

Operations with Polynomials & Factoring Polynomials Practice

Find the sum.

1. $(-5x^2 + 4x - 2) + (-8x^2 + 2x + 1)$ 2. $(8x^4 + 2x^2 - 1) + (3x^3 - 5x^2 + 7x + 1)$

$$-13x^2 + 6x - 1$$

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

3. $(7x^6 + 2x^5 - 3x^2 + 9x) + (5x^5 + 8x^3 - 6x^2 + 2x - 5)$

$$7x^6 + 7x^5 + 8x^3 - 9x^2 + 11x - 5$$

Find the difference.

4. $(7x^4 - 9x^3 - 4x^2 + 5x + 6) - (2x^4 + 3x^2 - x^2 + x - 4)$

$$7x^4 - 9x^3 - 4x^2 + 5x + 6 - 2x^4 - 3x^2 + x^2 - x + 4$$

$$\boxed{5x^4 - 9x^3 - 6x^2 + 4x + 10}$$

5. $(4x^5 - 7x^3 - 9x^2 + 18) - (14x^5 - 8x^4 + 11x^2 + x)$

$$4x^5 - 7x^3 - 9x^2 + 18 - 14x^5 + 8x^4 - 11x^2 - x$$

$$\boxed{-10x^5 + 8x^4 - 7x^3 - 20x^2 - x + 18}$$

6. $(11x^4 - 9x^2 + 3x + 11) - (2x^4 + 6x^3 + 2x - 9)$

$$11x^4 - 9x^2 + 3x + 11 - 2x^4 - 6x^3 - 2x + 9$$

$$\boxed{9x^4 - 6x^3 - 9x^2 + x + 20}$$

Find the product.

7. $-4x^2(11x^3 + 2x^2 + 9x + 1)$

$$-44x^5 - 8x^4 - 36x^3 - 4x^2$$

8. $(5x^2 - 4x + 6)(-2x + 3)$

$$-10x^3 + 8x^2 - 12x + 15x^2 - 12x + 18$$

$$\boxed{-10x^3 + 23x^2 - 24x + 18}$$

9. $(3x^3 - 9x + 7)(x^2 - 2x + 1)$

$$3x^5 - 6x^4 + 3x^3 - 9x^3 + 18x^2 - 9x + 7x^2 - 14x + 7$$

$$\boxed{3x^5 - 6x^4 - 6x^3 + 25x^2 - 23x + 7}$$

11. $(4 - 5x)(1 - 2x)(3x + 2)$

$$(4 - 8x - 5x + 10x^2)(3x + 2)$$

$$(4 - 13x + 10x^2)(3x + 2)$$

$$12x - 39x^2 + 30x^3 + 8 - 26x + 20x^2$$

$$\boxed{30x^3 - 19x^2 - 14x + 8}$$

13. $(7h + 4)^2 = (7h + 4)(7h + 4)$

$$49h^2 + 28h + 28h + 16$$

$$\boxed{49h^2 + 56h + 16}$$

Divide using polynomial long division.

15. $(3x^2 - 14x - 5) \div (x - 5)$

$$\begin{array}{r} 3x + 1 \\ x-5 \overline{) 3x^2 - 14x - 5} \\ \underline{-(3x^2 - 15x)} \\ x - 5 \\ \underline{-(x - 5)} \\ 0 \end{array}$$

0 no remainder!

$$\boxed{3x + 1}$$

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

$$(x^2 + 2x - 3x - 6)(x + 4)$$

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

$$x^3 - x^2 - 6x + 4x^2 - 4x - 24$$

$$\boxed{x^3 + 3x^2 - 10x - 24}$$

12. $(2y - 5)(2y + 5)$

$$4y^2 + 10y - 10y - 25$$

$$\boxed{4y^2 - 25}$$

14. $(2t + 4)^3 = (2t + 4)(2t + 4)(2t + 4)$

$$(2t + 4)(4t^2 + 8t + 8t + 16)$$

$$(2t + 4)(4t^2 + 16t + 16)$$

$$8t^3 + 32t^2 + 32t + 16t^2 + 64t + 64$$

$$\boxed{8t^3 + 48t^2 + 96t + 64}$$

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

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

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

17. $(5x^4 - 2x^3 - 7x^2 - 39) \div (x^2 + 2x - 4)$

$$\begin{array}{r}
 5x^2 - 12x + 37 \\
 x^2 + 2x - 4 \overline{) 5x^4 - 2x^3 - 7x^2 - 39} \\
 \underline{-(5x^4 + 10x^3 - 20x^2)} \\
 -12x^3 + 13x^2 - 39 \\
 \underline{-(-12x^3 - 24x^2 + 48x)} \\
 37x^2 - 48x - 39 \\
 \underline{-(37x^2 + 74x - 148)} \\
 -122x + 109
 \end{array}$$

$$\boxed{5x^2 - 12x + 37 + \frac{-122x + 109}{x^2 + 2x - 4}}$$

Divide using synthetic division.

19. $(4x^2 - 13x - 5) \div (x - 2)$

$$\begin{array}{r|rrrr}
 2 & 4 & -13 & -5 & \\
 & \downarrow & 8 & -10 & \\
 \hline
 & 4 & -5 & -15 & \\
 & x & & \# & \text{remainder}
 \end{array}$$

$$\boxed{4x - 5 - \frac{15}{x - 2}}$$

21. $(3x^3 - 5x^2 - 2) \div (x - 1)$

$$\begin{array}{r|rrrrr}
 1 & 3 & -5 & 0 & -2 & \\
 & \downarrow & 3 & -2 & -2 & \\
 \hline
 & 3 & -2 & -2 & -4 & \\
 & x^2 & x & + & \text{remainder}
 \end{array}$$

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

18. $(7x^3 + x^2 + x) \div (x^2 + 1)$

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

$$\boxed{7x + 1 + \frac{-6x - 1}{x^2 + 1}}$$

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

$$\begin{array}{r|rrrr}
 -3 & 1 & 0 & -4 & 6 \\
 & \downarrow & -3 & 9 & -15 \\
 \hline
 & 1 & -3 & 5 & -9 \\
 & x^2 & x & + & \text{remainder}
 \end{array}$$

$$\boxed{x^2 - 3x + 5 - \frac{9}{x + 3}}$$

22. $(x^4 + 4x^3 + 16x - 35) \div (x + 5)$

$$\begin{array}{r|rrrrr}
 -5 & 1 & 4 & 0 & 16 & -35 \\
 & \downarrow & -5 & 5 & -25 & 45 \\
 \hline
 & 1 & -1 & 5 & -9 & 10 \\
 & x^3 & x^2 & x & + & \text{remainder}
 \end{array}$$

$$\boxed{x^3 - x^2 + 5x - 9 + \frac{10}{x + 5}}$$

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

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

Factor the polynomial completely.

23. $x^3 - 2x^2 - 24x$

$$x(x^2 - 2x - 24)$$

$$\boxed{x(x-6)(x+4)}$$

24. $3p^5 - 192p^3$

$$3p^3(p^2 - 64)$$

$$\boxed{3p^3(p-8)(p+8)}$$

25. $2q^4 + 9q^3 - 18q^2$

$$q^2(2q^2 + 9q - 18)$$

$$\boxed{q^2(2q-3)(q+6)}$$

$\star 26. x^3 + 64$

$$a=x \quad b=4$$

$$\boxed{(x+4)(x^2 - 4x + 16)}$$

$\star 27. g^3 - 343$

$$a=g \quad b=7$$

$$\boxed{(g-7)(g^2 + 7g + 49)}$$

$\star 28. 3h^9 - 192h^6$

$$3h^6(h^3 - 64)$$

$$a=h \quad b=4$$

$$\boxed{3h^6(h-4)(h^2 + 4h + 16)}$$

29. $y^3 - 5y^2 + 6y - 30$

$$y^2(y-5) + 6(y-5)$$

$$\boxed{(y^2-6)(y-5)}$$

30. $3a^3 + 18a^2 + 8a + 48$

$$3a^2(a+6) + 8(a+6)$$

$$\boxed{(3a^2+8)(a+6)}$$

31. $2k^3 - 20k^2 + 5k - 50$

$$2k^2(k-10) + 5(k-10)$$

$$\boxed{(2k^2+5)(k-10)}$$

32. $49k^4 - 9$

$$\boxed{(7k^2-3)(7k^2+3)}$$

33. $c^4 + 9c^2 + 20$

$$\boxed{(c^2+5)(c^2+4)}$$

34. $3r^8 + 3r^5 - 60r^2$

$$3r^2(r^6 + r^3 - 20)$$

$$\boxed{3r^2(r^3+5)(r^3-4)}$$