01 다항식의 나눗셈

1. (다항식)÷(단항식)의 꼴

$$(A+B)\div M=(A+B)\times\frac{1}{M}=\frac{A}{M}+\frac{B}{M}$$

2. (다항식)÷(다항식)의 꼴

두 다항식을 내림차순으로 정리한 다음 자연수의 나눗셈과 같은 방법으로 직접 나누어 몫과 나머지를 구한다. 이때 나머지의 차수가 나누는 식의 차수보다 작을 때까지 나눈다.

◪ 다음 식을 계산하여라.

1. $(a^4b^3-3a^2b^4)\div\left(-\frac{1}{2}ab^2\right)^2$

2. $\left(-\frac{1}{4}a^2b+ab^2+3ab\right)\div\frac{1}{4}ab$

3. $(4xy+xy^2-2x^2y)\div\left(-\frac{1}{3}xy\right)$

4. $(2ab^2-4a^2b+6a)\div(-2a)$

5. $(8ab^2+4ab)\div 2a$

6. $\left(\frac{1}{2}x^4y^3-\frac{1}{3}xy^2\right)\div\left(-\frac{1}{6}xy^2\right)$

7. $\{6ab^2+(2a^2b)^2\}\div\frac{2}{3}ab^2$

8. $(24x^2-18x^3)\div\frac{6x^2}{5}$

9. $(x^5y^2-2x^2y^5)\div\left(-\frac{1}{2}xy\right)^2$

10. $(8x^2-4xy)\div\frac{1}{2}x$

11. $(5xyz+10x^2y^2z)\div 5x$

12. $(2x^2z-8x^2yz)\div 2xz$

13. $(6x^2yz-15xz)\div 3xz$

14. $(12a^2bc^2-9ab^2c+24abc^3)\div 3abc$

15. $(-12a^3b^2c^3+4ab^2c+8ab^2c^2)\div(-4b^2c)$

16. $(x^2z^3+xy^3z^2)\div\dfrac{x}{y^2z^4}$

17. $(4xyz-6x^2yz)\div 2xy$

18. $(9a^3b^2c-abc-3ab^2c)\div 3abc$

19. $(-4xyz+12x^2y^2z)\div(-4xy)$

20. $\left(\dfrac{2}{3}x^2y-\dfrac{xy}{3}\right)\div\dfrac{2}{3}x$

21. $(-xy+y^2)\div\left(-\dfrac{1}{5}y\right)-(12x^2+15xy)\div 3x$

22. $2x(4x-7y)-(8x^2y^2-4x^3y)\div\dfrac{2}{3}xy$

23. $(9a^2-48ab)\div(-3a)-(36b^2-16ab)\div 4b$

24. $-3a^2(2ab^2+b)-(12a^4b^2-8a^2b)\div 4a^2b$

25. $(9x^2+6xy)\div(-3x)-(12xy-16y^2)\div 2y$

◪ **다음을 계산하여 몫과 나머지를 각각 구하여라.**

26. $(3x^3-11x^2+5)\div(3x-2)$

27. $(3x^3+5x^2+x-7)\div(3x-1)$

28. $(x^3-2x^2+5)\div(x-3)$

29. $(2x^3+x^2-7x+4)\div(2x-1)$

30. $(2x^3+x^2-3x-5)\div(x+1)$

31. $(15x^3-23x^2+6)\div(3x-1)$

32. $(2x^3-5x^2+4)\div(x^2-2x-3)$

33. $(2x^3+x^2-3x+1)\div(x^2-2x+3)$

34. $(3x^3-5x^2+4x-7)\div(x^2+2)$

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35. $(-2x^3+x^2-x+1)\div(x^2+1)$

36. $(2x^3+2x^2-x+4)\div(x^2-2x+2)$

37. $(4x^3+5x^2-3x-1)\div(x^2+2x-3)$

38. $(2x^3-7x-2)\div(x^2+3x+1)$

39. $(2x^3-3x^2+4x+1)\div(x^2-x-2)$

◪ 다음 나눗셈을 하여 몫과 나머지를 구하여라.

40. $x+1\overline{)x^3-3x^2+4x+1}$

41. $x+1\overline{)x^2+3x+1}$

42. $x+1\overline{)x^3+2x^2-5x+2}$

43. $-x-1\overline{)2x^2-4x+5}$

44. $3x+2\overline{)6x^2+5x-1}$

45. $x+1\overline{)-5x^2-3x-1}$

46. $x+2\overline{)4x^3-x^2+5x+6}$

47. $x-2\overline{)2x^3+3x^2+4x+5}$

48. $x-1\overline{)-2x^3-4x^2+3x+2}$

49. $x^2+x+1\overline{)x^3+2x^2+3x+3}$

50. $x^2-x+2\overline{)2x^3-x^2+3x-8}$

51. $x^2+2x-1\overline{)x^3+5x^2-3x+2}$

52. $2x^2+2x-1\overline{)4x^3+2x^2-3x+6}$

53. $x^2-2x-1\overline{)4x^3-x^2-2x+6}$

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02 다항식의 나눗셈의 성질

다항식 A를 다항식 $B(B\neq 0)$로 나누었을 때의 몫을 Q, 나머지를 R라고 하면

$A=BQ+R$ (단, R의 차수는 B의 차수보다 낮다.)

가 성립한다.

특히 $R=0$일 때, A는 B로 나누어떨어진다고 한다.

$$\begin{array}{r} \text{Q(몫)} \\ \text{B)}\ \overline{\text{A}} \\ \text{BQ} \\ \hline \text{R(나머지)} \end{array}$$

◪ **다음 두 다항식 A, B에 대하여 A를 B로 나누었을 때의 몫 Q와 나머지 R를 구하여 $A=BQ+R$ 꼴로 나타내어라.**

54. $A=2x^2-5x+3, B=x+1$

55. $A=x^3+3x^2-x+2, B=x-1$

56. $A=2x^3-3x^2+x-3, B=x-2$

57. $A=-x^2+2x+5, B=x+2$

58. $A=2x^3+x^2-7x+7,\ B=2x-1$

59. $A=2x^3+x^2-x+1, B=x^2+1$

60. $A=4x^3+3x+2,\ B=x^2-2x+3$

61. $A=4x^3-x+2, B=2x^2+x+2$

62. $A=3x^3+x^2-3x+3,\ B=x^2-x+1$

63. $A=x^3-3x^2+x-3, B=x^2-2x-1$

64. $A=x^3+2x^2+x+1, B=x^2+x+2$

65. $A=x^3+2x-1, B=x^2+2x-1$

66. $A=3x^3+3x^2-2x+2, B=x^2-x+2$

67. $A=3x^3-x^2+4x+3,\ B=x^2+2$

68. $A=2x^3+2x^2-x+1, B=x^2-x+1$

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정답 및 해설

1) $\frac{4a^2}{b}-12$

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

$=(a^4b^3-3a^2b^4)\times\frac{4}{a^2b^4}$

$=\frac{4a^2}{b}-12$

2) $-a+4b+12$

⇨ $\left(-\frac{1}{4}a^2b+ab^2+3ab\right)\div\frac{1}{4}ab$

$=\left(-\frac{1}{4}a^2b+ab^2+3ab\right)\times\frac{4}{ab}=-a+4b+12$

3) $6x-3y-12$

⇨ $(4xy+xy^2-2x^2y)\div\left(-\frac{1}{3}xy\right)$

$=(4xy+xy^2-2x^2y)\times\left(-\frac{3}{xy}\right)=6x-3y-12$

4) $-b^2+2ab-3$

5) $4b^2+2b$

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

⇨ $\left(\frac{1}{2}x^4y^3-\frac{1}{3}xy^2\right)\div\left(-\frac{1}{6}xy^2\right)$

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

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

$=-3x^3y+2$

7) $9+6a^3$

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

$=(6ab^2+4a^4b^2)\times\frac{3}{2ab^2}=9+6a^3$

8) $20-15x$

⇨ $(24x^2-18x^3)\div\frac{6x^2}{5}$

$=(24x^2-18x^3)\times\frac{5}{6x^2}=20-15x$

9) $4x^3-8y^3$

⇨ $(x^5y^2-2x^2y^5)\div\left(-\frac{1}{2}xy\right)^2$

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

$=(x^5y^2-2x^2y^5)\times\frac{4}{x^2y^2}=4x^3-8y^3$

10) $16x-8y$

⇨ $(8x^2-4xy)\div\frac{1}{2}x=(8x^2-4xy)\times\frac{2}{x}=16x-8y$

11) $yz+2xy^2z$

⇨ $(5xyz+10x^2y^2z)\div5x$

$=\frac{5xyz+10x^2y^2z}{5x}$

$=\frac{5xyz}{5x}+\frac{10x^2y^2z}{5x}=yz+2xy^2z$

12) $x-4xy$

⇨ $(2x^2z-8x^2yz)\div2xz$

$=\frac{2x^2z}{2xz}-\frac{8x^2yz}{2xz}=x-4xy$

13) $2xy-5$

14) $4ac-3b+8c^2$

15) $3a^3c^2-a-2ac$

⇨ $(-12a^3b^2c^3+4ab^2c+8ab^2c^2)\div(-4b^2c)$

$=\frac{-12a^3b^2c^3}{-4b^2c}+\frac{4ab^2c}{-4b^2c}+\frac{8ab^2c^2}{-4b^2c}=3a^3c^2-a-2ac$

16) $xy^2z^7+y^5z^6$

⇨ $(x^2z^3+xy^3z^2)\div\frac{x}{y^2z^4}$

$=(x^2z^3+xy^3z^2)\times\frac{y^2z^4}{x}=xy^2z^7+y^5z^6$

17) $2z-3xz$

⇨ $(4xyz-6x^2yz)\div2xy$

$=\frac{4xyz-6x^2yz}{2xy}$

$=\frac{4xyz}{2xy}-\frac{6x^2yz}{2xy}=2z-3xz$

18) $3a^2b-\frac{1}{3}-b$

⇨ $(9a^3b^2c-abc-3ab^2c)\div3abc$

$=\frac{9a^3b^2c}{3abc}-\frac{abc}{3abc}-\frac{3ab^2c}{3abc}=3a^2b-\frac{1}{3}-b$

19) $z-3xyz$

⇨ $(-4xyz+12x^2y^2z)\div(-4xy)$

$=\frac{-4xyz}{-4xy}+\frac{12x^2y^2z}{-4xy}=z-3xyz$

20) $xy-\frac{y}{2}$

⇨ $\left(\frac{2}{3}x^2y-\frac{xy}{3}\right)\div\frac{2}{3}x=\left(\frac{2}{3}x^2y-\frac{xy}{3}\right)\times\frac{3}{2x}=xy-\frac{y}{2}$

21) $x-10y$

⇨ $(-xy+y^2)\div\left(-\frac{1}{5}y\right)-(12x^2+15xy)\div3x$

$=(-xy+y^2)\times\left(-\frac{5}{y}\right)-(12x^2+15xy)\times\frac{1}{3x}$

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$=5x-5y-4x-5y$
$=x-10y$

22) $14x^2-26xy$

⇨ $2x(4x-7y)-(8x^2y^2-4x^3y)\div\frac{2}{3}xy$

$=8x^2-14xy-(8x^2y^2-4x^3y)\times\frac{3}{2xy}$
$=8x^2-14xy-12xy+6x^2$
$=14x^2-26xy$

23) $a+7b$

⇨ $(9a^2-48ab)\div(-3a)-(36b^2-16ab)\div 4b$
$=-3a+16b-9b+4a=a+7b$

24) $-6a^3b^2-6a^2b+2$

⇨ $-3a^2(2ab^2+b)-(12a^4b^2-8a^2b)\div 4a^2b$
$=-6a^3b^2-3a^2b-3a^2b+2=-6a^3b^2-6a^2b+2$

25) $-9x+6y$

⇨ $(9x^2+6xy)\div(-3x)-(12xy-16y^2)\div 2y$
$=-3x-2y-6x+8y=-9x+6y$

26) 몫 : x^2-3x-2, 나머지 : 1

⇨
$$\begin{array}{r} x^2-3x-2 \\ 3x-2\overline{)\,3x^3-11x^2\quad+5} \\ 3x^3-\ 2x^2 \\ \hline -9x^2 \\ -9x^2+6x \\ \hline -6x+5 \\ -6x+4 \\ \hline 1 \end{array}$$

∴ 몫 : x^2-3x-2 , 나머지 : 1

27) 몫: x^2+2x+1, 나머지: -6

⇨ $3x^3+5x^2+x-7$을 $3x-1$로 나누면
$3x^3+5x^2+x-7=(3x-1)(x^2+2x+1)-6$이므로
몫은 x^2+2x+1이다.

28) 몫:x^2+x+3, 나머지:14

$$\begin{array}{r} x^2+\ x\ +3 \\ x-3\overline{)\,x^3-2x^2\quad+5} \\ x^3-3x^2 \\ \hline x^2 \\ x^2-3x \\ \hline 3x+5 \\ 3x-9 \\ \hline 14 \end{array}$$

⇨

∴몫:x^2+x+3, 나머지:14

29) 몫: x^2+x-3, 나머지: 1

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

따라서 몫은 x^2+x-3 이고, 나머지는 1 이다.

30) 몫: $2x^2-x-2$, 나머지: -3

31) 몫 : $5x^2-6x-2$,나머지 : 4

32) 몫: $2x-1$, 나머지: $4x+1$

33) 몫:$2x+5$, 나머지:$x-14$

⇨
$$\begin{array}{r} 2x+5 \\ x^2-2x+3\overline{)\,2x^3+x^2-3x+1} \\ 2x^3-4x^2+6x \\ \hline 5x^2-9x+1 \\ 5x^2-10x+15 \\ \hline x-14 \end{array}$$

∴몫 : $2x+5$, 나머지 : $x-14$

34) 몫: $3x-5$, 나머지: $-2x+3$

⇨ $3x^3-5x^2+4x-7$을 x^2+2로 나누면
$3x^3-5x^2+4x-7=(x^2+2)(3x-5)-2x+3$이므로
몫은 $3x-5$이고 나머지는 $-2x+3$이다.

35) 몫:$-2x+1$, 나머지:x

⇨
$$\begin{array}{r} -2x+1 \\ x^2+1\overline{)\,-2x^3+x^2-x+1} \\ -2x^3\quad -2x \\ \hline x^2+x+1 \\ x^2\quad +1 \\ \hline x \end{array}$$

∴몫 :$-2x+1$, 나머지 : x

36) 몫 : $2x+6$, 나머지 : $7x-8$

⇨ $2x^3+2x^2-x+4$를 x^2-2x+2로 나누면
$2x^3+2x^2-x+4=(2x+6)(x^2-2x+2)+7x-8$에서
몫은 $2x+6$이고 나머지는 $7x-8$이다.

37) 몫:$4x-3$, 나머지:$15x-10$

$$\begin{array}{r} 4x-\ 3 \\ x^2+2x-3\overline{)\,4x^3+5x^2-\ 3x-\ 1} \\ 4x^3+8x^2-12x \\ \hline -3x^2+\ 9x-\ 1 \\ -3x^2-\ 6x+\ 9 \\ \hline 15x-10 \end{array}$$

⇨ ∴몫:$4x-3$, 나머지:$15x-10$

38) 몫:$2x-6$, 나머지:$9x+4$

$$\begin{array}{r} 2x-6 \\ x^2+3x+1\overline{)\,2x^3\quad -7x-2} \\ 2x^3+6x^2+2x \\ \hline -6x^2-9x-2 \\ -6x^2-18x-6 \\ \hline 9x+4 \end{array}$$

⇨

$\therefore$ 몫:$2x-6$, 나머지:$9x+4$

39) 몫: $2x-1$ 나머지: $7x-1$

⇨ $2x^3-3x^2+4x+1$을 x^2-x-2로 나누면

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

40) 몫:x^2-4x+8, 나머지:-7

⇨

$$\begin{array}{r} x^2-4x+8 \\ x+1\overline{)\,x^3-3x^2+4x+1} \\ x^3+x^2 \\ \hline -4x^2+4x \\ -4x^2-4x \\ \hline 8x+1 \\ 8x+8 \\ \hline -7 \end{array}$$

41) 몫:$x+2$, 나머지:-1

⇨

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

42) 몫:x^2+x-6, 나머지:8

⇨

$$\begin{array}{r} x^2+x-6 \\ x+1\overline{)\,x^3+2x^2-5x+2} \\ x^3+x^2 \\ \hline x^2-5x \\ x^2+x \\ \hline -6x+2 \\ -6x-6 \\ \hline 8 \end{array}$$

43) 몫:$-2x+6$, 나머지:11

⇨

$$\begin{array}{r} -2x+6 \\ -x-1\overline{)\,2x^2-4x+5} \\ 2x^2+2x \\ \hline -6x+5 \\ -6x-6 \\ \hline 11 \end{array}$$

44) 몫:$2x+\frac{1}{3}$, 나머지:$-\frac{5}{3}$

⇨

$$\begin{array}{r} 2x+\frac{1}{3} \\ 3x+2\overline{)\,6x^2+5x-1} \\ 6x^2+4x \\ \hline x-1 \\ x+\frac{2}{3} \\ \hline -\frac{5}{3} \end{array}$$

45) 몫:$-5x+2$, 나머지:-3

⇨

$$\begin{array}{r} -5x+2 \\ x+1\overline{)\,-5x^2-3x-1} \\ -5x^2-5x \\ \hline 2x-1 \\ 2x+2 \\ \hline -3 \end{array}$$

46) 몫:$4x^2-9x+23$, 나머지:-40

⇨

$$\begin{array}{r} 4x^2-9x+23 \\ x+2\overline{)\,4x^3-x^2+5x+6} \\ 4x^3+8x^2 \\ \hline -9x^2+5x \\ -9x^2-18x \\ \hline 23x+6 \\ 23x+46 \\ \hline -40 \end{array}$$

47) 몫: $2x^2+7x+18$, 나머지: 41

48) 몫:$-2x^2-6x-3$, 나머지:-1

⇨

$$\begin{array}{r} -2x^2-6x-3 \\ x-1\overline{)\,-2x^3-4x^2+3x+2} \\ -2x^3+2x^2 \\ \hline -6x^2+3x \\ -6x^2+6x \\ \hline -3x+2 \\ -3x+3 \\ \hline -1 \end{array}$$

49) 몫:$x+1$ 나머지:$x+2$

⇨

$$\begin{array}{r} x+1 \Leftarrow \text{몫} \\ x^2+x+1\overline{)\,x^3+2x^2+3x+3} \\ x^3+x^2+x \\ \hline x^2+2x+3 \\ x^2+x+1 \\ \hline x+2 \Leftarrow \text{나머지} \end{array}$$

50) 몫: $2x+1$, 나머지: -10

⇨ $2x^3-x^2+3x-8$을 x^2-x+2로 나누면

$2x^3-x^2+3x-8=(x^2-x+2)(2x+1)-10$

51) 몫:$x+3$ 나머지:$-8x+5$

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⇨
$$\begin{array}{r} x+3 \\ x^2+2x-1\overline{)\,x^3+5x^2-3x+2} \\ x^3+2x^2-x \\ \hline 3x^2-2x+2 \\ 3x^2+6x-3 \\ \hline -8x+5 \end{array}$$
⇐몫
⇐나머지

52) 몫: $2x-1$ 나머지: $x+5$

⇨
$$\begin{array}{r} 2x-1 \\ 2x^2+2x-1\overline{)\,4x^3+2x^2-3x+6} \\ 4x^3+4x^2-2x \\ \hline -2x^2-x+6 \\ -2x^2-2x+1 \\ \hline x+5 \end{array}$$
⇐몫
⇐나머지

53) 몫: $4x+7$ 나머지: $16x+13$

⇨
$$\begin{array}{r} 4x+7 \\ x^2-2x-1\overline{)\,4x^3-x^2-2x+6} \\ 4x^3-8x^2-4x \\ \hline 7x^2+2x+6 \\ 7x^2-14x-7 \\ \hline 16x+13 \end{array}$$
⇐몫
⇐나머지

54) $2x^2-5x+3=(x+1)(2x-7)+10$

⇨
$$\begin{array}{r} 2x-7 \\ x+1\overline{)\,2x^2-5x+3} \\ 2x^2+2x \\ \hline -7x+3 \\ -7x-7 \\ \hline 10 \end{array}$$
⇐몫
⇐$2x\times(x+1)$
⇐$-7\times(x+1)$
⇐나머지

$\therefore 2x^2-5x+3=(x+1)(2x-7)+10$

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

⇨
$$\begin{array}{r} x^2+4x+3 \\ x-1\overline{)\,x^3+3x^2-x+2} \\ x^3-x^2 \\ \hline 4x^2-x+2 \\ 4x^2-4x \\ \hline 3x+2 \\ 3x-3 \\ \hline 5 \end{array}$$

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

56) $2x^3-3x^2+x-3=(x-2)(2x^2+x+3)+3$

⇨
$$\begin{array}{r} 2x^2+x+3 \\ x-2\overline{)\,2x^3-3x^2+x-3} \\ 2x^3-4x^2 \\ \hline x^2+x-3 \\ x^2-2x \\ \hline 3x-3 \\ 3x-6 \\ \hline 3 \end{array}$$

$\therefore 2x^3-3x^2+x-3=(x-2)(2x^2+x+3)+3$

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

⇨
$$\begin{array}{r} -x+4 \\ x+2\overline{)\,-x^2+2x+5} \\ -x^2-2x \\ \hline 4x+5 \\ 4x+8 \\ \hline -3 \end{array}$$

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

58) $2x^3+x^2-7x+7=(2x-1)(x^2+x-3)+4$

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

$\therefore 2x^3+x^2-7x+7=(2x-1)(x^2+x-3)+4$

59) $2x^3+x^2-x+1=(x^2+1)(2x+1)-3x$

⇨
$$\begin{array}{r} 2x+1 \\ x^2+1\overline{)\,2x^3+x^2-x+1} \\ 2x^3+2x \\ \hline x^2-3x+1 \\ x^2+1 \\ \hline -3x \end{array}$$

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

60) $(x^2-2x+3)(4x+8)+7x-22$

⇨ A를 B로 나누면

$4x^3+3x+2=(x^2-2x+3)(4x+8)+7x-22$이므로

$Q=4x+8$ $R=7x-22$이다.

61) $4x^3-x+2=(2x^2+x+2)(2x-1)+(-4x+4)$

⇨
$$\begin{array}{r} 2x-1 \\ 2x^2+x+2\overline{)\,4x^3-x+2} \\ 4x^3+2x^2+4x \\ \hline -2x^2-5x+2 \\ -2x^2-x-2 \\ \hline -4x+4 \end{array}$$

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

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

⇨ A를 B로 나누면

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

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

⇨
$$\begin{array}{r} x-1 \\ x^2-2x-1\overline{)\,x^3-3x^2+x-3} \\ x^3-2x^2-x \\ \hline -x^2+2x-3 \\ -x^2+2x+1 \\ \hline -4 \end{array}$$

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

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

⇨
$$\begin{array}{r} x+1 \quad \Leftarrow Q \\ x^2+x+2\overline{)\,x^3+2x^2+x+1} \\ \underline{x^3+\ x^2+2x} \\ x^2-x+1 \\ \underline{x^2+x+2} \\ -2x-1 \Leftarrow R \end{array}$$

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

65) $(x^2+2x-1)(x-2)+7x-3$

⇨
$$\begin{array}{r} x-2 \quad \Leftarrow Q \\ x^2+2x-1\overline{)\,x^3\quad +2x-1} \\ \underline{x^3\ +\ 2x^2-x} \\ -2x^2+3x-1 \\ \underline{-2x^2-4x+2} \\ 7x-3 \Leftarrow R \end{array}$$

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

66) $(x^2-x+2)(3x+6)-2x-10$

⇨
$$\begin{array}{r} 3x+6 \quad \Leftarrow Q \\ x^2-x+2\overline{)\,3x^3+3x^2-2x+2} \\ \underline{3x^3-3x^2+6x} \\ 6x^2-8x+2 \\ \underline{6x^2-6x+12} \\ -2x-10 \Leftarrow R \end{array}$$

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

67) $3x^3-x^2+4x+3=(x^2+2)(3x-1)-2x+5$

$$\begin{array}{r} 3x\ -1 \\ x^2+2\overline{)\,3x^3-x^2+4x+3} \\ \underline{3x^3\quad +6x} \\ -x^2-2x+3 \\ \text{⇨}\quad \underline{-x^2\quad -2} \\ -2x+5 \end{array}$$

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

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

⇨
$$\begin{array}{r} 2x+4 \quad \Leftarrow Q \\ x^2-x+1\overline{)\,2x^3+2x^2-\ x+1} \\ \underline{2x^3-2x^2+2x} \\ 4x^2-3x+1 \\ \underline{4x^2-4x+4} \\ x-3 \Leftarrow R \end{array}$$

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