Operations with Polynomials

Emphasis on Dividing Polynomials

Divide each of the following using LONG DIVISION:

1. $(x^2 + 7x - 30) \div (x - 3)$

$x + 10$

$x-3 \;|\; x^2 + 7x - 30$

$-x^2 + 3x$

$10x - 30$

$-10x + 30$

0

$x+10$

2. $(x^2 + 3x - 40) \div (x - 5)$

$x + 8$

$x-5 \;|\; x^2 + 3x - 40$

$-x^2 + 5x$

$8x - 40$

$-8x + 40$

0

$x+8$

3. $(x^2 - 13x + 12) \div (x - 1)$

$x - 12$

$x-1 \;|\; x^2 - 13x + 12$

$-x^2 + 1x$

$-12x + 12$

$+12x \mp 12$

0

$x-12$

4. $(a^2 + 7x - 11) \div (3 - a)$

$-a - 10$

$-a+3 \;|\; a^2 + 7a - 11$

$-a^2 + 3a$

$10a - 11$

$-10a + 30$

19

$-a - 10 + \frac{19}{3-a}$

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

$-r - 6$

$-r+1 \;|\; r^2 + 5r + 7$

$-r^2 + r$

$6r + 7$

$-6r + 6$

13

$-r - 6 + \frac{13}{1-r}$

6. $(2x^3 - 13x^2 + 26x - 24) \div (x - 4)$

$2x^2 - 5x + 6$

$x-4 \;|\; 2x^3 - 13x^2 + 26x - 24$

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

$-5x^2 + 26x - 24$

$+5x^2 \mp 20x$

$6x - 24$

$-6x + 24$

0

$2x^2 - 5x + 6$

7. $(x^3 - 4x^2 + 6x - 4) \div (x - 2)$

$x^2 - 2x + 2$

$x-2 \;|\; x^3 - 4x^2 + 6x - 4$

$-x^3 + 2x^2$

$-2x^2 + 6x - 4$

$+2x^2 \mp 4x$

$2x - 4$

$-2x + 4$

0

$x^2 - 2x + 2$

8. $(2x^3 + 3x^2 - 4x + 15) \div (x + 3)$

$2x^2 - 3x + 5$

$x+3 \;|\; 2x^3 + 3x^2 - 4x + 15$

$-2x^3 \mp 6x^2$

$-3x^2 - 4x + 15$

$+3x^2 + 9x$

$5x + 15$

$-5x \mp 15$

0

$2x^2 - 3x + 5$

9. $(3x^3 - 8x^2 + 11x - 14) \div (x - 2)$

$3x^2 - 2x + 7$

$x-2 \;|\; 3x^3 - 8x^2 + 11x - 14$

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

$-2x^2 + 11x - 14$

$+2x^2 \mp 4x$

$7x - 14$

$-7x + 14$

0

$3x^2 - 2x + 7$

10. $(4a^4 + 2a^2 - 4a + 12) \div (a + 2)$

$4a^3 - 8a^2 + 18a - 40$

$a+2 \;|\; 4a^4 + 0a^3 + 2a^2 - 4a + 12$

$-4a^4 \mp 8a^3$

$-8a^3 + 2a^2 - 4a + 12$

$+8a^3 + 16a^2$

$18a^2 - 4a + 12$

$-18a^2 \mp 36a$

$-40a + 12$

$+40a + 80$

92

$4a^3 - 8a^2 + 18a - 40 + \frac{92}{a+2}$

11. $(6b^4 - 8b^3 + 12b - 14) \div (b - 2)$	12. $(4y^3 - 6y^2 + 4y - 1) \div (2y - 1)$
13. $(3x^4 - 5x^3 + x^2 + 7x) \div (3x + 1)$	14. $(8x^4 - 4x^2 + x + 4) \div (2x + 1)$
15. $(8y^5 - 2y^4 - 16y^2 + 4) \div (4y - 1)$	16. $(15b^3 + 8b^2 - 21b + 6) \div (5b - 4)$
17. $(6c^3 - 17c^2 + 6c + 8) \div (3c - 4)$	18. $(x^2 - 6x - 20) \div (x + 2)$
19. $(3z^4 - 6z^3 - 9z^2 + 3z - 6) \div (z + 3)$	20. $(y^5 - 3y^2 - 20) \div (y - 2)$

(11)

$$\begin{array}{r|l} & 6b^3+4b^2+8b+28 \\ b-2 & 6b^4-8b^3+12b-14 \\ & -6b^4+12b^3 \\ \hline & \quad 4b^3+12b-14 \\ & \quad -4b^3+8b^2 \\ \hline & \quad\quad 8b^2+12b-14 \\ & \quad\quad -8b^2+16b \\ \hline & \quad\quad\quad 28b-14 \\ & \quad\quad\quad -28b+56 \\ \hline & \quad\quad\quad\quad 42 \end{array}$$

$$\boxed{6b^3+4b^2+8b+28+\frac{42}{b-2}}$$

(12)

$$\begin{array}{r|l} & 2y^2-2y+1 \\ 2y-1 & 4y^3-6y^2+4y-1 \\ & -4y^3+2y^2 \\ \hline & \quad -4y^2+4y-1 \\ & \quad +4y^2-2y \\ \hline & \quad\quad 2y-1 \\ & \quad\quad -2y+1 \\ \hline & \quad\quad\quad 0 \end{array}$$

$$\boxed{2y^2-2y+1}$$

(13)

$$\begin{array}{r|l} & x^3-2x^2+1x+2 \\ 3x+1 & 3x^4-5x^3+x^2+7x \\ & -3x^4-x^3 \\ \hline & \quad -6x^3+x^2+7x \\ & \quad +6x^3+2x^2 \\ \hline & \quad\quad 3x^2+7x \\ & \quad\quad -3x^2-1x \\ \hline & \quad\quad\quad 6x \end{array} \qquad \begin{array}{r} 6x \\ -6x-2 \\ \hline -2 \end{array}$$

$$\boxed{x^3-2x^2+x+2-\frac{2}{3x+1}}$$

(14)

$$2x+1 \;\overline{)\; 8x^4+0x^3-4x^2+x+4}$$

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

$-8x^4 \mp 4x^3$

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

$+4x^3 + 2x^2$

$-2x^2 + x + 4$

$+2x^2 + x$

$2x + 4$

$-2x \mp 1$

3

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

(15)

$$4y-1 \;\overline{)\; 8y^5-2y^4+0y^3-16y^2+0y+4}$$

$2y^4 - 4y - 1$

$-8y^5 + 2y^4$

$-16y^2 + 0y + 4$

$+16y^2 \mp 4y$

$-4y + 4$

$+4y \mp 1$

3

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

(16)

$$5b-4 \;\overline{)\; 15b^3+8b^2-21b+6}$$

$3b^2 + 4b - 1$

$-15b^3 + 12b^2$

$20b^2 - 21b + 6$

$-20b^2 + 16b$

$-5b + 6$

$+5b \mp 4$

2

$$3b^2 + 4b - 1 + \frac{2}{5b-4}$$

(17)

$$3c-4 \;\overline{)\; 6c^3 - 17c^2 + 6c + 8}$$

$$2c^2 - 3c - 2$$

$$-6c^3 + 8c^2$$
$$-9c^2 + 6c + 8$$
$$+9c^2 \mp 12c$$
$$-6c + 8$$
$$+6c \mp 8$$
$$0$$

$$\boxed{2c^2 - 3c - 2}$$

(18)

$$x+2 \;\overline{)\; x^2 - 6x - 20}$$

$$x - 8$$

$$-x^2 \mp 2x$$
$$-8x - 20$$
$$+8x + 16$$
$$-4$$

$$\boxed{x - 8 - \frac{4}{x+2}}$$

(19)

$$z+3 \;\overline{)\; 3z^4 - 6z^3 - 9z^2 + 3z - 6}$$

$$3z^3 - 15z^2 + 36z - 105$$

$$-3z^4 \mp 9z^3$$
$$-15z^3 - 9z^2 + 3z - 6$$
$$+15z^3 + 45z^2$$
$$36z^2 + 3z - 6$$
$$-36z^2 \mp 108z$$
$$-105z - 6$$
$$+105z + 315$$
$$309$$

$$\boxed{3z^3 - 15z^2 + 36z - 105 + \frac{309}{z+3}}$$

(20)

$$y-2 \;\overline{)\; y^5 + 0y^4 - 3y^2 + 0y - 20}$$

$$y^4 + 2y^3 + 4y^2 + 5y + 10$$

$$\begin{array}{r} y^5 + 0y^4 - 3y^2 + 0y - 20 \\ -y^5 + 2y^4 \\ \hline 2y^4 - 3y^2 + 0y - 20 \\ -2y^4 + 4y^3 \\ \hline 4y^3 - 3y^2 + 0y - 20 \\ -4y^3 + 8y^2 \\ \hline 5y^2 + 0y - 20 \\ -5y^2 + 10y \\ \hline 10y - 20 \\ -10y + 20 \\ \hline 0 \end{array}$$

$$\boxed{y^4 + 2y^3 + 4y^2 + 5y + 10}$$