

Sample Test Solutions

Polynomials

1. Subtract the polynomials.

$$\begin{aligned} & 2x^2 - 6x - 4 \text{ from } -4x^2 + 6x + 10 \\ &= -4x^2 + 6x + 10 - (2x^2 - 6x - 4) \\ &= -4x^2 + 6x + 10 + (-2x^2 + 6x + 4) \\ &= -6x^2 + 12x + 14 \end{aligned}$$

2. Multiply.

$$\begin{aligned} & (4x - 1)(3x^2 - x + 6) \\ &= 4x(3x^2 - x + 6) - 1(3x^2 - x + 6) \\ &= 12x^3 - 4x^2 + 24x - 3x^2 + x - 6 \\ &= 12x^3 - 7x^2 + 25x - 6 \end{aligned}$$

3. Factor completely.

$$\begin{aligned} & ax - 2bx + ay - 2by \\ &= x(a - 2b) + y(a - 2b) \\ &= (a - 2b)(x + y) \end{aligned}$$

4. Factor completely.

$$\begin{aligned} & y^3 + 64 \\ &= (y)^3 + (4)^3 \\ &= (y + 4)(y^2 - 4y + 16) \end{aligned}$$

5. Factor completely.

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

6. Factor completely.

$$\begin{aligned} & x^3 - 9x \\ &= x(x^2 - 9) \\ &= x(x - 3)(x + 3) \end{aligned}$$

Rational Expressions

7. Simplify.

$$\begin{aligned} & \frac{2x^2 - 7x - 4}{x^2 - 5x + 4} \\ &= \frac{(2x + 1)(x - 4)}{(x - 1)(x - 4)} \\ &= \frac{2x + 1}{x - 1} \end{aligned}$$

8. Multiply.

$$\begin{aligned} & \frac{4a + 36}{a^2 - 7a - 18} \cdot \frac{a^2 - a - 6}{a^2 - 81} \\ &= \frac{4(a + 9)}{(a - 9)(a + 2)} \cdot \frac{(a - 3)(a + 2)}{(a - 9)(a + 9)} \end{aligned}$$

$$= \frac{4}{(a-9)} \cdot \frac{(a-3)}{(a-9)}$$

$$= \frac{4(a-3)}{(a-9)^2}$$

9. Divide.

$$\frac{6a^2b^2}{a^2-4} \div \frac{3ab^2}{a-2}$$

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

$$= \frac{2a}{a+2}$$

10. Subtract.

$$\frac{5}{2x-5} - \frac{3}{4x+3}$$

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

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

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

$$= \frac{14x+30}{(2x-5)(4x+3)}$$

11. Simplify.

$$\frac{\frac{3}{x} + \frac{2}{y}}{\frac{5}{x} - \frac{6}{y^2}}$$

$$= \frac{\frac{3}{x} \left(\frac{y}{y} \right) + \frac{2}{y} \left(\frac{x}{x} \right)}{\frac{5}{x} \left(\frac{y^2}{y^2} \right) - \frac{6}{y^2} \left(\frac{x}{x} \right)}$$

$$= \frac{3y+2x}{\frac{xy}{5y^2-6x}} \cdot \frac{xy^2}{xy^2}$$

$$= \frac{3y+2x}{xy} \div \frac{5y^2-6x}{xy^2}$$

$$= \frac{3y+2x}{xy} \cdot \frac{xy^2}{5y^2-6x}$$

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

12. Solve.

$$\frac{3}{n} + \frac{1}{6} = \frac{11}{3n}, \quad n \neq 0$$

$$(6n) \left(\frac{3}{n} + \frac{1}{6} \right) = (6n) \left(\frac{11}{3n} \right)$$

$$(6n) \left(\frac{3}{n} \right) + (6n) \left(\frac{1}{6} \right) = (6n) \left(\frac{11}{3n} \right)$$

$$18+n=22$$

$$n=4$$

$$\{4\}$$

13. Solve.

$$\frac{7}{x-4} = \frac{x}{x^2-16} + \frac{1}{x+4}, \quad x \neq -4 \text{ and } x \neq 4$$

$$(x-4)(x+4)\left(\frac{7}{x-4}\right) = (x-4)(x+4)\left(\frac{x}{x^2-16} + \frac{1}{x+4}\right)$$

$$7(x+4) = x+1(x-4)$$

$$7x+28 = x+x-4$$

$$7x+28 = 2x-4$$

$$5x = -32$$

$$x = \frac{-32}{5}$$

$$x = \frac{-32}{5}$$

$$\left\{ \frac{-32}{5} \right\}$$

Radicals

14. Simplify. All variables represent positive real numbers.

$$\sqrt{75x^3y^4}$$

$$= \sqrt{3 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y}$$

$$= 5xy^2\sqrt{3x}$$

15. Find the sum.

$$4\sqrt{20x} + 5\sqrt{45x} - 10\sqrt{80x}$$

$$= 4(2)\sqrt{5x} + 5(3)\sqrt{5x} - 10(4)\sqrt{5x}$$

$$= 8\sqrt{5x} + 15\sqrt{5x} - 40\sqrt{5x}$$

$$= -17\sqrt{5x}$$

16. Multiply.

$$(2\sqrt[3]{6})(5\sqrt[3]{4})$$

$$= (2)(5)(\sqrt[3]{6})(\sqrt[3]{4})$$

$$= 10(\sqrt[3]{24})$$

$$= 10\sqrt[3]{2 \cdot 2 \cdot 2 \cdot 3}$$

$$= 10(2)\sqrt[3]{3}$$

$$= 20\sqrt[3]{3}$$

17. Multiply.

$$(3\sqrt{2} + 2)(5\sqrt{2} - 3)$$

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

$$= 15\sqrt{4} - 9\sqrt{2} + 10\sqrt{2} - 6$$

$$= 15(2) + 1\sqrt{2} - 6$$

$$= 30 + \sqrt{2} - 6$$

$$= 24 + \sqrt{2}$$

18. Rationalize the denominator.

$$\frac{\sqrt{7}}{\sqrt{12}}$$

$$= \frac{\sqrt{7}}{2\sqrt{3}}$$

$$= \frac{\sqrt{7} \sqrt{3}}{2\sqrt{3} \sqrt{3}}$$

$$= \frac{\sqrt{21}}{2\sqrt{9}}$$

$$= \frac{\sqrt{21}}{2(3)}$$

$$= \frac{\sqrt{21}}{6}$$

19. Solve and check.

$$\sqrt{3x-1} + 1 = 4$$

$$\sqrt{3x-1} = 3$$

$$(\sqrt{3x-1})^2 = (3)^2$$

$$3x-1 = 9$$

$$3x = 10$$

$$x = \frac{10}{3}$$

Check

$$\sqrt{3\left(\frac{10}{3}\right) - 1} + 1 = 4$$

$$\sqrt{10-1} + 1 = 4$$

$$\sqrt{9} + 1 = 4$$

$$3 + 1 = 4$$

$$4 = 4$$

$$\left\{\frac{10}{3}\right\}$$

20. Write the following using positive rational exponents.

$$\sqrt[3]{2y}$$

$$= (2y)^{\frac{1}{3}}$$

$$= 2^{\frac{1}{3}} y^{\frac{1}{3}}$$

Quadratic Equations

21. Solve.

$$z^2 + 9 = 10z$$

$$z^2 - 10z + 9 = 0$$

$$(z-1)(z-9) = 0$$

$$z-1 = 0 \text{ or } z-9 = 0$$

$$z = 1 \quad \text{or} \quad z = 9$$

$$\{1, 9\}$$

22. Solve.

$$x^2 + 6x - 3 = 0$$

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

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

$$(x+3)(x+3) = 12$$

$$(x+3)^2 = 12$$

$$x+3 = \pm\sqrt{12}$$

$$x = -3 \pm \sqrt{12}$$

$$x = -3 \pm 2\sqrt{3}$$

$$\{-3 \pm 2\sqrt{3}\}$$

23. Solve.

$$3x^2 - 8x + 2 = 0$$

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(3)(2)}}{2(3)}$$

$$x = \frac{8 \pm \sqrt{64 - 24}}{6}$$

$$x = \frac{8 \pm \sqrt{40}}{6}$$

$$x = \frac{8 \pm 2\sqrt{10}}{6}$$

$$x = \frac{2(4 \pm \sqrt{10})}{6}$$

$$x = \frac{4 \pm \sqrt{10}}{3}$$

$$\left\{ \frac{4 \pm \sqrt{10}}{3} \right\}$$

Complex Numbers

24. Add.

$$(-6 + 4i) + (8 - 7i)$$

$$= (-6 + 8) + (4 - 7)i$$

$$= 2 - 3i$$

25. Multiply.

$$(-3 - 2i)(5 + 6i)$$

$$= (-3)(5) + (-3)(6i) + (-2i)(5) + (-2i)(6i)$$

$$= -15 - 18i - 10i - 12i^2$$

$$= -15 - 28i - 12(-1)$$

$$= -15 - 28i + 12$$

$$= -3 - 28i$$

Functions

26. Find the domain.

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

Set the denominator equal to zero and solve for the variable.

$$x + 4 = 0$$

$$x = -4$$

Exclude this value from the domain.

The domain of the function is all real numbers except -4.

27. If $f(x) = 2x^2 - 5x - 7$, find $f(-2)$.

$$f(-2) = 2(-2)^2 - 5(-2) - 7$$

$$= 2(4) - (-10) - 7$$

$$= 8 + 10 - 7$$

$$= 11$$

Systems of Equations

28. Solve the system of equations.

$$4x - y = 9$$

$$2x + 3y = -27$$

Substitution Method

Solving the first equation for y

$$y = 4x - 9$$

Substituting in place of y in the second equation

$$2x + 3(4x - 9) = -27$$

$$2x + 12x - 27 = -27$$

$$14x - 27 = -27$$

$$14x = 0$$

$$x = 0$$

$$y = 4(0) - 9$$

$$y = -9$$

$$\{(0, -9)\}$$

Elimination by Addition Method

$$3(4x - y) = 3(9)$$

$$2x + 3y = -27$$

$$12x - 3y = 27$$

$$2x + 3y = -27$$

Adding the equations

$$14x + 0y = 0$$

$$14x = 0$$

$$x = 0$$

Substituting x=0 in the first equation and

solving for y

$$4(0) - y = 9$$

$$-y = 9$$

$$y = -9$$

$$\{(0, -9)\}$$

Absolute Value Equations

29. Solve. $|3x - 1| = 11$

$$3x - 1 = 11 \quad \text{or} \quad 3x - 1 = -11$$

$$3x = 12 \quad \text{or} \quad 3x = -10$$

$$x = 4 \quad \text{or} \quad x = \frac{-10}{3}$$

$$\left\{ \frac{-10}{3}, 4 \right\}$$

30. Solve.

$$|x + 3| = -4$$

$$\phi$$

No solution

Distance cannot be negative.