PRACTICE SET 4: POLYNOMIAL ALGEBRA AND FACTORING

1. Simplify: $(3x^2 + 2x) + (5x^2 - x)$.

A. $8x^3 + x$

B. $8x^2 - x$

C. $8x^2 + x$

D. $2x^2 + x$

2. Factor: $x^2 - 16$.

A. $(x - 4)(x + 4)$

B. $(x - 16)(x + 1)$

C. $(x - 4)^2$

D. $(x - 2)(x + 8)$

3. Multiply: $(x + 2)(x + 3)$.

A. $x^2 + 6$

B. $x^2 + 5$

C. $x^2 + 6x + 5$

D. $x^2 + 5x + 6$

4. Factor: $x^2 + 7x + 10$.

A. $(x - 2)(x - 5)$

B. $(x + 2)(x + 5)$

C. $(x + 1)(x + 10)$

D. $(x - 1)(x - 10)$

5. What is $(2x)^2$?

A. $4x^2$

B. $2x^2$

C. $4x$

D. $2x^4$

6. Solve: $x^2 - 25 = 0$.

A. $x = 25$

B. $x = 5$ only

C. $x = -5$ only

D. $x = 5$ or $x = -5$

7. Factor: $2x^2 + 8x$.

A. $2(x^2 + 4)$

B. $2x(x + 4)$

C. $x(2x + 8)$

D. $2(x^2 + 8)$

8. Multiply: $(x - 3)(x + 3)$.

A. $x^2 + 9$

B. $x^2 - 6x + 9$

C. $x^2 - 9$

D. $x^2 + 6x - 9$

9. Factor: $x^2 - 5x + 6$.

A. $(x - 2)(x - 3)$

B. $(x + 2)(x + 3)$

C. $(x - 1)(x - 6)$

D. $(x + 1)(x + 6)$

10. Simplify: $3x^2 \cdot 2x^3$.

A. $5x^5$

B. $5x^6$

C. $6x^6$

D. $6x^5$

11. Solve: $x^2 - 4x = 0$.

A. $x = 4$ only

B. $x = 0$ or $x = 4$

C. $x = -4$ only

D. $x = 0$ or $x = -4$

12. Factor: $x^2 - 9x + 20$.

A. $(x - 2)(x - 10)$

B. $(x + 4)(x + 5)$

C. $(x - 4)(x + 5)$

D. $(x - 4)(x - 5)$

13. Expand: $(x + 4)^2$.

A. $x^2 + 8x + 16$

B. $x^2 + 16$

C. $x^2 - 8x + 16$

D. $x^2 + 4x + 4$

14. Simplify: $(x^5)/(x^2)$.

A. x^7

B. x^2

C. x^3

D. x^{10}

15. Factor: $3x^2 - 12$.

A. $3(x^2 - 4)$

B. $3(x - 4)(x + 4)$

C. $3(x - 2)^2$

D. $3(x - 2)(x + 2)$

16. Multiply: $(2x + 1)(x - 5)$.

A. $2x^2 - 9x - 5$

B. $2x^2 + 9x - 5$

C. $2x^2 - 11x - 5$

D. $2x^2 - x - 5$

17. Solve: $x^2 + 6x + 8 = 0$.

A. $x = -1$ or $x = -8$

B. $x = 1$ or $x = 8$

C. $x = -2$ or $x = -4$

D. $x = 2$ or $x = 4$

18. Simplify: $(2x^3)(3x^4)$.

A. $5x^7$

B. $6x^7$

C. $6x^{12}$

D. $5x^{12}$

19. Factor: $x^2 + 2x - 15$.

A. $(x - 3)(x - 5)$

B. $(x + 3)(x - 5)$

C. $(x + 3)(x + 5)$

D. $(x - 3)(x + 5)$

20. What is the degree of $4x^3 - 2x^2 + x - 7$?

A. 3

B. 2

C. 1

D. 4

21. Solve: $x^2 = 49$.

A. $x = 7$ only

B. $x = -7$ only

C. $x = 49$

D. $x = 7$ or $x = -7$

22. Factor: $x^2 - 8x + 16$.

A. $(x - 4)^2$

B. $(x - 4)(x + 4)$

C. $(x + 4)^2$

D. $(x - 8)(x + 2)$

23. Multiply: $3x(x^2 - 2x + 1)$.

A. $3x^2 - 2x + 1$

B. $x^3 - 2x^2 + x$

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

D. $3x^2 - 6x^2 + 1$

24. Factor: $x^2 - 11x + 24$.

A. $(x - 2)(x - 12)$

B. $(x - 3)(x - 8)$

C. $(x + 3)(x + 8)$

D. $(x + 2)(x + 12)$

25. Simplify: $(x^4 \cdot x^3)/(x^2)$.

A. x^4

B. x^6

C. x^7

D. x^5

26. Solve: $x^2 - 3x - 10 = 0$.

A. $x = 5$ or $x = -2$

B. $x = -5$ or $x = 2$

C. $x = 5$ or $x = 2$

D. $x = -5$ or $x = -2$

27. Factor: $4x^2 - 9$.

A. $(2x - 3)^2$

B. $(4x - 3)(x + 3)$

C. $(2x - 3)(2x + 3)$

D. $(2x + 3)^2$

28. Multiply: $(x + 1)(x^2 - x + 1)$.

A. $x^3 - x + 1$

B. $x^3 - 1$

C. $x^3 + x$

D. $x^3 + 1$

29. Simplify: $(x^3)^3$.

A. x^6

B. x^9

C. $3x^3$

D. x^{12}

30. Factor: $x^2 + 5x$.

A. $(x + 5)$

B. $x(x + 5x)$

C. $5(x + 1)$

D. $x(x + 5)$

31. Solve: $2x^2 = 18$.

A. $x = 3$ or $x = -3$

B. $x = 9$

C. $x = 6$ or $x = -6$

D. $x = 3$ only

32. Factor: $x^2 - 14x + 49$.

A. $(x - 7)(x + 7)$

B. $(x + 7)^2$

C. $(x - 7)^2$

D. $(x - 14)(x - 3)$

33. Multiply: $(x - 4)(x + 5)$.

A. $x^2 - 9x - 20$

B. $x^2 - x + 20$

C. $x^2 + 9x + 20$

D. $x^2 + x - 20$

34. Simplify: $(4x^2y)(2xy^3)$.

A. $6x^3y^4$

B. $8x^3y^4$

C. $8x^2y^4$

D. $8x^3y^3$

35. Factor: $x^2 - 6x$.

A. $x(x - 6)$

B. $(x - 6)(x + 1)$

C. $6(x - 1)$

D. $(x - 3)^2$

36. Solve: $x^2 + x - 12 = 0$.

A. $x = 4$ or $x = 3$

B. $x = -4$ or $x = -3$

C. $x = 4$ or $x = -3$

D. $x = -4$ or $x = 3$

37. What is the leading coefficient of $5x^4 - 3x^2 + 2$?

A. 2

B. 5

C. 3

D. 4

38. Factor: $6x^2 + 9x$.

A. $3(x^2 + 3x)$

B. $6x(x + 3)$

C. $3x(2x + 3)$

D. $3(2x^2 + 3x)$

39. Solve: $x^2 - 16 = 0$.

A. $x = 4$ or $x = -4$

B. $x = 16$

C. $x = 8$

D. $x = 4$ only

40. Simplify: $(5x^2)^2$.

A. $10x^2$

B. $5x^4$

C. $25x^2$

D. $25x^4$

41. Factor: $x^2 + 4x + 4$.

A. $(x + 2)(x - 2)$

B. $(x - 2)^2$

C. $(x + 2)^2$

D. $(x + 4)(x + 1)$

42. Multiply: $2x(x + 3)$.

A. $2x + 6$

B. $2x^2 + 3$

C. $2x + 3x$

D. $2x^2 + 6x$

43. Solve: $x^2 - 5x = 0$.

A. $x = 0$ or $x = 5$

B. $x = 5$ only

C. $x = -5$

D. $x = 0$ or $x = -5$

44. Simplify: $4x^3 - x^3$.

A. $4x^6$

B. $3x^3$

C. 4

D. $3x^0$

45. Factor: $x^2 - 100$.

A. $(x - 10)^2$

B. $(x + 10)^2$

C. $(x - 50)(x + 2)$

D. $(x - 10)(x + 10)$

46. Multiply: $(x + 1)(x + 7)$.

A. $x^2 + 8x + 7$

B. $x^2 + 7x + 1$

C. $x^2 + 6x + 7$

D. $x^2 + 8x + 1$

47. Simplify: $(3xy^2)^3$.

A. $9x^3y^6$

B. $27x^3y^5$

C. $27x^3y^6$

D. $3x^3y^6$

48. Factor: $x^2 - 2x - 8$.

A. $(x - 4)(x - 2)$

B. $(x - 4)(x + 2)$

C. $(x + 4)(x - 2)$

D. $(x - 8)(x + 1)$

49. Solve: $x^2 + 2x - 3 = 0$.

A. $x = 1$ or $x = 3$

B. $x = -1$ or $x = 3$

C. $x = 3$ or $x = -3$

D. $x = 1$ or $x = -3$

50. Simplify: $x^2 + 3x^2 - x^2$.

A. $3x^2$

B. $4x^2$

C. $3x^4$

D. $5x^2$

PRACTICE SET 4: ANSWER KEY AND EXPLANATIONS

1. C — $8x^2 + x$. Combining like terms: $3x^2 + 5x^2 = 8x^2$ and $2x - x = x$, giving $8x^2 + x$. Like terms have identical variable parts and combine through addition or subtraction of coefficients.
2. A — $(x - 4)(x + 4)$. The expression $x^2 - 16$ is a difference of squares, where $16 = 4^2$. The factored form follows the pattern $a^2 - b^2 = (a - b)(a + b)$.
3. D — $x^2 + 5x + 6$. Using FOIL: $x \cdot x = x^2$, $x \cdot 3 = 3x$, $2 \cdot x = 2x$, $2 \cdot 3 = 6$. Combining the middle terms gives $x^2 + 5x + 6$.
4. B — $(x + 2)(x + 5)$. Two numbers that multiply to 10 and add to 7 are 2 and 5. Both are positive because the constant and middle coefficient are positive.
5. A — $4x^2$. Squaring $(2x)$ means squaring both the coefficient and the variable: $2^2 \cdot x^2 = 4x^2$. The exponent applies to every factor inside the parentheses.
6. D — $x = 5$ or $x = -5$. Adding 25 gives $x^2 = 25$, and taking the square root yields both positive and negative solutions: $x = \pm 5$.
7. B — $2x(x + 4)$. The greatest common factor of $2x^2$ and $8x$ is $2x$, leaving $(x + 4)$ inside the parentheses.
8. C — $x^2 - 9$. This is a difference of squares pattern: $(x - 3)(x + 3) = x^2 - 3^2 = x^2 - 9$. The middle terms cancel.
9. A — $(x - 2)(x - 3)$. Two numbers that multiply to 6 and add to -5 are -2 and -3. Both are negative because the constant is positive and the middle coefficient is negative.
10. D — $6x^5$. Multiplying coefficients: $3 \times 2 = 6$. Adding exponents on like bases: $x^2 \cdot x^3 = x^5$. The result is $6x^5$.
11. B — $x = 0$ or $x = 4$. Factoring gives $x(x - 4) = 0$, so by the zero product property, $x = 0$ or $x = 4$.
12. D — $(x - 4)(x - 5)$. Two numbers that multiply to 20 and add to -9 are -4 and -5. Both are negative since the constant is positive and the middle coefficient is negative.
13. A — $x^2 + 8x + 16$. Squaring a binomial follows the pattern $(a + b)^2 = a^2 + 2ab + b^2$, giving $x^2 + 2(x)(4) + 16 = x^2 + 8x + 16$.
14. C — x^3. Dividing like bases subtracts exponents: $x^5/x^2 = x^{5-2} = x^3$.

15. D — $3(x - 2)(x + 2)$. Pulling out the GCF of 3 gives $3(x^2 - 4)$, and $x^2 - 4$ is a difference of squares that factors further into $(x - 2)(x + 2)$.

16. A — $2x^2 - 9x - 5$. Using FOIL: $2x \cdot x = 2x^2$, $2x \cdot (-5) = -10x$, $1 \cdot x = x$, $1 \cdot (-5) = -5$. Combining gives $2x^2 - 9x - 5$.

17. C — $x = -2$ or $x = -4$. Factoring gives $(x + 2)(x + 4) = 0$ because two numbers that multiply to 8 and add to 6 are 2 and 4. Solutions are negatives of these factors.

18. B — $6x^7$. Multiplying coefficients gives $2 \times 3 = 6$, and adding exponents gives $x^3 \cdot x^4 = x^7$. The product is $6x^7$.

19. D — $(x - 3)(x + 5)$. Two numbers that multiply to -15 and add to 2 are -3 and 5. Opposite signs are needed when the constant is negative.

20. A — 3. The degree of a polynomial is the highest exponent on the variable, which is 3 in $4x^3$.

21. D — $x = 7$ or $x = -7$. Taking the square root of both sides produces both positive and negative roots: $x = \pm 7$.

22. A — $(x - 4)^2$. This is a perfect square trinomial since $16 = 4^2$ and the middle term $-8x = 2(x)(-4)$. The factored form is $(x - 4)^2$.

23. C — $3x^3 - 6x^2 + 3x$. Distributing $3x$ to each term: $3x \cdot x^2 = 3x^3$, $3x \cdot (-2x) = -6x^2$, and $3x \cdot 1 = 3x$.

24. B — $(x - 3)(x - 8)$. Two numbers that multiply to 24 and add to -11 are -3 and -8. Both negatives produce a positive constant.

25. D — x^5. The numerator is $x^{4+3} = x^7$, and dividing by x^2 gives $x^{7-2} = x^5$.

26. A — $x = 5$ or $x = -2$. Factoring gives $(x - 5)(x + 2) = 0$ because two numbers that multiply to -10 and add to -3 are -5 and 2.

27. C — $(2x - 3)(2x + 3)$. This is a difference of squares: $4x^2 = (2x)^2$ and $9 = 3^2$. The pattern $a^2 - b^2 = (a - b)(a + b)$ gives the factored form.

28. D — $x^3 + 1$. This is a sum of cubes pattern: $(a + b)(a^2 - ab + b^2) = a^3 + b^3$. With $a = x$ and $b = 1$, the product is $x^3 + 1$.

29. B — x^9. Power-to-a-power multiplies exponents: $(x^3)^3 = x^{3x3} = x^9$.

30. D — $x(x + 5)$. Pulling out the GCF of x gives $x(x + 5)$.

31. A — $x = 3$ or $x = -3$. Dividing both sides by 2 gives $x^2 = 9$, then taking the square root gives $x = \pm 3$.

32. C — $(x - 7)^2$. This is a perfect square trinomial since $49 = 7^2$ and $-14x = 2(x)(-7)$. The factored form is $(x - 7)^2$.

33. D — $x^2 + x - 20$. Using FOIL: $x \cdot x = x^2$, $x \cdot 5 = 5x$, $-4 \cdot x = -4x$, $-4 \cdot 5 = -20$. Combining the middle terms gives $x^2 + x - 20$.

34. B — $8x^3y^4$. Multiplying coefficients: $4 \times 2 = 8$. Adding exponents: $x^2 \cdot x = x^3$ and $y \cdot y^3 = y^4$. The product is $8x^3y^4$.

35. A — $x(x - 6)$. Pulling out the GCF of x leaves $(x - 6)$ inside.

36. D — $x = -4$ or $x = 3$. Factoring gives $(x + 4)(x - 3) = 0$ because two numbers that multiply to -12 and add to 1 are 4 and -3.

37. B — 5. The leading coefficient is the coefficient of the highest-degree term, which is $5x^4$.

38. C — $3x(2x + 3)$. The GCF of $6x^2$ and $9x$ is $3x$, leaving $(2x + 3)$ inside.

39. A — $x = 4$ or $x = -4$. Adding 16 gives $x^2 = 16$, and the square root gives both positive and negative roots.

40. D — $25x^4$. Squaring $(5x^2)$ means squaring both factors: $5^2 = 25$ and $(x^2)^2 = x^4$.

41. C — $(x + 2)^2$. This is a perfect square trinomial since $4 = 2^2$ and $4x = 2(x)(2)$. The factored form is $(x + 2)^2$.

42. D — $2x^2 + 6x$. Distributing $2x$ to each term: $2x \cdot x = 2x^2$ and $2x \cdot 3 = 6x$.

43. A — $x = 0$ or $x = 5$. Factoring gives $x(x - 5) = 0$, so $x = 0$ or $x = 5$.

44. B — $3x^3$. Combining like terms: $4x^3 - x^3 = (4 - 1)x^3 = 3x^3$.

45. D — $(x - 10)(x + 10)$. The expression is a difference of squares with $100 = 10^2$. The pattern $a^2 - b^2 = (a - b)(a + b)$ gives the factored form.

46. A — $x^2 + 8x + 7$. Using FOIL: $x \cdot x = x^2$, $x \cdot 7 = 7x$, $1 \cdot x = x$, $1 \cdot 7 = 7$. Combining gives $x^2 + 8x + 7$.

47. C — $27x^3y^6$. The cube applies to each factor: $3^3 = 27$, x^3 stays, and $(y^2)^3 = y^6$. The result is $27x^3y^6$.

48. B — $(x - 4)(x + 2)$. Two numbers that multiply to -8 and add to -2 are -4 and 2. Opposite signs are needed because the constant is negative.

49. D — $x = 1$ or $x = -3$. Factoring gives $(x - 1)(x + 3) = 0$ because two numbers that multiply to -3 and add to 2 are -1 and 3.

50. A — $3x^2$. Combining like terms: $x^2 + 3x^2 - x^2 = (1 + 3 - 1)x^2 = 3x^2$.