13-2 (1) $a^2 + b^2 + c^2 = (a+b+c)^2 - 2(\boxed{ab+bc+ca})$ 에서

$$6 = 2^2 - 2(ab+bc+ca)$$

$$\therefore ab+bc+ca = \boxed{-1}$$

(2) $a^2 + b^2 + c^2 = (a+b+c)^2 - 2(ab+bc+ca)$ 에서

$$11 = 5^2 - 2(ab+bc+ca)$$

$$\therefore ab+bc+ca = 7$$

(3) $a^2 + b^2 + c^2 = (a+b+c)^2 - 2(ab+bc+ca)$ 에서

$$2 = 4^2 - 2(ab+bc+ca)$$

$$\therefore ab+bc+ca = 7$$

(4) $5 = 3^2 - 2(ab+bc+ca)$

$$\therefore ab+bc+ca = 2$$

(5) $9 = (-1)^2 - 2(ab+bc+ca)$

$$\therefore ab+bc+ca = -4$$

13-3 (1) $a^2 + b^2 + c^2 = (a+b+c)^2 - 2(ab+bc+ca)$

$$= 3^2 - 2 \cdot 2 = \boxed{5}$$

이므로

$$a^3 + b^3 + c^3$$

$$= (a+b+c)(a^2+b^2+c^2-ab-bc-ca) + 3abc$$

$$= 3(\boxed{5} - 2) + 3 \cdot (-2) = \boxed{3}$$

(2) $a^2 + b^2 + c^2 = 2^2 - 2 \cdot (-1) = 6$ 이므로

$$a^3 + b^3 + c^3$$

$$= (a+b+c)(a^2+b^2+c^2-ab-bc-ca) + 3abc$$

$$= 2\{6 - (-1)\} + 3 \cdot (-6) = -4$$

(3) $a^2 + b^2 + c^2 = (a+b+c)^2 - 2(ab+bc+ca)$ 에서

$$8 = 4^2 - 2(ab+bc+ca) \quad \therefore ab+bc+ca = 4$$

$$\therefore a^3 + b^3 + c^3$$

$$= (a+b+c)(a^2+b^2+c^2-ab-bc-ca) + 3abc$$

$$= 4(8 - 4) + 3 \cdot 4 = 28$$

(4) $7 = 1^2 - 2(ab+bc+ca)$ 에서

$$ab+bc+ca = -3$$

$$\therefore a^3 + b^3 + c^3$$

$$= (a+b+c)(a^2+b^2+c^2-ab-bc-ca) + 3abc$$

$$= 1\{7 - (-3)\} + 3 \cdot (-3) = 1$$

14-1 (1) $100 = a$ 로 놓으면

$$101^2 = (a+1)^2 = a^2 + \boxed{2}a + 1$$

$$= 100^2 + 200 + 1 = \boxed{10201}$$

(2) $26 = a$ 로 놓으면

$$27 \times 25 - 26^2 = (a+1)(a-1) - a^2$$

$$= a^2 - 1 - a^2 = -1$$

(3) $100 = a$ 로 놓으면

$$101 \times (10000 - 100 + 1) = (a+1)(a^2 - a + 1)$$

$$= a^3 + 1$$

$$= 100^3 + 1 = 1000001$$

(4) $100 = a$ 로 놓으면

$$99 \times (10000 + 100 + 1) = (a-1)(a^2 + a + 1)$$

$$= a^3 - 1$$

$$= 100^3 - 1 = 999999$$

14-2 (1) 주어진 식에 $(2-1) = 1$ 을 곱하면

$$(2-1)(2+1)(2^2+1)(2^4+1)$$

$$= (2^2-1)(2^2+1)(2^4+1)$$

$$= (\boxed{2^4}-1)(2^4+1)$$

$$= \boxed{2^8}-1 = \boxed{255}$$

(2) 주어진 식에 $\frac{1}{2}(3-1) = 1$ 을 곱하면

$$\frac{1}{2}(3-1)(3+1)(3^2+1)(3^4+1)$$

$$= \frac{1}{2}(3^2-1)(3^2+1)(3^4+1)$$

$$= \frac{1}{2}(3^4-1)(3^4+1) = \frac{3^8-1}{2}$$

(3) 주어진 식에 $-\frac{1}{4}(1-5)=1$ 을 곱하면

$$\begin{aligned} & -\frac{1}{4}(1-5)(1+5)(1+5^2)(1+5^4)(1+5^8) \\ & = -\frac{1}{4}(1-5^2)(1+5^2)(1+5^4)(1+5^8) \\ & = -\frac{1}{4}(1-5^4)(1+5^4)(1+5^8) \\ & = -\frac{1}{4}(1-5^8)(1+5^8) \\ & = -\frac{1-5^{16}}{4} = \frac{5^{16}-1}{4} \end{aligned}$$

(4) 주어진 식에 $-\frac{1}{3}(1-4)=1$ 을 곱하면

$$\begin{aligned} & -\frac{1}{3}(1-4)(1+4)(1+4^2)(1+4^4)(1+4^8) \\ & = -\frac{1}{3}(1-4^2)(1+4^2)(1+4^4)(1+4^8) \\ & = -\frac{1}{3}(1-4^4)(1+4^4)(1+4^8) \\ & = -\frac{1}{3}(1-4^8)(1+4^8) \\ & = -\frac{1-4^{16}}{3} = \frac{4^{16}-1}{3} = \frac{2^{32}-1}{3} \end{aligned}$$

STEP 2

42쪽~47쪽

1-1 (1) $9x^2+6x+1$

(2) $x^2-4xy+4y^2$

(3) x^2-4

(4) x^2-25y^2

(5) $(x-7)(x+3)=x^2+(3-7)x-21$

$$=x^2-4x-21$$

(6) $(x+4y)(x-5y)=x^2+(-5+4)xy-20y^2$

$$=x^2-xy-20y^2$$

(7) $(3x+5y)(2x+y)=6x^2+(3+10)xy+5y^2$

$$=6x^2+13xy+5y^2$$

(8) $(2x-3y)(3x+5y)=6x^2+(10-9)xy-15y^2$

$$=6x^2+xy-15y^2$$

1-2 (1) $x^2+xy+\frac{1}{4}y^2$

(2) $9x^2-12xy+4y^2$

(3) $16x^2-y^2$

(4) $-x^2+9y^2$

(5) $(x-2)(x+5)=x^2+(5-2)x-10$

$$=x^2+3x-10$$

(6) $(x-3y)(x-2y)=x^2+(-2-3)xy+6y^2$

$$=x^2-5xy+6y^2$$

(7) $(3x-2y)(2x+5y)=6x^2+(15-4)xy-10y^2$

$$=6x^2+11xy-10y^2$$

$$\begin{aligned} (8) \quad (4x+3y)(2x-3y) &= 8x^2+(-12+6)xy-9y^2 \\ &= 8x^2-6xy-9y^2 \end{aligned}$$

2-1 (1) $a^2+b^2=(a+b)^2-2ab=6^2-2\cdot 4=28$

$$(a-b)^2=(a+b)^2-4ab=6^2-4\cdot 4=20$$

(2) $a^2+b^2=(-2)^2-2\cdot 1=2$

$$(a-b)^2=(-2)^2-4\cdot 1=0$$

(3) $a^2+b^2=(a-b)^2+2ab$

$$=(-2)^2+2\cdot 4=12$$

$$(a+b)^2=(a-b)^2+4ab$$

$$=(-2)^2+4\cdot 4=20$$

(4) $a^2+b^2=1^2+2\cdot 3=7$

$$(a+b)^2=1^2+4\cdot 3=13$$

(5) $a^2+\frac{1}{a^2}=\left(a+\frac{1}{a}\right)^2-2=(-6)^2-2=34$

$$\left(a-\frac{1}{a}\right)^2=\left(a+\frac{1}{a}\right)^2-4=(-6)^2-4=32$$

(6) $a^2+\frac{1}{a^2}=\left(a-\frac{1}{a}\right)^2+2=4^2+2=18$

$$\left(a+\frac{1}{a}\right)^2=\left(a-\frac{1}{a}\right)^2+4=4^2+4=20$$

2-2 (1) $a^2+b^2=5^2-2\cdot(-1)=27$

$$(a-b)^2=5^2-4\cdot(-1)=29$$

(2) $a^2+b^2=4^2-2\cdot 3=10$

$$(a-b)^2=4^2-4\cdot 3=4$$

(3) $a^2+b^2=(-3)^2+2\cdot 4=17$

$$(a+b)^2=(-3)^2+4\cdot 4=25$$

(4) $a^2+b^2=5^2+2\cdot(-3)=19$

$$(a+b)^2=5^2+4\cdot(-3)=13$$

(5) $a^2+\frac{1}{a^2}=5^2-2=23$

$$\left(a-\frac{1}{a}\right)^2=5^2-4=21$$

(6) $a^2+\frac{1}{a^2}=(-2)^2+2=6$

$$\left(a+\frac{1}{a}\right)^2=(-2)^2+4=8$$

3-1 (1) $-x^2-2x^2=-3x^2$ 이므로 x^2 의 계수는 -3

(2) $x^2+2x^2=3x^2$ 이므로 x^2 의 계수는 3

(3) $-4x^2-3x^2=-7x^2$ 이므로 x^2 의 계수는 -7

(4) $(x^2+3x-1)^2=(x^2+3x-1)(x^2+3x-1)$ 에서 $-x^2+9x^2-x^2=7x^2$ 이므로 x^2 의 계수는 7

3-2 (1) $-xy-3xy=-4xy$ 이므로 xy 의 계수는 -4

(2) $-xy+12xy=11xy$ 이므로 xy 의 계수는 11

(3) $-6xy-xy=-7xy$ 이므로 xy 의 계수는 -7

(4) $(2x-3y+4)^2=(2x-3y+4)(2x-3y+4)$ 에서 $-6xy-6xy=-12xy$ 이므로 xy 의 계수는 -12

4-1 (1) $27x^3 + 27x^2 + 9x + 1$

(2) $8x^3 + 6x^2y + \frac{3}{2}xy^2 + \frac{1}{8}y^3$

(3) $x^3 - 9x^2 + 27x - 27$

(4) $64x^3 - 48x^2y + 12xy^2 - y^3$

4-2 (1) $x^3 + 15x^2 + 75x + 125$

(2) $8x^3 + 60x^2y + 150xy^2 + 125y^3$

(3) $27x^3 - 9x^2 + x - \frac{1}{27}$

(4) $27x^3 - 54x^2y + 36xy^2 - 8y^3$

5-1 (1) $(x+3)(x^2-3x+9)=x^3+3^3$

$=x^3+27$

(2) $(x+4y)(x^2-4xy+16y^2)=x^3+(4y)^3$

$=x^3+64y^3$

(3) $(x-1)(x^2+x+1)=x^3-1^3$

$=x^3-1$

(4) $(4x-y)(16x^2+4xy+y^2)=(4x)^3-y^3$

$=64x^3-y^3$

(5) $x^2+25y^2+z^2+10xy+10yz+2zx$

(6) $(3x-2y+2)^2$

$=9x^2+4y^2+4-12xy-8y+12x$

$=9x^2+4y^2-12xy+12x-8y+4$

(7) $(x+y+3)(x^2+y^2-xy-3x-3y+9)$

$=(x+y+3)(x^2+y^2+3^2-xy-3y-3x)$

$=x^3+y^3+3^3-3 \cdot x \cdot y \cdot 3$

$=x^3+y^3-9xy+27$

5-2 (1) $(5x+y)(25x^2-5xy+y^2)=(5x)^3+y^3$

$=125x^3+y^3$

(2) $(3x+2y)(9x^2-6xy+4y^2)=(3x)^3+(2y)^3$

$=27x^3+8y^3$

(3) $(x-2y)(x^2+2xy+4y^2)=x^3-(2y)^3$

$=x^3-8y^3$

(4) $(3x-4y)(9x^2+12xy+16y^2)=(3x)^3-(4y)^3$

$=27x^3-64y^3$

(5) $9x^2+y^2+z^2+6xy-2yz-6zx$

(6) $(2x+y-3)^2$

$=4x^2+y^2+9+4xy-6y-12x$

$=4x^2+y^2+4xy-12x-6y+9$

(7) $(x-y-2)(x^2+y^2+xy+2x-2y+4)$

$=(x-y-2)(x^2+y^2+4+xy+2x-2y)$

$=x^3-y^3-8-6xy$

$=x^3-y^3-6xy-8$

6-1 (1) $(x^2-2x)(x^2-2x+4)$

$=t(t+4)$

← $x^2-2x=t$ 로 치환

$=t^2+4t$

$=(x^2-2x)^2+4(x^2-2x)$ ← $t=x^2-2x$ 대입

$=x^4-4x^3+4x^2+4x^2-8x$

$=x^4-4x^3+8x^2-8x$

(2) $(x-y+4)(x+y+4)$

$=\{(x+4)-y\}\{(x+4)+y\}$

$=(t-y)(t+y)$ ← $x+4=t$ 로 치환

$=t^2-y^2$

$=(x+4)^2-y^2$ ← $t=x+4$ 대입

$=x^2+8x-y^2+16$

(3) $x(x+2)(x-2)(x+4)$

$=(x^2+2x)(x^2+2x-8)$

$=t(t-8)$

← $x^2+2x=t$ 로 치환

$=t^2-8t$

$=(x^2+2x)^2-8(x^2+2x)$ ← $t=x^2+2x$ 대입

$=x^4+4x^3+4x^2-8x^2-16x$

$=x^4+4x^3-4x^2-16x$

(4) $(x-1)(x-3)(x+5)(x+7)$

$=\{(x-1)(x+5)\}\{(x-3)(x+7)\}$

$=(x^2+4x-5)(x^2+4x-21)$

$=(t-5)(t-21)$

← $x^2+4x=t$ 로 치환

$=t^2-26t+105$

$=(x^2+4x)^2-26(x^2+4x)+105$ ← $t=x^2+4x$ 대입

$=x^4+8x^3+16x^2-26x^2-104x+105$

$=x^4+8x^3-10x^2-104x+105$

6-2 (1) $(2x^2-x+3)(2x^2-x+5)$

$=(t+3)(t+5)$

← $2x^2-x=t$ 로 치환

$=t^2+8t+15$

$=(2x^2-x)^2+8(2x^2-x)+15$ ← $t=2x^2-x$ 대입

$=4x^4-4x^3+x^2+16x^2-8x+15$

$=4x^4-4x^3+17x^2-8x+15$

(2) $(-x-y+2)(x+y+2)$

$=-(x+y-2)(x+y+2)$

$=(t-2)(t+2)$ ← $x+y=t$ 로 치환

$=(t^2-4)=-t^2+4$

$=(x+y)^2+4$ ← $t=x+y$ 대입

$=-x^2-2xy-y^2+4$

(3) $(x+1)(x-2)(x+2)(x-3)$

$=(x^2-x-2)(x^2-x-6)$

$=(t-2)(t-6)$ ← $x^2-x=t$ 로 치환

$=t^2-8t+12$

$=(x^2-x)^2-8(x^2-x)+12$ ← $t=x^2-x$ 대입

$=x^4-2x^3+x^2-8x^2+8x+12$

$=x^4-2x^3-7x^2+8x+12$

$$\begin{aligned}
(4) & (x-1)(x-2)(x+5)(x+6) \\
&= \{(x-1)(x+5)\} \{(x-2)(x+6)\} \\
&= (x^2+4x-5)(x^2+4x-12) \\
&= (t-5)(t-12) \quad \leftarrow x^2+4x=t \text{로 치환} \\
&= t^2-17t+60 \\
&= (x^2+4x)^2-17(x^2+4x)+60 \quad \leftarrow t=x^2+4x \text{ 대입} \\
&= x^4+8x^3+16x^2-17x^2-68x+60 \\
&= x^4+8x^3-x^2-68x+60
\end{aligned}$$

7-1 (1) $a^2+b^2=(a+b)^2-2ab$ 에서

$$5=(-1)^2-2ab \quad \therefore ab=-2$$

(2) $(a-b)^2=(a+b)^2-4ab=(-1)^2-4 \cdot (-2)=9$

$$\therefore a-b=3 \quad (\because a>b)$$

(3) $a^3-b^3=(a-b)^3+3ab(a-b)$
 $=3^3+3 \cdot (-2) \cdot 3=9$

(4) $a^4-b^4=(a^2+b^2)(a^2-b^2)$
 $=(a^2+b^2)(a+b)(a-b)$
 $=5 \cdot (-1) \cdot 3=-15$

7-2 (1) $a^2+b^2=(a-b)^2+2ab$ 에서

$$10=2^2+2ab \quad \therefore ab=3$$

(2) $(a+b)^2=(a-b)^2+4ab=2^2+4 \cdot 3=16$

$$\therefore a+b=4 \quad (\because a+b>0)$$

(3) $a^3+b^3=(a+b)^3-3ab(a+b)$
 $=4^3-3 \cdot 3 \cdot 4=28$

(4) $a^4-b^4=(a^2+b^2)(a^2-b^2)$
 $=(a^2+b^2)(a+b)(a-b)$
 $=10 \cdot 4 \cdot 2=80$

8-1 (1) $x^2+\frac{1}{x^2}=\left(x+\frac{1}{x}\right)^2-2=4^2-2=14$

(2) $\left(x-\frac{1}{x}\right)^2=\left(x+\frac{1}{x}\right)^2-4=4^2-4=12$

(3) $x^3+\frac{1}{x^3}=\left(x+\frac{1}{x}\right)^3-3\left(x+\frac{1}{x}\right)=4^3-3 \cdot 4=52$

8-2 $x \neq 0$ 이므로 $x^2+2x-1=0$ 의 양변을 x 로 나누면

$$x+2-\frac{1}{x}=0 \quad \therefore x-\frac{1}{x}=-2$$

(1) $x^2+\frac{1}{x^2}=\left(x-\frac{1}{x}\right)^2+2=(-2)^2+2=6$

(2) $\left(x+\frac{1}{x}\right)^2=\left(x-\frac{1}{x}\right)^2+4=(-2)^2+4=8$

(3) $x^3-\frac{1}{x^3}=\left(x-\frac{1}{x}\right)^3+3\left(x-\frac{1}{x}\right)$
 $=(-2)^3+3 \cdot (-2)=-14$

9-1 (1) $a^2+b^2+c^2=(a+b+c)^2-2(ab+bc+ca)$
 $=2^2-2 \cdot (-9)=22$

(2) $a^3+b^3+c^3$
 $=(a+b+c)(a^2+b^2+c^2-ab-bc-ca)+3abc$
 $=2\{22-(-9)\}+3 \cdot (-18)=8$

9-2 (1) $a^2+b^2+c^2=(a+b+c)^2-2(ab+bc+ca)$ 에서

$$14=2^2-2(ab+bc+ca)$$

$$\therefore ab+bc+ca=-5$$

(2) $a^3+b^3+c^3$
 $=(a+b+c)(a^2+b^2+c^2-ab-bc-ca)+3abc$
 $=2\{14-(-5)\}+3 \cdot (-6)=20$

10-1 (1) $200=a$ 로 놓으면

$$199 \times 201=(a-1)(a+1)=a^2-1$$

$$=200^2-1=39999$$

(2) 주어진 식에 $(2-1)=1$ 을 곱하면

$$\begin{aligned}
& (2-1)(2+1)(2^2+1)(2^4+1)(2^8+1)(2^{16}+1) \\
&= (2^2-1)(2^2+1)(2^4+1)(2^8+1)(2^{16}+1) \\
&= (2^4-1)(2^4+1)(2^8+1)(2^{16}+1) \\
&= (2^8-1)(2^8+1)(2^{16}+1) \\
&= (2^{16}-1)(2^{16}+1) \\
&= 2^{32}-1
\end{aligned}$$

10-2 (1) $100=a$ 로 놓으면

$$\begin{aligned}
101^3-100^3 &= (a+1)^3-a^3 \\
&= a^3+3a^2+3a+1-a^3 \\
&= 3a^2+3a+1 \\
&= 3 \cdot 100^2+3 \cdot 100+1 \\
&= 30301
\end{aligned}$$

(2) 주어진 식에 $\frac{1}{8}(9-1)=1$ 을 곱하면

$$\begin{aligned}
& \frac{1}{8}(9-1)(9+1)(9^2+1)(9^4+1)(9^8+1) \\
&= \frac{1}{8}(9^2-1)(9^2+1)(9^4+1)(9^8+1) \\
&= \frac{1}{8}(9^4-1)(9^4+1)(9^8+1) \\
&= \frac{1}{8}(9^8-1)(9^8+1) \\
&= \frac{9^{16}-1}{8} = \frac{3^{32}-1}{8}
\end{aligned}$$

STEP 3 48쪽~51쪽

01 $(6ab^2)^3 \times \left(-\frac{1}{3}a^3b\right)^2 = 216a^3b^6 \times \frac{1}{9}a^6b^2 = 24a^9b^8$

02 $-2x^2+2x^2+3x^2=3x^2$ 이므로 x^2 의 계수는 3

$$03 \quad 3x^3 + 2ax^3 = (3+2a)x^3 \circ | \text{므로}$$

$$3+2a=0 \quad \therefore a=-\frac{3}{2}$$

$$04 \quad (5x+y)(-5x+y) = -(5x+y)(5x-y) \\ = -(25x^2 - y^2) \\ = -25x^2 + y^2$$

$$05 \quad 8x^3 + 36x^2y + 54xy^2 + 27y^3$$

$$06 \quad x^3 - 12x^2y + 48xy^2 - 64y^3$$

$$07 \quad (4x+3y)(16x^2-12xy+9y^2) = (4x)^3 + (3y)^3 \\ = 64x^3 + 27y^3$$

$$08 \quad (x-5y)(x^2+5xy+25y^2) = x^3 - (5y)^3 \\ = x^3 - 125y^3$$

$$09 \quad 4x^2 + 9y^2 + z^2 - 12xy + 6yz - 4zx$$

$$10 \quad (x+2y-z)(x^2+4y^2+z^2-2xy+2yz+zx) \\ = x^3 + (2y)^3 + (-z)^3 - 3 \cdot x \cdot 2y \cdot (-z) \\ = x^3 + 8y^3 - z^3 + 6xyz$$

$$11 \quad (2x-y+3)(-2x+y+3) \\ = -(2x-y+3)(2x-y-3) \\ = -(t+3)(t-3) \quad \leftarrow 2x-y=t \text{로 치환} \\ = -(t^2-9) \\ = -t^2+9 \\ = -(2x-y)^2+9 \quad \leftarrow t=2x-y \text{ 대입} \\ = -(4x^2-4xy+y^2)+9 \\ = -4x^2+4xy-y^2+9$$

$$12 \quad (x-1)(x-2)(x+3)(x+4) \\ = \{(x-1)(x+3)\}\{(x-2)(x+4)\} \\ = (x^2+2x-3)(x^2+2x-8) \\ = (t-3)(t-8) \quad \leftarrow x^2+2x=t \text{로 치환} \\ = t^2-11t+24 \\ = (x^2+2x)^2-11(x^2+2x)+24 \quad \leftarrow t=x^2+2x \text{ 대입} \\ = x^4+4x^3+4x^2-11x^2-22x+24 \\ = x^4+4x^3-7x^2-22x+24$$

$$13 \quad (x-1)(x-2)(x-3)(x-4) \\ = \{(x-1)(x-4)\}\{(x-2)(x-3)\} \\ = (x^2-5x+4)(x^2-5x+6) \\ = \{(x^2-5x+1)+3\}\{(x^2-5x+1)+5\} \\ = 3 \cdot 5 = 15$$

$$14 \quad a^2+b^2 = (a+b)^2 - 2ab \\ = 2^2 - 2 \cdot (-1) = 6$$

$$15 \quad (a+b)^2 = (a-b)^2 + 4ab \\ = (-3)^2 + 4 \cdot (-2) = 1$$

$$16 \quad x^2+y^2 = (x+y)^2 - 2xy \text{에서} \\ 45 = 9^2 - 2xy \quad \therefore xy = 18 \\ \therefore \frac{y}{x} + \frac{x}{y} = \frac{x^2+y^2}{xy} = \frac{45}{18} = \frac{5}{2}$$

$$17 \quad a^3+b^3 = (a+b)^3 - 3ab(a+b) \\ = 4^3 - 3 \cdot 2 \cdot 4 = 40$$

$$18 \quad a^3-b^3 = (a-b)^3 + 3ab(a-b) \\ = (-3)^3 + 3 \cdot 2 \cdot (-3) = -45$$

$$19 \quad x^2+y^2 = (x+y)^2 - 2xy \text{에서} \\ 10 = 2^2 - 2xy \quad \therefore xy = -3 \\ x^3+y^3 = (x+y)^3 - 3xy(x+y) \\ = 2^3 - 3 \cdot (-3) \cdot 2 = 26$$

$$20 \quad a^2+b^2 = (3+2\sqrt{2}) + (3-2\sqrt{2}) = 6 \circ | \text{고,} \\ a^2b^2 = (3+2\sqrt{2})(3-2\sqrt{2}) = 1 \text{에서} \\ ab = 1 \quad (\because a, b \text{는 양수}) \text{이므로} \\ (a+b)^2 = a^2+b^2+2ab \\ = 6+2 \cdot 1 = 8 \\ \therefore a+b = 2\sqrt{2} \quad (\because a, b \text{는 양수}) \\ \therefore a^3+b^3 = (a+b)^3 - 3ab(a+b) \\ = (2\sqrt{2})^3 - 3 \cdot 1 \cdot 2\sqrt{2} = 10\sqrt{2}$$

$$21 \quad \ominus 1, \omin� -36$$

$$22 \quad \left(a - \frac{1}{a}\right)^2 = \left(a + \frac{1}{a}\right)^2 - 4 = 3^2 - 4 = 5 \\ \therefore a - \frac{1}{a} = \sqrt{5} \quad (\because a > 1)$$

$$23 \quad \left(a + \frac{1}{a}\right)^2 = \left(a - \frac{1}{a}\right)^2 + 4 = 3^2 + 4 = 13 \\ \therefore a + \frac{1}{a} = \sqrt{13} \quad (\because a > 0)$$

$$24 \quad a^3 + \frac{1}{a^3} = \left(a + \frac{1}{a}\right)^3 - 3\left(a + \frac{1}{a}\right) \\ = (-2)^3 - 3 \cdot (-2) = -2$$

25 $a^2 + \frac{1}{a^2} = \left(a - \frac{1}{a}\right)^2 + 2$ 에서

$$6 = \left(a - \frac{1}{a}\right)^2 + 2, \left(a - \frac{1}{a}\right)^2 = 4$$

$$\therefore a - \frac{1}{a} = 2 \quad (\because a > 1)$$

$$\begin{aligned} \therefore a^3 - \frac{1}{a^3} &= \left(a - \frac{1}{a}\right)^3 + 3\left(a - \frac{1}{a}\right) \\ &= 2^3 + 3 \cdot 2 = 14 \end{aligned}$$

26 $a^2 + \frac{1}{a^2} = \left(a + \frac{1}{a}\right)^2 - 2$ 에서

$$8 = \left(a + \frac{1}{a}\right)^2 - 2, \left(a + \frac{1}{a}\right)^2 = 10$$

$$\therefore a + \frac{1}{a} = \sqrt{10} \quad (\because a > 0)$$

$$\begin{aligned} \therefore a^3 + \frac{1}{a^3} &= \left(a + \frac{1}{a}\right)^3 - 3\left(a + \frac{1}{a}\right) \\ &= (\sqrt{10})^3 - 3\sqrt{10} = 7\sqrt{10} \end{aligned}$$

27 $x \neq 0$ 이므로 $x^2 - 3x + 1 = 0$ 의 양변을 x 로 나누면

$$x - 3 + \frac{1}{x} = 0 \quad \therefore x + \frac{1}{x} = 3$$

$$\begin{aligned} \therefore x^3 + \frac{1}{x^3} &= \left(x + \frac{1}{x}\right)^3 - 3\left(x + \frac{1}{x}\right) \\ &= 3^3 - 3 \cdot 3 = 18 \end{aligned}$$

28 $a^2 + b^2 + c^2 = (a+b+c)^2 - 2(ab+bc+ca)$
 $= (-2)^2 - 2 \cdot (-1) = 6$

29 $a^2 + b^2 + c^2 = (a+b+c)^2 - 2(ab+bc+ca)$ 에서
 $13 = 3^2 - 2(ab+bc+ca)$
 즉, $ab+bc+ca = -2$ 이므로
 $(a-b)^2 + (b-c)^2 + (c-a)^2$
 $= a^2 - 2ab + b^2 + b^2 - 2bc + c^2 + c^2 - 2ca + a^2$
 $= 2(a^2 + b^2 + c^2 - ab - bc - ca)$
 $= 2\{13 - (-2)\} = 30$

30 $a^2 + b^2 + c^2 = (a+b+c)^2 - 2(ab+bc+ca)$
 $= 4^2 - 2 \cdot 1 = 14$
 $\therefore a^3 + b^3 + c^3$
 $= (a+b+c)(a^2 + b^2 + c^2 - ab - bc - ca) + 3abc$
 $= 4(14 - 1) + 3 \cdot (-6) = 34$

31 $3^2, 3^4, 3^{16}$

32 주어진 식에 $-(3-4)=1$ 을 곱하면
 $-(3-4)(3+4)(3^2+4^2)(3^4+4^4)$
 $= -(3^2-4^2)(3^2+4^2)(3^4+4^4)$
 $= -(3^4-4^4)(3^4+4^4)$
 $= -(3^8-4^8)$
 $= 4^8 - 3^8 = 2^{16} - 3^8$

3 다항식의 나눗셈

STEP 1

54쪽~63쪽

01-1 (1) $10a^3 \div 2a^2 = \frac{10a^3}{2a^2} = \boxed{5a}$

(2) $12x^3 \div (-3x) = \frac{12x^3}{-3x} = \boxed{-4x^2}$

(3) $12a^4b^5 \div 4ab^2 = \frac{12a^4b^5}{4ab^2} = 3a^3b^3$

(4) $3x^2y^5 \div \frac{1}{2}x^3y^3 = 3x^2y^5 \times \frac{2}{x^3y^3} = \frac{6y^2}{x}$

(5) $6ab^2 \div \left(-\frac{1}{3a^4b^3}\right) = 6ab^2 \times (-3a^4b^3) = -18a^5b^5$

02-1 (1) $(6a^2b + 4ab^2) \div 2a = \frac{6a^2b}{2a} + \frac{4ab^2}{2a}$
 $= 3ab + \boxed{2b^2}$

(2) $(6x^3y - 15xy^2) \div 3y = \frac{6x^3y}{3y} - \frac{15xy^2}{3y}$
 $= \boxed{2x^3} - 5xy$

(3) $(3ab^2 - 6a^2b + 9ab) \div (-3a)$
 $= \frac{3ab^2}{-3a} - \frac{6a^2b}{-3a} + \frac{9ab}{-3a}$
 $= -b^2 + 2ab - 3b$

(4) $(5x^3y - 3x^2y^2 + 2xy^3) \div \frac{1}{2}xy$
 $= 5x^3y \times \frac{2}{xy} - 3x^2y^2 \times \frac{2}{xy} + 2xy^3 \times \frac{2}{xy}$
 $= 10x^2 - 6xy + 4y^2$

(5) $(2a^2b - 3ab^2 + 4ab) \div \frac{1}{3a^2b}$
 $= (2a^2b - 3ab^2 + 4ab) \times 3a^2b$
 $= 6a^4b^2 - 9a^3b^3 + 12a^3b^2$

(6) $(4x^2y + 3xy^3 - 2x^2y^2) \div \left(-\frac{1}{2xy^3}\right)$
 $= (4x^2y + 3xy^3 - 2x^2y^2) \times (-2xy^3)$
 $= -8x^3y^4 - 6x^2y^6 + 4x^3y^5$

03-1 (1)

$$\begin{array}{r} x-3 \\ x-1 \overline{) x^2-4x+5} \\ \underline{x^2-x} \quad \leftarrow x \times (x-1) \\ -3x+5 \\ \underline{-3x+3} \quad \leftarrow -3 \times (x-1) \\ 2 \end{array}$$

\therefore 몫: $\boxed{x-3}$, 나머지: $\boxed{2}$

$$\begin{array}{r}
 2x-1 \\
 x+2 \overline{) 2x^2+3x-3} \\
 \underline{2x^2+4x} \quad \leftarrow 2x \times (x+2) \\
 -x-3 \\
 \underline{-x-2} \quad \leftarrow -1 \times (x+2) \\
 -1
 \end{array}$$

∴ 몫 : $2x-1$, 나머지 : -1

$$\begin{array}{r}
 2x \\
 2x+1 \overline{) 4x^2+2x-7} \\
 \underline{4x^2+2x} \quad \leftarrow 2x \times (2x+1) \\
 -7
 \end{array}$$

∴ 몫 : $2x$, 나머지 : -7

$$\begin{array}{r}
 2x-2 \\
 -3x-2 \overline{) -6x^2+2x+4} \\
 \underline{-6x^2-4x} \quad \leftarrow 2x \times (-3x-2) \\
 6x+4 \\
 \underline{6x+4} \quad \leftarrow -2 \times (-3x-2) \\
 0
 \end{array}$$

∴ 몫 : $2x-2$, 나머지 : 0

$$\begin{array}{r}
 x^2+x-4 \\
 x+1 \overline{) x^3+2x^2-3x-6} \\
 \underline{x^3+x^2} \quad \leftarrow x^2 \times (x+1) \\
 x^2-3x \\
 \underline{x^2+x} \quad \leftarrow x \times (x+1) \\
 -4x-6 \\
 \underline{-4x-4} \quad \leftarrow -4 \times (x+1) \\
 -2
 \end{array}$$

∴ 몫 : x^2+x-4 , 나머지 : -2

$$\begin{array}{r}
 2x^2+3x+5 \\
 x-2 \overline{) 2x^3-x^2-x+3} \\
 \underline{2x^3-4x^2} \quad \leftarrow 2x^2 \times (x-2) \\
 3x^2-x \\
 \underline{3x^2-6x} \quad \leftarrow 3x \times (x-2) \\
 5x+3 \\
 \underline{5x-10} \quad \leftarrow 5 \times (x-2) \\
 13
 \end{array}$$

∴ 몫 : $2x^2+3x+5$, 나머지 : 13

$$\begin{array}{r}
 3x^2-7x+20 \\
 x+3 \overline{) 3x^3+2x^2-x-2} \\
 \underline{3x^3+9x^2} \quad \leftarrow 3x^2 \times (x+3) \\
 -7x^2-x \\
 \underline{-7x^2-21x} \quad \leftarrow -7x \times (x+3) \\
 20x-2 \\
 \underline{20x+60} \quad \leftarrow 20 \times (x+3) \\
 -62
 \end{array}$$

∴ 몫 : $3x^2-7x+20$, 나머지 : -62

$$\begin{array}{r}
 2x^2-2x-1 \\
 2x-1 \overline{) 4x^3-6x^2-3} \\
 \underline{4x^3-2x^2} \quad \leftarrow 2x^2 \times (2x-1) \\
 -4x^2 \\
 \underline{-4x^2+2x} \quad \leftarrow -2x \times (2x-1) \\
 -2x-3 \\
 \underline{-2x+1} \quad \leftarrow -1 \times (2x-1) \\
 -4
 \end{array}$$

∴ 몫 : $2x^2-2x-1$, 나머지 : -4

$$\begin{array}{r}
 x+1 \\
 x^2+2x-2 \overline{) x^3+3x^2-x+2} \\
 \underline{x^3+2x^2-2x} \quad \leftarrow x \times (x^2+2x-2) \\
 x^2+x+2 \\
 \underline{x^2+2x-2} \quad \leftarrow 1 \times (x^2+2x-2) \\
 -x+4
 \end{array}$$

∴ 몫 : $x+1$, 나머지 : $-x+4$

$$\begin{array}{r}
 x+1 \\
 x^2-3x+2 \overline{) x^3-2x^2+4x-3} \\
 \underline{x^3-3x^2+2x} \quad \leftarrow x \times (x^2-3x+2) \\
 x^2+2x-3 \\
 \underline{x^2-3x+2} \quad \leftarrow 1 \times (x^2-3x+2) \\
 5x-5
 \end{array}$$

∴ 몫 : $x+1$, 나머지 : $5x-5$

$$\begin{array}{r}
 2x+1 \\
 x^2-3 \overline{) 2x^3+x^2-4x+3} \\
 \underline{2x^3-6x} \quad \leftarrow 2x^2 \times (x^2-3) \\
 x^2+2x+3 \\
 \underline{x^2-3} \quad \leftarrow 1 \times (x^2-3) \\
 2x+6
 \end{array}$$

∴ 몫 : $2x+1$, 나머지 : $2x+6$

$$\begin{array}{r}
 3x+3 \\
 x^2-x+2 \overline{) 3x^3-x^2-5x+2} \\
 \underline{3x^3-3x^2+6x} \quad \leftarrow 3x \times (x^2-x+2) \\
 3x^2-11x+2 \\
 \underline{3x^2-3x+6} \quad \leftarrow 3 \times (x^2-x+2) \\
 -8x-4
 \end{array}$$

∴ 몫 : $3x+3$, 나머지 : $-8x-4$

04-1 (1) $2x^2-5x+3 = (x+1)(\overline{2x-7}) + 10$

(2) $x^3-2x^2-5x+2 = (x-3)(x^2+x-2) - 4$

(3) $6x^3-7x^2-8x-9 = (2x-5)(3x^2+4x+6) + 21$

(4) $4x^3-x+5 = (2x^2+x-3)(2x-1) + 6x+2$

04-2 (1) $A = (x^2-x+2)(\overline{2x+1}) + 3x-1$

$= (2x^3+x^2-2x^2-x+4x+2) + 3x-1$

$= 2x^3-x^2+\overline{6x}+1$

$$\begin{aligned}
 (2) A &= (2x-3)(5x-2)-2 \\
 &= (10x^2-4x-15x+6)-2 \\
 &= 10x^2-19x+4
 \end{aligned}$$

$$\begin{aligned}
 (3) A &= (x-2)(x^2-x-5)+3 \\
 &= (x^3-x^2-5x-2x^2+2x+10)+3 \\
 &= x^3-3x^2-3x+13
 \end{aligned}$$

$$\begin{aligned}
 (4) A &= (x^2+2x-4)(3x-5)+2x+3 \\
 &= (3x^3-5x^2+6x^2-10x-12x+20)+2x+3 \\
 &= 3x^3+x^2-20x+23
 \end{aligned}$$

04-3 (1) $x^3+x^2-3x-3=B(\overline{x-1})-4$ 에서

$$B = \{(x^3+x^2-3x-3)+4\} \div (x-1)$$

$$\begin{array}{r}
 x^2+2x-1 \\
 x-1 \overline{) x^3 + x^2 - 3x + 1} \\
 \underline{x^3 - x^2} \\
 2x^2 - 3x \\
 \underline{2x^2 - 2x} \\
 -x + 1 \\
 \underline{-x + 1} \\
 0
 \end{array}$$

$$\therefore B = \overline{x^2+2x-1}$$

(2) $6x^2+x-16=B(2x+3)-4$ 에서

$$B = \{(6x^2+x-16)+4\} \div (2x+3)$$

$$\begin{array}{r}
 3x-4 \\
 2x+3 \overline{) 6x^2 + x - 12} \\
 \underline{6x^2+9x} \\
 -8x-12 \\
 \underline{-8x-12} \\
 0
 \end{array}$$

$$\therefore B = 3x-4$$

(3) $x^3+3x^2+2x-4=B(x+2)+3x+2$ 에서

$$B = \{(x^3+3x^2+2x-4)-3x-2\} \div (x+2)$$

$$\begin{array}{r}
 x^2+x-3 \\
 x+2 \overline{) x^3 + 3x^2 - x - 6} \\
 \underline{x^3+2x^2} \\
 x^2 - x \\
 \underline{x^2+2x} \\
 -3x-6 \\
 \underline{-3x-6} \\
 0
 \end{array}$$

$$\therefore B = x^2+x-3$$

(4) $2x^3-7x^2+4x+5=B(x^2-2x-1)+2$ 에서

$$B = \{(2x^3-7x^2+4x+5)-2\} \div (x^2-2x-1)$$

$$\begin{array}{r}
 2x-3 \\
 x^2-2x-1 \overline{) 2x^3 - 7x^2 + 4x + 3} \\
 \underline{2x^3-4x^2-2x} \\
 -3x^2+6x+3 \\
 \underline{-3x^2+6x+3} \\
 0
 \end{array}$$

$$\therefore B = 2x-3$$

05-1 (1)

$$\begin{array}{r}
 \boxed{2} \overline{) 1 \quad -3 \quad 1 \quad 5} \\
 \underline{ } \\
 1 \quad -1 \quad -1 \quad \boxed{3}
 \end{array}$$

$$\therefore \text{몫} : \overline{x^2-x-1}, \text{나머지} : \boxed{3}$$

$$\begin{array}{r}
 \boxed{-2} \overline{) 1 \quad -2 \quad -5 \quad 3} \\
 \underline{ } \\
 1 \quad -4 \quad 3 \quad \boxed{-3}
 \end{array}$$

$$\therefore \text{몫} : \overline{x^2-4x+3}, \text{나머지} : \boxed{-3}$$

$$\begin{array}{r}
 3 \overline{) 1 \quad 1 \quad -1 \quad 4} \\
 \underline{ } \\
 1 \quad 4 \quad 11 \quad \boxed{37}
 \end{array}$$

$$\therefore \text{몫} : \overline{x^2+4x+11}, \text{나머지} : 37$$

$$\begin{array}{r}
 -1 \overline{) 2 \quad -3 \quad -4 \quad 1} \\
 \underline{ } \\
 2 \quad -5 \quad 1 \quad \boxed{0}
 \end{array}$$

$$\therefore \text{몫} : \overline{2x^2-5x+1}, \text{나머지} : 0$$

$$\begin{array}{r}
 -2 \overline{) 2 \quad 3 \quad -1 \quad 5} \\
 \underline{ } \\
 2 \quad -1 \quad 1 \quad \boxed{3}
 \end{array}$$

$$\therefore \text{몫} : \overline{2x^2-x+1}, \text{나머지} : 3$$

$$\begin{array}{r}
 -3 \overline{) 3 \quad 4 \quad -12 \quad -1} \\
 \underline{ } \\
 3 \quad -5 \quad 3 \quad \boxed{-10}
 \end{array}$$

$$\therefore \text{몫} : \overline{3x^2-5x+3}, \text{나머지} : -10$$

$$\begin{array}{r}
 \boxed{1} \overline{) 1 \quad 2 \quad -4 \quad 2 \quad 1} \\
 \underline{ } \\
 1 \quad 3 \quad -1 \quad 1 \quad \boxed{2}
 \end{array}$$

$$\therefore \text{몫} : \overline{x^3+3x^2-x+1}, \text{나머지} : \boxed{2}$$

$$\begin{array}{r}
 -2 \overline{) 1 \quad -2 \quad -3 \quad 4 \quad 5} \\
 \underline{ } \\
 1 \quad -4 \quad 5 \quad -6 \quad \boxed{17}
 \end{array}$$

$$\therefore \text{몫} : \overline{x^3-4x^2+5x-6}, \text{나머지} : 17$$

$$\begin{array}{r}
 -1 \overline{) 2 \quad -3 \quad -1 \quad 3 \quad -4} \\
 \underline{ } \\
 2 \quad -5 \quad 4 \quad -1 \quad \boxed{-3}
 \end{array}$$

$$\therefore \text{몫} : \overline{2x^3-5x^2+4x-1}, \text{나머지} : -3$$

$$\begin{array}{r}
 2 \overline{) 3 \quad 1 \quad -5 \quad -7 \quad -3} \\
 \underline{ } \\
 3 \quad 7 \quad 9 \quad 11 \quad \boxed{19}
 \end{array}$$

$$\therefore \text{몫} : \overline{3x^3+7x^2+9x+11}, \text{나머지} : 19$$

05-2 (1)

$$\begin{array}{r|rrrr} -1 & 1 & \boxed{0} & -3 & 2 \\ & & -1 & 1 & 2 \\ \hline & 1 & -1 & -2 & \boxed{4} \end{array}$$

∴ 몫 : $x^2 - x - 2$, 나머지 : $\boxed{4}$

(2)

$$\begin{array}{r|rrrr} 2 & 1 & \boxed{0} & -5 & 3 \\ & & 2 & 4 & -2 \\ \hline & 1 & 2 & -1 & \boxed{1} \end{array}$$

∴ 몫 : $x^2 + 2x - 1$, 나머지 : $\boxed{1}$

(3)

$$\begin{array}{r|rrrr} -2 & 1 & 2 & 0 & -4 \\ & & -2 & 0 & 0 \\ \hline & 1 & 0 & 0 & \boxed{-4} \end{array}$$

∴ 몫 : x^2 , 나머지 : -4

(4)

$$\begin{array}{r|rrrr} 2 & 1 & -3 & 4 & 0 \\ & & 2 & -2 & 4 \\ \hline & 1 & -1 & 2 & \boxed{4} \end{array}$$

∴ 몫 : $x^2 - x + 2$, 나머지 : 4

(5)

$$\begin{array}{r|rrrr} -3 & 2 & 4 & 0 & 7 \\ & & -6 & 6 & -18 \\ \hline & 2 & -2 & 6 & \boxed{-11} \end{array}$$

∴ 몫 : $2x^2 - 2x + 6$, 나머지 : -11

(6)

$$\begin{array}{r|rrrr} -2 & 1 & -4 & 0 & 0 \\ & & -2 & 12 & -24 \\ \hline & 1 & -6 & 12 & \boxed{-24} \end{array}$$

∴ 몫 : $x^2 - 6x + 12$, 나머지 : -24

(7)

$$\begin{array}{r|rrrr} -1 & 2 & 0 & -1 & 0 \\ & & -2 & 2 & -1 \\ \hline & 2 & -2 & 1 & \boxed{-1} \end{array}$$

∴ 몫 : $2x^2 - 2x + 1$, 나머지 : -1

(8)

$$\begin{array}{r|rrrr} 2 & 3 & 0 & 0 & -5 \\ & & 6 & 12 & 24 \\ \hline & 3 & 6 & 12 & \boxed{19} \end{array}$$

∴ 몫 : $3x^2 + 6x + 12$, 나머지 : 19

(9)

$$\begin{array}{r|rrrrr} -2 & 1 & -1 & \boxed{0} & 1 & -2 \\ & & -2 & 6 & -12 & 22 \\ \hline & 1 & -3 & 6 & -11 & \boxed{20} \end{array}$$

∴ 몫 : $x^3 - 3x^2 + 6x - 11$, 나머지 : $\boxed{20}$

(10)

$$\begin{array}{r|rrrrr} -1 & 1 & 2 & -1 & 0 & -3 \\ & & -1 & -1 & 2 & -2 \\ \hline & 1 & 1 & -2 & 2 & \boxed{-5} \end{array}$$

∴ 몫 : $x^3 + x^2 - 2x + 2$, 나머지 : -5

(11)

$$\begin{array}{r|rrrrr} 2 & 1 & -1 & 0 & 0 & 3 \\ & & 2 & 2 & 4 & 8 \\ \hline & 1 & 1 & 2 & 4 & \boxed{11} \end{array}$$

∴ 몫 : $x^3 + x^2 + 2x + 4$, 나머지 : 11

(12)

$$\begin{array}{r|rrrrr} 3 & 1 & 0 & 0 & -5 & 0 \\ & & 3 & 9 & 27 & 66 \\ \hline & 1 & 3 & 9 & 22 & \boxed{66} \end{array}$$

∴ 몫 : $x^3 + 3x^2 + 9x + 22$, 나머지 : 66

06-1 (1) $f(x) = \left(x - \frac{1}{2}\right)Q(x) + \boxed{R}$

$$= (2x - 1) \cdot \boxed{\frac{1}{2}Q(x)} + R$$

$$\therefore \text{몫 : } \boxed{\frac{1}{2}Q(x)}, \text{ 나머지 : } \boxed{R}$$

(2) $f(x) = \left(x + \frac{1}{3}\right)Q(x) + R$

$$= (3x + 1) \cdot \boxed{\frac{1}{3}Q(x)} + R$$

$$\therefore \text{몫 : } \boxed{\frac{1}{3}Q(x)}, \text{ 나머지 : } \boxed{R}$$

(3) $f(x) = \left(x - \frac{1}{4}\right)Q(x) + R$

$$= (4x - 1) \cdot \boxed{\frac{1}{4}Q(x)} + R$$

$$\therefore \text{몫 : } \boxed{\frac{1}{4}Q(x)}, \text{ 나머지 : } R$$

(4) $f(x) = \left(x - \frac{5}{3}\right)Q(x) + R$

$$= (3x - 5) \cdot \boxed{\frac{1}{3}Q(x)} + R$$

$$\therefore \text{몫 : } \boxed{\frac{1}{3}Q(x)}, \text{ 나머지 : } R$$

(5) $f(x) = \left(x - \frac{3}{4}\right)Q(x) + R$

$$= (4x - 3) \cdot \boxed{\frac{1}{4}Q(x)} + R$$

$$\therefore \text{몫 : } \boxed{\frac{1}{4}Q(x)}, \text{ 나머지 : } R$$

(6) $f(x) = \left(x + \frac{3}{5}\right)Q(x) + R$

$$= (5x + 3) \cdot \boxed{\frac{1}{5}Q(x)} + R$$

$$\therefore \text{몫 : } \boxed{\frac{1}{5}Q(x)}, \text{ 나머지 : } R$$

(7) $f(x) = (3x - 1)Q(x) + R$

$$= \left(x - \frac{1}{3}\right) \cdot \boxed{3Q(x)} + R$$

$$\therefore \text{몫 : } \boxed{3Q(x)}, \text{ 나머지 : } R$$

(8) $f(x) = (4x + 1)Q(x) + R$

$$= \left(x + \frac{1}{4}\right) \cdot \boxed{4Q(x)} + R$$

$$\therefore \text{몫 : } \boxed{4Q(x)}, \text{ 나머지 : } R$$

$$(9) f(x) = (2x-5)Q(x) + R$$

$$= \left(x - \frac{5}{2}\right) \cdot 2Q(x) + R$$

$$\therefore \text{몫} : 2Q(x), \text{나머지} : R$$

$$(10) f(x) = (7x+4)Q(x) + R$$

$$= \left(x + \frac{4}{7}\right) \cdot 7Q(x) + R$$

$$\therefore \text{몫} : 7Q(x), \text{나머지} : R$$

06-2 (1)

$$\begin{array}{r|rrrr} \frac{1}{2} & 2 & 3 & -4 & -5 \\ & & 1 & 2 & -1 \\ \hline & 2 & 4 & -2 & -6 \end{array}$$

$$2x^3 + 3x^2 - 4x - 5 = \left(x - \frac{1}{2}\right)(2x^2 + 4x - 2) - 6$$

$$= (2x-1)(x^2 + 2x - 1) - 6$$

$$\therefore \text{몫} : \boxed{x^2 + 2x - 1}, \text{나머지} : \boxed{-6}$$

(2)

$$\begin{array}{r|rrrr} \frac{1}{2} & 2 & -3 & 5 & -1 \\ & & 1 & -1 & 2 \\ \hline & 2 & -2 & 4 & 1 \end{array}$$

$$2x^3 - 3x^2 + 5x - 1 = \left(x - \frac{1}{2}\right)(2x^2 - 2x + 4) + \boxed{1}$$

$$= (2x-1)(x^2 - x + 2) + 1$$

$$\therefore \text{몫} : \boxed{x^2 - x + 2}, \text{나머지} : \boxed{1}$$

(3)

$$\begin{array}{r|rrrr} -\frac{1}{2} & 4 & 0 & -3 & 2 \\ & & -2 & 1 & 1 \\ \hline & 4 & -2 & -2 & 3 \end{array}$$

$$4x^3 - 3x + 2 = \left(x + \frac{1}{2}\right)(4x^2 - 2x - 2) + 3$$

$$= (2x+1)(2x^2 - x - 1) + 3$$

$$\therefore \text{몫} : 2x^2 - x - 1, \text{나머지} : 3$$

(4)

$$\begin{array}{r|rrrr} \frac{1}{3} & 3 & -4 & -5 & 1 \\ & & 1 & -1 & -2 \\ \hline & 3 & -3 & -6 & -1 \end{array}$$

$$3x^3 - 4x^2 - 5x + 1 = \left(x - \frac{1}{3}\right)(3x^2 - 3x - 6) - 1$$

$$= (3x-1)(x^2 - x - 2) - 1$$

$$\therefore \text{몫} : x^2 - x - 2, \text{나머지} : -1$$

(5)

$$\begin{array}{r|rrrr} -\frac{1}{3} & 6 & -1 & 5 & -1 \\ & & -2 & 1 & -2 \\ \hline & 6 & -3 & 6 & -3 \end{array}$$

$$6x^3 - x^2 + 5x - 1 = \left(x + \frac{1}{3}\right)(6x^2 - 3x + 6) - 3$$

$$= (3x+1)(2x^2 - x + 2) - 3$$

$$\therefore \text{몫} : 2x^2 - x + 2, \text{나머지} : -3$$

(6)

$$\begin{array}{r|rrrr} \frac{1}{5} & 5 & 4 & -6 & -2 \\ & & 1 & 1 & -1 \\ \hline & 5 & 5 & -5 & -3 \end{array}$$

$$5x^3 + 4x^2 - 6x - 2 = \left(x - \frac{1}{5}\right)(5x^2 + 5x - 5) - 3$$

$$= (5x-1)(x^2 + x - 1) - 3$$

$$\therefore \text{몫} : x^2 + x - 1, \text{나머지} : -3$$

(7)

$$\begin{array}{r|rrrr} \frac{3}{2} & 2 & 3 & -5 & 3 \\ & & 3 & 9 & 6 \\ \hline & 2 & 6 & 4 & 9 \end{array}$$

$$2x^3 + 3x^2 - 5x + 3 = \left(x - \frac{3}{2}\right)(2x^2 + 6x + 4) + 9$$

$$= (2x-3)(x^2 + 3x + 2) + 9$$

$$\therefore \text{몫} : x^2 + 3x + 2, \text{나머지} : 9$$

(8)

$$\begin{array}{r|rrrr} \frac{2}{3} & 6 & -1 & -5 & 3 \\ & & 4 & 2 & -2 \\ \hline & 6 & 3 & -3 & 1 \end{array}$$

$$6x^3 - x^2 - 5x + 3 = \left(x - \frac{2}{3}\right)(6x^2 + 3x - 3) + 1$$

$$= (3x-2)(2x^2 + x - 1) + 1$$

$$\therefore \text{몫} : 2x^2 + x - 1, \text{나머지} : 1$$

(9)

$$\begin{array}{r|rrrr} -\frac{3}{4} & 8 & 2 & 1 & -2 \\ & & -6 & 3 & -3 \\ \hline & 8 & -4 & 4 & -5 \end{array}$$

$$8x^3 + 2x^2 + x - 2 = \left(x + \frac{3}{4}\right)(8x^2 - 4x + 4) - 5$$

$$= (4x+3)(2x^2 - x + 1) - 5$$

$$\therefore \text{몫} : 2x^2 - x + 1, \text{나머지} : -5$$

(10)

$$\begin{array}{r|rrrr} -\frac{4}{3} & 3 & -2 & 1 & 5 \\ & & -4 & 8 & -12 \\ \hline & 3 & -6 & 9 & -7 \end{array}$$

$$3x^3 - 2x^2 + x + 5 = \left(x + \frac{4}{3}\right)(3x^2 - 6x + 9) - 7$$

$$= (3x+4)(x^2 - 2x + 3) - 7$$

$$\therefore \text{몫} : x^2 - 2x + 3, \text{나머지} : -7$$

(11)

$$\begin{array}{r|rrrr} -\frac{5}{3} & 3 & -1 & -1 & 4 \\ & & -5 & 10 & -15 \\ \hline & 3 & -6 & 9 & -11 \end{array}$$

$$3x^3 - x^2 - x + 4 = \left(x + \frac{5}{3}\right)(3x^2 - 6x + 9) - 11$$

$$= (3x+5)(x^2 - 2x + 3) - 11$$

$$\therefore \text{몫} : x^2 - 2x + 3, \text{나머지} : -11$$

$$1-1 \quad (1) 12a^2b^3 \div 3a^3b^2 = \frac{12a^2b^3}{3a^3b^2} = \frac{4b}{a}$$

$$(2) 2ab^5 \div 4a^3b^2 = \frac{2ab^5}{4a^3b^2} = \frac{b^3}{2a^2}$$

$$(3) 3x^2y \div \frac{3}{2}xy^3 = 3x^2y \times \frac{2}{3xy^3} = \frac{2x}{y^2}$$

$$(4) 4x^3y^2 \div \left(\frac{1}{2xy^3}\right) = 4x^3y^2 \times 2xy^3 = 8x^4y^5$$

$$1-2 \quad (1) 3a^4b^2 \div 6a^2b = \frac{3a^4b^2}{6a^2b} = \frac{1}{2}a^2b$$

$$(2) 6a^3b^2 \div (-9a^5b^7) = \frac{6a^3b^2}{-9a^5b^7} = -\frac{2}{3a^2b^5}$$

$$(3) x^3y^5 \div \left(\frac{1}{3}xy^2\right)^2 = x^3y^5 \div \left(\frac{1}{9}x^2y^4\right) \\ = x^3y^5 \times \frac{9}{x^2y^4} = 9xy$$

$$(4) 2xy^3 \div \left(-\frac{1}{2xy^2}\right)^3 = 2xy^3 \div \left(-\frac{1}{8x^3y^6}\right) \\ = 2xy^3 \times (-8x^3y^6) = -16x^4y^9$$

$$2-1 \quad (1) (9ab^2 + 6a^3b) \div 3a$$

$$= \frac{9ab^2}{3a} + \frac{6a^3b}{3a} = 3b^2 + 2a^2b$$

$$(2) (12ab^4 - 8a^3b) \div 4a^2b^2 \\ = \frac{12ab^4}{4a^2b^2} - \frac{8a^3b}{4a^2b^2} = \frac{3b^2}{a} - \frac{2a}{b}$$

$$(3) (a^3bc^2 + 2a^2b^3c) \div 3ab^2c^3 \\ = \frac{a^3bc^2}{3ab^2c^3} + \frac{2a^2b^3c}{3ab^2c^3} = \frac{a^2}{3bc} + \frac{2ab}{3c^2}$$

$$2-2 \quad (1) (x^3y^2 + 4x^2y^4) \div 2xy^3$$

$$= \frac{x^3y^2}{2xy^3} + \frac{4x^2y^4}{2xy^3} = \frac{x^2}{2y} + 2xy$$

$$(2) (12x^3yz^4 - 6x^2z^3) \div 3xy^2 \\ = \frac{12x^3yz^4}{3xy^2} - \frac{6x^2z^3}{3xy^2} = \frac{4x^2z^4}{y} - \frac{2xz^3}{y^2}$$

$$(3) (2xyz^3 + 3x^2y^3z) \div 5xyz^2 \\ = \frac{2xyz^3}{5xyz^2} + \frac{3x^2y^3z}{5xyz^2} = \frac{2}{5}z + \frac{3xy^2}{5z}$$

$$3-1 \quad (1) (6a^2b^3 + 8ab^4 - 4a^3b) \div 2a^4b^2$$

$$= \frac{6a^2b^3}{2a^4b^2} + \frac{8ab^4}{2a^4b^2} - \frac{4a^3b}{2a^4b^2} = \frac{3b}{a^2} + \frac{4b^2}{a^3} - \frac{2}{ab}$$

$$(2) (8a^3b^2 - 4a^2b + 2ab^3) \div 4ab \\ = \frac{8a^3b^2}{4ab} - \frac{4a^2b}{4ab} + \frac{2ab^3}{4ab} = 2a^2b - a + \frac{1}{2}b^2$$

$$(3) (2a^2b^3c + 3abc^4 - 4ac^2) \div 6a^3b \\ = \frac{2a^2b^3c}{6a^3b} + \frac{3abc^4}{6a^3b} - \frac{4ac^2}{6a^3b} = \frac{b^2c}{3a} + \frac{c^4}{2a^2} - \frac{2c^2}{3a^2b}$$

$$3-2 \quad (1) (6xy^3 + 9x^3y^2 - 12xy^2) \div 2xy$$

$$= \frac{6xy^3}{2xy} + \frac{9x^3y^2}{2xy} - \frac{12xy^2}{2xy} \\ = 3y^2 + \frac{9}{2}x^2y - 6y$$

$$(2) (5xyz^2 - 3xz^3 + 4y^2z) \div 2x^2z^3$$

$$= \frac{5xyz^2}{2x^2z^3} - \frac{3xz^3}{2x^2z^3} + \frac{4y^2z}{2x^2z^3} \\ = \frac{5y}{2xz} - \frac{3}{2x} + \frac{2y^2}{x^2z^2}$$

$$(3) (2xy^2 - 4x^3y - 12x^4y^5) \div (-6x^2y^3)$$

$$= \frac{2xy^2}{-6x^2y^3} - \frac{4x^3y}{-6x^2y^3} - \frac{12x^4y^5}{-6x^2y^3} \\ = -\frac{1}{3xy} + \frac{2x}{3y^2} + 2x^2y^2$$

$$4-1 \quad (1) 3x^2 - 8x - 1 = (x-2)(3x-2) - 5$$

$$(2) 3x^3 - 2x^2 + x + 1 = (x-1)(3x^2 + x + 2) + 3$$

$$(3) x^4 - 3x^3 + 2x - 1 = (x^2 + 1)(x^2 - 3x - 1) + 5x$$

$$4-2 \quad (1) 8x^2 - 6x - 2 = (2x-1)(4x-1) - 3$$

$$(2) 6x^3 - 5x^2 + 3x - 2 = (2x^2 - x + 3)(3x-1) - 7x + 1$$

$$(3) 2x^4 + 3x^2 - 2x - 1 \\ = (x^2 + x - 1)(2x^2 - 2x + 7) - 11x + 6$$

$$5-1 \quad (1)$$

$$\begin{array}{r} 3x-8 \\ x+2 \overline{) 3x^2-2x+3} \\ \underline{3x^2+6x} \\ -8x+3 \text{ 또는 } \begin{array}{r|rr} 3 & 3 & -2 & 3 \\ & -6 & 16 \\ \hline & 3 & -8 & 19 \end{array} \\ \underline{-8x-16} \\ 19 \end{array}$$

∴ 몫 : $3x-8$, 나머지 : 19

$$(2)$$

$$\begin{array}{r} x^2+4x+9 \\ x-3 \overline{) x^3+x^2-3x+5} \\ \underline{x^3-3x^2} \\ 4x^2-3x \text{ 또는 } \begin{array}{r|rrrr} 3 & 1 & 1 & -3 & 5 \\ & 3 & 12 & 27 \\ \hline & 1 & 4 & 9 & 32 \end{array} \\ \underline{4x^2-12x} \\ 9x+5 \\ \underline{9x-27} \\ 32 \end{array}$$

∴ 몫 : x^2+4x+9 , 나머지 : 32

$$(3)$$

$$\begin{array}{r} x-1 \\ x^2+x-3 \overline{) x^3-x^2-3x} \\ \underline{x^3+x^2-3x} \\ -x^2+2x+3 \\ \underline{-x^2-x+3} \\ 3x \end{array}$$

∴ 몫 : $x-1$, 나머지 : 3x

참고

나누는 식이 일차식이 아니므로 조립제법을 이용하지 않는다.

5-2 (1)

$$\begin{array}{r} x-4 \\ 2x+1 \overline{) 2x^2-7x+3} \\ \underline{2x^2+x} \\ -8x+3 \end{array} \quad \text{또는} \quad \begin{array}{r} -\frac{1}{2} \left| \begin{array}{rrr} 2 & -7 & 3 \\ & -1 & 4 \\ 2 & -8 & 7 \end{array} \right. \\ \hline 2x^2-7x+3 \\ \hline -8x-4 \\ \hline -8x-4 \\ \hline 7 \end{array}$$

$$= \left(x + \frac{1}{2}\right)(2x-8) + 7$$

$$= (2x+1)(x-4) + 7$$

∴ 몫 : $x-4$, 나머지 : 7

(2)

$$\begin{array}{r} x^2+2x-1 \\ 2x-1 \overline{) 2x^3+3x^2-4x+2} \\ \underline{2x^3-x^2} \\ 4x^2-4x \\ \underline{4x^2-2x} \\ -2x+2 \\ \underline{-2x+1} \\ 1 \end{array} \quad \text{또는} \quad \begin{array}{r} \frac{1}{2} \left| \begin{array}{rrrr} 2 & 3 & -4 & 2 \\ & 1 & 2 & -1 \\ 2 & 4 & -2 & 1 \end{array} \right. \\ \hline 2x^3+3x^2-4x+2 \\ \hline -2x+2 \\ \hline -2x+1 \\ \hline 1 \end{array}$$

$$= \left(x - \frac{1}{2}\right)(2x^2+4x-2) + 1$$

$$= (2x-1)(x^2+2x-1) + 1$$

∴ 몫 : x^2+2x-1 , 나머지 : 1

(3)

$$\begin{array}{r} 3x-1 \\ 2x^2+3x-2 \overline{) 6x^3+7x^2-x+3} \\ \underline{6x^3+9x^2-6x} \\ -2x^2+5x+3 \\ \underline{-2x^2-3x+2} \\ 8x+1 \end{array}$$

∴ 몫 : $3x-1$, 나머지 : $8x+1$

6-1 (1) $A = (x^2-2x+3)(x+3) + 2x-5$

$$= (x^3+3x^2-2x^2-6x+3x+9) + 2x-5$$

$$= x^3+x^2-x+4$$

(2) $x^3+2x^2+4x+8 = B(x+1) + x+6$ 에서

$$B = \{(x^3+2x^2+4x+8) - (x+6)\} \div (x+1)$$

$$\begin{array}{r} -1 \left| \begin{array}{rrrr} 1 & 2 & 3 & 2 \\ & -1 & -1 & -2 \\ 1 & 1 & 2 & 0 \end{array} \right. \\ \hline 0 \end{array}$$

∴ $B = x^2+x+2$

6-2 (1) $A = (2x^2-x+1)(3x+2) + 3x-2$

$$= (6x^3+4x^2-3x^2-2x+3x+2) + 3x-2$$

$$= 6x^3+x^2+4x$$

(2) $2x^3-3x^2+5x+1 = B(x^2-x+2) + 3$ 에서

$$B = \{(2x^3-3x^2+5x+1) - 3\} \div (x^2-x+2)$$

$$\begin{array}{r} 2x-1 \\ x^2-x+2 \overline{) 2x^3-3x^2+5x-2} \\ \underline{2x^3-2x^2+4x} \\ -x^2+x-2 \\ \underline{-x^2+x-2} \\ 0 \end{array}$$

∴ $B = 2x-1$

7-1 (1)

$$\begin{array}{r} 1 \left| \begin{array}{rrrr} 1 & -3 & 5 & -7 \\ & 1 & -2 & 3 \\ 1 & -2 & 3 & -4 \end{array} \right. \\ \hline -4 \end{array}$$

∴ 몫 : x^2-2x+3 , 나머지 : -4

(2)

$$\begin{array}{r} 2 \left| \begin{array}{rrrrr} 1 & -1 & 2 & -4 & -3 \\ & 2 & 2 & 8 & 8 \\ 1 & 1 & 4 & 4 & 5 \end{array} \right. \\ \hline 5 \end{array}$$

∴ 몫 : x^3+x^2+4x+4 , 나머지 : 5

(3)

$$\begin{array}{r} \frac{1}{2} \left| \begin{array}{rrrr} 2 & 3 & -4 & 3 \\ & 1 & 2 & -1 \\ 2 & 4 & -2 & 2 \end{array} \right. \\ \hline 2 \end{array}$$

$$2x^3+3x^2-4x+3 = \left(x - \frac{1}{2}\right)(2x^2+4x-2) + 2$$

$$= (2x-1)(x^2+2x-1) + 2$$

∴ 몫 : x^2+2x-1 , 나머지 : 2

7-2 (1)

$$\begin{array}{r} -1 \left| \begin{array}{rrrr} 1 & -2 & -3 & 4 \\ & -1 & 3 & 0 \\ 1 & -3 & 0 & 4 \end{array} \right. \\ \hline 4 \end{array}$$

∴ 몫 : x^2-3x , 나머지 : 4

(2)

$$\begin{array}{r} -2 \left| \begin{array}{rrrrr} 1 & 2 & -2 & 3 & -3 \\ & -2 & 0 & 4 & -14 \\ 1 & 0 & -2 & 7 & -17 \end{array} \right. \\ \hline -17 \end{array}$$

∴ 몫 : x^3-2x+7 , 나머지 : -17

(3)

$$\begin{array}{r} -\frac{1}{3} \left| \begin{array}{rrrr} 3 & -2 & -4 & 1 \\ & -1 & 1 & 1 \\ 3 & -3 & -3 & 2 \end{array} \right. \\ \hline 2 \end{array}$$

$$3x^3-2x^2-4x+1 = \left(x + \frac{1}{3}\right)(3x^2-3x-3) + 2$$

$$= (3x+1)(x^2-x-1) + 2$$

∴ 몫 : x^2-x-1 , 나머지 : 2

8-1 (1) $f(x) = \left(x - \frac{5}{3}\right)Q(x) + R = (3x-5) \cdot \frac{1}{3}Q(x) + R$

∴ 몫 : $\frac{1}{3}Q(x)$, 나머지 : R

(2) $f(x) = (4x-3)Q(x) + R = \left(x - \frac{3}{4}\right) \cdot 4Q(x) + R$

∴ 몫 : $4Q(x)$, 나머지 : R

8-2 (1) $f(x) = \left(x - \frac{1}{5}\right)Q(x) + R = (5x-1) \cdot \frac{1}{5}Q(x) + R$

∴ 몫 : $\frac{1}{5}Q(x)$, 나머지 : R

(2) $f(x) = (5x-3)Q(x) + R = \left(x - \frac{3}{5}\right) \cdot 5Q(x) + R$

∴ 몫 : $5Q(x)$, 나머지 : R

STEP 3

68쪽~69쪽

$$\begin{aligned} 01 \quad (6x^2y - 9x^3y^2) \div 3xy^3 &= \frac{6x^2y}{3xy^3} - \frac{9x^3y^2}{3xy^3} \\ &= \frac{2x}{y^2} - \frac{3x^2}{y} \end{aligned}$$

$$\begin{aligned} 02 \quad (6a^2bc^2 - 8ab^3c) \div \frac{1}{2ac^3} &= (6a^2bc^2 - 8ab^3c) \times 2ac^3 \\ &= 12a^3bc^5 - 16a^2b^3c^4 \end{aligned}$$

$$\begin{aligned} 03 \quad & -\frac{1}{2} \left| \begin{array}{rrr} 2 & -7 & 2 \\ & -1 & 4 \\ 2 & -8 & 6 \end{array} \right. \\ & 2x^2 - 7x + 2 = \left(x + \frac{1}{2}\right)(2x - 8) + 6 \\ & = (2x + 1)(x - 4) + 6 \\ \therefore \text{몫} : x - 4, \text{나머지} : 6 \end{aligned}$$

$$\begin{aligned} 04 \quad & 3 \left| \begin{array}{rrrr} 1 & -2 & -5 & 2 \\ & 3 & 3 & -6 \\ 1 & 1 & -2 & -4 \end{array} \right. \\ \therefore \text{몫} : x^2 + x - 2, \text{나머지} : -4 \end{aligned}$$

$$\begin{aligned} 05 \quad & \begin{array}{r} x+3 \\ x^2+2x-3 \overline{) x^3+5x^2+4x+1} \\ \underline{x^3+2x^2-3x} \\ 3x^2+7x+1 \\ \underline{3x^2+6x-9} \\ x+10 \end{array} \\ \therefore \text{몫} : x+3, \text{나머지} : x+10 \end{aligned}$$

$$\begin{aligned} 06 \quad & -\frac{1}{3} \left| \begin{array}{rrrr} 3 & -5 & -5 & 2 \\ & -1 & 2 & 1 \\ 3 & -6 & -3 & 3 \end{array} \right. \\ & 3x^3 - 5x^2 - 5x + 2 = \left(x + \frac{1}{3}\right)(3x^2 - 6x - 3) + 3 \\ & = (3x + 1)(x^2 - 2x - 1) + 3 \\ \text{따라서 몫 } Q(x) &= x^2 - 2x - 1, \text{나머지 } R = 3 \text{이므로} \\ Q(-2) + R &= 7 + 3 = 10 \end{aligned}$$

$$\begin{aligned} 07 \quad & \begin{array}{r} 2x+1 \\ x^2-2x+5 \overline{) 2x^3-3x^2+7x+2} \\ \underline{2x^3-4x^2+10x} \\ x^2-3x+2 \\ \underline{x^2-2x+5} \\ -x-3 \end{array} \\ \text{따라서 몫 } Q(x) &= 2x+1, \text{나머지 } R(x) = -x-3 \text{이므로} \\ Q(1) + R(1) &= 3 - 4 = -1 \end{aligned}$$

$$\begin{aligned} 08 \quad A &= (3x^2 + 5x + 2)(x - 3) + 6x + 5 \\ &= (3x^3 - 9x^2 + 5x^2 - 15x + 2x - 6) + 6x + 5 \\ &= 3x^3 - 4x^2 - 7x - 1 \end{aligned}$$

$$\begin{aligned} 09 \quad A &= (x^2 - 2x + 4)(2x - 3) + 3x + 2 \\ &= (2x^3 - 3x^2 - 4x^2 + 6x + 8x - 12) + 3x + 2 \\ &= 2x^3 - 7x^2 + 17x - 10 \end{aligned}$$

$$\begin{aligned} 10 \quad 2x^3 - 5x^2 - 6x + 4 &= B(x - 3) - x - 2 \text{에서} \\ B &= \{(2x^3 - 5x^2 - 6x + 4) + x + 2\} \div (x - 3) \\ & 3 \left| \begin{array}{rrrr} 2 & -5 & -5 & 6 \\ & 6 & 3 & -6 \\ 2 & 1 & -2 & 0 \end{array} \right. \\ \therefore B &= 2x^2 + x - 2 \end{aligned}$$

$$\begin{aligned} 11 \quad 2x^3 + 5x^2 - x - 2 &= B(2x - 1) - 4x + 1 \text{에서} \\ B &= \{(2x^3 + 5x^2 - x - 2) + 4x - 1\} \div (2x - 1) \\ & \frac{1}{2} \left| \begin{array}{rrrr} 2 & 5 & 3 & -3 \\ & 1 & 3 & 3 \\ 2 & 6 & 6 & 0 \end{array} \right. \\ & 2x^3 + 5x^2 + 3x - 3 = \left(x - \frac{1}{2}\right)(2x^2 + 6x + 6) \\ & = (2x - 1)(x^2 + 3x + 3) \\ \therefore B &= x^2 + 3x + 3 \end{aligned}$$

$$\begin{aligned} 12 \quad & 2 \left| \begin{array}{rrrr} 3 & -2 & 0 & -5 \\ & 6 & 8 & 16 \\ 3 & 4 & 8 & 11 \end{array} \right. \\ \text{따라서 } a &= 2, b = 6, c = 0, d = 8 \text{이므로} \\ a + b + c + d &= 16 \end{aligned}$$

$$\begin{aligned} 13 \quad & -\frac{1}{2} \left| \begin{array}{rrrr} 4 & 0 & 5 & 2 \\ & -2 & 1 & -3 \\ 4 & -2 & 6 & -1 \end{array} \right. \\ \text{따라서 } a &= -\frac{1}{2}, b = -2, c = 1, d = -3 \text{이므로} \\ abcd &= -3 \end{aligned}$$

$$\begin{aligned} 14 \quad f(x) &= \left(x + \frac{2}{3}\right)Q(x) + R = (3x + 2) \cdot \frac{1}{3}Q(x) + R \\ \therefore \text{몫} : \frac{1}{3}Q(x), \text{나머지} : R \end{aligned}$$

$$\begin{aligned} 15 \quad f(x) &= (2x - 7)Q(x) + R = \left(x - \frac{7}{2}\right) \cdot 2Q(x) + R \\ \therefore \text{몫} : 2Q(x), \text{나머지} : R \end{aligned}$$

4 항등식

STEP 1

72쪽~79쪽

- 01-1** (1) 등식 $4x-2=x+1$ 은 $x=1$ 일 때만 성립하므로 이 등식은 x 에 대한 방정식이다.
 (2) 등식 $(x+2)^2=x^2+4x+4$ 는 x 에 어떤 값을 대입해도 성립하므로 이 등식은 x 에 대한 항등식이다.

- 01-2** (1) 항
 (2) 방 $x=1$ 일 때만 성립한다.
 (3) 방 $x=0$ 또는 $x=3$ 일 때만 성립한다.
 (4) 항

- 02-1** (1) $a+1=0, b-2=0$
 $\therefore a=-1, b=2$
 (2) $a-2=1, b+2=5$
 $\therefore a=3, b=3$
 (3) $a-b=2, a+b=6$
 두 식을 연립하여 풀면 $a=4, b=2$
 (4) 양변에 $x=0$ 을 대입하면 $b=2$
 양변에 $x=1$ 을 대입하면 $a=5$

다른 풀이

$$ax-b(x-1)=3x+2 \text{의 좌변을 정리하면}$$

$$(a-b)x+b=3x+2 \text{이므로}$$

$$a-b=3, b=2 \quad \therefore a=5, b=2$$

- 02-2** (1) $a=0, b-3=0$
 $\therefore a=0, b=3$
 (2) $a-3=0, b+1=0$
 $\therefore a=3, b=-1$
 (3) $a-1=0, b=4$
 $\therefore a=1, b=4$
 (4) $a+2=5, b-3=-2$
 $\therefore a=3, b=1$
 (5) $a+b=4, a-b=2$
 두 식을 연립하여 풀면 $a=3, b=1$
 (6) $2a-b=-5, a+b=-1$
 두 식을 연립하여 풀면 $a=-2, b=1$
 (7) 양변에 $x=0$ 을 대입하면 $-b=-3 \quad \therefore b=3$
 양변에 $x=1$ 을 대입하면 $a=3$

다른 풀이

$$ax+b(x-1)=6x-3 \text{의 좌변을 정리하면}$$

$$(a+b)x-b=6x-3 \text{이므로}$$

$$a+b=6, -b=-3 \quad \therefore a=3, b=3$$

- (8) 양변에 $x=0$ 을 대입하면 $a=-2$
 양변에 $x=-1$ 을 대입하면 $-b=-6 \quad \therefore b=6$

다른 풀이

$$a(x+1)+bx=4x-2 \text{의 좌변을 정리하면}$$

$$(a+b)x+a=4x-2 \text{이므로}$$

$$a+b=4, a=-2 \quad \therefore a=-2, b=6$$

- 03-1** (1) $a-2=0, b-3=0, c+5=0$
 $\therefore a=2, b=3, c=-5$
 (2) $a+1=2, b-2=-6, c-3=5$
 $\therefore a=1, b=-4, c=8$
 (3) $a-1=0, b=0, c-2=0$
 $\therefore a=1, b=0, c=2$
 (4) $a=4, b+1=-3, -c=1$
 $\therefore a=4, b=-4, c=-1$
 (5) $a-4=1, b-2=-4, c+3=1$
 $\therefore a=5, b=-2, c=-2$

- 03-2** (1) 우변을 정리하면
 $x^2+2x+3=ax^2+bx-a+c$ 이므로
 $a=1, b=2, -a+c=3$
 $\therefore a=1, b=2, c=4$
 (2) 우변을 정리하면
 $2x^2-x+1=ax^2+(2a+b)x+a+c$ 이므로
 $a=2, 2a+b=-1, a+c=1$
 $\therefore a=2, b=-5, c=-1$
 (3) 우변을 정리하면
 $x^2+3x-4=ax^2+bx-a+2b+c$ 이므로
 $a=1, b=3, -a+2b+c=-4$
 $\therefore a=1, b=3, c=-9$
 (4) 우변을 정리하면
 $x^2+ax-3=bx^2+(b+c)x+c$ 이므로
 $b=1, b+c=a, c=-3$
 $\therefore a=-2, b=1, c=-3$
 (5) 우변을 정리하면
 $ax^2-5x+b=2x^2+(2c-3)x-3c$ 이므로
 $a=2, -5=2c-3, b=-3c$
 $\therefore a=2, b=3, c=-1$

- 03-3** (1) 양변에 $x=0$ 을 대입하면 $-3=-b$
 양변에 $x=-1$ 을 대입하면 $-6=2c$
 양변에 $x=1$ 을 대입하면 $2=2a$
 $\therefore a=1, b=3, c=-3$
 (2) 양변에 $x=0$ 을 대입하면 $-4=-b$
 양변에 $x=1$ 을 대입하면 $2=2a$
 양변에 $x=-1$ 을 대입하면 $-8=2c$
 $\therefore a=1, b=4, c=-4$

- (3) 양변에 $x=0$ 을 대입하면 $3=-b$
 양변에 $x=1$ 을 대입하면 $6=2c$
 양변에 $x=-1$ 을 대입하면 $4=2a$
 $\therefore a=2, b=-3, c=3$
- (4) 양변에 $x=0$ 을 대입하면 $2=-b+c$
 양변에 $x=1$ 을 대입하면 $1=c$
 양변에 $x=2$ 를 대입하면 $2=2a+b+c$
 $\therefore a=1, b=-1, c=1$
- (5) 양변에 $x=0$ 을 대입하면 $-3=b$
 양변에 $x=-1$ 을 대입하면 $-5=-c$
 양변에 $x=1$ 을 대입하면 $3=2a+2b+c$
 $\therefore a=2, b=-3, c=5$

04-1 (1) 좌변을 전개하면

$$6x^2 + \boxed{7x} - 3 = ax^2 + bx + c \text{이므로}$$

$$a = \boxed{6}, b = 7, c = -3$$

(2) 좌변을 전개하면

$$8x^3 + \boxed{12x^2} + 6x + 1 = ax^3 + bx^2 + cx + d \text{이므로}$$

$$a = 8, b = 12, c = \boxed{6}, d = 1$$

(3) 좌변을 전개하면

$$27x^3 - 8 = ax^3 + bx^2 + cx + d \text{이므로}$$

$$a = 27, b = 0, c = 0, d = -8$$

(4) 좌변을 전개하면

$$x^4 + 4x^3 - 2x^2 - 12x + 9 = ax^4 + bx^3 + cx^2 + dx + 9$$

$$\text{이므로 } a = 1, b = 4, c = -2, d = -12$$

(5) 좌변을 전개하면

$$x^4 - 10x^3 + 35x^2 - 50x + 24$$

$$= x^4 + ax^3 + bx^2 + cx + d \text{이므로}$$

$$a = -10, b = 35, c = -50, d = 24$$

참고

$$(x-1)(x-2)(x-3)(x-4)$$

$$= \{(x-1)(x-4)\} \{(x-2)(x-3)\}$$

$$= \{(x^2-5x)+4\} \{(x^2-5x)+6\}$$

$$\quad \leftarrow x^2-5x=t \text{로 치환하여 전개해도 된다.}$$

$$= (x^2-5x)^2 + 10(x^2-5x) + 24$$

$$= x^4 - 10x^3 + (25+10)x^2 - 50x + 24$$

05-1 (1) $2x^2+ax+b=(x+3)(\boxed{2x+3})+3$

$$= 2x^2 + \boxed{9x} + 12$$

$$\therefore a = 9, b = \boxed{12}$$

(2) $x^2+ax+b=(x-2)(x+4)-1$

$$= x^2 + 2x - 9$$

$$\therefore a = 2, b = -9$$

(3) $x^2+ax+b=(x+1)(x+5)+6$

$$= x^2 + 6x + 11$$

$$\therefore a = 6, b = 11$$

$$(4) ax^2+8x+b=(3x-1)(x+3)-5$$

$$= 3x^2 + 8x - 8$$

$$\therefore a = 3, b = -8$$

05-2 (1) $x^3+ax^2+bx+c=(x+3)(\boxed{x^2+4x-2})+1$

$$= x^3 + 7x^2 + \boxed{10x} - 5$$

$$\therefore a = 7, b = 10, c = \boxed{-5}$$

(2) $x^3+ax^2+bx+c=(x-4)(x^2+x+2)+5$

$$= x^3 - 3x^2 - 2x - 3$$

$$\therefore a = -3, b = -2, c = -3$$

(3) $2x^3+ax^2+bx+c=(2x+1)(x^2-3x+1)-2$

$$= 2x^3 - 5x^2 - x - 1$$

$$\therefore a = -5, b = -1, c = -1$$

(4) $ax^3+bx^2+7x+c=(x-2)(2x^2-3x+1)+4$

$$= 2x^3 - 7x^2 + 7x + 2$$

$$\therefore a = 2, b = -7, c = 2$$

05-3 (1) $x^3+ax^2+bx+c=(\boxed{x^2+1})(x-2)+3x-1$

$$= x^3 - 2x^2 + 4x - \boxed{3}$$

$$\therefore a = \boxed{-2}, b = 4, c = -3$$

(2) $x^3+ax^2+bx+c=(x^2-2x)(x+1)-4$

$$= x^3 - x^2 - 2x - 4$$

$$\therefore a = -1, b = -2, c = -4$$

(3) $2x^3+ax^2+bx+c=(2x^2+3x-1)(x-2)+3x+1$

$$= 2x^3 - x^2 - 4x + 3$$

$$\therefore a = -1, b = -4, c = 3$$

(4) $ax^3+bx^2+cx+4=(3x^2+x-2)(2x-1)+2$

$$= 6x^3 - x^2 - 5x + 4$$

$$\therefore a = 6, b = -1, c = -5$$

06-1 (1) $(3k-2)x+(k-1)y-2k+1=0$ 을 k 에 대하여 정

리하면 $(3x+y-2)k+(-2x-y+1)=0$

이 식이 k 에 대한 항등식이므로

$$3x+y-2=\boxed{0}, -2x-y+1=\boxed{0}$$

두 식을 연립하여 풀면 $x=1, y=\boxed{-1}$

(2) $(-2k+1)x+(k-1)y+k+1=0$ 을 k 에 대하여

정리하면 $(-2x+y+1)k+(x-y+1)=0$

이 식이 k 에 대한 항등식이므로

$$-2x+y+1=\boxed{0}, x-y+1=\boxed{0}$$

두 식을 연립하여 풀면 $x=\boxed{2}, y=3$

(3) $(k+2)x+(-2k+1)y-3k-1=0$ 을 k 에 대하여

정리하면 $(x-2y-3)k+(2x+y-1)=0$

이 식이 k 에 대한 항등식이므로

$$x-2y-3=0, 2x+y-1=0$$

두 식을 연립하여 풀면 $x=1, y=-1$

- (4) $(2k+1)x + (-3k+2)y + 2k - 6 = 0$ 을 k 에 대하여 정리하면
 $(2x-3y+2)k + (x+2y-6) = 0$
 이 식이 k 에 대한 항등식이므로
 $2x-3y+2=0, x+2y-6=0$
 두 식을 연립하여 풀면 $x=2, y=2$
- (5) $(k+2)x + (-3k-2)y + 4k - 4 = 0$ 을 k 에 대하여 정리하면
 $(x-3y+4)k + (2x-2y-4) = 0$
 이 식이 k 에 대한 항등식이므로
 $x-3y+4=0, 2x-2y-4=0$
 두 식을 연립하여 풀면 $x=5, y=3$
- (6) $(-k+2)x + (2k-1)y + 5k - 4 = 0$ 을 k 에 대하여 정리하면
 $(-x+2y+5)k + (2x-y-4) = 0$
 이 식이 k 에 대한 항등식이므로
 $-x+2y+5=0, 2x-y-4=0$
 두 식을 연립하여 풀면 $x=1, y=-2$
- (7) $(4k+2)x + (-3k+3)y - 5k - 7 = 0$ 을 k 에 대하여 정리하면
 $(4x-3y-5)k + (2x+3y-7) = 0$
 이 식이 k 에 대한 항등식이므로
 $4x-3y-5=0, 2x+3y-7=0$
 두 식을 연립하여 풀면 $x=2, y=1$
- (8) $(3k+1)x + (k-2)y + k + 12 = 0$ 을 k 에 대하여 정리하면
 $(3x+y+1)k + (x-2y+12) = 0$
 이 식이 k 에 대한 항등식이므로
 $3x+y+1=0, x-2y+12=0$
 두 식을 연립하여 풀면 $x=-2, y=5$

07-1 $(3x^3+2x^2+x+1)^2 = a_0 + a_1x + a_2x^2 + \cdots + a_6x^6$ 의

- (1) 양변에 $x=\boxed{0}$ 을 대입하면
 $1^2 = a_0 \quad \therefore a_0 = 1$
- (2) 양변에 $x=\boxed{1}$ 을 대입하면
 $7^2 = a_0 + a_1 + a_2 + a_3 + a_4 + a_5 + a_6$
 $\therefore a_0 + a_1 + a_2 + a_3 + a_4 + a_5 + a_6 = 49 \quad \cdots \cdots \textcircled{1}$
- (3) 양변에 $x=\boxed{-1}$ 을 대입하면
 $(-1)^2 = a_0 - a_1 + a_2 - a_3 + a_4 - a_5 + a_6$
 $\therefore a_0 - a_1 + a_2 - a_3 + a_4 - a_5 + a_6 = 1 \quad \cdots \cdots \textcircled{2}$
- (4) $\textcircled{1} + \textcircled{2}$ 을 하면
 $2(a_0 + a_2 + a_4 + a_6) = \boxed{50}$
 $\therefore a_0 + a_2 + a_4 + a_6 = \boxed{25}$
- (5) $\textcircled{1} - \textcircled{2}$ 을 하면
 $2(a_1 + a_3 + a_5) = \boxed{48}$
 $\therefore a_1 + a_3 + a_5 = \boxed{24}$

07-2 $(x^2+2x+3)^3 = a_0 + a_1x + a_2x^2 + \cdots + a_6x^6$ 의

- (1) 양변에 $x=0$ 을 대입하면
 $3^3 = a_0 \quad \therefore a_0 = 27$
- (2) 양변에 $x=1$ 을 대입하면
 $6^3 = a_0 + a_1 + a_2 + a_3 + a_4 + a_5 + a_6$
 $\therefore a_0 + a_1 + a_2 + a_3 + a_4 + a_5 + a_6 = 216$
- (3) 양변에 $x=-1$ 을 대입하면
 $2^3 = a_0 - a_1 + a_2 - a_3 + a_4 - a_5 + a_6$
 $\therefore a_0 - a_1 + a_2 - a_3 + a_4 - a_5 + a_6 = 8$

07-3 $(x+1)^{10} = a_0 + a_1x + a_2x^2 + \cdots + a_{10}x^{10}$ 의

- (1) 양변에 $x=0$ 을 대입하면
 $1^{10} = a_0 \quad \therefore a_0 = 1$
- (2) 양변에 $x=1$ 을 대입하면
 $2^{10} = a_0 + a_1 + a_2 + \cdots + a_{10}$
 $\therefore a_0 + a_1 + a_2 + \cdots + a_{10} = 1024$
- (3) 양변에 $x=-1$ 을 대입하면
 $a_0 - a_1 + a_2 - \cdots + a_{10} = 0$

07-4 $(x^2-3x+1)^4 = a_0 + a_1x + a_2x^2 + \cdots + a_8x^8$ 의

- (1) 양변에 $x=\boxed{1}$ 을 대입하면
 $(-1)^4 = a_0 + a_1 + a_2 + \cdots + a_8$
 $\therefore a_0 + a_1 + a_2 + \cdots + a_8 = \boxed{1} \quad \cdots \cdots \textcircled{1}$
- (2) 양변에 $x=\boxed{-1}$ 을 대입하면
 $\boxed{5^4} = a_0 - a_1 + a_2 - \cdots + a_8$
 $\therefore a_0 - a_1 + a_2 - \cdots + a_8 = 625 \quad \cdots \cdots \textcircled{2}$
- (3) $\textcircled{1} + \textcircled{2}$ 을 하면
 $2(a_0 + a_2 + a_4 + a_6 + a_8) = 626$
 $\therefore a_0 + a_2 + a_4 + a_6 + a_8 = \boxed{313}$

07-5 $(3x^2+x-2)^5 = a_0 + a_1x + a_2x^2 + \cdots + a_{10}x^{10}$ 의

- (1) 양변에 $x=1$ 을 대입하면
 $2^5 = a_0 + a_1 + a_2 + a_3 + \cdots + a_{10}$
 $\therefore a_0 + a_1 + a_2 + a_3 + \cdots + a_{10} = 32 \quad \cdots \cdots \textcircled{1}$
- (2) 양변에 $x=-1$ 을 대입하면
 $a_0 - a_1 + a_2 - a_3 + \cdots + a_{10} = 0 \quad \cdots \cdots \textcircled{2}$
- (3) $\textcircled{1} + \textcircled{2}$ 을 하면
 $2(a_0 + a_2 + a_4 + a_6 + a_8 + a_{10}) = 32$
 $\therefore a_0 + a_2 + a_4 + a_6 + a_8 + a_{10} = 16$

07-6 $(x^3+x^2+x+1)^2 = a_0 + a_1x + a_2x^2 + \cdots + a_6x^6$ 의

- (1) 양변에 $x=\boxed{1}$ 을 대입하면
 $4^2 = a_0 + a_1 + a_2 + a_3 + a_4 + a_5 + a_6$
 $\therefore a_0 + a_1 + a_2 + a_3 + a_4 + a_5 + a_6 = \boxed{16} \quad \cdots \cdots \textcircled{1}$
- (2) 양변에 $x=\boxed{-1}$ 을 대입하면
 $a_0 - a_1 + a_2 - a_3 + a_4 - a_5 + a_6 = \boxed{0} \quad \cdots \cdots \textcircled{2}$

(3) ㉠-㉡을 하면

$$2(a_1 + a_3 + a_5) = \boxed{16}$$

$$\therefore a_1 + a_3 + a_5 = \boxed{8}$$

07-7 $(x-1)^{10} = a_0 + a_1x + a_2x^2 + \cdots + a_{10}x^{10}$ 의

(1) 양변에 $x=1$ 을 대입하면

$$a_0 + a_1 + a_2 + a_3 + \cdots + a_{10} = 0 \quad \cdots \cdots \textcircled{7}$$

(2) 주어진 식의 양변에 $x=-1$ 을 대입하면

$$(-2)^{10} = a_0 - a_1 + a_2 - a_3 + \cdots + a_{10}$$

$$\therefore a_0 - a_1 + a_2 - a_3 + \cdots + a_{10} = 1024 \quad \cdots \cdots \textcircled{8}$$

(3) ㉠-㉡을 하면

$$2(a_1 + a_3 + a_5 + a_7 + a_9) = -1024$$

$$\therefore a_1 + a_3 + a_5 + a_7 + a_9 = -512$$

STEP 2

80쪽~83쪽

1-1 (1) 방정식

(2) 항등식

1-2 (1) 방정식

(2) 항등식

2-1 (1) $a+2=0, b-1=0 \quad \therefore a=-2, b=1$

(2) $a-4=0, b+2=0 \quad \therefore a=4, b=-2$

(3) $a-3=3, b-2=1 \quad \therefore a=6, b=3$

(4) $a+1=4, b+3=-1 \quad \therefore a=3, b=-4$

2-2 (1) $a-1=0, b=0 \quad \therefore a=1, b=0$

(2) $2a-6=0, b+3=0 \quad \therefore a=3, b=-3$

(3) $a+2=1, b+4=2 \quad \therefore a=-1, b=-2$

(4) $a-5=0, b+2=6 \quad \therefore a=5, b=4$

3-1 (1) $a+b=1, a-b=7$

두 식을 연립하여 풀면 $a=4, b=-3$

(2) $a-b=-1, a+b=5$

두 식을 연립하여 풀면 $a=2, b=3$

(3) 양변에 $x=0$ 을 대입하면 $2a=4 \quad \therefore a=2$

양변에 $x=-2$ 를 대입하면 $-2b=-10 \quad \therefore b=5$

(4) 양변에 $x=0$ 을 대입하면 $-3b=6 \quad \therefore b=-2$

양변에 $x=3$ 을 대입하면 $3a=12 \quad \therefore a=4$

3-2 (1) $a+3b=8, a-2b=-7$

두 식을 연립하여 풀면 $a=-1, b=3$

(2) $a-2b=2, 2a-b=7$

두 식을 연립하여 풀면 $a=4, b=1$

(3) 양변에 $x=1$ 을 대입하면 $2a=-6 \quad \therefore a=-3$

양변에 $x=-1$ 을 대입하면 $-2b=-2 \quad \therefore b=1$

(4) 양변에 $x=-3$ 을 대입하면 $-5a=-10 \quad \therefore a=2$

양변에 $x=2$ 를 대입하면 $5b=15 \quad \therefore b=3$

4-1 (1) 좌변을 전개하면

$$x^2 + 7x + 12 = ax^2 + bx + c \text{이므로}$$

$$a=1, b=7, c=12$$

(2) 좌변을 전개하면

$$x^2 - 4 = ax^2 + bx + c \text{이므로}$$

$$a=1, b=0, c=-4$$

(3) 좌변을 전개하면

$$6x^2 + x - 2 = ax^2 + bx + c \text{이므로}$$

$$a=6, b=1, c=-2$$

4-2 (1) 좌변을 전개하면

$$x^2 + 4x - 5 = ax^2 + bx + c \text{이므로}$$

$$a=1, b=4, c=-5$$

(2) 좌변을 전개하면

$$9x^2 - 25 = ax^2 + bx + c \text{이므로}$$

$$a=9, b=0, c=-25$$

(3) 좌변을 전개하면

$$12x^2 + 5x - 2 = ax^2 + bx + c \text{이므로}$$

$$a=12, b=5, c=-2$$

5-1 (1) $a-3=0, b+1=0, c-1=0$

$$\therefore a=3, b=-1, c=1$$

(2) $a+2=4, b-3=2, c-1=-3$

$$\therefore a=2, b=5, c=-2$$

(3) 우변을 전개하면

$$x^2 - 3x - 1 = ax^2 + (-2a+b)x + a+c \text{이므로}$$

$$a=1, -2a+b=-3, a+c=-1$$

$$\therefore a=1, b=-1, c=-2$$

(4) 양변에 $x=0$ 을 대입하면 $-1=-b$

양변에 $x=1$ 을 대입하면 $4=2a$

양변에 $x=-1$ 을 대입하면 $0=2c$

$$\therefore a=2, b=1, c=0$$

(5) 좌변을 전개하면

$$x^3 - 9x^2 + 27x - 27 = ax^3 + bx^2 + cx + d \text{이므로}$$

$$a=1, b=-9, c=27, d=-27$$

(6) 좌변을 전개하면

$$4x^4 + 4x^3 - 3x^2 - 2x + 1 = ax^4 + bx^3 + cx^2 + dx + 1$$

이므로

$$a=4, b=4, c=-3, d=-2$$

5-2 (1) $a+2=0, b-3=0, c+4=0$

$\therefore a=-2, b=3, c=-4$

(2) $a-4=5, b+1=-3, c-2=0$

$\therefore a=9, b=-4, c=2$

(3) 우변을 전개하면

$4x^2+ax-2=2bx^2+(-b+2c)x-c$ 이므로

$4=2b, a=-b+2c, -2=-c$

$\therefore a=2, b=2, c=2$

(4) 양변에 $x=0$ 을 대입하면 $2=2b$

양변에 $x=1$ 을 대입하면 $-3=-a$

양변에 $x=2$ 를 대입하면 $-4=2c$

$\therefore a=3, b=1, c=-2$

(5) 좌변을 전개하면

$8x^3+1=ax^3+bx^2+cx+d$ 이므로

$a=8, b=0, c=0, d=1$

(6) 좌변을 전개하면

$x^4-6x^3+3x^2+18x+9=ax^4+bx^3+cx^2+dx+9$

이므로

$a=1, b=-6, c=3, d=18$

6-1 (1) $x^2+ax+b=(x-2)(x+5)+3$

$=x^2+3x-7$

$\therefore a=3, b=-7$

(2) $x^3+ax^2+bx+c=(x-3)(x^2-x+4)-5$

$=x^3-4x^2+7x-17$

$\therefore a=-4, b=7, c=-17$

6-2 (1) $ax^3+bx^2+cx-1=(x^2-2x+4)(3x-1)+3$

$=3x^3-7x^2+14x-1$

$\therefore a=3, b=-7, c=14$

(2) $x^3+ax^2+bx+c=(x^2+x-3)(x+3)+2x+4$

$=x^3+4x^2+2x-5$

$\therefore a=4, b=2, c=-5$

7-1 (1) $(2k-1)x+(k-2)y-3k-3=0$ 을 k 에 대하여 정리하면

$(2x+y-3)k+(-x-2y-3)=0$

이 식이 k 에 대한 항등식이므로

$2x+y-3=0, -x-2y-3=0$

두 식을 연립하여 풀면 $x=3, y=-3$

(2) $(-3k+2)x+(-k+3)y+k+4=0$ 을 k 에 대하여 정리하면

$(-3x-y+1)k+(2x+3y+4)=0$

이 식이 k 에 대한 항등식이므로

$-3x-y+1=0, 2x+3y+4=0$

두 식을 연립하여 풀면 $x=1, y=-2$

7-2 (1) $(-k+3)x+(-2k-1)y+3k-2=0$ 을 k 에 대하여 정리하면

$(-x-2y+3)k+(3x-y-2)=0$

이 식이 k 에 대한 항등식이므로

$-x-2y+3=0, 3x-y-2=0$

두 식을 연립하여 풀면 $x=1, y=1$

(2) $(2k+3)x+(k-2)y-5k+3=0$ 을 k 에 대하여 정리하면

$(2x+y-5)k+(3x-2y+3)=0$

이 식이 k 에 대한 항등식이므로

$2x+y-5=0, 3x-2y+3=0$

두 식을 연립하여 풀면 $x=1, y=3$

8-1 $(3x^3-2x^2+x-1)^2=a_0+a_1+a_2x^2+\dots+a_6x^6$ 의

양변에 $x=1$ 을 대입하면

$1^2=a_0+a_1+a_2+a_3+a_4+a_5+a_6$

$\therefore a_0+a_1+a_2+a_3+a_4+a_5+a_6=1$ ㉠

양변에 $x=-1$ 을 대입하면

$(-7)^2=a_0-a_1+a_2-a_3+a_4-a_5+a_6$

$\therefore a_0-a_1+a_2-a_3+a_4-a_5+a_6=49$ ㉡

(1) ㉠+㉡을 하면

$2(a_0+a_2+a_4+a_6)=50$

$\therefore a_0+a_2+a_4+a_6=25$

참고

주어진 식의 양변에 $x=0$ 을 대입하면 $a_0=1$ 이므로
 $a_2+a_4+a_6=24$

(2) ㉠-㉡을 하면

$2(a_1+a_3+a_5)=-48$

$\therefore a_1+a_3+a_5=-24$

8-2 $(x^2-2x+1)^3=a_0+a_1x+a_2x^2+\dots+a_6x^6$ 의

양변에 $x=1$ 을 대입하면

$a_0+a_1+a_2+a_3+a_4+a_5+a_6=0$ ㉠

양변에 $x=-1$ 을 대입하면

$4^3=a_0-a_1+a_2-a_3+a_4-a_5+a_6$

$\therefore a_0-a_1+a_2-a_3+a_4-a_5+a_6=64$ ㉡

(1) ㉠+㉡을 하면

$2(a_0+a_2+a_4+a_6)=64$

$\therefore a_0+a_2+a_4+a_6=32$

참고

주어진 식의 양변에 $x=0$ 을 대입하면 $a_0=1$ 이므로
 $a_2+a_4+a_6=31$

(2) ㉠-㉡을 하면

$2(a_1+a_3+a_5)=-64$

$\therefore a_1+a_3+a_5=-32$

01 $(x-1)^2 = x^2 - 2x + 1$

02 주어진 식이 x 에 대한 항등식이 되려면

$$a-2=3, b-3=-2$$

$$\text{따라서 } a=5, b=1 \text{이므로 } a+b=6$$

03 주어진 식이 x 에 대한 항등식이므로

$$a-b=3, a+b=5$$

$$\text{두 식을 연립하여 풀면 } a=4, b=1 \text{이므로}$$

$$ab=4$$

04 주어진 등식의 양변을 전개하면

$$x^2+2x+1=x^2+(a+4)x+2a+b+4$$

$$\text{이 식이 } x \text{에 대한 항등식이므로}$$

$$a+4=2, 2a+b+4=1$$

$$\text{따라서 } a=-2, b=1 \text{이므로 } a-b=-3$$

05 주어진 식이 x 에 대한 항등식이므로

$$a+1=0, b-3=0, c-4=0$$

$$\text{따라서 } a=-1, b=3, c=4 \text{이므로}$$

$$a+b+c=6$$

06 주어진 식이 x 에 대한 항등식이므로

$$a-2=1, b-1=-3, c+4=5$$

$$\text{따라서 } a=3, b=-2, c=1 \text{이므로}$$

$$abc=-6$$

07 우변을 전개하면

$$x^3+ax^2+bx+6=x^3+2x^2+(-3+c)x+3c \text{이므로}$$

$$a=2, b=-3+c, 6=3c$$

$$\text{따라서 } a=2, b=-1, c=2 \text{이므로}$$

$$abc=-4$$

08 양변에 $x=0$ 을 대입하면 $-4=2b$

$$\text{양변에 } x=-1 \text{을 대입하면 } -5=-c$$

$$\text{양변에 } x=-2 \text{를 대입하면 } 0=2a$$

$$\text{따라서 } a=0, b=-2, c=5 \text{이므로}$$

$$a-b+c=7$$

09 양변에 $x=0$ 을 대입하면 $-1=-a$

$$\text{양변에 } x=1 \text{을 대입하면 } -5=2b$$

$$\text{양변에 } x=-1 \text{을 대입하면 } 5=2c$$

$$\text{따라서 } a=1, b=-\frac{5}{2}, c=\frac{5}{2} \text{이므로}$$

$$abc=-\frac{25}{4}$$

10 $2x^3+ax^2+bx+c=(x-1)(2x^2+x-3)+3$

$$=2x^3-x^2-4x+6$$

$$\text{따라서 } a=-1, b=-4, c=6 \text{이므로}$$

$$abc=24$$

11 $(k+2)x+(3k+5)y+k+3=0$ 을 k 에 대하여 정리하면

$$(x+3y+1)k+(2x+5y+3)=0$$

$$\text{이 식이 } k \text{에 대한 항등식이므로}$$

$$x+3y+1=0, 2x+5y+3=0$$

$$\text{두 식을 연립하여 풀면 } x=-4, y=1 \text{이므로}$$

$$x+y=-3$$

12 $(2k+1)x+(-k-3)y-k+7=0$ 을 k 에 대하여 정리하면

$$(2x-y-1)k+(x-3y+7)=0$$

$$\text{이 식이 } k \text{에 대한 항등식이므로}$$

$$2x-y-1=0, x-3y+7=0$$

$$\text{두 식을 연립하여 풀면 } x=2, y=3 \text{이므로}$$

$$x^2+y^2=13$$

13 $(2x+1)^{10}=a_0+a_1x+a_2x^2+\cdots+a_{10}x^{10}$ 의

$$\text{양변에 } x=\boxed{1} \text{을 대입하면}$$

$$a_0+a_1+a_2+\cdots+a_{10}=3^{10} \quad \cdots \textcircled{A}$$

$$\text{주어진 식의 양변에 } x=\boxed{-1} \text{을 대입하면}$$

$$(-1)^{10}=a_0-a_1+a_2-\cdots+a_{10}$$

$$\therefore a_0-a_1+a_2-\cdots+a_{10}=1 \quad \cdots \textcircled{B}$$

$$\textcircled{A}-\textcircled{B} \text{을 하면}$$

$$2(a_1+a_3+a_5+a_7+a_9)=3^{10}-1$$

$$\therefore a_1+a_3+a_5+a_7+a_9=\boxed{\frac{3^{10}-1}{2}}$$

14 $(x^3-x^2+x-1)^2=a_0+a_1x+a_2x^2+\cdots+a_6x^6$ 의

$$\text{양변에 } x=1 \text{을 대입하면}$$

$$a_0+a_1+a_2+a_3+a_4+a_5+a_6=0 \quad \cdots \textcircled{A}$$

$$\text{양변에 } x=-1 \text{을 대입하면}$$

$$(-4)^2=a_0-a_1+a_2-a_3+a_4-a_5+a_6$$

$$\therefore a_0-a_1+a_2-a_3+a_4-a_5+a_6=16 \quad \cdots \textcircled{B}$$

$$\textcircled{A}+\textcircled{B} \text{을 하면}$$

$$2(a_0+a_2+a_4+a_6)=16$$

$$\therefore a_0+a_2+a_4+a_6=8$$

$$\text{이때, 주어진 식의 양변에 } x=0 \text{을 대입하면}$$

$$(-1)^2=a_0 \quad \therefore a_0=1$$

$$\therefore a_2+a_4+a_6=(a_0+a_2+a_4+a_6)-a_0$$

$$=8-1=7$$

5 나머지정리

STEP 1

88쪽~98쪽

01-1 (1)

$$\begin{array}{r|rr} -1 & 1 & 2 & -5 \\ & & -1 & -1 \\ \hline & 1 & 1 & -6 \end{array}$$

$$\therefore Q(x) = \boxed{x+1}, R = -6$$

(2)

$$\begin{array}{r|rrr} 2 & 1 & -3 & 1 & 5 \\ & & 2 & -2 & -2 \\ \hline & 1 & -1 & -1 & 3 \end{array}$$

$$\therefore Q(x) = \boxed{x^2 - x - 1}, R = 3$$

(3)

$$\begin{array}{r|rrrr} 1 & 1 & 2 & -4 & 3 & 2 \\ & & 1 & 3 & -1 & 2 \\ \hline & 1 & 3 & -1 & 2 & 4 \end{array}$$

$$\therefore Q(x) = \boxed{x^3 + 3x^2 - x + 2}, R = 4$$

01-2 (1)

$$\begin{array}{r|rr} 2 & 1 & -4 & 2 \\ & & 2 & -4 \\ \hline & 1 & -2 & -2 \end{array}$$

$$\therefore Q(x) = x - 2, R = -2$$

(2)

$$\begin{array}{r|rr} -1 & 3 & 1 & -4 \\ & & -3 & 2 \\ \hline & 3 & -2 & -2 \end{array}$$

$$\therefore Q(x) = 3x - 2, R = -2$$

(3)

$$\begin{array}{r|rrrr} -2 & 1 & 2 & -1 & 3 \\ & & -2 & 0 & 2 \\ \hline & 1 & 0 & -1 & 5 \end{array}$$

$$\therefore Q(x) = x^2 - 1, R = 5$$

(4)

$$\begin{array}{r|rrrr} 2 & 1 & 0 & -2 & 2 \\ & & 2 & 4 & 4 \\ \hline & 1 & 2 & 2 & 6 \end{array}$$

$$\therefore Q(x) = x^2 + 2x + 2, R = 6$$

(5)

$$\begin{array}{r|rrrrr} 1 & 1 & -1 & 2 & 4 & -2 \\ & & 1 & 0 & 2 & 6 \\ \hline & 1 & 0 & 2 & 6 & 4 \end{array}$$

$$\therefore Q(x) = x^3 + 2x + 6, R = 4$$

(6)

$$\begin{array}{r|rrrrr} 2 & 1 & -4 & 0 & -2 & 1 \\ & & 2 & -4 & -8 & -20 \\ \hline & 1 & -2 & -4 & -10 & -19 \end{array}$$

$$\therefore Q(x) = x^3 - 2x^2 - 4x - 10, R = -19$$

02-1 다항식 $f(x) = 2x^3 + 4x^2 - x - 2$ 를

(1) 일차식 $x - 1$ 로 나눌 때의 나머지는

$$f(\boxed{1}) = 2 \cdot 1^3 + 4 \cdot 1^2 - 1 - 2 = \boxed{3}$$

(2) 일차식 $x + 1$ 로 나눌 때의 나머지는

$$f(\boxed{-1}) = 2 \cdot (-1)^3 + 4 \cdot (-1)^2 - (-1) - 2 = \boxed{1}$$

(3) 일차식 $x - 2$ 로 나눌 때의 나머지는

$$f(2) = 2 \cdot 2^3 + 4 \cdot 2^2 - 2 - 2 = 28$$

(4) 일차식 $x + 2$ 로 나눌 때의 나머지는

$$f(-2) = 2 \cdot (-2)^3 + 4 \cdot (-2)^2 - (-2) - 2 = 0$$

(5) 일차식 $x - \frac{1}{2}$ 로 나눌 때의 나머지는

$$f\left(\frac{1}{2}\right) = 2 \cdot \left(\frac{1}{2}\right)^3 + 4 \cdot \left(\frac{1}{2}\right)^2 - \frac{1}{2} - 2 = -\frac{5}{4}$$

(6) 일차식 $x + \frac{1}{2}$ 로 나눌 때의 나머지는

$$f\left(-\frac{1}{2}\right) = 2 \cdot \left(-\frac{1}{2}\right)^3 + 4 \cdot \left(-\frac{1}{2}\right)^2 - \left(-\frac{1}{2}\right) - 2 = -\frac{3}{4}$$

02-2 다항식 $f(x) = x^3 - 2x^2 + 4x + 1$ 을

(1) 일차식 $x - 1$ 로 나눌 때의 나머지는

$$f(1) = 1^3 - 2 \cdot 1^2 + 4 \cdot 1 + 1 = 4$$

(2) 일차식 $x + 2$ 로 나눌 때의 나머지는

$$f(-2) = (-2)^3 - 2 \cdot (-2)^2 + 4 \cdot (-2) + 1 = -23$$

(3) 일차식 $x - \frac{1}{3}$ 로 나눌 때의 나머지는

$$f\left(\frac{1}{3}\right) = \left(\frac{1}{3}\right)^3 - 2 \cdot \left(\frac{1}{3}\right)^2 + 4 \cdot \frac{1}{3} + 1 = \frac{58}{27}$$

(4) 일차식 $x + \frac{1}{3}$ 로 나눌 때의 나머지는

$$f\left(-\frac{1}{3}\right) = \left(-\frac{1}{3}\right)^3 - 2 \cdot \left(-\frac{1}{3}\right)^2 + 4 \cdot \left(-\frac{1}{3}\right) + 1 = -\frac{16}{27}$$

02-3 다항식 $f(x) = x^3 - 4x + 1$ 을

(1) 일차식 $x + 1$ 로 나눌 때의 나머지는

$$f(-1) = (-1)^3 - 4 \cdot (-1) + 1 = 4$$

(2) 일차식 $x - 2$ 로 나눌 때의 나머지는

$$f(2) = 2^3 - 4 \cdot 2 + 1 = 1$$

(3) 일차식 $x - \frac{1}{3}$ 로 나눌 때의 나머지는

$$f\left(\frac{1}{3}\right) = \left(\frac{1}{3}\right)^3 - 4 \cdot \frac{1}{3} + 1 = -\frac{8}{27}$$

(4) 일차식 $x + \frac{1}{3}$ 로 나눌 때의 나머지는

$$f\left(-\frac{1}{3}\right) = \left(-\frac{1}{3}\right)^3 - 4 \cdot \left(-\frac{1}{3}\right) + 1 = \frac{62}{27}$$

03-1 다항식 $f(x) = x^3 + 2x^2 + 4x - 1$ 을

- (1) 일차식 $2x - 1$ 로 나눌 때의 나머지는

$$f\left(\frac{1}{2}\right) = \left(\frac{1}{2}\right)^3 + 2 \cdot \left(\frac{1}{2}\right)^2 + 4 \cdot \frac{1}{2} - 1 = \frac{13}{8}$$

- (2) 일차식 $2x + 1$ 로 나눌 때의 나머지는

$$f\left(-\frac{1}{2}\right) = \left(-\frac{1}{2}\right)^3 + 2 \cdot \left(-\frac{1}{2}\right)^2 + 4 \cdot \left(-\frac{1}{2}\right) - 1 = -\frac{21}{8}$$

- (3) 일차식 $3x - 1$ 로 나눌 때의 나머지는

$$f\left(\frac{1}{3}\right) = \left(\frac{1}{3}\right)^3 + 2 \cdot \left(\frac{1}{3}\right)^2 + 4 \cdot \frac{1}{3} - 1 = \frac{16}{27}$$

- (4) 일차식 $3x + 1$ 로 나눌 때의 나머지는

$$f\left(-\frac{1}{3}\right) = \left(-\frac{1}{3}\right)^3 + 2 \cdot \left(-\frac{1}{3}\right)^2 + 4 \cdot \left(-\frac{1}{3}\right) - 1 = -\frac{58}{27}$$

- (5) 일차식 $3x - 2$ 로 나눌 때의 나머지는

$$f\left(\frac{2}{3}\right) = \left(\frac{2}{3}\right)^3 + 2 \cdot \left(\frac{2}{3}\right)^2 + 4 \cdot \frac{2}{3} - 1 = \frac{77}{27}$$

- (6) 일차식 $2x + 3$ 으로 나눌 때의 나머지는

$$f\left(-\frac{3}{2}\right) = \left(-\frac{3}{2}\right)^3 + 2 \cdot \left(-\frac{3}{2}\right)^2 + 4 \cdot \left(-\frac{3}{2}\right) - 1 = -\frac{47}{8}$$

03-2 다항식 $f(x) = 3x^3 - x^2 + x - 2$ 를

- (1) 일차식 $2x - 1$ 로 나눌 때의 나머지는

$$f\left(\frac{1}{2}\right) = 3 \cdot \left(\frac{1}{2}\right)^3 - \left(\frac{1}{2}\right)^2 + \frac{1}{2} - 2 = -\frac{11}{8}$$

- (2) 일차식 $2x - 3$ 으로 나눌 때의 나머지는

$$f\left(\frac{3}{2}\right) = 3 \cdot \left(\frac{3}{2}\right)^3 - \left(\frac{3}{2}\right)^2 + \frac{3}{2} - 2 = \frac{59}{8}$$

- (3) 일차식 $3x + 2$ 로 나눌 때의 나머지는

$$f\left(-\frac{2}{3}\right) = 3 \cdot \left(-\frac{2}{3}\right)^3 - \left(-\frac{2}{3}\right)^2 + \left(-\frac{2}{3}\right) - 2 = -4$$

- (4) 일차식 $4x - 1$ 로 나눌 때의 나머지는

$$f\left(\frac{1}{4}\right) = 3 \cdot \left(\frac{1}{4}\right)^3 - \left(\frac{1}{4}\right)^2 + \frac{1}{4} - 2 = -\frac{113}{64}$$

03-3 다항식 $f(x) = x^3 - 2x + 2$ 를

- (1) 일차식 $2x + 1$ 로 나눌 때의 나머지는

$$f\left(-\frac{1}{2}\right) = \left(-\frac{1}{2}\right)^3 - 2 \cdot \left(-\frac{1}{2}\right) + 2 = \frac{23}{8}$$

- (2) 일차식 $3x + 1$ 로 나눌 때의 나머지는

$$f\left(-\frac{1}{3}\right) = \left(-\frac{1}{3}\right)^3 - 2 \cdot \left(-\frac{1}{3}\right) + 2 = \frac{71}{27}$$

- (3) 일차식 $4x - 3$ 으로 나눌 때의 나머지는

$$f\left(\frac{3}{4}\right) = \left(\frac{3}{4}\right)^3 - 2 \cdot \frac{3}{4} + 2 = \frac{59}{64}$$

- (4) 일차식 $5x - 2$ 로 나눌 때의 나머지는

$$f\left(\frac{2}{5}\right) = \left(\frac{2}{5}\right)^3 - 2 \cdot \frac{2}{5} + 2 = \frac{158}{125}$$

04-1 (1) $f(1) = \boxed{1}$ 이므로

$$1 + a + 3 = 1 \quad \therefore a = \boxed{-3}$$

- (2) $f\left(\frac{1}{2}\right) = \boxed{2}$ 이므로

$$4 \cdot \left(\frac{1}{2}\right)^2 + a \cdot \frac{1}{2} + 3 = 2 \quad \therefore a = \boxed{-4}$$

- (3) $f(-2) = 3$ 이므로

$$2 \cdot (-2)^2 + (-2) + a = 3 \quad \therefore a = -3$$

- (4) $f(2) = 5$ 이므로

$$4 - 2a - 1 = 5 \quad \therefore a = -1$$

- (5) $f\left(-\frac{1}{3}\right) = \frac{2}{9}$ 이므로

$$\frac{2}{9} - 1 + a = \frac{2}{9} \quad \therefore a = 1$$

- (6) $f\left(\frac{3}{2}\right) = 7$ 이므로

$$\frac{9}{4} + \frac{3}{2}a + 4 = 7 \quad \therefore a = \frac{1}{2}$$

- (7) $f(1) = -2$ 이므로

$$1^3 + a \cdot 1^2 - 2 \cdot 1 - 3 = -2 \quad \therefore a = 2$$

- (8) $f(-3) = 12$ 이므로

$$-27 - 18 + 3a + 3 = 12 \quad \therefore a = 18$$

04-2 (1) $f(-1) = \boxed{-4}$ 이므로

$$1 - a + b = -4 \quad \therefore -a + b = -5 \quad \cdots \cdots \textcircled{1}$$

$$f(2) = 5 \text{이므로}$$

$$4 + 2a + b = 5 \quad \therefore 2a + b = 1 \quad \cdots \cdots \textcircled{2}$$

$$\textcircled{1}, \textcircled{2} \text{을 연립하여 풀면 } a = \boxed{2}, b = \boxed{-3}$$

- (2) $f(1) = \boxed{4}$ 이므로

$$1 + a + b = 4 \quad \therefore a + b = 3 \quad \cdots \cdots \textcircled{1}$$

$$f(-2) = 4 \text{이므로}$$

$$4 - 2a + b = 4 \quad \therefore -2a + b = 0 \quad \cdots \cdots \textcircled{2}$$

$$\textcircled{1}, \textcircled{2} \text{을 연립하여 풀면 } a = \boxed{1}, b = \boxed{2}$$

- (3) $f(1) = 3$ 이므로

$$1 + a + b = 3 \quad \therefore a + b = 2 \quad \cdots \cdots \textcircled{1}$$

$$f(-1) = 7 \text{이므로}$$

$$1 - a + b = 7 \quad \therefore -a + b = 6 \quad \cdots \cdots \textcircled{2}$$

$$\textcircled{1}, \textcircled{2} \text{을 연립하여 풀면 } a = -2, b = 4$$

- (4) $f(2) = 1$ 이므로

$$4 + 2a + b = 1 \quad \therefore 2a + b = -3 \quad \cdots \cdots \textcircled{1}$$

$$f(-3) = 11 \text{이므로}$$

$$9 - 3a + b = 11 \quad \therefore -3a + b = 2 \quad \cdots \cdots \textcircled{2}$$

$$\textcircled{1}, \textcircled{2} \text{을 연립하여 풀면 } a = -1, b = -1$$

- (5) $f(1) = -1$ 이므로

$$1 + a + b = -1 \quad \therefore a + b = -2 \quad \cdots \cdots \textcircled{1}$$

$$f(3) = 1 \text{이므로}$$

$$9 + 3a + b = 1 \quad \therefore 3a + b = -8 \quad \cdots \cdots \textcircled{2}$$

$$\textcircled{1}, \textcircled{2} \text{을 연립하여 풀면 } a = -3, b = 1$$

- (6) $f(-2)=15$ 이므로
 $4-2a+b=15 \quad \therefore -2a+b=11 \quad \cdots \cdots \textcircled{㉠}$
 $f(4)=3$ 이므로
 $16+4a+b=3 \quad \therefore 4a+b=-13 \quad \cdots \cdots \textcircled{㉡}$
 $\textcircled{㉠}, \textcircled{㉡}$ 을 연립하여 풀면 $a=-4, b=3$
- (7) $f(-3)=16$ 이므로
 $9-3a+b=16 \quad \therefore -3a+b=7 \quad \cdots \cdots \textcircled{㉠}$
 $f(5)=8$ 이므로
 $25+5a+b=8 \quad \therefore 5a+b=-17 \quad \cdots \cdots \textcircled{㉡}$
 $\textcircled{㉠}, \textcircled{㉡}$ 을 연립하여 풀면 $a=-3, b=-2$
- (8) $f(1)=2$ 이므로
 $1+a+b-2=2 \quad \therefore a+b=3 \quad \cdots \cdots \textcircled{㉠}$
 $f(2)=10$ 이므로
 $8+4a+2b-2=10 \quad \therefore 2a+b=2 \quad \cdots \cdots \textcircled{㉡}$
 $\textcircled{㉠}, \textcircled{㉡}$ 을 연립하여 풀면 $a=-1, b=4$
- (9) $f(-1)=-1$ 이므로
 $-1+a-b+4=-1 \quad \therefore a-b=-4 \quad \cdots \cdots \textcircled{㉠}$
 $f(3)=7$ 이므로
 $27+9a+3b+4=7 \quad \therefore 3a+b=-8 \quad \cdots \cdots \textcircled{㉡}$
 $\textcircled{㉠}, \textcircled{㉡}$ 을 연립하여 풀면 $a=-3, b=1$

05-1 (1)

$$\begin{array}{r} x+4 \\ x^2-x+1 \overline{) x^3+3x^2-4x+1} \\ \underline{x^3-x^2+x} \\ 4x^2-5x+1 \\ \underline{4x^2-4x+4} \\ -x-3 \end{array}$$

$$\therefore R(x) = \boxed{-x-3}$$

(2)

$$\begin{array}{r} x+6 \\ x^2-3x+2 \overline{) x^3+3x^2-x+2} \\ \underline{x^3-3x^2+2x} \\ 6x^2-3x+2 \\ \underline{6x^2-18x+12} \\ 15x-10 \end{array}$$

$$\therefore R(x) = 15x-10$$

(3)

$$\begin{array}{r} -x-3 \\ x^2-5x+2 \overline{) -x^3+2x^2+x-4} \\ \underline{-x^3+5x^2-2x} \\ -3x^2+3x-4 \\ \underline{-3x^2+15x-6} \\ -12x+2 \end{array}$$

$$\therefore R(x) = -12x+2$$

05-2 (1)

$$\begin{array}{r} -x-1 \\ x^2+x+2 \overline{) -x^3-2x^2-3x+3} \\ \underline{-x^3-x^2-2x} \\ -x^2-x+3 \\ \underline{-x^2-x-2} \\ 5 \end{array}$$

$$\therefore R(x) = \boxed{5}$$

(2)

$$\begin{array}{r} x+1 \\ 2x^2+2x-1 \overline{) 2x^3+4x^2+x-5} \\ \underline{2x^3+2x^2-x} \\ 2x^2+2x-5 \\ \underline{2x^2+2x-1} \\ -4 \end{array}$$

$$\therefore R(x) = -4$$

(3)

$$\begin{array}{r} -2x+1 \\ x^2+2x-1 \overline{) -2x^3-3x^2+4x+10} \\ \underline{-2x^3-4x^2+2x} \\ x^2+2x+10 \\ \underline{x^2+2x-1} \\ 11 \end{array}$$

$$\therefore R(x) = 11$$

(4)

$$\begin{array}{r} x-3 \\ x^2-x+2 \overline{) x^3-4x^2+5x-14} \\ \underline{x^3-x^2+2x} \\ -3x^2+3x-14 \\ \underline{-3x^2+3x-6} \\ -8 \end{array}$$

$$\therefore R(x) = -8$$

05-3 (1) $f(x)$ 를 $(x+1)(x-1)$ 로 나눌 때의 몫을 $Q(x)$,

나머지를 $ax+b$ (a, b 는 상수)라 하면

$$f(x) = (x+1)(x-1)Q(x) + \boxed{ax+b}$$

이때, $f(-1)=-2, f(1)=4$ 이므로

$$f(-1)=-2 \text{에서 } -a+b=-2 \quad \cdots \cdots \textcircled{㉠}$$

$$f(1)=4 \text{에서 } \boxed{a+b}=4 \quad \cdots \cdots \textcircled{㉡}$$

$\textcircled{㉠}, \textcircled{㉡}$ 을 연립하여 풀면 $a=3, b=\boxed{1}$

따라서 구하는 나머지는 $3x+1$

(2) $f(x)$ 를 $(x+2)(x-3)$ 으로 나눌 때의 몫을 $Q(x)$,

나머지를 $ax+b$ (a, b 는 상수)라 하면

$$f(x) = (x+2)(x-3)Q(x) + ax+b$$

이때, $f(-2)=-4, f(3)=1$ 이므로

$$f(-2)=-4 \text{에서 } -2a+b=-4 \quad \cdots \cdots \textcircled{㉠}$$

$$f(3)=1 \text{에서 } 3a+b=1 \quad \cdots \cdots \textcircled{㉡}$$

$\textcircled{㉠}, \textcircled{㉡}$ 을 연립하여 풀면 $a=1, b=-2$

따라서 구하는 나머지는 $x-2$

- (3) $f(x)$ 를 $(x-1)(x-2)$ 로 나눌 때의 몫을 $Q(x)$,
나머지를 $ax+b$ (a, b 는 상수)라 하면
 $f(x) = (x-1)(x-2)Q(x) + ax+b$
 이때, $f(1)=5, f(2)=9$ 이므로
 $f(1)=5$ 에서 $a+b=5$ ㉠
 $f(2)=9$ 에서 $2a+b=9$ ㉡
 ㉠, ㉡을 연립하여 풀면 $a=4, b=1$
 따라서 구하는 나머지는 $4x+1$

- (4) $f(x)$ 를 $(x+2)(x-4)$ 로 나눌 때의 몫을 $Q(x)$,
나머지를 $ax+b$ (a, b 는 상수)라 하면
 $f(x) = (x+2)(x-4)Q(x) + ax+b$
 이때, $f(-2)=6, f(4)=-6$ 이므로
 $f(-2)=6$ 에서 $-2a+b=6$ ㉠
 $f(4)=-6$ 에서 $4a+b=-6$ ㉡
 ㉠, ㉡을 연립하여 풀면 $a=-2, b=2$
 따라서 구하는 나머지는 $-2x+2$

- (5) $f(x)$ 를 $(x-1)(x-3)$ 으로 나눌 때의 몫을 $Q(x)$,
나머지를 $ax+b$ (a, b 는 상수)라 하면
 $f(x) = (x-1)(x-3)Q(x) + ax+b$
 이때, $f(1)=3, f(3)=7$ 이므로
 $f(1)=3$ 에서 $a+b=3$ ㉠
 $f(3)=7$ 에서 $3a+b=7$ ㉡
 ㉠, ㉡을 연립하여 풀면 $a=2, b=1$
 따라서 구하는 나머지는 $2x+1$

- 05-4** (1) $f(x)$ 를 x^2-x-2 로 나눌 때의 몫을 $Q(x)$,
나머지를 $ax+b$ (a, b 는 상수)라 하면
 $f(x) = (x^2-x-2)Q(x) + ax+b$
 $= (x+1)(\boxed{x-2})Q(x) + ax+b$
 이때, $f(-1)=3, f(2)=6$ 이므로
 $f(-1)=3$ 에서 $-a+b=3$ ㉠
 $f(2)=6$ 에서 $2a+b=6$ ㉡
 ㉠, ㉡을 연립하여 풀면 $a=\boxed{1}, b=\boxed{4}$
 따라서 구하는 나머지는 $\boxed{x+4}$

- (2) $f(x)$ 를 x^2-5x+6 으로 나눌 때의 몫을 $Q(x)$,
나머지를 $ax+b$ (a, b 는 상수)라 하면
 $f(x) = (x^2-5x+6)Q(x) + ax+b$
 $= (x-2)(x-3)Q(x) + ax+b$
 이때, $f(2)=-4, f(3)=-7$ 이므로
 $f(2)=-4$ 에서 $2a+b=-4$ ㉠
 $f(3)=-7$ 에서 $3a+b=-7$ ㉡
 ㉠, ㉡을 연립하여 풀면 $a=-3, b=2$
 따라서 구하는 나머지는 $-3x+2$

- (3) $f(x)$ 를 x^2-6x+5 로 나눌 때의 몫을 $Q(x)$,
나머지를 $ax+b$ (a, b 는 상수)라 하면
 $f(x) = (x^2-6x+5)Q(x) + ax+b$
 $= (x-1)(x-5)Q(x) + ax+b$
 이때, $f(1)=3, f(5)=-5$ 이므로
 $f(1)=3$ 에서 $a+b=3$ ㉠
 $f(5)=-5$ 에서 $5a+b=-5$ ㉡
 ㉠, ㉡을 연립하여 풀면 $a=-2, b=5$
 따라서 구하는 나머지는 $-2x+5$

- (4) $f(x)$ 를 x^2+6x+8 로 나눌 때의 몫을 $Q(x)$,
나머지를 $ax+b$ (a, b 는 상수)라 하면
 $f(x) = (x^2+6x+8)Q(x) + ax+b$
 $= (x+2)(x+4)Q(x) + ax+b$
 이때, $f(-2)=3, f(-4)=1$ 이므로
 $f(-2)=3$ 에서 $-2a+b=3$ ㉠
 $f(-4)=1$ 에서 $-4a+b=1$ ㉡
 ㉠, ㉡을 연립하여 풀면 $a=1, b=5$
 따라서 구하는 나머지는 $x+5$

- (5) $f(x)$ 를 x^2-x-12 로 나눌 때의 몫을 $Q(x)$,
나머지를 $ax+b$ (a, b 는 상수)라 하면
 $f(x) = (x^2-x-12)Q(x) + ax+b$
 $= (x+3)(x-4)Q(x) + ax+b$
 이때, $f(-3)=6, f(4)=-1$ 이므로
 $f(-3)=6$ 에서 $-3a+b=6$ ㉠
 $f(4)=-1$ 에서 $4a+b=-1$ ㉡
 ㉠, ㉡을 연립하여 풀면 $a=-1, b=3$
 따라서 구하는 나머지는 $-x+3$

06-1 $f(x)=2x^3+x^2+ax-5$ 에 대하여

- (1) $f(1)=\boxed{0}$ 이므로
 $2+1+a-5=0 \quad \therefore a=\boxed{2}$
 (2) $f(-2)=\boxed{0}$ 이므로
 $-16+4-2a-5=0 \quad \therefore a=\boxed{-\frac{17}{2}}$
 (3) $f(-1)=0$ 이므로
 $-2+1-a-5=0 \quad \therefore a=-6$
 (4) $f(3)=0$ 이므로
 $54+9+3a-5=0 \quad \therefore a=-\frac{58}{3}$
 (5) $f\left(\frac{1}{2}\right)=0$ 이므로
 $\frac{1}{4}+\frac{1}{4}+\frac{a}{2}-5=0 \quad \therefore a=9$
 (6) $f\left(\frac{1}{3}\right)=0$ 이므로
 $\frac{2}{27}+\frac{1}{9}+\frac{a}{3}-5=0 \quad \therefore a=\frac{130}{9}$

06-2 $f(x)=x^3+ax-2$ 에 대하여

(1) $f(2)=\boxed{0}$ 이므로

$$8+2a-2=0 \quad \therefore a=\boxed{-3}$$

(2) $f\left(-\frac{1}{2}\right)=\boxed{0}$ 이므로

$$-\frac{1}{8}-\frac{a}{2}-2=0 \quad \therefore a=\boxed{-\frac{17}{4}}$$

(3) $f(-4)=0$ 이므로

$$-64-4a-2=0 \quad \therefore a=-\frac{33}{2}$$

(4) $f\left(\frac{1}{4}\right)=0$ 이므로

$$\frac{1}{64}+\frac{a}{4}-2=0 \quad \therefore a=\frac{127}{16}$$

(5) $f\left(\frac{1}{3}\right)=0$ 이므로

$$\frac{1}{27}+\frac{a}{3}-2=0 \quad \therefore a=\frac{53}{9}$$

(6) $f\left(\frac{3}{2}\right)=0$ 이므로

$$\frac{27}{8}+\frac{3}{2}a-2=0 \quad \therefore a=-\frac{11}{12}$$

07-1 (1) $f(x)=x^3-2x^2+ax+b$ 에 대하여

$$f(-1)=\boxed{0}$$
이므로

$$-1-2-a+b=0 \quad \therefore -a+b=\boxed{3}$$

$$f(2)=0$$
이므로

$$8-8+2a+b=0 \quad \therefore 2a+b=0$$

$$\text{두 식을 연립하여 풀면 } a=\boxed{-1}, b=\boxed{2}$$

(2) $f(x)=x^3+x^2+ax+b$ 에 대하여 $f(2)=0$ 이므로

$$8+4+2a+b=0 \quad \therefore 2a+b=-12$$

$$f(-2)=0$$
이므로

$$-8+4-2a+b=0 \quad \therefore -2a+b=4$$

$$\text{두 식을 연립하여 풀면 } a=-4, b=-4$$

(3) $f(x)=x^3+ax^2+bx-6$ 에 대하여 $f(-2)=0$ 이므로

$$-8+4a-2b-6=0 \quad \therefore 2a-b=7$$

$$f(-3)=0$$
이므로

$$-27+9a-3b-6=0 \quad \therefore 3a-b=11$$

$$\text{두 식을 연립하여 풀면 } a=4, b=1$$

(4) $f(x)=x^3-3x^2+ax+b$ 에 대하여 $f(1)=0$ 이므로

$$1-3+a+b=0 \quad \therefore a+b=2$$

$$f(3)=0$$
이므로

$$27-27+3a+b=0 \quad \therefore 3a+b=0$$

$$\text{두 식을 연립하여 풀면 } a=-1, b=3$$

(5) $f(x)=x^3+ax^2-10x+b$ 에 대하여 $f(-2)=0$ 이므로

$$-8+4a+20+b=0 \quad \therefore 4a+b=-12$$

$$f(4)=0$$
이므로

$$64+16a-40+b=0 \quad \therefore 16a+b=-24$$

$$\text{두 식을 연립하여 풀면 } a=-1, b=-8$$

(6) $f(x)=x^3-6x^2+ax+b$ 에 대하여 $f(2)=0$ 이므로

$$8-24+2a+b=0 \quad \therefore 2a+b=16$$

$$f(3)=0$$
이므로

$$27-54+3a+b=0 \quad \therefore 3a+b=27$$

$$\text{두 식을 연립하여 풀면 } a=11, b=-6$$

(7) $f(x)=x^3+ax^2-17x+b$ 에 대하여 $f(1)=0$ 이므로

$$1+a-17+b=0 \quad \therefore a+b=16$$

$$f(3)=0$$
이므로

$$27+9a-51+b=0 \quad \therefore 9a+b=24$$

$$\text{두 식을 연립하여 풀면 } a=1, b=15$$

07-2 (1) $x^2-2x-8=(x+2)(x-4)$ 에서 $f(-2)=\boxed{0}$ 이므로

$$-8-12-2a+b=0 \quad \therefore -2a+b=20$$

$$f(4)=0$$
이므로

$$64-48+4a+b=0 \quad \therefore 4a+b=\boxed{-16}$$

$$\text{두 식을 연립하여 풀면 } a=\boxed{-6}, b=\boxed{8}$$

(2) $x^2+x-2=(x-1)(x+2)$ 에서 $f(1)=0$ 이므로

$$1+a+b+4=0 \quad \therefore a+b=-5$$

$$f(-2)=0$$
이므로

$$-8+4a-2b+4=0 \quad \therefore 2a-b=2$$

$$\text{두 식을 연립하여 풀면 } a=-1, b=-4$$

(3) $x^2-2x-3=(x+1)(x-3)$ 에서 $f(-1)=0$ 이므로

$$-1-3-a+b=0 \quad \therefore -a+b=4$$

$$f(3)=0$$
이므로

$$27-27+3a+b=0 \quad \therefore 3a+b=0$$

$$\text{두 식을 연립하여 풀면 } a=-1, b=3$$

(4) $x^2+2x-8=(x-2)(x+4)$ 에서 $f(2)=0$ 이므로

$$8a+4b-32+32=0 \quad \therefore 2a+b=0$$

$$f(-4)=0$$
이므로

$$-64a+16b+64+32=0 \quad \therefore -4a+b=-6$$

$$\text{두 식을 연립하여 풀면 } a=1, b=-2$$

(5) $x^2+4x+3=(x+1)(x+3)$ 에서 $f(-1)=0$ 이므로

$$-1+1-a+b=0 \quad \therefore -a+b=0$$

$$f(-3)=0$$
이므로

$$-27+9-3a+b=0 \quad \therefore -3a+b=18$$

$$\text{두 식을 연립하여 풀면 } a=-9, b=-9$$

(6) $x^2-x-6=(x+2)(x-3)$ 에서 $f(-2)=0$ 이므로

$$-8-8-2a+b=0 \quad \therefore -2a+b=16$$

$$f(3)=0$$
이므로

$$27-18+3a+b=0 \quad \therefore 3a+b=-9$$

$$\text{두 식을 연립하여 풀면 } a=-5, b=6$$

(7) $x^2+5x+6=(x+2)(x+3)$ 에서 $f(-2)=0$ 이므로

$$-8+4a-22+b=0 \quad \therefore 4a+b=30$$

$$f(-3)=0$$
이므로

$$-27+9a-33+b=0 \quad \therefore 9a+b=60$$

$$\text{두 식을 연립하여 풀면 } a=6, b=6$$

1-1 $f(x)=2x^3-3x^2+x-2$ 이므로

(1) $f(1)=2-3+1-2=-2$

(2) $f(-2)=-16-12-2-2=-32$

(3) $f\left(\frac{1}{3}\right)=\frac{2}{27}-\frac{1}{3}+\frac{1}{3}-2=-\frac{52}{27}$

(4) $f\left(\frac{3}{2}\right)=\frac{27}{4}-\frac{27}{4}+\frac{3}{2}-2=-\frac{1}{2}$

(5) $f\left(\frac{1}{2}\right)=\frac{1}{4}-\frac{3}{4}+\frac{1}{2}-2=-2$

(6) $f\left(-\frac{1}{4}\right)=-\frac{1}{32}-\frac{3}{16}-\frac{1}{4}-2=-\frac{79}{32}$

1-2 $f(x)=2x^3+x^2-2x-2$ 이므로

(1) $f(-1)=-2+1+2-2=-1$

(2) $f(3)=54+9-6-2=55$

(3) $f\left(-\frac{1}{2}\right)=-\frac{1}{4}+\frac{1}{4}+1-2=-1$

(4) $f\left(\frac{1}{3}\right)=\frac{2}{27}+\frac{1}{9}-\frac{2}{3}-2=-\frac{67}{27}$

(5) $f\left(\frac{3}{6}\right)=f\left(\frac{1}{2}\right)=\frac{1}{4}+\frac{1}{4}-1-2=-\frac{5}{2}$

(6) $f\left(-\frac{3}{4}\right)=-\frac{27}{32}+\frac{9}{16}+\frac{3}{2}-2=-\frac{25}{32}$

2-1 (1) $f(3)=-2$ 이므로

$$9+3a-5=-2 \quad \therefore a=-2$$

(2) $f(1)=1$ 이므로

$$-3+a-2=1 \quad \therefore a=6$$

2-2 (1) $f\left(\frac{1}{2}\right)=2$ 이므로

$$\frac{1}{2}+\frac{a}{2}=2 \quad \therefore a=3$$

(2) $f\left(-\frac{1}{3}\right)=-3$ 이므로

$$\frac{a}{9}-\frac{1}{3}-4=-3 \quad \therefore a=12$$

3-1 (1) $f(2)=2$ 이므로

$$4+2a+b=2 \quad \therefore 2a+b=-2 \quad \dots\dots \textcircled{1}$$

$$f(-5)=9 \text{이므로}$$

$$25-5a+b=9 \quad \therefore -5a+b=-16 \quad \dots\dots \textcircled{2}$$

$$\textcircled{1}, \textcircled{2} \text{을 연립하여 풀면 } a=2, b=-6$$

(2) $f(1)=-1$ 이므로

$$1+a+b=-1 \quad \therefore a+b=-2 \quad \dots\dots \textcircled{3}$$

$$f(4)=5 \text{이므로}$$

$$16+4a+b=5 \quad \therefore 4a+b=-11 \quad \dots\dots \textcircled{4}$$

$$\textcircled{3}, \textcircled{4} \text{을 연립하여 풀면 } a=-3, b=1$$

3-2 (1) $f(1)=3$ 이므로

$$1+a+b=3 \quad \therefore a+b=2 \quad \dots\dots \textcircled{1}$$

$$f(3)=7 \text{이므로}$$

$$9+3a+b=7 \quad \therefore 3a+b=-2 \quad \dots\dots \textcircled{2}$$

$$\textcircled{1}, \textcircled{2} \text{을 연립하여 풀면 } a=-2, b=4$$

(2) $f(-2)=-1$ 이므로

$$4-2a+b=-1 \quad \therefore -2a+b=-5 \quad \dots\dots \textcircled{3}$$

$$f(2)=3 \text{이므로}$$

$$4+2a+b=3 \quad \therefore 2a+b=-1 \quad \dots\dots \textcircled{4}$$

$$\textcircled{3}, \textcircled{4} \text{을 연립하여 풀면 } a=1, b=-3$$

4-1 (1) $f(x)$ 를 $(x+1)(x+3)$ 으로 나눌 때의 몫을 $Q(x)$,나머지를 $ax+b$ (a, b 는 상수)라 하면

$$f(x)=(x+1)(x+3)Q(x)+ax+b$$

$$f(-1)=-2 \text{이므로}$$

$$-a+b=-2 \quad \dots\dots \textcircled{1}$$

$$f(-3)=-10 \text{이므로}$$

$$-3a+b=-10 \quad \dots\dots \textcircled{2}$$

$$\textcircled{1}, \textcircled{2} \text{을 연립하여 풀면 } a=4, b=2$$

따라서 구하는 나머지는 $4x+2$

(2) $f(x)$ 를 x^2+x-12 , 즉 $(x-3)(x+4)$ 로 나눌 때의

몫을 $Q(x)$, 나머지를 $ax+b$ (a, b 는 상수)라 하면

$$f(x)=(x-3)(x+4)Q(x)+ax+b$$

$$f(3)=6 \text{이므로 } 3a+b=6 \quad \dots\dots \textcircled{3}$$

$$f(-4)=-1 \text{이므로 } -4a+b=-1 \quad \dots\dots \textcircled{4}$$

$$\textcircled{3}, \textcircled{4} \text{을 연립하여 풀면 } a=1, b=3$$

따라서 구하는 나머지는 $x+3$

(3) $f(x)$ 를 $x^2-4x-12$, 즉 $(x+2)(x-6)$ 으로 나눌 때

의 몫을 $Q(x)$, 나머지를 $ax+b$ (a, b 는 상수)라 하면

$$f(x)=(x+2)(x-6)Q(x)+ax+b$$

$$f(-2)=-1 \text{이므로}$$

$$-2a+b=-1 \quad \dots\dots \textcircled{5}$$

$$f(6)=7 \text{이므로}$$

$$6a+b=7 \quad \dots\dots \textcircled{6}$$

$$\textcircled{5}, \textcircled{6} \text{을 연립하여 풀면 } a=1, b=1$$

따라서 구하는 나머지는 $x+1$ **4-2** (1) $f(x)$ 를 $(x+2)(x+3)$ 으로 나눌 때의 몫을 $Q(x)$,나머지를 $ax+b$ (a, b 는 상수)라 하면

$$f(x)=(x+2)(x+3)Q(x)+ax+b$$

$$f(-2)=4 \text{이므로}$$

$$-2a+b=4 \quad \dots\dots \textcircled{7}$$

$$f(-3)=5 \text{이므로}$$

$$-3a+b=5 \quad \dots\dots \textcircled{8}$$

$$\textcircled{7}, \textcircled{8} \text{을 연립하여 풀면 } a=-1, b=2$$

따라서 구하는 나머지는 $-x+2$

(2) $f(x)$ 를 x^2+x-2 , 즉 $(x-1)(x+2)$ 로 나눌 때의 몫을 $Q(x)$, 나머지를 $ax+b$ (a, b 는 상수)라 하면
 $f(x)=(x-1)(x+2)Q(x)+ax+b$
 $f(1)=-1$ 이므로
 $a+b=-1$ ㉠
 $f(-2)=-4$ 이므로
 $-2a+b=-4$ ㉡
 ㉠, ㉡을 연립하여 풀면 $a=1, b=-2$
 따라서 구하는 나머지는 $x-2$

(3) $f(x)$ 를 $x^2-7x+10$, 즉 $(x-2)(x-5)$ 로 나눌 때의 몫을 $Q(x)$, 나머지를 $ax+b$ (a, b 는 상수)라 하면
 $f(x)=(x-2)(x-5)Q(x)+ax+b$
 $f(2)=-3$ 이므로
 $2a+b=-3$ ㉠
 $f(5)=-9$ 이므로
 $5a+b=-9$ ㉡
 ㉠, ㉡을 연립하여 풀면 $a=-2, b=1$
 따라서 구하는 나머지는 $-2x+1$

5-1 (1) $f(-1)=0$ 이므로
 $-1+a+2+3=0 \quad \therefore a=-4$
 (2) $f(3)=0$ 이므로
 $27+9a-6+3=0 \quad \therefore a=-\frac{8}{3}$
 (3) $f\left(-\frac{3}{2}\right)=0$ 이므로
 $-\frac{27}{8}+\frac{9}{4}a+3+3=0 \quad \therefore a=-\frac{7}{6}$

5-2 (1) $f(1)=0$ 이므로
 $1-4+a-4=0 \quad \therefore a=7$
 (2) $f\left(\frac{1}{3}\right)=0$ 이므로
 $\frac{1}{27}-\frac{4}{9}+\frac{a}{3}-4=0 \quad \therefore a=\frac{119}{9}$
 (3) $f\left(-\frac{2}{4}\right)=f\left(-\frac{1}{2}\right)=0$ 이므로
 $-\frac{1}{8}-1-\frac{a}{2}-4=0 \quad \therefore a=-\frac{41}{4}$

6-1 (1) $f(1)=0$ 이므로
 $1+a+b+10=0 \quad \therefore a+b=-11$
 $f(2)=0$ 이므로
 $8+4a+2b+10=0 \quad \therefore 2a+b=-9$
 두 식을 연립하여 풀면 $a=2, b=-13$
 (2) $f(-1)=0$ 이므로
 $-1+3-a+b=0 \quad \therefore -a+b=-2$
 $f(-4)=0$ 이므로
 $-64+48-4a+b=0 \quad \therefore -4a+b=16$
 두 식을 연립하여 풀면 $a=-6, b=-8$

(3) $x^2+5x+6=(x+2)(x+3)$ 에서
 $f(-2)=0$ 이므로
 $-8+8-2a+b=0 \quad \therefore -2a+b=0$
 $f(-3)=0$ 이므로
 $-27+18-3a+b=0 \quad \therefore -3a+b=9$
 두 식을 연립하여 풀면 $a=-9, b=-18$

(4) $x^2+3x+2=(x+1)(x+2)$ 에서
 $f(-1)=0$ 이므로
 $-1+a-b-6=0 \quad \therefore a-b=7$
 $f(-2)=0$ 이므로
 $-8+4a-2b-6=0 \quad \therefore 2a-b=7$
 두 식을 연립하여 풀면 $a=0, b=-7$

6-2 (1) $f(-2)=0$ 이므로
 $-8+4a-2b-12=0 \quad \therefore 2a-b=10$
 $f(2)=0$ 이므로
 $8+4a+2b-12=0 \quad \therefore 2a+b=2$
 두 식을 연립하여 풀면 $a=3, b=-4$
 (2) $f(2)=0$ 이므로
 $8-24+2a+b=0 \quad \therefore 2a+b=16$
 $f(4)=0$ 이므로
 $64-96+4a+b=0 \quad \therefore 4a+b=32$
 두 식을 연립하여 풀면 $a=8, b=0$
 (3) $x^2+x-6=(x-2)(x+3)$ 에서
 $f(2)=0$ 이므로
 $8-4+2a+b=0 \quad \therefore 2a+b=-4$
 $f(-3)=0$ 이므로
 $-27-9-3a+b=0 \quad \therefore -3a+b=36$
 두 식을 연립하여 풀면 $a=-8, b=12$
 (4) $x^2-3x-4=(x+1)(x-4)$ 에서
 $f(-1)=0$ 이므로
 $-a+b+13-12=0 \quad \therefore -a+b=-1$
 $f(4)=0$ 이므로
 $64a+16b-52-12=0 \quad \therefore 4a+b=4$
 두 식을 연립하여 풀면 $a=1, b=0$

STEP 3 102쪽~103쪽

01 $f(1)$

02 다항식 $f(x)$ 를 $3x-1$ 로 나눌 때의 몫을 $Q(x)$ 라 하면
 $f(x)=\left(x-\frac{1}{3}\right)Q(x)+3=(3x-1)\cdot\frac{1}{3}Q(x)+3$
 따라서 $f(x)$ 를 $x-\frac{1}{3}$ 로 나눌 때의 나머지도 3이다.

03 $a=f(1)=1-3-1+2=-1$

$$b=f\left(-\frac{1}{2}\right)=-\frac{1}{8}-\frac{3}{4}+\frac{1}{2}+2=\frac{13}{8}$$

$$\therefore b-a=\frac{13}{8}-(-1)=\frac{21}{8}$$

04 $f(2)=1$ 이므로

$$8-2+a=1 \quad \therefore a=-5$$

05 $f(1)=2+a-4=a-2$,

$$f(2)=16+2a-4=2a+12 \text{이고,}$$

$$f(1)=f(2) \text{이므로}$$

$$a-2=2a+12 \quad \therefore a=-14$$

06 $f(-3)=-4$ 이므로

$$9-3a+b=-4 \quad \therefore -3a+b=-13 \quad \cdots \cdots \textcircled{㉠}$$

$$f(5)=20 \text{이므로}$$

$$25+5a+b=20 \quad \therefore 5a+b=-5 \quad \cdots \cdots \textcircled{㉡}$$

$$\textcircled{㉠}, \textcircled{㉡} \text{을 연립하여 풀면 } a=1, b=-10 \text{이므로}$$

$$a+b=-9$$

07 $f(1)=6$ 이므로

$$1+a+b=6 \quad \therefore a+b=5 \quad \cdots \cdots \textcircled{㉠}$$

$$f(-2)=-3 \text{이므로}$$

$$4-2a+b=-3 \quad \therefore -2a+b=-7 \quad \cdots \cdots \textcircled{㉡}$$

$$\textcircled{㉠}, \textcircled{㉡} \text{을 연립하여 풀면 } a=4, b=1$$

$$\text{따라서 } f(x)=x^2+4x+1 \text{이므로}$$

$$f(3)=9+12+1=22$$

08 $f(x)$ 를 $(x+1)(x-3)$ 으로 나눌 때의 몫을 $Q(x)$, 나머지를 $ax+b$ (a, b 는 상수)라 하면

$$f(x)=(x+1)(x-3)Q(x)+\boxed{ax+b}$$

$$f(-1)=3 \text{이므로 } -a+b=3 \quad \cdots \cdots \textcircled{㉠}$$

$$f(3)=-1 \text{이므로 } 3a+b=\boxed{-1} \quad \cdots \cdots \textcircled{㉡}$$

$$\textcircled{㉠}, \textcircled{㉡} \text{을 연립하여 풀면 } a=-1, b=2$$

$$\text{따라서 구하는 나머지는 } \boxed{-x+2}$$

09 $f(x)$ 를 $(x+2)(x-2)$ 로 나눌 때의 몫을 $Q(x)$, 나머지를 $ax+b$ (a, b 는 상수)라 하면

$$f(x)=(x+2)(x-2)Q(x)+ax+b$$

$$f(-2)=-5 \text{이므로 } -2a+b=-5 \quad \cdots \cdots \textcircled{㉠}$$

$$f(2)=11 \text{이므로 } 2a+b=11 \quad \cdots \cdots \textcircled{㉡}$$

$$\textcircled{㉠}, \textcircled{㉡} \text{을 연립하여 풀면 } a=4, b=3$$

$$\text{따라서 구하는 나머지는 } 4x+3$$

10 $f(x)$ 를 x^2+x-6 , 즉 $(x-2)(x+3)$ 으로 나눌 때의 몫을 $Q(x)$, 나머지를 $ax+b$ (a, b 는 상수)라 하면

$$f(x)=(x-2)(x+3)Q(x)+ax+b$$

$$f(2)=8 \text{이므로 } 2a+b=8 \quad \cdots \cdots \textcircled{㉠}$$

$$f(-3)=-7 \text{이므로 } -3a+b=-7 \quad \cdots \cdots \textcircled{㉡}$$

$$\textcircled{㉠}, \textcircled{㉡} \text{을 연립하여 풀면 } a=3, b=2$$

$$\text{따라서 구하는 나머지는 } 3x+2$$

11 $f(1)=0$ 이므로 $3+a+1=0 \quad \therefore a=-4$

$$\text{따라서 } f(x)=3x^3-4x+1 \text{이므로}$$

$$f\left(\frac{1}{3}\right)=\frac{1}{9}-\frac{4}{3}+1=-\frac{2}{9}$$

12 $f(-1)=0$ 이므로

$$1+a-b+2=0 \quad \therefore a-b=-3$$

$$f(-2)=0 \text{이므로}$$

$$8+4a-2b+2=0 \quad \therefore 2a-b=-5$$

$$\text{두 식을 연립하여 풀면}$$

$$a=-2, b=1 \text{이므로 } a+b=-1$$

13 $f(x)=x^3-2x^2+ax+b$ 가 x^2+2x-8 , 즉

$$(x-2)(x+4) \text{로 나누어떨어지므로}$$

$$f(2)=0 \text{에서}$$

$$8-8+2a+b=0 \quad \therefore 2a+b=0 \quad \cdots \cdots \textcircled{㉠}$$

$$f(-4)=0 \text{에서}$$

$$-64-32-4a+b=0 \quad \therefore -4a+b=96 \quad \cdots \cdots \textcircled{㉡}$$

$$\textcircled{㉠}, \textcircled{㉡} \text{을 연립하여 풀면 } a=-16, b=32$$

$$\text{따라서 } f(x)=x^3-2x^2-16x+32 \text{이므로}$$

$$\text{구하는 나머지는 } f(-2)=48$$

14 $f(x)$ 를 x^2-x-2 로 나눌 때의 몫을 $Q_1(x)$ 라 하면

$$f(x)=(x^2-x-2)Q_1(x)+x+9$$

$$=(x+1)(x-2)Q_1(x)+x+9 \quad \cdots \cdots \textcircled{㉠}$$

$$f(x) \text{를 } x^2+2x-3 \text{으로 나눌 때의 몫을 } Q_2(x) \text{라 하면}$$

$$f(x)=(x^2+2x-3)Q_2(x)+x-1$$

$$=(x-1)(x+3)Q_2(x)+x-1 \quad \cdots \cdots \textcircled{㉡}$$

$$f(x) \text{를 } x^2+x-6 \text{으로 나눌 때의 몫을 } Q(x), \text{ 나머지를 } ax+b \text{ (a, b 는 상수)라 하면}$$

$$f(x)=(x^2+x-6)Q(x)+ax+b$$

$$=(x-2)(x+3)Q(x)+ax+b$$

$$\text{이때, } \textcircled{㉠} \text{에서 } f(2)=\boxed{11} \text{이므로}$$

$$2a+b=\boxed{11} \quad \cdots \cdots \textcircled{㉢}$$

$$\text{또, } \textcircled{㉡} \text{에서 } f(-3)=\boxed{-4} \text{이므로}$$

$$-3a+b=\boxed{-4} \quad \cdots \cdots \textcircled{㉣}$$

$$\textcircled{㉢}, \textcircled{㉣} \text{을 연립하여 풀면 } a=3, b=5$$

$$\text{따라서 구하는 나머지는 } \boxed{3x+5}$$

STEP 1

106쪽~123쪽

01-1 (1) $x^2y + xy^2 + xy = \boxed{xy(x+y+1)}$

(2) $xy + x + y + 1 = x(y+1) + (y+1)$
 $= \boxed{(x+1)}(y+1)$

(3) $4xy(x+2)$

(4) $(x+y)(x+y+3)$

(5) $xy - y^2 + xz - yz = (x-y)y + (x-y)z$
 $= (x-y)(y+z)$

(6) $ax + bx - ay - by = (a+b)x - (a+b)y$
 $= (a+b)(x-y)$

01-2 (1) $x^2 + 2x + 1 = x^2 + 2 \cdot x \cdot 1 + 1^2$
 $= \boxed{(x+1)}^2$

(2) $9x^2 - 6x + 1 = (3x)^2 - 2 \cdot 3x \cdot 1 + 1^2$
 $= \boxed{(3x-1)}^2$

(3) $(x+2)^2$

(4) $(4x+y)^2$

(5) $4x^2 + \frac{4}{3}x + \frac{1}{9} = (2x)^2 + 2 \cdot 2x \cdot \frac{1}{3} + \left(\frac{1}{3}\right)^2$
 $= \left(2x + \frac{1}{3}\right)^2$

(6) $(x-5)^2$

(7) $(2x-5)^2$

(8) $x^2 - 2 + \frac{1}{x^2} = x^2 - 2 \cdot x \cdot \frac{1}{x} + \left(\frac{1}{x}\right)^2$
 $= \left(x - \frac{1}{x}\right)^2$

01-3 (1) $x^2 - 4 = x^2 - 2^2$
 $= \boxed{(x+2)}(x-2)$

(2) $x^3 - 9xy^2 = x(x^2 - 9y^2)$
 $= x\{x^2 - (3y)^2\}$
 $= x(x+3y)\boxed{(x-3y)}$

(3) $(3x+y)(3x-y)$

(4) $\left(x + \frac{1}{5}y\right)\left(x - \frac{1}{5}y\right)$

(5) $-16x^2 + 1 = -(16x^2 - 1)$
 $= -(4x+1)(4x-1)$

(6) $x^2 - (y-z)^2 = \{x + (y-z)\}\{x - (y-z)\}$
 $= (x+y-z)(x-y+z)$

(7) $x^4 - y^4 = (x^2 + y^2)(x^2 - y^2)$
 $= (x^2 + y^2)(x+y)(x-y)$

(8) $x^3y - xy^3 = xy(x^2 - y^2)$
 $= xy(x+y)(x-y)$

01-4 (1) $x^2 + 5x + 6 = x^2 + (2+3)x + 2 \cdot 3$
 $= (x+2)\boxed{(x+3)}$

(2) $x^2 - 2x - 8 = x^2 + (2-4)x + 2 \cdot (-4)$
 $= \boxed{(x+2)}(x-4)$

(3) $(x-1)(x-3)$

(4) $(x-2)(x-4)$

(5) $(x-3y)(x-7y)$

(6) $(x-4y)(x+5y)$

(7) $(x+3y)(x-8y)$

(8) $(x-2y)(x-5y)$

01-5 (1) $2x^2 + 5x + 3 = (x+1)\boxed{(2x+3)}$

(2) $2x^2 - 7x + 3 = \boxed{(x-3)}(2x-1)$

(3) $(2x+1)(2x+3)$

(4) $(x+3)(3x+2)$

(5) $(x+5y)(2x+y)$

(6) $(2x-1)(2x-5)$

(7) $(x-y)(5x-3y)$

(8) $(2x-1)(3x-2)$

01-6 (1) $3x^2 + 4x - 7 = (x-1)\boxed{(3x+7)}$

(2) $3x^2 + 11xy - 4y^2 = (x+4y)\boxed{(3x-y)}$

(3) $(x+3)(2x-3)$

(4) $(x-2)(5x+3)$

(5) $(x-y)(2x+7y)$

(6) $(x+1)(2x-3)$

(7) $(x-3y)(7x+y)$

(8) $(2x+3)(2x-5)$

02-1 (1) $x^3 + 6x^2 + 12x + 8 = x^3 + 3 \cdot \boxed{x^2} \cdot 2 + 3 \cdot x \cdot 2^2 + 2^3$
 $= \boxed{(x+2)}^3$

(2) $x^3 + 9x^2 + 27x + 27 = x^3 + 3 \cdot x^2 \cdot 3 + 3 \cdot x \cdot \boxed{3^2} + 3^3$
 $= \boxed{(x+3)}^3$

(3) $8x^3 + 12x^2 + 6x + 1$
 $= (2x)^3 + 3 \cdot (2x)^2 \cdot 1 + 3 \cdot 2x \cdot 1^2 + 1^3$
 $= (2x+1)^3$

(4) $(x+4)^3$

(5) $(x+y)^3$

(6) $(3x+y)^3$

(7) $(x+5)^3$

02-2 (1) $x^3 - 9x^2 + 27x - 27 = x^3 - 3 \cdot x^2 \cdot 3 + 3 \cdot x \cdot \boxed{3^2} - 3^3$
 $= \boxed{(x-3)}^3$

(2) $8x^3 - 12x^2y + 6xy^2 - y^3$
 $= \boxed{(2x)}^3 - 3 \cdot (2x)^2 \cdot y + 3 \cdot 2x \cdot y^2 - y^3$
 $= \boxed{(2x-y)}^3$

(3) $x^3 - 3x^2 + 3x - 1 = x^3 - 3 \cdot x^2 \cdot 1 + 3 \cdot x \cdot 1^2 - 1^3$
 $= (x-1)^3$

- (4) $(x-4)^3$
 (5) $(3x-y)^3$
 (6) $(x-5y)^3$
 (7) $(4x-y)^3$
 (8) $(3x-2y)^3$

02-3 (1) $x^3+1=x^3+1^3$

$$= (\overline{x+1})(x^2-x\cdot 1+1^2)$$

$$= (x+1)(\overline{x^2-x+1})$$

(2) $x^3+8y^3=x^3+(\overline{2y})^3$

$$= (x+2y)\{x^2-x\cdot 2y+(2y)^2\}$$

$$= (x+2y)(\overline{x^2-2xy+4y^2})$$

(3) $x^3+27=x^3+3^3$

$$= (x+3)(x^2-x\cdot 3+3^2)$$

$$= (x+3)(x^2-3x+9)$$

(4) $8x^3+1=(2x)^3+1^3$

$$= (2x+1)(4x^2-2x+1)$$

(5) $2x^3+250=2(x^3+5^3)$

$$= 2(x+5)(x^2-5x+25)$$

(6) $x^3+64y^3=x^3+(4y)^3$

$$= (x+4y)(x^2-4xy+16y^2)$$

(7) $27x^3+8y^3=(3x)^3+(2y)^3$

$$= (3x+2y)(9x^2-6xy+4y^2)$$

(8) $64x^4+xy^3=x\{(4x)^3+y^3\}$

$$= x(4x+y)(16x^2-4xy+y^2)$$

02-4 (1) $x^3-8=x^3-2^3$

$$= (x-2)(x^2+x\cdot \overline{2}+2^2)$$

$$= (x-2)(\overline{x^2+2x+4})$$

(2) $8x^3-27y^3=(2x)^3-(3y)^3$

$$= (2x-3y)\{(2x)^2+2x\cdot 3y+(3y)^2\}$$

$$= (2x-3y)(\overline{4x^2+6xy+9y^2})$$

(3) $x^3-27=x^3-3^3$

$$= (x-3)(x^2+x\cdot 3+3^2)$$

$$= (x-3)(x^2+3x+9)$$

(4) $64x^3-1=(4x)^3-1^3$

$$= (4x-1)(16x^2+4x+1)$$

(5) $27x^3-8=(3x)^3-2^3$

$$= (3x-2)(9x^2+6x+4)$$

(6) $x^3-125y^3=x^3-(5y)^3$

$$= (x-5y)(x^2+5xy+25y^2)$$

(7) $27x^3-y^3=(3x)^3-y^3$

$$= (3x-y)(9x^2+3xy+y^2)$$

(8) $16x^5y-2x^2y^4=2x^2y\{(2x)^3-y^3\}$

$$= 2x^2y(2x-y)(4x^2+2xy+y^2)$$

03-1 (1) $x^2+y^2+4z^2+2xy+4yz+4zx$

$$= x^2+y^2+(\overline{2z})^2+2\cdot x\cdot y+2\cdot y\cdot 2z+2\cdot 2z\cdot x$$

$$= (\overline{x+y+2z})^2$$

(2) $x^2+y^2+z^2-2xy+2yz-2zx$

$$= x^2+(-y)^2+(-z)^2$$

$$+ 2\cdot x\cdot (-y)+2\cdot (-y)\cdot (\overline{-z})+2\cdot (-z)\cdot x$$

$$= \{x+(-y)+(-z)\}^2=(\overline{x-y-z})^2$$

(3) $x^2+9y^2+z^2+6xy+6yz+2zx$

$$= x^2+(3y)^2+z^2+2\cdot x\cdot 3y+2\cdot 3y\cdot z+2\cdot z\cdot x$$

$$= (x+3y+z)^2$$

(4) $4x^2+y^2+9z^2+4xy+6yz+12zx$

$$= (2x)^2+y^2+(3z)^2+2\cdot 2x\cdot y+2\cdot y\cdot 3z+2\cdot 3z\cdot 2x$$

$$= (2x+y+3z)^2$$

(5) $x^2+y^2+z^2+2xy-2yz-2zx$

$$= x^2+y^2+(-z)^2+2\cdot x\cdot y+2\cdot y\cdot (-z)+2\cdot (-z)\cdot x$$

$$= (x+y-z)^2$$

(6) $4x^2+4y^2+z^2-8xy-4yz+4zx$

$$= (2x)^2+(-2y)^2+z^2$$

$$+ 2\cdot 2x\cdot (-2y)+2\cdot (-2y)\cdot z+2\cdot z\cdot 2x$$

$$= (2x-2y+z)^2$$

03-2 (1) $x^2+y^2+2xy+2x+2y+1$

$$= x^2+y^2+\overline{1}+2xy+2y+2x$$

$$= x^2+y^2+1^2+2\cdot x\cdot y+2\cdot y\cdot \overline{1}+2\cdot 1\cdot x$$

$$= (\overline{x+y+1})^2$$

(2) $x^2+y^2+2xy-6x-6y+9$

$$= x^2+y^2+9+2xy-6y-6x$$

$$= x^2+y^2+(-3)^2+2\cdot x\cdot y+2\cdot y\cdot (-3)+2\cdot (-3)\cdot x$$

$$= (\overline{x+y-3})^2$$

(3) $25x^2+y^2+10xy+10x+2y+1$

$$= 25x^2+y^2+1+10xy+2y+10x$$

$$= (5x)^2+y^2+1^2+2\cdot 5x\cdot y+2\cdot y\cdot 1+2\cdot 1\cdot 5x$$

$$= (5x+y+1)^2$$

(4) $x^2+4y^2+4xy+4x+8y+4$

$$= x^2+4y^2+4+4xy+8y+4x$$

$$= x^2+(2y)^2+2^2+2\cdot x\cdot 2y+2\cdot 2y\cdot 2+2\cdot 2\cdot x$$

$$= (x+2y+2)^2$$

(5) $x^2+16y^2-8xy+2x-8y+1$

$$= x^2+16y^2+1-8xy-8y+2x$$

$$= x^2+(-4y)^2+1^2$$

$$+ 2\cdot x\cdot (-4y)+2\cdot (-4y)\cdot 1+2\cdot 1\cdot x$$

$$= (x-4y+1)^2$$

(6) $4x^2+y^2-4xy-20x+10y+25$

$$= 4x^2+y^2+25-4xy+10y-20x$$

$$= (2x)^2+(-y)^2+(-5)^2$$

$$+ 2\cdot 2x\cdot (-y)+2\cdot (-y)\cdot (-5)+2\cdot (-5)\cdot 2x$$

$$= (2x-y-5)^2$$

$$\begin{aligned}
 \text{03-3 (1)} \quad & x^3 + 8y^3 + 27z^3 - 18xyz \\
 &= x^3 + (2y)^3 + (3z)^3 - 3 \cdot x \cdot \boxed{2y} \cdot 3z \\
 &= (x + 2y + 3z) \{x^2 + (2y)^2 + (\boxed{3z})^2 \\
 &\quad - x \cdot 2y - 2y \cdot 3z - 3z \cdot x\} \\
 &= (x + 2y + 3z)(x^2 + 4y^2 + 9z^2 - 2xy - 6yz - 3zx)
 \end{aligned}$$

$$\begin{aligned}
 \text{(2)} \quad & x^3 + y^3 - z^3 + 3xyz \\
 &= x^3 + y^3 + (-z)^3 - \boxed{3} \cdot x \cdot y \cdot (-z) \\
 &= \{x + y + (-z)\} \{x^2 + y^2 + (-z)^2 \\
 &\quad - x \cdot y - y \cdot (-z) - (-z) \cdot \boxed{x}\} \\
 &= (\boxed{x + y - z})(x^2 + y^2 + z^2 - xy + yz + zx)
 \end{aligned}$$

$$\begin{aligned}
 \text{(3)} \quad & x^3 + 8y^3 + z^3 - 6xyz \\
 &= x^3 + (2y)^3 + z^3 - 3 \cdot x \cdot 2y \cdot z \\
 &= (x + 2y + z) \{x^2 + (2y)^2 + z^2 - x \cdot 2y - 2y \cdot z - z \cdot x\} \\
 &= (x + 2y + z)(x^2 + 4y^2 + z^2 - 2xy - 2yz - zx)
 \end{aligned}$$

$$\begin{aligned}
 \text{(4)} \quad & x^3 + y^3 + 64z^3 - 12xyz \\
 &= x^3 + y^3 + (4z)^3 - 3 \cdot x \cdot y \cdot 4z \\
 &= (x + y + 4z)(x^2 + y^2 + 16z^2 - xy - 4yz - 4zx)
 \end{aligned}$$

$$\begin{aligned}
 \text{(5)} \quad & x^3 - y^3 - z^3 - 3xyz \\
 &= x^3 + (-y)^3 + (-z)^3 - 3 \cdot x \cdot (-y) \cdot (-z) \\
 &= (x - y - z)(x^2 + y^2 + z^2 + xy - yz + zx)
 \end{aligned}$$

$$\begin{aligned}
 \text{(6)} \quad & 27x^3 + y^3 - z^3 + 9xyz \\
 &= (3x)^3 + y^3 + (-z)^3 - 3 \cdot 3x \cdot y \cdot (-z) \\
 &= (3x + y - z)(9x^2 + y^2 + z^2 - 3xy + yz + 3zx)
 \end{aligned}$$

$$\begin{aligned}
 \text{03-4 (1)} \quad & x^3 + y^3 - 3xy + 1 \\
 &= x^3 + y^3 + 1 - 3xy \\
 &= x^3 + y^3 + 1^3 - \boxed{3} \cdot x \cdot y \cdot 1 \\
 &= (x + y + 1)(x^2 + \boxed{y^2} + 1^2 - x \cdot y - y \cdot 1 - 1 \cdot x) \\
 &= (\boxed{x + y + 1})(x^2 + y^2 - xy - x - y + 1)
 \end{aligned}$$

$$\begin{aligned}
 \text{(2)} \quad & x^3 - y^3 - 6xy - 8 \\
 &= x^3 - y^3 - 8 - 6xy \\
 &= x^3 + (-y)^3 + (-2)^3 - 3 \cdot x \cdot (-y) \cdot (\boxed{-2}) \\
 &= (x - y - 2)(x^2 + y^2 + 4 + \boxed{xy} - 2y + 2x) \\
 &= (x - y - 2)(x^2 + y^2 + \boxed{xy} + 2x - 2y + 4)
 \end{aligned}$$

$$\begin{aligned}
 \text{(3)} \quad & x^3 + 8y^3 - 6xy + 1 \\
 &= x^3 + 8y^3 + 1 - 6xy \\
 &= x^3 + (2y)^3 + 1^3 - 3 \cdot x \cdot 2y \cdot 1 \\
 &= (x + 2y + 1)(x^2 + 4y^2 + 1 - x \cdot 2y - 2y \cdot 1 - 1 \cdot x) \\
 &= (x + 2y + 1)(x^2 + 4y^2 - 2xy - x - 2y + 1)
 \end{aligned}$$

$$\begin{aligned}
 \text{(4)} \quad & x^3 + y^3 + 9xy - 27 \\
 &= x^3 + y^3 - 27 + 9xy \\
 &= x^3 + y^3 + (-3)^3 - 3 \cdot x \cdot y \cdot (-3) \\
 &= (x + y - 3)(x^2 + y^2 + 9 - xy + 3y + 3x) \\
 &= (x + y - 3)(x^2 + y^2 - xy + 3x + 3y + 9)
 \end{aligned}$$

$$\begin{aligned}
 \text{(5)} \quad & x^3 - y^3 + 12xy + 64 \\
 &= x^3 - y^3 + 64 + 12xy \\
 &= x^3 + (-y)^3 + 4^3 - 3 \cdot x \cdot (-y) \cdot 4 \\
 &= (x - y + 4)(x^2 + y^2 + 16 + xy + 4y - 4x) \\
 &= (x - y + 4)(x^2 + y^2 + xy - 4x + 4y + 16)
 \end{aligned}$$

$$\begin{aligned}
 \text{(6)} \quad & x^3 - 27y^3 + 18xy + 8 \\
 &= x^3 - 27y^3 + 8 + 18xy \\
 &= x^3 + (-3y)^3 + 2^3 - 3 \cdot x \cdot (-3y) \cdot 2 \\
 &= (x - 3y + 2)(x^2 + 9y^2 + 4 + 3xy + 6y - 2x) \\
 &= (x - 3y + 2)(x^2 + 9y^2 + 3xy - 2x + 6y + 4)
 \end{aligned}$$

$$\begin{aligned}
 \text{04-1 (1)} \quad & (x + y)^2 + 2(x + y) + 1 \\
 &= t^2 + 2t + 1 \quad \leftarrow x + y = t \text{로 치환} \\
 &= (\boxed{t + 1})^2 \\
 &= (x + y + \boxed{1})^2 \quad \leftarrow t = x + y \text{ 대입}
 \end{aligned}$$

$$\begin{aligned}
 \text{(2)} \quad & (x + y)(x + y - 3) - 4 \\
 &= t(t - 3) - 4 \quad \leftarrow x + y = t \text{로 치환} \\
 &= t^2 - 3t - 4 \\
 &= (t + 1)(t - \boxed{4}) \\
 &= (x + y + 1)(x + y - \boxed{4}) \quad \leftarrow t = x + y \text{ 대입}
 \end{aligned}$$

$$\begin{aligned}
 \text{(3)} \quad & (x + y)^2 - 5(x + y) + 4 \\
 &= t^2 - 5t + 4 \quad \leftarrow x + y = t \text{로 치환} \\
 &= (t - 1)(t - 4) \\
 &= (x + y - 1)(x + y - 4) \quad \leftarrow t = x + y \text{ 대입}
 \end{aligned}$$

$$\begin{aligned}
 \text{(4)} \quad & (3x + y)(3x + y + 2) - 8 \\
 &= t(t + 2) - 8 \quad \leftarrow 3x + y = t \text{로 치환} \\
 &= t^2 + 2t - 8 \\
 &= (t - 2)(t + 4) \\
 &= (3x + y - 2)(3x + y + 4) \quad \leftarrow t = 3x + y \text{ 대입}
 \end{aligned}$$

$$\begin{aligned}
 \text{(5)} \quad & (x - 2y)(x - 2y - 8) + 15 \\
 &= t(t - 8) + 15 \quad \leftarrow x - 2y = t \text{로 치환} \\
 &= t^2 - 8t + 15 \\
 &= (t - 3)(t - 5) \\
 &= (x - 2y - 3)(x - 2y - 5) \quad \leftarrow t = x - 2y \text{ 대입}
 \end{aligned}$$

$$\begin{aligned}
 \text{04-2 (1)} \quad & (x^2 + 5x + 4)(x^2 + 5x + 2) - 24 \\
 &= (t + 4)(t + 2) - 24 \quad \leftarrow x^2 + 5x = t \text{로 치환} \\
 &= t^2 + 6t - 16 \\
 &= (t - \boxed{2})(t + 8) \\
 &= (x^2 + 5x - 2)(\boxed{x^2 + 5x} + 8) \quad \leftarrow t = x^2 + 5x \text{ 대입}
 \end{aligned}$$

$$\begin{aligned}
 \text{(2)} \quad & (x^2 - 2x)^2 - 2x^2 + 4x - 3 \\
 &= (x^2 - 2x)^2 - 2(\boxed{x^2 - 2x}) - 3 \\
 &= t^2 - 2t - 3 \quad \leftarrow x^2 - 2x = t \text{로 치환} \\
 &= (t + 1)(t - 3) \\
 &= (\boxed{x^2 - 2x} + 1)(x^2 - 2x - 3) \quad \leftarrow t = x^2 - 2x \text{ 대입} \\
 &= (x - 1)^2(x + 1)(\boxed{x - 3})
 \end{aligned}$$

$$\begin{aligned}
(3) & (x^2+8x+1)(x^2+8x+2)-30 \\
& = (t+1)(t+2)-30 \quad \leftarrow x^2+8x=t \text{로 치환} \\
& = t^2+3t-28 \\
& = (t-4)(t+7) \\
& = (x^2+8x-4)(x^2+8x+7) \quad \leftarrow t=x^2+8x \text{ 대입} \\
& = (x^2+8x-4)(x+1)(x+7) \\
(4) & (x^2+3x)^2-2x^2-6x-8 \\
& = (x^2+3x)^2-2(x^2+3x)-8 \\
& = t^2-2t-8 \quad \leftarrow x^2+3x=t \text{로 치환} \\
& = (t+2)(t-4) \\
& = (x^2+3x+2)(x^2+3x-4) \quad \leftarrow t=x^2+3x \text{ 대입} \\
& = (x+1)(x+2)(x-1)(x+4) \\
(5) & (x^2+4x)^2-4x^2-16x-5 \\
& = (x^2+4x)^2-4(x^2+4x)-5 \\
& = t^2-4t-5 \quad \leftarrow x^2+4x=t \text{로 치환} \\
& = (t+1)(t-5) \\
& = (x^2+4x+1)(x^2+4x-5) \quad \leftarrow t=x^2+4x \text{ 대입} \\
& = (x^2+4x+1)(x-1)(x+5)
\end{aligned}$$

05-1 (1) $x(x+1)(x-2)(x+3)-72$

$$\begin{aligned}
& = \{x(x+1)\}\{(x-2)(x+3)\}-72 \\
& = (x^2+x)(x^2+x-6)-72 \\
& = t(\overline{t-6})-72 \quad \leftarrow x^2+x=t \text{로 치환} \\
& = t^2-6t-72 \\
& = (t+6)(t-12) \\
& = (x^2+x+6)(\overline{x^2+x}-12) \quad \leftarrow t=x^2+x \text{ 대입} \\
& = (x^2+x+6)(x-3)(\overline{x+4}) \\
(2) & (x-3)(x-5)(x+1)(x+3)+11 \\
& = \{(x-3)(x+1)\}\{(\overline{x-5})(x+3)\}+11 \\
& = (x^2-2x-3)(x^2-2x-15)+11 \\
& = (\overline{t-3})(t-15)+11 \quad \leftarrow x^2-2x=t \text{로 치환} \\
& = t^2-18t+56 \\
& = (t-4)(t-14) \\
& = (x^2-2x-4)(\overline{x^2-2x}-14) \quad \leftarrow t=x^2-2x \text{ 대입} \\
(3) & x(x+1)(x+2)(x+3)-24 \\
& = \{x(x+3)\}\{(x+1)(x+2)\}-24 \\
& = (\overline{x^2+3x})(x^2+3x+2)-24 \\
& = t(t+2)-24 \quad \leftarrow x^2+3x=t \text{로 치환} \\
& = t^2+2t-24 \\
& = (t-4)(\overline{t+6}) \\
& = (x^2+3x-4)(x^2+3x+6) \quad \leftarrow t=x^2+3x \text{ 대입} \\
& = (x-1)(\overline{x+4})(x^2+3x+6) \\
(4) & (x+1)(x-3)(x+5)(x-7)+60 \\
& = \{(x+1)(x-3)\}\{(x+5)(x-7)\}+60 \\
& = (x^2-2x-3)(x^2-2x-35)+60 \\
& = (t-3)(t-35)+60 \quad \leftarrow x^2-2x=t \text{로 치환} \\
& = t^2-38t+165
\end{aligned}$$

$$\begin{aligned}
& = (t-5)(t-33) \\
& = (x^2-2x-5)(x^2-2x-33) \quad \leftarrow t=x^2-2x \text{ 대입} \\
(5) & (x-1)(x+2)(x-3)(x+4)+24 \\
& = \{(x-1)(x+2)\}\{(x-3)(x+4)\}+24 \\
& = (x^2+x-2)(x^2+x-12)+24 \\
& = (t-2)(t-12)+24 \quad \leftarrow x^2+x=t \text{로 치환} \\
& = t^2-14t+48 \\
& = (t-6)(t-8) \\
& = (x^2+x-6)(x^2+x-8) \quad \leftarrow t=x^2+x \text{ 대입} \\
& = (x-2)(x+3)(x^2+x-8) \\
(6) & (x+1)(x+2)(x-2)(x-3)-60 \\
& = \{(x+1)(x-2)\}\{(x+2)(x-3)\}-60 \\
& = (x^2-x-2)(x^2-x-6)-60 \\
& = (t-2)(t-6)-60 \quad \leftarrow x^2-x=t \text{로 치환} \\
& = t^2-8t-48 \\
& = (t+4)(t-12) \\
& = (x^2-x+4)(x^2-x-12) \quad \leftarrow t=x^2-x \text{ 대입} \\
& = (x^2-x+4)(x+3)(x-4) \\
(7) & x(x+2)(x+4)(x+6)+15 \\
& = \{x(x+6)\}\{(x+2)(x+4)\}+15 \\
& = (x^2+6x)(x^2+6x+8)+15 \\
& = t(t+8)+15 \quad \leftarrow x^2+6x=t \text{로 치환} \\
& = t^2+8t+15 \\
& = (t+3)(t+5) \\
& = (x^2+6x+3)(x^2+6x+5) \quad \leftarrow t=x^2+6x \text{ 대입} \\
& = (x^2+6x+3)(x+1)(x+5)
\end{aligned}$$

06-1 (1) x^4+2x^2-3

$$\begin{aligned}
& = X^2+2X-3 \quad \leftarrow x^2=X \text{로 치환} \\
& = (X-1)(\overline{X+3}) \\
& = (x^2-1)(x^2+3) \quad \leftarrow X=x^2 \text{ 대입} \\
& = (\overline{x+1})(x-1)(x^2+3) \\
(2) & 2x^4-9x^2+4 \\
& = 2X^2-\overline{9X}+4 \quad \leftarrow x^2=X \text{로 치환} \\
& = (X-4)(2X-1) \\
& = (\overline{x^2}-4)(2x^2-1) \quad \leftarrow X=x^2 \text{ 대입} \\
& = (x+2)(\overline{x-2})(2x^2-1) \\
(3) & x^4-5x^2+4 \\
& = X^2-5X+4 \quad \leftarrow x^2=X \text{로 치환} \\
& = (X-1)(X-4) \\
& = (x^2-1)(x^2-4) \quad \leftarrow X=x^2 \text{ 대입} \\
& = (x+1)(x-1)(x+2)(x-2) \\
(4) & x^4-10x^2+9 \\
& = X^2-10X+9 \quad \leftarrow x^2=X \text{로 치환} \\
& = (X-1)(X-9) \\
& = (x^2-1)(x^2-9) \quad \leftarrow X=x^2 \text{ 대입} \\
& = (x+1)(x-1)(x+3)(x-3)
\end{aligned}$$

$$\begin{aligned}
(5) \quad & x^4 + x^2 - 2 \\
&= X^2 + X - 2 \quad \leftarrow x^2 = X \text{로 치환} \\
&= (X-1)(X+2) \\
&= (x^2-1)(x^2+2) \quad \leftarrow X = x^2 \text{ 대입} \\
&= (x+1)(x-1)(x^2+2) \\
(6) \quad & 2x^4 - 17x^2 - 9 \\
&= 2X^2 - 17X - 9 \quad \leftarrow x^2 = X \text{로 치환} \\
&= (X-9)(2X+1) \\
&= (x^2-9)(2x^2+1) \quad \leftarrow X = x^2 \text{ 대입} \\
&= (x+3)(x-3)(2x^2+1) \\
(7) \quad & 3x^4 - 14x^2 + 8 \\
&= 3X^2 - 14X + 8 \quad \leftarrow x^2 = X \text{로 치환} \\
&= (X-4)(3X-2) \\
&= (x^2-4)(3x^2-2) \quad \leftarrow X = x^2 \text{ 대입} \\
&= (x+2)(x-2)(3x^2-2) \\
(8) \quad & x^4 - 16 \\
&= X^2 - 16 \quad \leftarrow x^2 = X \text{로 치환} \\
&= (X+4)(X-4) \\
&= (x^2+4)(x^2-4) \quad \leftarrow X = x^2 \text{ 대입} \\
&= (x^2+4)(x+2)(x-2)
\end{aligned}$$

06-2 (1) $x^4 + 4$

$$\begin{aligned}
&= (x^4 + 4x^2 + 4) - 4x^2 \quad \leftarrow 4x^2 \text{ 더하고 빼기} \\
&= (x^2+2)^2 - (\boxed{2x})^2 \quad \leftarrow A^2 - B^2 \text{ 꼴로 변형} \\
&= (x^2+2+2x)(x^2+2-\boxed{2x}) \\
&= (x^2+\boxed{2x}+2)(x^2-2x+2) \\
(2) \quad & x^4 + 7x^2 + 16 \\
&= (x^4 + 8x^2 + 16) - \boxed{x^2} \quad \leftarrow x^2 \text{ 더하고 빼기} \\
&= (x^2+4)^2 - x^2 \quad \leftarrow A^2 - B^2 \text{ 꼴로 변형} \\
&= (x^2+4+\boxed{x})(x^2+4-x) \\
&= (x^2+x+4)(x^2-\boxed{x}+4) \\
(3) \quad & x^4 + 64 \\
&= (x^4 + 16x^2 + 64) - 16x^2 \quad \leftarrow 16x^2 \text{ 더하고 빼기} \\
&= (x^2+8)^2 - (4x)^2 \quad \leftarrow A^2 - B^2 \text{ 꼴로 변형} \\
&= (x^2+8+4x)(x^2+8-4x) \\
&= (x^2+4x+8)(x^2-4x+8) \\
(4) \quad & x^4 + x^2 + 25 \\
&= (x^4 + 10x^2 + 25) - 9x^2 \quad \leftarrow 9x^2 \text{ 더하고 빼기} \\
&= (x^2+5)^2 - (3x)^2 \quad \leftarrow A^2 - B^2 \text{ 꼴로 변형} \\
&= (x^2+5+3x)(x^2+5-3x) \\
&= (x^2+3x+5)(x^2-3x+5) \\
(5) \quad & x^4 + 5x^2 + 9 \\
&= (x^4 + 6x^2 + 9) - x^2 \quad \leftarrow x^2 \text{ 더하고 빼기} \\
&= (x^2+3)^2 - x^2 \quad \leftarrow A^2 - B^2 \text{ 꼴로 변형} \\
&= (x^2+3+x)(x^2+3-x) \\
&= (x^2+x+3)(x^2-x+3)
\end{aligned}$$

$$\begin{aligned}
06-3 \quad (1) \quad & x^4 - 15x^2 + 9 \\
&= (x^4 - 6x^2 + 9) - \boxed{9x^2} \quad \leftarrow -15x^2 \text{ 분리하기} \\
&= (x^2-3)^2 - (3x)^2 \quad \leftarrow A^2 - B^2 \text{ 꼴로 변형} \\
&= (x^2-3+3x)(\boxed{x^2-3}-3x) \\
&= (x^2+\boxed{3x}-3)(x^2-3x-3) \\
(2) \quad & x^4 - 35x^2 + 25 \\
&= (x^4 - \boxed{10x^2} + 25) - 25x^2 \quad \leftarrow -35x^2 \text{ 분리하기} \\
&= (x^2-5)^2 - (5x)^2 \quad \leftarrow A^2 - B^2 \text{ 꼴로 변형} \\
&= (x^2-5+\boxed{5x})(x^2-5-5x) \\
&= (x^2+\boxed{5x}-5)(x^2-5x-5) \\
(3) \quad & x^4 - 11x^2 + 1 \\
&= (x^4 - 2x^2 + 1) - 9x^2 \quad \leftarrow -11x^2 \text{ 분리하기} \\
&= (x^2-1)^2 - (3x)^2 \quad \leftarrow A^2 - B^2 \text{ 꼴로 변형} \\
&= (x^2+3x-1)(x^2-3x-1) \\
(4) \quad & x^4 - 12x^2 + 16 \\
&= (x^4 - 8x^2 + 16) - 4x^2 \quad \leftarrow -12x^2 \text{ 분리하기} \\
&= (x^2-4)^2 - (2x)^2 \quad \leftarrow A^2 - B^2 \text{ 꼴로 변형} \\
&= (x^2+2x-4)(x^2-2x-4) \\
(5) \quad & x^4 - 14x^2 + 25 \\
&= (x^4 - 10x^2 + 25) - 4x^2 \quad \leftarrow -14x^2 \text{ 분리하기} \\
&= (x^2-5)^2 - (2x)^2 \quad \leftarrow A^2 - B^2 \text{ 꼴로 변형} \\
&= (x^2+2x-5)(x^2-2x-5)
\end{aligned}$$

07-1 (1) $2x^2 + xy + 5x + 3y - 3$ $\leftarrow y$ 의 차수가 가장 낮다.

$$\begin{aligned}
&= (x+3)y + 2x^2 + 5x - 3 \\
&= (x+3)y + (x+3)(2x-1) \\
&= (x+3)(\boxed{2x+y-1}) \\
(2) \quad & x^2 + xy - xyz - y^2z \quad \leftarrow z \text{의 차수가 가장 낮다.} \\
&= (-xy - y^2)z + x^2 + xy \\
&= -(x+y)yz + (\boxed{x+y})x \\
&= (x+y)(\boxed{x-yz}) \\
(3) \quad & x^2y - zx^2 - y^3 + y^2z \quad \leftarrow z \text{의 차수가 가장 낮다.} \\
&= (-x^2 + y^2)z + x^2y - \boxed{y^3} \\
&= -(x^2 - y^2)z + (x^2 - y^2)y \\
&= (\boxed{x^2 - y^2})(y-z) = (x+y)(x-y)(y-z) \\
(4) \quad & y^2 - 3xy - y + 6x - 2 \quad \leftarrow x \text{의 차수가 가장 낮다.} \\
&= (-3y+6)x + y^2 - y - 2 \\
&= -3(y-2)x + (y+1)(y-2) \\
&= (-3x+y+1)(y-2) \\
(5) \quad & 3x^2 - 12xy + x + 8y - 2 \quad \leftarrow y \text{의 차수가 가장 낮다.} \\
&= (-12x+8)y + 3x^2 + x - 2 \\
&= -4(3x-2)y + (x+1)(3x-2) \\
&= (3x-2)(x-4y+1) \\
(6) \quad & x^2 + zx - y^2 + yz \quad \leftarrow z \text{의 차수가 가장 낮다.} \\
&= (x+y)z + x^2 - y^2 \\
&= (x+y)z + (x+y)(x-y) \\
&= (x+y)(x-y+z)
\end{aligned}$$

(7) $y^2 + 2xy - z^2 + 2zx$ ← x 의 차수가 가장 낮다.

$$\begin{aligned} &= (2y + 2z)x + y^2 - z^2 \\ &= 2x(y + z) + (y + z)(y - z) \\ &= (y + z)(2x + y - z) \end{aligned}$$

(8) $x^2 - 3xy - 4z^2 - 6yz$ ← y 의 차수가 가장 낮다.

$$\begin{aligned} &= (-3x - 6z)y + x^2 - 4z^2 \\ &= -3(x + 2z)y + (x + 2z)(x - 2z) \\ &= (x + 2z)(x - 3y - 2z) \end{aligned}$$

(9) $y^3 + xy^2 - yz^2 - z^2x$ ← x 의 차수가 가장 낮다.

$$\begin{aligned} &= (y^2 - z^2)x + y^3 - yz^2 \\ &= (y^2 - z^2)x + (y^2 - z^2)y \\ &= (y^2 - z^2)(x + y) \\ &= (y + z)(y - z)(x + y) \end{aligned}$$

(10) $x^2y + zx^2 - z^2y - z^3$ ← y 의 차수가 가장 낮다.

$$\begin{aligned} &= (x^2 - z^2)y + zx^2 - z^3 \\ &= (x^2 - z^2)y + (x^2 - z^2)z \\ &= (x^2 - z^2)(y + z) \\ &= (x + z)(x - z)(y + z) \end{aligned}$$

07-2 (1) $x^2 - 2y^2 - xy + 4x + y + 3$

$$\begin{aligned} &= x^2 + (-y + 4)x + (-2y^2 + y + 3) \\ &= x^2 + (-y + 4)x + (y + 1)(-2y + 3) \end{aligned}$$

$$\begin{array}{rcl} x & \nearrow & y+1 \rightarrow (y+1)x \\ x & \searrow & -2y+3 \rightarrow \frac{(-2y+3)x}{(-y+4)x} + \end{array}$$

$$= (x + y + 1)(x - 2y + 3)$$

(2) $x^2 - 3y^2 + 2xy - x - 7y - 2$

$$\begin{aligned} &= x^2 + (2y - 1)x + (-3y^2 - 7y - 2) \\ &= x^2 + (2y - 1)x + (-y - 2)(3y + 1) \end{aligned}$$

$$\begin{array}{rcl} x & \nearrow & -y-2 \rightarrow (-y-2)x \\ x & \searrow & 3y+1 \rightarrow \frac{(3y+1)x}{(2y-1)x} + \end{array}$$

$$= (x - y - 2)(x + 3y + 1)$$

(3) $x^2 + 4y^2 + 4xy - 4x - 8y - 5$

$$\begin{aligned} &= x^2 + (4y - 4)x + (4y^2 - 8y - 5) \\ &= x^2 + (4y - 4)x + (2y + 1)(2y - 5) \end{aligned}$$

$$\begin{array}{rcl} x & \nearrow & 2y+1 \rightarrow (2y+1)x \\ x & \searrow & 2y-5 \rightarrow \frac{(2y-5)x}{(4y-4)x} + \end{array}$$

$$= (x + 2y + 1)(x + 2y - 5)$$

(4) $2x^2 + 2y^2 + 5xy + 10x + 11y + 12$

$$\begin{aligned} &= 2x^2 + (5y + 10)x + (2y^2 + 11y + 12) \\ &= 2x^2 + (5y + 10)x + (y + 4)(2y + 3) \end{aligned}$$

$$\begin{array}{rcl} x & \nearrow & 2y+3 \rightarrow (4y+6)x \\ 2x & \searrow & y+4 \rightarrow \frac{(y+4)x}{(5y+10)x} + \end{array}$$

$$= (x + 2y + 3)(2x + y + 4)$$

(5) $x^2 + 12y^2 - 7xy - x + 5y - 2$

$$\begin{aligned} &= x^2 + (-7y - 1)x + (12y^2 + 5y - 2) \\ &= x^2 + (-7y - 1)x + (3y + 2)(4y - 1) \end{aligned}$$

$$\begin{array}{rcl} x & \nearrow & -(3y+2) \rightarrow (-3y-2)x \\ x & \searrow & -(4y-1) \rightarrow \frac{(-4y-1)x}{(-7y-1)x} + \end{array}$$

$$\begin{aligned} &= \{x - (3y + 2)\} \{x - (4y - 1)\} \\ &= (x - 3y - 2)(x - 4y + 1) \end{aligned}$$

(6) $x^2 + 3y^2 - 4xy + x - 5y - 2$

$$\begin{aligned} &= x^2 + (-4y + 1)x + (3y^2 - 5y - 2) \\ &= x^2 + (-4y + 1)x + (y - 2)(3y + 1) \end{aligned}$$

$$\begin{array}{rcl} x & \nearrow & -(y-2) \rightarrow (-y+2)x \\ x & \searrow & -(3y+1) \rightarrow \frac{(-3y-1)x}{(-4y+1)x} + \end{array}$$

$$\begin{aligned} &= \{x - (y - 2)\} \{x - (3y + 1)\} \\ &= (x - y + 2)(x - 3y - 1) \end{aligned}$$

(7) $x^2 + 2y^2 - 3xy - 6x + 7y + 5$

$$\begin{aligned} &= x^2 + (-3y - 6)x + (2y^2 + 7y + 5) \\ &= x^2 + (-3y - 6)x + (y + 1)(2y + 5) \end{aligned}$$

$$\begin{array}{rcl} x & \nearrow & -(y+1) \rightarrow (-y-1)x \\ x & \searrow & -(2y+5) \rightarrow \frac{(-2y-5)x}{(-3y-6)x} + \end{array}$$

$$\begin{aligned} &= \{x - (y + 1)\} \{x - (2y + 5)\} \\ &= (x - y - 1)(x - 2y - 5) \end{aligned}$$

(8) $3x^2 + 2y^2 - 5xy - 11x + 7y - 4$

$$\begin{aligned} &= 3x^2 + (-5y - 11)x + (2y^2 + 7y - 4) \\ &= 3x^2 + (-5y - 11)x + (y + 4)(2y - 1) \end{aligned}$$

$$\begin{array}{rcl} x & \nearrow & -(y+4) \rightarrow (-y-4)x \\ 3x & \searrow & -(2y-1) \rightarrow \frac{(-2y-1)x}{(-5y-11)x} + \end{array}$$

$$\begin{aligned} &= \{x - (y + 4)\} \{3x - (2y - 1)\} \\ &= (x - y - 4)(3x - 2y + 1) \end{aligned}$$

08-1 (1) $f(x) = x^3 - 3x^2 + 4x - 2$ 로 놓으면

$f(1) = 0$ 이므로 일차식 $x - 1$ 은 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrr} 1 & 1 & -3 & 4 & -2 \\ & & 1 & -2 & 2 \\ \hline & 1 & -2 & 2 & 0 \end{array}$$

$$\therefore x^3 - 3x^2 + 4x - 2 = (x - 1)(x^2 - 2x + 2)$$

(2) $f(x) = x^3 - x^2 - 5x - 3$ 으로 놓으면

$f(-1) = 0$ 이므로 일차식 $x + 1$ 은 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrr} -1 & 1 & -1 & -5 & -3 \\ & & -1 & 2 & 3 \\ \hline & 1 & -2 & -3 & 0 \end{array}$$

$$\begin{aligned} \therefore x^3 - x^2 - 5x - 3 &= (x + 1)(x^2 - 2x - 3) \\ &= (x + 1)^2(x - 3) \end{aligned}$$

(3) $f(x) = x^3 + 3x^2 - 4$ 로 놓으면

$f(1) = 0$ 이므로 일차식 $x-1$ 은 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrr} 1 & 1 & 3 & 0 & -4 \\ & & 1 & 4 & 4 \\ \hline & 1 & 4 & 4 & 0 \end{array}$$

$$\begin{aligned} \therefore x^3 + 3x^2 - 4 &= (x-1)(x^2 + 4x + 4) \\ &= (x-1)(x+2)^2 \end{aligned}$$

(4) $f(x) = x^3 - 6x^2 - x + 30$ 으로 놓으면

$f(-2) = 0$ 이므로 일차식 $x+2$ 는 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrr} -2 & 1 & -6 & -1 & 30 \\ & & -2 & 16 & -30 \\ \hline & 1 & -8 & 15 & 0 \end{array}$$

$$\begin{aligned} \therefore x^3 - 6x^2 - x + 30 &= (x+2)(x^2 - 8x + 15) \\ &= (x+2)(x-3)(x-5) \end{aligned}$$

(5) $f(x) = x^3 - 3x^2 - 6x + 8$ 로 놓으면

$f(1) = 0$ 이므로 일차식 $x-1$ 은 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrr} 1 & 1 & -3 & -6 & 8 \\ & & 1 & -2 & -8 \\ \hline & 1 & -2 & -8 & 0 \end{array}$$

$$\begin{aligned} \therefore x^3 - 3x^2 - 6x + 8 &= (x-1)(x^2 - 2x - 8) \\ &= (x-1)(x+2)(x-4) \end{aligned}$$

(6) $f(x) = 2x^3 + 5x^2 - 7x + 2$ 로 놓으면

$f\left(\frac{1}{2}\right) = 0$ 이므로 일차식 $x - \frac{1}{2}$ 은 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrr} \frac{1}{2} & 2 & 5 & -7 & 2 \\ & & 1 & 3 & -2 \\ \hline & 2 & 6 & -4 & 0 \end{array}$$

$$\begin{aligned} \therefore 2x^3 + 5x^2 - 7x + 2 &= \left(x - \frac{1}{2}\right)(2x^2 + 6x - 4) \\ &= (2x-1)(x^2 + 3x - 2) \end{aligned}$$

08-2 (1) $f(x) = x^4 + 3x^3 - 2x^2 - 6x + 4$ 로 놓으면

$f(1) = 0, f(-2) = 0$ 이므로

일차식 $x-1, x+2$ 는 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrrr} 1 & 1 & 3 & -2 & -6 & 4 \\ & & 1 & 4 & 2 & -4 \\ -2 & 1 & 4 & 2 & -4 & 0 \\ & & -2 & -4 & 4 & \\ \hline & 1 & 2 & -2 & 0 & \end{array}$$

$$\begin{aligned} \therefore x^4 + 3x^3 - 2x^2 - 6x + 4 \\ &= (x-1)(x+2)(x^2 + 2x - 2) \end{aligned}$$

(2) $f(x) = x^4 + 2x^3 - 7x^2 - 8x + 12$ 로 놓으면

$f(1) = 0, f(-2) = 0$ 이므로

일차식 $x-1, x+2$ 는 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrrr} 1 & 1 & 2 & -7 & -8 & 12 \\ & & 1 & 3 & -4 & -12 \\ -2 & 1 & 3 & -4 & -12 & 0 \\ & & -2 & -2 & 12 & \\ \hline & 1 & 1 & -6 & 0 & \end{array}$$

$$\begin{aligned} \therefore x^4 + 2x^3 - 7x^2 - 8x + 12 \\ &= (x-1)(x+2)(x^2 + x - 6) \\ &= (x-1)(x+2)(x-2)(x+3) \end{aligned}$$

(3) $f(x) = x^4 + x^3 - 7x^2 - 13x - 6$ 으로 놓으면

$f(-1) = 0, f(-2) = 0$ 이므로

일차식 $x+1, x+2$ 는 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrrr} -1 & 1 & 1 & -7 & -13 & -6 \\ & & -1 & 0 & 7 & 6 \\ -2 & 1 & 0 & -7 & -6 & 0 \\ & & -2 & 4 & 6 & \\ \hline & 1 & -2 & -3 & 0 & \end{array}$$

$$\begin{aligned} \therefore x^4 + x^3 - 7x^2 - 13x - 6 \\ &= (x+1)(x+2)(x^2 - 2x - 3) \\ &= (x+1)(x+2)(x+1)(x-3) \\ &= (x+1)^2(x+2)(x-3) \end{aligned}$$

(4) $f(x) = 2x^4 - 2x^3 - x^2 + 2x - 1$ 로 놓으면

$f(1) = 0, f(-1) = 0$ 이므로

일차식 $x-1, x+1$ 은 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrrr} 1 & 2 & -2 & -1 & 2 & -1 \\ & & 2 & 0 & -1 & 1 \\ -1 & 2 & 0 & -1 & 1 & 0 \\ & & -2 & 2 & -1 & \\ \hline & 2 & -2 & 1 & 0 & \end{array}$$

$$\begin{aligned} \therefore 2x^4 - 2x^3 - x^2 + 2x - 1 \\ &= (x-1)(x+1)(2x^2 - 2x + 1) \end{aligned}$$

(5) $f(x) = x^4 - x^3 - 3x^2 - 3x - 18$ 로 놓으면

$f(-2) = 0, f(3) = 0$ 이므로

일차식 $x+2, x-3$ 은 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrrr} -2 & 1 & -1 & -3 & -3 & -18 \\ & & -2 & 6 & -6 & 18 \\ 3 & 1 & -3 & 3 & -9 & 0 \\ & & 3 & 0 & 9 & \\ \hline & 1 & 0 & 3 & 0 & \end{array}$$

$$\begin{aligned} \therefore x^4 - x^3 - 3x^2 - 3x - 18 \\ &= (x+2)(x-3)(x^2 + 3x) \end{aligned}$$

- (6) $f(x) = 3x^4 - 3x^3 - 4x^2 - 2x - 4$ 로 놓으면
 $f(-1) = 0, f(2) = 0$ 이므로
 일차식 $x+1, x-2$ 는 $f(x)$ 의 인수이다.

-1	3	-3	-4	-2	-4
		-3	6	-2	4
2	3	-6	2	-4	0
		6	0	4	
	3	0	2	0	

$$\therefore 3x^4 - 3x^3 - 4x^2 - 2x - 4$$

$$= (x+1)(x-2)(3x^2+2)$$

- (7) $f(x) = x^4 - 15x^2 - 10x + 24$ 로 놓으면
 $f(1) = 0, f(-2) = 0$ 이므로
 일차식 $x-1, x+2$ 는 $f(x)$ 의 인수이다.

1	1	0	-15	-10	24
		1	1	-14	-24
-2	1	1	-14	-24	0
		-2	2	24	
	1	-1	-12	0	

$$\therefore x^4 - 15x^2 - 10x + 24$$

$$= (x-1)(x+2)(x^2-x-12)$$

$$= (x-1)(x+2)(x+3)(x-4)$$

09-1 (1) $a^4 + c^2a^2 + b^2c^2 - b^4$

$$= (a^2 + b^2)c^2 + (a^4 - b^4)$$

$$= (a^2 + b^2)c^2 + (a^2 + b^2)(a^2 - b^2)$$

$$= (a^2 + b^2)(a^2 - b^2 + c^2)$$

$$\text{즉, } (a^2 + b^2)(a^2 - b^2 + c^2) = 0$$

$$\text{이때, } a^2 + b^2 > 0 \text{이므로}$$

$$a^2 - b^2 + c^2 = 0 \quad \therefore a^2 + c^2 = b^2$$

따라서 빗변의 길이가 b 인 직각삼각형이다.

(2) $a^2 + b^2 + c^2 - ab - bc - ca$

$$= \frac{1}{2}(2a^2 + 2b^2 + 2c^2 - 2ab - 2bc - 2ca)$$

$$= \frac{1}{2}\{(a^2 - 2ab + b^2) + (b^2 - 2bc + c^2) + (c^2 - 2ca + a^2)\}$$

$$= \frac{1}{2}\{(a-b)^2 + (b-c)^2 + (c-a)^2\}$$

$$\text{즉, } (a-b)^2 + (b-c)^2 + (c-a)^2 = 0$$

$$a-b=0, b-c=0, c-a=0 \quad \therefore a=b=c$$

따라서 정삼각형이다.

(3) $b^2 - ab - c^2 + ac = (-b+c)a + (b^2 - c^2)$

$$= -a(b-c) + (b+c)(b-c)$$

$$= (-a+b+c)(b-c)$$

$$\text{즉, } (-a+b+c)(b-c) = 0$$

$$\text{이때, } -a+b+c \neq 0 \text{이므로}$$

$$b-c=0 \quad \therefore b=c$$

따라서 $b=c$ 인 이등변삼각형이다.

참고

두 변의 길이의 합이 나머지 한 변의 길이보다 커야 삼각형이 되므로
 $b+c > a \quad \therefore -a+b+c \neq 0$

(4) $a^3 + a^2c - ab^2 - b^2c = (a^2 - b^2)c + (a^3 - ab^2)$

$$= (a^2 - b^2)c + a(a^2 - b^2)$$

$$= (a^2 - b^2)(c+a)$$

$$= (a+b)(a-b)(a+c)$$

$$\text{즉, } (a+b)(a-b)(a+c) = 0$$

이때, $a+b > 0, a+c > 0$ 이므로

$$a-b=0 \quad \therefore a=b$$

따라서 $a=b$ 인 이등변삼각형이다.

(5) $ab - bc + b^2 - ac = a(b-c) + (b^2 - bc)$

$$= a(b-c) + b(b-c)$$

$$= (a+b)(b-c)$$

$$\text{즉, } (a+b)(b-c) = 0$$

이때, $a+b > 0$ 이므로

$$b-c=0 \quad \therefore b=c$$

따라서 $b=c$ 인 이등변삼각형이다.

(6) $a^3 + b^3 + a^2b - ac^2 + ab^2 - bc^2$

$$= (-a-b)c^2 + (a^3 + a^2b + ab^2 + b^3)$$

$$= -c^2(a+b) + a^2(a+b) + b^2(a+b)$$

$$= (a^2 + b^2 - c^2)(a+b)$$

$$\text{즉, } (a^2 + b^2 - c^2)(a+b) = 0$$

이때, $a+b > 0$ 이므로

$$a^2 + b^2 - c^2 = 0 \quad \therefore c^2 = a^2 + b^2$$

따라서 빗변의 길이가 c 인 직각삼각형이다.

(7) $a^3 + b^3 + c^3 - 3abc$

$$= (a+b+c)(a^2 + b^2 + c^2 - ab - bc - ca)$$

$$= \frac{1}{2}(a+b+c)\{(a-b)^2 + (b-c)^2 + (c-a)^2\}$$

$$\text{즉, } (a+b+c)\{(a-b)^2 + (b-c)^2 + (c-a)^2\} = 0$$

$$\text{이때, } a+b+c > 0 \text{이므로}$$

$$(a-b)^2 + (b-c)^2 + (c-a)^2 = 0$$

$$a-b=0, b-c=0, c-a=0 \quad \therefore a=b=c$$

따라서 정삼각형이다.

10-1 (1) $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$

$$= (a+b)\{(a+b)^2 - 3ab\}$$

$$= 3(3^2 - 3 \cdot 2) = 9$$

(2) $a^4 + a^2b^2 + b^4 = (a^4 + 2a^2b^2 + b^4) - a^2b^2$

$$= (a^2 + b^2)^2 - (ab)^2$$

$$= (a^2 + b^2 + ab)(a^2 + b^2 - ab)$$

$$= \{(a+b)^2 - ab\}\{(a+b)^2 - 3ab\}$$

$$= (4^2 - 3)(4^2 - 3 \cdot 3) = 91$$

$$\begin{aligned} (3) \quad & a^3 - 2a^2b + 2ab^2 - b^3 \\ &= a^3 - b^3 - 2a^2b + 2ab^2 \\ &= (a-b)(a^2 + ab + b^2) - 2ab(a-b) \\ &= (a-b)(a^2 - ab + b^2) \\ &= (a-b)\{(a-b)^2 + ab\} \\ &= 3(3^2 - 2) = 21 \end{aligned}$$

$$\begin{aligned} (4) \quad & (1+b)a^2 + (1-a)b^2 - 2ab \\ &= a^2 + a^2b + b^2 - ab^2 - 2ab \\ &= (1+b)a^2 + (-b^2 - 2b)a + b^2 \end{aligned}$$

$$\begin{array}{rcl} a & \nearrow & -b \rightarrow (-b - b^2)a \\ (1+b)a & \searrow & -b \rightarrow \underline{-ba} \end{array} + \frac{(-b^2 - 2b)a}{(-b^2 - 2b)a}$$

$$\begin{aligned} &= (a-b)\{(1+b)a-b\} \\ &= (a-b)(a-b+ab) \\ &= 2(2+3)=10 \end{aligned}$$

$$\begin{aligned}
 (5) \quad & a^2b - ab^2 + b^2c - bc^2 + c^2a - ca^2 \\
 &= (b-c)a^2 + (-b^2+c^2)a + b^2c - bc^2 \\
 &= (b-c)a^2 - (b+c)(b-c)a + bc(\overline{b-c}) \\
 &= (b-c)\{a^2 - (b+c)a + bc\} \\
 &= (b-c)(a-b)(\overline{a-c})
 \end{aligned}$$

○) 때, $a-b=3 \cdots \cdots \textcircled{㉑}$, $b-c=2 \cdots \cdots \textcircled{㉒}$ 에서

㉠+㉡을 하면 $a-c=\boxed{5}$ 이므로

(주어진 식) = $2 \cdot 3 \cdot 5 = \boxed{30}$

$$\begin{aligned}
 (6) \quad & -a^2b + ab^2 - b^2c + bc^2 + ca^2 - c^2a \\
 & = (-b + c)a^2 + (b^2 - c^2)a - b^2c + bc^2 \\
 & = -(b - c)a^2 + (b + c)(b - c)a - bc(b - c) \\
 & = -(b - c)\{a^2 - (b + c)a + bc\} \\
 & = -(b - c)(a - b)(a - c)
 \end{aligned}$$

○) 때, $a-b=-1 \dots\dots \textcircled{㉠}$, $b-c=3 \dots\dots \textcircled{㉡}$ 에서

㉠+㉡을 하면 $a-c=2$ 이므로

$$(\text{주어진 식}) = (-3) \cdot (-1) \cdot 2 = 6$$

$$\begin{aligned} (7) \quad & a^2b - ab^2 - b^2c - bc^2 + ca^2 + c^2a \\ &= (b+c)a^2 + (-b^2+c^2)a - b^2c - bc^2 \\ &= (b+c)a^2 - (b+c)(b-c)a - bc(b+c) \\ &= (b+c)\{a^2 - (b-c)a - bc\} \\ &= (b+c)(a-b)(a+c) \end{aligned}$$

○이때, $a-b=4 \cdots \cdots \textcircled{㉠}$, $b+c=1 \cdots \cdots \textcircled{㉡}$ 에서

㉠+㉡을 하면 $c+a=5$ 이므로

$$(\text{주어진 식}) = 1 \cdot 4 \cdot 5 = 20$$

$$\begin{aligned}
 (8) \quad & -a^2b - ab^2 + b^2c + bc^2 - ca^2 + c^2a \\
 &= (-b-c)a^2 + (-b^2+c^2)a + b^2c + bc^2 \\
 &= -(b+c)a^2 - (b+c)(b-c)a + bc(b+c) \\
 &= -(b+c)\{a^2 + (b-c)a - bc\} \\
 &= -(b+c)(a+b)(a-c)
 \end{aligned}$$

이때, $a+b=5 \dots\dots \ominus$, $c-a=-2 \dots\dots \textcircled{L}$ 에서
 $\ominus + \textcircled{L}$ 을 하면 $b+c=3$ 이므로
 (주어진 식) $= (-3) \cdot 5 \cdot 2 = -30$

11-1 (1) $99=a$ 로 놓으면

$$\begin{aligned} 99^2 - 1 &= a^2 - 1^2 \\ &= (\boxed{a+1})(a-1) \\ &= (99+1)(99-1) \\ &= 100 \cdot 98 = \boxed{9800} \end{aligned}$$

(2) $55=a, 45=b$ 로 놓으면

$$\begin{aligned}\frac{55^3 - 45^3}{55 \cdot 100 + 45^2} &= \frac{a^3 - b^3}{a(a+b) + b^2} \\ &= \frac{(a-b)(a^2 + ab + b^2)}{a^2 + ab + b^2} \\ &= \boxed{a-b} \\ &= 55 - 45 = \boxed{10}\end{aligned}$$

$$\begin{aligned} (3) \quad & 53^2 + 51^2 - 49^2 - 47^2 \\ &= (53^2 - 47^2) + (51^2 - 49^2) \\ &= (53+47)(53-47) + (51+\boxed{49})(51-49) \\ &= \boxed{100} \cdot 6 + 100 \cdot 2 = \boxed{800} \end{aligned}$$

$$\begin{aligned}(4) \quad 21^2 - 19^2 &= (21 + 19)(21 - 19) \\ &= 40 \cdot 2 = 80\end{aligned}$$

(5) $101=a$ 로 놓으면

$$\begin{aligned} 101^2 - 2 \cdot 101 + 1 &= a^2 - 2a + 1 \\ &= (a-1)^2 \\ &= (101-1)^2 \\ &= 10000 \end{aligned}$$

(6) $998=a$ 로 놓으면

$$\begin{aligned}\frac{998^3+8}{996\cdot 998+4}&=\frac{a^3+8}{(a-2)a+4} \\&=\frac{(a+2)(a^2-2a+4)}{a^2-2a+4} \\&=a+2=998+2=1000\end{aligned}$$

(7) $65=a, 25=b$ 로 놓으면

$$\begin{aligned}\frac{65^2+25\cdot 90}{65^3-25^3}&=\frac{a^2+b(a+b)}{a^3-b^3} \\&=\frac{a^2+ab+b^2}{(a-b)(a^2+ab+b^2)} \\&=\frac{1}{a-b}=\frac{1}{65-25}=\frac{1}{40}\end{aligned}$$

(8) $59=a$ 로 놓으면

$$\begin{aligned} & \frac{59^3-1}{59^2+59+1} \times \frac{1}{59^2-1} \\ &= \frac{a^3-1}{a^2+a+1} \times \frac{1}{a^2-1} \\ &= \frac{(a-1)(a^2+a+1)}{a^2+a+1} \times \frac{1}{(a+1)(a-1)} \\ &= \frac{1}{a+1} = \frac{1}{59+1} = \frac{1}{60} \end{aligned}$$

1-1 (1) $4ab + 12a^2b - 2a^3b^2 = 2ab(2 + 6a - a^2b)$
 $= -2ab(a^2b - 6a - 2)$

(2) $(a+b)(a+b-1)$

(3) $x^2 + zx - yz - xy = (x+z)x - (x+z)y$
 $= (x+z)(x-y)$

1-2 (1) $3ab^2 - 9a^2b^3 - 6a^2b + 15ab$

$$= 3ab(b - 3ab^2 - 2a + 5)$$

$$= -3ab(3ab^2 + 2a - b - 5)$$

(2) $(a+b)^3 - 4ab(a+b) = (a+b)\{(a+b)^2 - 4ab\}$
 $= (a+b)(a^2 - 2ab + b^2)$
 $= (a+b)(a-b)^2$

(3) $ab - ca + bc - c^2 = (b-c)a + (b-c)c$
 $= (b-c)(c+a)$

2-1 (1) $(x+3)^2$

(2) $(a-10)^2$

(3) $\left(x + \frac{1}{5}\right)^2$

(4) $\left(x - \frac{3}{4}\right)^2$

(5) $(3a+5b)(3a-5b)$

2-2 (1) $(3x+4y)^2$

(2) $(2a-7b)^2$

(3) $\left(\frac{1}{2}x+y\right)^2$

(4) $\left(3x - \frac{2}{3}\right)^2$

(5) $4x^2 - (y+z)^2 = \{2x + (y+z)\}\{2x - (y+z)\}$
 $= (2x+y+z)(2x-y-z)$

3-1 (1) $(x+2)(x+8)$

(2) $(x-y)(x+5y)$

(3) $(a+3b)(5a+b)$

(4) $(3x-y)(4x+3y)$

3-2 (1) $(a-3b)(a-5b)$

(2) $(x+4)(x-8)$

(3) $(a-6)(3a-5)$

(4) $(2x-3y)(4x+5y)$

4-1 (1) $(x-2y)^2 - 4(x-2y) + 4$

$$= t^2 - 4t + 4 \quad \leftarrow x-2y=t \text{로 치환}$$

$$= (t-2)^2$$

$$= (x-2y-2)^2 \quad \leftarrow t=x-2y \text{ 대입}$$

(2) $(a+b)(a+b-5) + 6$

$$= t(t-5) + 6$$

$\leftarrow a+b=t \text{로 치환}$

$$= t^2 - 5t + 6$$

$$= (t-2)(t-3)$$

$$= (a+b-2)(a+b-3)$$

$\leftarrow t=a+b \text{ 대입}$

(3) $(x^2-3x+3)(x^2-3x-5) + 7$

$$= (t+3)(t-5) + 7$$

$\leftarrow x^2-3x=t \text{로 치환}$

$$= t^2 - 2t - 8$$

$$= (t+2)(t-4)$$

$$= (x^2-3x+2)(x^2-3x-4)$$

$\leftarrow t=x^2-3x \text{ 대입}$

$$= (x-1)(x-2)(x+1)(x-4)$$

(4) $(x^2+2x)^2 + 3x^2 + 6x - 18$

$$= (x^2+2x)^2 + 3(x^2+2x) - 18$$

$$= t^2 + 3t - 18$$

$\leftarrow x^2+2x=t \text{로 치환}$

$$= (t-3)(t+6)$$

$$= (x^2+2x-3)(x^2+2x+6)$$

$\leftarrow t=x^2+2x \text{ 대입}$

$$= (x-1)(x+3)(x^2+2x+6)$$

4-2 (1) $(x-y)(x-y-9) + 14$

$$= t(t-9) + 14$$

$\leftarrow x-y=t \text{로 치환}$

$$= t^2 - 9t + 14$$

$$= (t-2)(t-7)$$

$$= (x-y-2)(x-y-7)$$

$\leftarrow t=x-y \text{ 대입}$

(2) $(a-3b+1)(a-3b-5) - 7$

$$= (t+1)(t-5) - 7$$

$\leftarrow a-3b=t \text{로 치환}$

$$= t^2 - 4t - 12$$

$$= (t+2)(t-6)$$

$$= (a-3b+2)(a-3b-6)$$

$\leftarrow t=a-3b \text{ 대입}$

(3) $(x^2-x-5)(x^2-x-10) - 14$

$$= (t-5)(t-10) - 14$$

$\leftarrow x^2-x=t \text{로 치환}$

$$= t^2 - 15t + 36$$

$$= (t-3)(t-12)$$

$$= (x^2-x-3)(x^2-x-12)$$

$\leftarrow t=x^2-x \text{ 대입}$

$$= (x^2-x-3)(x+3)(x-4)$$

(4) $(x^2+x)^2 - x^2 - x - 30$

$$= (x^2+x)^2 - (x^2+x) - 30$$

$$= t^2 - t - 30$$

$\leftarrow x^2+x=t \text{로 치환}$

$$= (t+5)(t-6)$$

$$= (x^2+x+5)(x^2+x-6)$$

$\leftarrow t=x^2+x \text{ 대입}$

$$= (x^2+x+5)(x-2)(x+3)$$

5-1 (1) $(5x+y)^3$

(2) $\left(x + \frac{1}{3}\right)^3$

(3) $(x-2y)^3$

(4) $\left(a - \frac{1}{4}\right)^3$

$$\begin{aligned}
(5) \quad & 8x^3 + 125 = (2x)^3 + 5^3 \\
& = (2x+5)(4x^2 - 10x + 25) \\
(6) \quad & 3x^4y^2 + 81xy^5 = 3xy^2(x^3 + 27y^3) \\
& = 3xy^2\{x^3 + (3y)^3\} \\
& = 3xy^2(x+3y)(x^2 - 3xy + 9y^2) \\
(7) \quad & 8x^3 - 1 = (2x)^3 - 1^3 \\
& = (2x-1)(4x^2 + 2x + 1) \\
(8) \quad & 16x^4y - 54xy^4 = 2xy(8x^3 - 27y^3) \\
& = 2xy\{(2x)^3 - (3y)^3\} \\
& = 2xy(2x-3y)(4x^2 + 6xy + 9y^2)
\end{aligned}$$

5-2 (1) $(3a+2)^3$

$$\begin{aligned}
(2) \quad & \left(2x + \frac{1}{2}\right)^3 \\
(3) \quad & (2x-3y)^3 \\
(4) \quad & \left(3x - \frac{1}{2}\right)^3 \\
(5) \quad & 64a^3 + 27b^3 = (4a)^3 + (3b)^3 \\
& = (4a+3b)(16a^2 - 12ab + 9b^2) \\
(6) \quad & 5a^4bc^3 + 40ab^4c^3 = 5abc^3(a^3 + 8b^3) \\
& = 5abc^3\{a^3 + (2b)^3\} \\
& = 5abc^3(a+2b)(a^2 - 2ab + 4b^2) \\
(7) \quad & a^3 - \frac{1}{27} = a^3 - \left(\frac{1}{3}\right)^3 \\
& = \left(a - \frac{1}{3}\right)\left(a^2 + \frac{1}{3}a + \frac{1}{9}\right) \\
(8) \quad & 250a^3c^2 - 16b^3c^2 = 2c^2(125a^3 - 8b^3) \\
& = 2c^2\{(5a)^3 - (2b)^3\} \\
& = 2c^2(5a-2b)(25a^2 + 10ab + 4b^2)
\end{aligned}$$

6-1 (1) $x^2 + y^2 + 16z^2 - 2xy - 8yz + 8zx$

$$\begin{aligned}
& = x^2 + (-y)^2 + (4z)^2 \\
& \quad + 2 \cdot x \cdot (-y) + 2 \cdot (-y) \cdot 4z + 2 \cdot 4z \cdot x \\
& = (x-y+4z)^2 \\
(2) \quad & 4a^2 + b^2 + 25c^2 + 4ab - 10bc - 20ca \\
& = (2a)^2 + b^2 + (-5c)^2 \\
& \quad + 2 \cdot 2a \cdot b + 2 \cdot b \cdot (-5c) + 2 \cdot (-5c) \cdot 2a \\
& = (2a+b-5c)^2 \\
(3) \quad & x^2 + y^2 + 2xy + 12x + 12y + 36 \\
& = x^2 + y^2 + 36 + 2xy + 12y + 12x \\
& = x^2 + y^2 + 6^2 + 2 \cdot x \cdot y + 2 \cdot y \cdot 6 + 2 \cdot 6 \cdot x \\
& = (x+y+6)^2 \\
(4) \quad & x^2 + 16y^2 - 8xy + 6x - 24y + 9 \\
& = x^2 + 16y^2 + 9 - 8xy - 24y + 6x \\
& = x^2 + (-4y)^2 + 3^2 + 2 \cdot x \cdot (-4y) + 2 \cdot (-4y) \cdot 3 + 2 \cdot 3 \cdot x \\
& = (x-4y+3)^2 \\
(5) \quad & x^3 + y^3 + 27z^3 - 9xyz \\
& = x^3 + y^3 + (3z)^3 - 3 \cdot x \cdot y \cdot 3z \\
& = (x+y+3z)(x^2 + y^2 + 9z^2 - xy - 3yz - 3zx)
\end{aligned}$$

$$\begin{aligned}
(6) \quad & x^3 - y^3 + 8z^3 + 6xyz \\
& = x^3 + (-y)^3 + (2z)^3 - 3 \cdot x \cdot (-y) \cdot 2z \\
& = (x-y+2z)(x^2 + y^2 + 4z^2 + xy + 2yz - 2zx) \\
(7) \quad & x^3 + y^3 - 9xy + 27 \\
& = x^3 + y^3 + 27 - 9xy \\
& = x^3 + y^3 + 3^3 - 3 \cdot x \cdot y \cdot 3 \\
& = (x+y+3)(x^2 + y^2 + 9 - xy - 3y - 3x) \\
& = (x+y+3)(x^2 + y^2 - xy - 3x - 3y + 9) \\
(8) \quad & 8x^3 - y^3 - 6xy - 1 \\
& = 8x^3 - y^3 - 1 - 6xy \\
& = (2x)^3 + (-y)^3 + (-1)^3 - 3 \cdot 2x \cdot (-y) \cdot (-1) \\
& = (2x-y-1)(4x^2 + y^2 + 1 + 2xy - y + 2x) \\
& = (2x-y-1)(4x^2 + y^2 + 2xy + 2x - y + 1)
\end{aligned}$$

6-2 (1) $9x^2 + y^2 + z^2 + 6xy - 2yz - 6zx$

$$\begin{aligned}
& = (3x)^2 + y^2 + (-z)^2 \\
& \quad + 2 \cdot 3x \cdot y + 2 \cdot y \cdot (-z) + 2 \cdot (-z) \cdot 3x \\
& = (3x+y-z)^2 \\
(2) \quad & x^2 + 4y^2 + 9z^2 - 4xy - 12yz + 6zx \\
& = x^2 + (-2y)^2 + (3z)^2 \\
& \quad + 2 \cdot x \cdot (-2y) + 2 \cdot (-2y) \cdot 3z + 2 \cdot 3z \cdot x \\
& = (x-2y+3z)^2 \\
(3) \quad & a^2 + b^2 - 2ab + 4a - 4b + 4 \\
& = a^2 + b^2 + 4 - 2ab - 4b + 4a \\
& = a^2 + (-b)^2 + 2^2 \\
& \quad + 2 \cdot a \cdot (-b) + 2 \cdot (-b) \cdot 2 + 2 \cdot 2 \cdot a \\
& = (a-b+2)^2 \\
(4) \quad & 9x^2 + y^2 + 6xy + 12x + 4y + 4 \\
& = 9x^2 + y^2 + 4 + 6xy + 4y + 12x \\
& = (3x)^2 + y^2 + 2^2 + 2 \cdot 3x \cdot y + 2 \cdot y \cdot 2 + 2 \cdot 2 \cdot 3x \\
& = (3x+y+2)^2 \\
(5) \quad & 8x^3 + 64y^3 + z^3 - 24xyz \\
& = (2x)^3 + (4y)^3 + z^3 - 3 \cdot 2x \cdot 4y \cdot z \\
& = (2x+4y+z)(4x^2 + 16y^2 + z^2 - 8xy - 4yz - 2zx) \\
(6) \quad & 8x^3 - y^3 - z^3 - 6xyz \\
& = (2x)^3 + (-y)^3 + (-z)^3 - 3 \cdot 2x \cdot (-y) \cdot (-z) \\
& = (2x-y-z)(4x^2 + y^2 + z^2 + 2xy - yz + 2zx) \\
(7) \quad & x^3 + 8y^3 - 24xy + 64 \\
& = x^3 + 8y^3 + 64 - 24xy \\
& = x^3 + (2y)^3 + 4^3 - 3 \cdot x \cdot 2y \cdot 4 \\
& = (x+2y+4)(x^2 + 4y^2 + 16 - 2xy - 8y - 4x) \\
& = (x+2y+4)(x^2 + 4y^2 - 2xy - 4x - 8y + 16) \\
(8) \quad & x^3 - 8y^3 + 12xy + 8 \\
& = x^3 - 8y^3 + 8 + 12xy \\
& = x^3 + (-2y)^3 + 2^3 - 3 \cdot x \cdot (-2y) \cdot 2 \\
& = (x-2y+2)(x^2 + 4y^2 + 4 + 2xy + 4y - 2x) \\
& = (x-2y+2)(x^2 + 4y^2 + 2xy - 2x + 4y + 4)
\end{aligned}$$

7-1 (1) $x(x-1)(x-2)(x-3)-120$
 $=\{x(x-3)\}\{(x-1)(x-2)\}-120$
 $=(x^2-3x)(x^2-3x+2)-120$
 $=t(t+2)-120 \quad \leftarrow x^2-3x=t \text{로 치환}$
 $=t^2+2t-120$
 $=(t-10)(t+12)$
 $=(x^2-3x-10)(x^2-3x+12) \quad \leftarrow t=x^2-3x \text{ 대입}$
 $=(x+2)(x-5)(x^2-3x+12)$

(2) $4x^4+3x^2-1$
 $=4X^2+3X-1 \quad \leftarrow x^2=X \text{로 치환}$
 $=(X+1)(4X-1)$
 $=(x^2+1)(4x^2-1) \quad \leftarrow X=x^2 \text{ 대입}$
 $=(x^2+1)(2x+1)(2x-1)$

(3) x^4-12x^2+4
 $=(x^4+4x^2+4)-16x^2 \quad \leftarrow 16x^2 \text{ 더하고 빼기}$
 $=(x^2+2)^2-(4x)^2 \quad \leftarrow A^2-B^2 \text{ 꼴로 변형}$
 $=(x^2+2+4x)(x^2+2-4x)$
 $=(x^2+4x+2)(x^2-4x+2)$

(4) x^4-19x^2+9
 $=(x^4+6x^2+9)-25x^2 \quad \leftarrow 25x^2 \text{ 더하고 빼기}$
 $=(x^2+3)^2-(5x)^2 \quad \leftarrow A^2-B^2 \text{ 꼴로 변형}$
 $=(x^2+3+5x)(x^2+3-5x)$
 $=(x^2+5x+3)(x^2-5x+3)$

(5) x^4-3x^2+1
 $=(x^4-2x^2+1)-x^2 \quad \leftarrow -3x^2 \text{ 분리하기}$
 $=(x^2-1)^2-x^2 \quad \leftarrow A^2-B^2 \text{ 꼴로 변형}$
 $=(x^2-1+x)(x^2-1-x)$
 $=(x^2+x-1)(x^2-x-1)$

(6) x^4-7x^2+9
 $=(x^4-6x^2+9)-x^2 \quad \leftarrow -7x^2 \text{ 분리하기}$
 $=(x^2-3)^2-x^2 \quad \leftarrow A^2-B^2 \text{ 꼴로 변형}$
 $=(x^2-3+x)(x^2-3-x)$
 $=(x^2+x-3)(x^2-x-3)$

7-2 (1) $(x+1)(x+2)(x-3)(x-4)-36$
 $=\{(x+1)(x-3)\}\{(x+2)(x-4)\}-36$
 $=(x^2-2x-3)(x^2-2x-8)-36$
 $=(t-3)(t-8)-36 \quad \leftarrow x^2-2x=t \text{로 치환}$
 $=t^2-11t-12$
 $=(t+1)(t-12)$
 $=(x^2-2x+1)(x^2-2x-12) \quad \leftarrow t=x^2-2x \text{ 대입}$
 $=(x-1)^2(x^2-2x-12)$

(2) x^4-11x^2+18
 $=X^2-11X+18 \quad \leftarrow x^2=X \text{로 치환}$
 $=(X-2)(X-9)$
 $=(x^2-2)(x^2-9) \quad \leftarrow X=x^2 \text{ 대입}$
 $=(x^2-2)(x+3)(x-3)$

(3) x^4+6x^2+25
 $=(x^4+10x^2+25)-4x^2 \quad \leftarrow 4x^2 \text{ 더하고 빼기}$
 $=(x^2+5)^2-(2x)^2 \quad \leftarrow A^2-B^2 \text{ 꼴로 변형}$
 $=(x^2+5+2x)(x^2+5-2x)$
 $=(x^2+2x+5)(x^2-2x+5)$

(4) x^4+4x^2+16
 $=(x^4+8x^2+16)-4x^2 \quad \leftarrow 4x^2 \text{ 더하고 빼기}$
 $=(x^2+4)^2-(2x)^2 \quad \leftarrow A^2-B^2 \text{ 꼴로 변형}$
 $=(x^2+4+2x)(x^2+4-2x)$
 $=(x^2+2x+4)(x^2-2x+4)$

(5) x^4-13x^2+4
 $=(x^4-4x^2+4)-9x^2 \quad \leftarrow -13x^2 \text{ 분리하기}$
 $=(x^2-2)^2-(3x)^2 \quad \leftarrow A^2-B^2 \text{ 꼴로 변형}$
 $=(x^2-2+3x)(x^2-2-3x)$
 $=(x^2+3x-2)(x^2-3x-2)$

(6) x^4-21x^2+36
 $=(x^4-12x^2+36)-9x^2 \quad \leftarrow -21x^2 \text{ 분리하기}$
 $=(x^2-6)^2-(3x)^2 \quad \leftarrow A^2-B^2 \text{ 꼴로 변형}$
 $=(x^2-6+3x)(x^2-6-3x)$
 $=(x^2+3x-6)(x^2-3x-6)$

8-1 (1) $2x^2+2xy-7x-y+3 \quad \leftarrow y \text{의 차수가 가장 낮다.}$

$$=(2x-1)y+2x^2-7x+3$$

$$=(2x-1)y+(x-3)(2x-1)$$

$$=(2x-1)(x+y-3)$$

(2) $x^2+3xy+zx+2y^2+2yz \quad \leftarrow z \text{의 차수가 가장 낮다.}$

$$=(x+2y)z+x^2+3xy+2y^2$$

$$=(x+2y)z+(x+y)(x+2y)$$

$$=(x+2y)(x+y+z)$$

(3) $x^2+6y^2+5xy+7x+17y+12$
 $=x^2+(5y+7)x+(6y^2+17y+12)$
 $=x^2+(5y+7)x+(2y+3)(3y+4)$

$$\begin{array}{l} x \quad \swarrow \quad \searrow \quad 2y+3 \rightarrow (2y+3)x \\ x \quad \quad \quad \quad 3y+4 \rightarrow (3y+4)x \end{array} +$$

$$\frac{(5y+7)x}{(5y+7)x}$$

$$=(x+2y+3)(x+3y+4)$$

8-2 (1) $5y^2+xy-16y-3x+3 \quad \leftarrow x \text{의 차수가 가장 낮다.}$

$$=(y-3)x+5y^2-16y+3$$

$$=(y-3)x+(y-3)(5y-1)$$

$$=(y-3)(x+5y-1)$$

(2) $x^3+x^2y-z^2x-z^2y \quad \leftarrow y \text{의 차수가 가장 낮다.}$

$$=(x^2-z^2)y+x^3-z^2x$$

$$=(x^2-z^2)y+(x^2-z^2)x$$

$$=(x^2-z^2)(x+y)$$

$$=(x+z)(x-z)(x+y)$$

$$\begin{aligned}
 (3) \quad & 2x^2 - y^2 + xy + x + 4y - 3 \\
 &= 2x^2 + (y+1)x - (y^2 - 4y + 3) \\
 &= 2x^2 + (y+1)x - (y-1)(y-3)
 \end{aligned}$$

$$\begin{array}{rcl}
 x & \nearrow & y-1 \rightarrow (2y-2)x \\
 2x & \searrow & -(y-3) \rightarrow \frac{(-y+3)x}{(y+1)x} +
 \end{array}$$

$$\begin{aligned}
 &= (x+y-1)\{2x-(y-3)\} \\
 &= (x+y-1)(2x-y+3)
 \end{aligned}$$

9-1 (1) $f(x) = x^3 - 8x^2 + 21x - 18$ 로 놓으면
 $f(2) = 0$ 이므로 일차식 $x-2$ 는 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrr}
 2 & 1 & -8 & 21 & -18 \\
 & & 2 & -12 & 18 \\
 \hline
 & 1 & -6 & 9 & 0
 \end{array}$$

$$\begin{aligned}
 \therefore x^3 - 8x^2 + 21x - 18 &= (x-2)(x^2 - 6x + 9) \\
 &= (x-2)(x-3)^2
 \end{aligned}$$

(2) $f(x) = x^4 - 3x^3 - x^2 + 9x - 6$ 으로 놓으면
 $f(1) = 0, f(2) = 0$ 이므로
일차식 $x-1, x-2$ 는 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrrrr}
 1 & 1 & -3 & -1 & 9 & -6 \\
 & & 1 & -2 & -3 & 6 \\
 2 & 1 & -2 & -3 & 6 & 0 \\
 & & 2 & 0 & -6 & \\
 \hline
 & 1 & 0 & -3 & 0 &
 \end{array}$$

$$\therefore x^4 - 3x^3 - x^2 + 9x - 6 = (x-1)(x-2)(x^2 - 3)$$

9-2 (1) $f(x) = 4x^3 - 4x^2 + 5x - 2$ 로 놓으면
 $f\left(\frac{1}{2}\right) = 0$ 이므로 일차식 $x - \frac{1}{2}$ 은 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrr}
 \frac{1}{2} & 4 & -4 & 5 & -2 \\
 & & 2 & -1 & 2 \\
 \hline
 & 4 & -2 & 4 & 0
 \end{array}$$

$$\begin{aligned}
 \therefore 4x^3 - 4x^2 + 5x - 2 &= \left(x - \frac{1}{2}\right)(4x^2 - 2x + 4) \\
 &= (2x-1)(2x^2 - x + 2)
 \end{aligned}$$

(2) $f(x) = x^4 - 8x^2 + 5x + 6$ 으로 놓으면
 $f(2) = 0, f(-3) = 0$ 이므로
일차식 $x-2, x+3$ 은 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrrr}
 2 & 1 & 0 & -8 & 5 & 6 \\
 & & 2 & 4 & -8 & -6 \\
 -3 & 1 & 2 & -4 & -3 & 0 \\
 & & -3 & 3 & 3 & \\
 \hline
 & 1 & -1 & -1 & 0 &
 \end{array}$$

$$\therefore x^4 - 8x^2 + 5x + 6 = (x-2)(x+3)(x^2 - x - 1)$$

STEP 3

130쪽~133쪽

01 다항식 $(x^2 + 3x)^2 - 2x^2 - 6x + 1$ 을 인수분해할 때, 먼저 공통부분인 $x^2 + 3x$ 를 치환한다.

02 다항식 $f(x) = x^3 - 2x^2 - 5x + 6$ 에 대하여 $f(-2) = 0$ 이므로 $f(x)$ 는 $x+2$ 를 인수로 가진다.

03 $a^2 - 4 = (a+2)(a-2)$

04 $(2x+3)^3$

05 $(3x-5y)^3$

06 $5a^3 + 40 = 5(a^3 + 8)$
 $= 5(a^3 + 2^3)$
 $= 5(a+2)(a^2 - 2a + 4)$

07 $x^3 - \frac{y^3}{8} = x^3 - \left(\frac{y}{2}\right)^3$
 $= \left(x - \frac{y}{2}\right)\left(x^2 + \frac{xy}{2} + \frac{y^2}{4}\right)$

08 $16x^2 + y^2 + 4z^2 + 8xy - 4yz - 16zx$
 $= (4x)^2 + y^2 + (-2z)^2$
 $+ 2 \cdot 4x \cdot y + 2 \cdot y \cdot (-2z) + 2 \cdot (-2z) \cdot 4x$
 $= (4x + y - 2z)^2$

09 $a^2 + b^2 - 2ab + 8a - 8b + 16$
 $= a^2 + b^2 + 16 - 2ab - 8b + 8a$
 $= a^2 + (-b)^2 + 4^2 + 2 \cdot a \cdot (-b) + 2 \cdot (-b) \cdot 4 + 2 \cdot 4 \cdot a$
 $= (a - b + 4)^2$

10 $x^3 + 8y^3 - 8z^3 + 12xyz$
 $= x^3 + (2y)^3 + (-2z)^3 - 3 \cdot x \cdot 2y \cdot (-2z)$
 $= (x + 2y - 2z)(x^2 + 4y^2 + 4z^2 - 2xy + 4yz + 2zx)$

11 $x^3 + 8y^3 - 3xy + \frac{1}{8}$
 $= x^3 + 8y^3 + \frac{1}{8} - 3xy$
 $= x^3 + (2y)^3 + \left(\frac{1}{2}\right)^3 - 3 \cdot x \cdot 2y \cdot \frac{1}{2}$
 $= \left(x + 2y + \frac{1}{2}\right)\left(x^2 + 4y^2 + \frac{1}{4} - 2xy - y - \frac{x}{2}\right)$
 $= \left(x + 2y + \frac{1}{2}\right)\left(x^2 + 4y^2 - 2xy - \frac{1}{2}x - y + \frac{1}{4}\right)$

12 $(x+y)(x+y+3)+2$

$$\begin{aligned} &= t(t+3)+2 && \leftarrow x+y=t \text{로 치환} \\ &= t^2+3t+2 \\ &= (t+1)(t+2) \\ &= (x+y+1)(x+y+2) && \leftarrow t=x+y \text{ 대입} \end{aligned}$$

13 $(x^2-5x+3)(x^2-5x+7)+3$

$$\begin{aligned} &= (t+3)(t+7)+3 && \leftarrow x^2-5x=t \text{로 치환} \\ &= t^2+10t+24 \\ &= (t+4)(t+6) \\ &= (x^2-5x+4)(x^2-5x+6) && \leftarrow t=x^2-5x \text{ 대입} \\ &= (x-1)(x-4)(x-2)(x-3) \end{aligned}$$

14 $(x-1)(x+1)(x+2)(x+4)-16$

$$\begin{aligned} &= \{(x-1)(x+4)\} \{(x+1)(x+2)\} - 16 \\ &= (x^2+3x-4)(x^2+3x+2) - 16 \\ &= (t-4)(t+2) - 16 && \leftarrow x^2+3x=t \text{로 치환} \\ &= t^2-2t-24 \\ &= (t+4)(t-6) \\ &= (x^2+3x+4)(x^2+3x-6) && \leftarrow t=x^2+3x \text{ 대입} \end{aligned}$$

15 $(x+1)(x-2)(x+3)(x+6)+54$

$$\begin{aligned} &= \{(x+1)(x+3)\} \{(x-2)(x+6)\} + 54 \\ &= (x^2+4x+3)(x^2+4x-12) + 54 \\ &= (t+3)(t-12) + 54 && \leftarrow x^2+4x=t \text{로 치환} \\ &= t^2-9t+18 \\ &= (t-3)(t-6) \\ &= (x^2+4x-3)(x^2+4x-6) && \leftarrow t=x^2+4x \text{ 대입} \end{aligned}$$

16 $9x^4+8x^2-1$

$$\begin{aligned} &= 9X^2+8X-1 && \leftarrow x^2=X \text{로 치환} \\ &= (9X-1)(X+1) \\ &= (9x^2-1)(x^2+1) && \leftarrow X=x^2 \text{ 대입} \\ &= (3x+1)(3x-1)(x^2+1) \end{aligned}$$

17 x^4+7x^2+64

$$\begin{aligned} &= (x^4+16x^2+64)-9x^2 && \leftarrow 9x^2 \text{ 더하고 빼기} \\ &= (x^2+8)^2-(3x)^2 && \leftarrow A^2-B^2 \text{ 꼴로 변형} \\ &= (x^2+8+3x)(x^2+8-3x) \\ &= (x^2+3x+8)(x^2-3x+8) \end{aligned}$$

18 x^4-17x^2+16

$$\begin{aligned} &= (x^4-8x^2+16)-9x^2 && \leftarrow -17x^2 \text{ 분리하기} \\ &= (x^2-4)^2-(3x)^2 && \leftarrow A^2-B^2 \text{ 꼴로 변형} \\ &= (x^2-4+3x)(x^2-4-3x) \\ &= (x^2+3x-4)(x^2-3x-4) \\ &= (x-1)(x+4)(x+1)(x-4) \end{aligned}$$

다른 풀이

$$\begin{aligned} &x^4-17x^2+16 \\ &= x^4+8x^2+16-25x^2 && \leftarrow 25x^2 \text{ 더하고 빼기} \\ &= (x^2+4)^2-(5x)^2 && \leftarrow A^2-B^2 \text{ 꼴로 변형} \\ &= (x^2+4+5x)(x^2+4-5x) \\ &= (x^2+5x+4)(x^2-5x+4) \\ &= (x+1)(x+4)(x-1)(x-4) \end{aligned}$$

19 x^4-6x^2+1

$$\begin{aligned} &= (x^4-2x^2+1)-4x^2 && \leftarrow -6x^2 \text{ 분리하기} \\ &= (x^2-1)^2-(2x)^2 && \leftarrow A^2-B^2 \text{ 꼴로 변형} \\ &= (x^2-1+2x)(x^2-1-2x) \\ &= (x^2+2x-1)(x^2-2x-1) \\ &\text{따라서 } a=2, b=-1, c=-2, d=-1 \\ &\text{또는 } a=-2, b=-1, c=2, d=-1 \text{ 이므로} \\ &ad+bc=0 \end{aligned}$$

20 a^2+ca-b^2-bc

$$\begin{aligned} &= (a-b)c+a^2-b^2 && \leftarrow c \text{의 차수가 가장 낮다.} \\ &= (a-b)c+(a+b)(a-b) \\ &= (a-b)(a+b+c) \end{aligned}$$

21 $x^3-zx^2-xy^2+y^2z$

$$\begin{aligned} &= -(x^2-y^2)z+x^3-xy^2 && \leftarrow z \text{의 차수가 가장 낮다.} \\ &= -(x^2-y^2)z+x(x^2-y^2) \\ &= (x^2-y^2)(x-z) \\ &= (x+y)(x-y)(x-z) \end{aligned}$$

22 $2a^2+b^2+3ab+a-b-6$

$$\begin{aligned} &= 2a^2+(\overline{3b+1})a+b^2-b-6 \\ &= 2a^2+(3b+1)a+(\overline{b+2})(b-3) \end{aligned}$$

$$\begin{array}{rcl} a & \nearrow & b+2 \rightarrow (2b+4)a \\ 2a & \searrow & b-3 \rightarrow (\overline{b-3})a \end{array} +$$

$$= (\overline{a+b+2})(2a+b-3)$$

23 $f(x)=x^3+5x^2-2x-24$ 로 놓으면

$f(2)=0$ 이므로 일차식 $x-2$ 는 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrr} 2 & 1 & 5 & -2 & -24 \\ & & 2 & 14 & 24 \\ \hline & 1 & 7 & 12 & 0 \end{array}$$

$$\begin{aligned} \therefore x^3+5x^2-2x-24 &= (x-2)(x^2+7x+12) \\ &= (x-2)(x+3)(x+4) \end{aligned}$$

- 24 $f(x)=2x^4-5x^3-8x^2+17x-6$ 으로 놓으면
 $f(1)=0, f(-2)=0$ 이므로
 일차식 $x-1, x+2$ 는 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrrrr} 1 & 2 & -5 & -8 & 17 & -6 \\ & & & 2 & -3 & -11 & 6 \\ -2 & 2 & -3 & -11 & 6 & 0 \\ & & -4 & 14 & -6 & \\ & 2 & -7 & 3 & 0 \end{array}$$

$$\begin{aligned} \therefore 2x^4-5x^3-8x^2+17x-6 \\ &= (x-1)(x+2)(2x^2-7x+3) \\ &= (x-1)(x+2)(x-3)(2x-1) \end{aligned}$$

- 25 $f(x)=x^4+x^3-3x^2-x+2$ 로 놓으면
 $f(1)=0, f(-1)=0$ 이므로
 일차식 $x-1, x+1$ 은 $f(x)$ 의 인수이다.

$$\begin{array}{r|rrrrrr} 1 & 1 & 1 & -3 & -1 & 2 \\ & & & 1 & 2 & -1 & -2 \\ -1 & 1 & 2 & -1 & -2 & 0 \\ & & -1 & -1 & 2 & \\ & 1 & 1 & -2 & 0 \end{array}$$

$$\begin{aligned} \therefore x^4+x^3-3x^2-x+2 \\ &= (x-1)(x+1)(x^2+x-2) \\ &= (x-1)(x+1)(x-1)(x+2) \\ &= (x-1)^2(x+1)(x+2) \end{aligned}$$

- 26 $a^2+b^2-2ab-bc+ca$ ← c 의 차수가 가장 낮다.

$$\begin{aligned} &= (a-b)c+a^2-2ab+b^2 \\ &= (a-b)c+(a-b)^2 \\ &= (a-b)(a-b+c) \\ \text{즉, } (a-b)(a-b+c) &= 0 \\ \text{이때, } a-b+c \neq 0 \text{이므로} \\ a-b &= 0 \quad \therefore a=b \end{aligned}$$

따라서 주어진 조건을 만족하는 삼각형은 $a=b$ 인 이등변 삼각형이다.

- 27 $ab(a+b)-bc(b+c)-ca(c-a)$
 $=a^2b+ab^2-b^2c-bc^2-c^2a+ca^2$
 $=(b+c)a^2+(b^2-c^2)a-b^2c-bc^2$
 $=(b+c)a^2+(b+c)(b-c)a-bc(b+c)$
 $=(b+c)\{a^2+(b-c)a-bc\}$
 $=(b+c)(a+b)(a-c)$
 즉, $(b+c)(a+b)(a-c)=0$
 이때, $b+c>0, a+b>0$ 이므로
 $a-c=0 \quad \therefore a=c$

따라서 주어진 조건을 만족하는 삼각형은 $a=c$ 인 이등변 삼각형이다.

- 28 $a-b=4 \cdots \cdots \textcircled{㉠}, b-c=1 \cdots \cdots \textcircled{㉡}$

$$\textcircled{㉠}+\textcircled{㉡} \text{을 하면 } a-c=5 \quad \therefore c-a=-5$$

$$\begin{aligned} &a^2+b^2+c^2-ab-bc-ca \\ &= \frac{1}{2}\{(a-b)^2+(b-c)^2+(c-a)^2\} \\ &= \frac{1}{2}\{4^2+1^2+(-5)^2\}=21 \end{aligned}$$

참고

$$\begin{aligned} &a^2+b^2+c^2-ab-bc-ca \\ &= \frac{1}{2}(2a^2+2b^2+2c^2-2ab-2bc-2ca) \\ &= \frac{1}{2}\{(a^2-2ab+b^2)+(b^2-2bc+c^2)+(c^2-2ca+a^2)\} \\ &= \frac{1}{2}\{(a-b)^2+(b-c)^2+(c-a)^2\} \end{aligned}$$

- 29 $a^2b+ab^2+b^2c-bc^2-c^2a-ca^2$

$$\begin{aligned} &= (b-c)a^2+(b^2-c^2)a+b^2c-bc^2 \\ &= (b-c)a^2+(b+c)(b-c)a+bc(b-c) \\ &= (b-c)\{a^2+(b+c)a+bc\} \\ &= (b-c)(a+b)(a+c) \end{aligned}$$

이때, $a+b=3 \cdots \cdots \textcircled{㉠}, b-c=2 \cdots \cdots \textcircled{㉡}$ 에서

$$\textcircled{㉠}-\textcircled{㉡} \text{을 하면 } a+c=1 \text{이므로}$$

$$(\text{주어진 식})=2 \cdot 3 \cdot 1=6$$

- 30 $46=a$ 로 놓으면

$$\begin{aligned} \frac{46^3-1}{46 \cdot 47+1} &= \frac{a^3-1}{a(a+1)+1} \\ &= \frac{(a-1)(a^2+a+1)}{a^2+a+1} \\ &= a-1 \\ &= 46-1=45 \end{aligned}$$

- 31 $77=a$ 로 놓으면

$$\begin{aligned} \frac{77^3+27}{77 \cdot 74+9} &= \frac{a^3+27}{a(a-3)+9} \\ &= \frac{a^3+3^3}{a^2-3a+9} \\ &= \frac{(a+3)(a^2-3a+9)}{a^2-3a+9} \\ &= a+3 \\ &= 77+3=80 \end{aligned}$$