

I. Operations with signed numbers and fractions.

1. Evaluate:

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|-----------------------|-----------------|----------------------------|
| (a) $4(-5)$ | (b) $4 - 5$ | (c) $4 + (-5)$ |
| (d) $-7 + 4$ | (e) $2 - (-4)$ | (f) $2(-4)$ |
| (g) $-8 + 10 - 3 - 1$ | (h) $-(-3) - 1$ | (i) $10 - 2 - 20 - 3 + 15$ |
| (g) 3^2 | (h) $(-3)^2$ | (i) $(-1)^2$ |
| (j) -3^2 | (k) $(-2)^4$ | (l) $(-1)^5$ |

2. Evaluate:

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|--|--|---|
| (a) $1 - (1 - 6)$ | (b) $(3 - 7)(2 - (-1))$ | (c) $(8 - (-2))(-7 + 5)$ |
| (d) $-3 - 2(4 - 7)$ | (e) $-2(1 - 3)^2 + 5$ | (f) $[2(3) - 1]^2 - 10$ |
| (g) $\frac{(2 - 3)^2 + 7}{1 - (5 - 2)}$ | (h) $\frac{2 - 4(1 - 3)}{-6 - 2(5 - 3)}$ | (i) $\frac{5(-3 + 2)^2 - 11}{5 - (5 - 2)^2}$ |
| (j) $3 - 2(1 - 5)$ | (k) $2(2 - 5)^2 - 12$ | (l) $-3(1 - 3)^2 - (1 - 10)$ |
| (m) $\frac{\sqrt{9} - (3 - 7)}{3 - \sqrt{25}}$ | (n) $\frac{\sqrt{9 + 25}}{\sqrt{9} + \sqrt{16}}$ | (o) $\frac{7 - (1 - 2)}{\sqrt{4} - \sqrt{6}}$ |

3. Evaluate:

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|------------------------------------|--|-----------------------|
| (a) $\frac{2}{5} - \frac{3}{4}$ | (b) $\frac{1}{9} - \frac{2}{3}$ | (c) $3 - \frac{1}{6}$ |
| (d) $\frac{-2}{15} + \frac{3}{10}$ | (e) $\left(-\frac{3}{8} \div \frac{9}{4}\right)$ | (f) $4 - \frac{3}{5}$ |

4. Evaluate:

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| (a) $\frac{2}{3}(95) - \left(\frac{1}{6}\right)^2$ | (b) $-\frac{3}{4} - \left(1 - \frac{5}{3}\right)$ | (c) $\frac{3}{2} - \left(-3 + \frac{1}{4}\right)$ |
| (d) $1 - \left(\frac{1}{3} - \frac{1}{2}\right)$ | (e) $-\frac{3}{4} \left(3 - \frac{1}{3}\right)$ | (f) $\left(-\frac{2}{3}\right)^2 + \left(-\frac{1}{3}\right)^3$ |
| (g) $2 - \left(1 - \frac{1}{3}\right)$ | (h) $\frac{1}{2} - \left(\frac{1}{3} - \frac{1}{4}\right)$ | (i) $\frac{1}{2} - \left(\frac{1}{4} - \frac{1}{3}\right)$ |

5. Evaluate the expressions for the indicated value of the variable:

- $x - y$ when $x = -6$ and $y = -2$.
- $x - y + z$ for $x = 8$, $y = -1$ and $z = -5$
- $(x + y)(x - y)$ when $x = -2$ and $y = -3$.
- $x^2 - y^2$ when $x = -2$ and $y = -3$.
- $-3x^2 + 10x + 9$ when $x = 3$.

- (f) $\frac{9}{5}x + 32$ when $x = -70$.
- (g) $-\frac{2}{3}x + 1$ when $x = 9$.
- (h) $a + 4b - 3c$ for $a = 1, b = -\frac{1}{2}, c = -\frac{5}{3}$.
- (i) $a^2 + b^2$ when $a = -2, b = -5$.
- (j) $(a + b)^2$ when $a = -2, b = -5$.
- (k) $a^2 + 2ab + b^2$ when $a = -2, b = -5$.
- (l) $a^2 + ab + b^2$ when $a = -3$ and $b = 2$.
- (m) $a^2 + ab + b^2$ when $a = -\frac{1}{5}$ and $b = \frac{1}{2}$.
- (n) $\sqrt{b^2 - 4ac}$ when $a = 1, b = -7, c = 6$.
- (o) $\sqrt{b^2 - 4ac}$ when $a = 1, b = \frac{1}{2}, c = -\frac{1}{2}$.
- (p) $-\frac{b}{2a}$ when $a = -\frac{2}{3}, b = -4$
- (q) $\frac{y_2 - y_1}{x_2 - x_1}$ when $x_1 = 4, x_2 = -2, y_1 = 3, y_2 = -9$.
- (r) $\frac{y_2 - y_1}{x_2 - x_1}$ when $x_1 = -1, x_2 = 2, y_1 = -5, y_2 = 1$.
- (s) $2x^2 - 4xy$ when $x = -3, y = -2$
- (t) $\frac{1}{x} + \frac{2}{y}$ for $x = -\frac{1}{5}$ and $y = \frac{2}{3}$.

6. Translate into algebraic language:

- (a) The product of two consecutive numbers.
- (b) The sum of three consecutive numbers.
- (c) The product of three consecutive numbers is 120.
- (d) The sum of the squares of two numbers.
- (e) The square of the sum of two numbers.
- (f) The quotient when a number increased by two is divided by twice the same number decreased by ten.
- (g) 10 less than 4 times a number is 24.
- (h) 12 less than 7 times a number 113.
- (i) 92 less than 2 times a number is 60.
- (j) 18 more than 3 times a number is 45.

II. Solving linear equations.

7. Solve:

- (a) $3x - 4 = -13$ (b) $11x - 4 = 18$ (c) $\frac{x}{5} = -3$
- (d) $x - \frac{1}{4} = \frac{1}{2}$ (e) $\frac{x}{2} - 5 = -2$ (f) $\frac{6}{5}x + 2 = 1$
- (g) $3(x - 2) = -2(x - 7)$ (h) $5y - 3(y + 2) = y + 4$ (i) $3(2t - 4) - t + 5 = 5t - 7$
- (j) $10(z - 2) = -4(z + 1)$ (k) $\frac{x}{3} - 5 = \frac{2x + 7}{6} + 6$ (l) $\frac{2w - 3}{4} + \frac{w}{3} = \frac{1}{6}$

8. Solve the linear equations:

(a) $8 - 2x = 2(-5 - 4x)$ (b) $\frac{x+4}{9} = \frac{x+8}{15}$ (c) $3(8 - x) + 6x + 5 = 5(x + 2) + 3$

9. Solve for the indicated variable:

(a) $I = P \cdot r \cdot t$ for t (b) $F = \frac{9}{5}C + 32$ for C (c) $2x - 3y = 8$ for y

(d) $3x + 2y - z = 8$ for x (e) $\frac{4}{x} = \frac{y}{5}$ for x (f) $\frac{P}{p} = \frac{B}{100}$ for p

(g) $2x - 3y + 4z = 8$ for z (h) $\frac{2y + x - z}{3} = 2$ for y (i) $3t - x = y$ for t

10. Write an algebraic equation in order to solve the following questions:

- (a) The length of a rectangle is three centimeters more than twice its width. The perimeter is 54 cm. Find the length and the width of the rectangle.
- (b) One number is six more than three times another number. Their sum is 75. Find the two numbers.
- (c) Find two consecutive integers such that three times the first is seven more than two times the second.
- (d) Three consecutive integers have the property that the sum of the first two is 21 less than three times the third. Find the three integers.

III. Equations of lines and their graphs.

11. Sketch the graphs of the following linear equations:

(a) $2x - 3y = 6$ (b) $x + 4y = 8$ (c) $y = -\frac{1}{2}x + 4$ (d) $y = 2x - 3$

(e) $-4x + 2x = 8$ (f) $x = -2$ (g) $y = -2$ (e) $x + y = 2$

12. Graph the line $4x + 3y = 1$ together with the points $(3, -4)$, $(0, 1)$ and $(1, -1)$ in the same set of coordinates. Are those points on the line? Check your answer analytically.

13. Find the slope of the lines described by the following information:

- (a) With equation $y = \frac{2}{3}x + 4$
- (b) With equation $2x - 3y = 8$
- (c) With equation $-5x + 2y = 3$
- (d) Passing through the points $(4, -2)$ and $(5, 1)$
- (e) Passing through the points $(-2, -2)$ and $(-3, 1)$
- (f) Parallel to the line with equation $4x - 2y = 3$
- (g) Perpendicular to the line with equation $x - 4y = 1$

14. Write an equation of the line described by the following information:

- (a) With slope -3 and passing through the point $(3, -2)$
- (b) With slope $-\frac{1}{2}$ and passing through the point $(3, -2)$
- (c) Passing through the points $(2, -1)$ and $(-4, -3)$
- (d) Parallel to the line with equation $y = 3x - 4$ and passing through $(1, 9)$.

- (e) Parallel to the line with equation $3x - 5y = 4$ and having the same y -intercept as the line with equation $x - 4y - 8 = 0$.
- (f) Vertical line passing through the point $(-5, 6)$.
- (g) Horizontal line passing through the point $(-5, 6)$.
- (h) Vertical line passing through the point $(3, 3)$.
- (i) Horizontal line passing through the point $(3, 3)$.

15. Solve the systems:

$$\begin{array}{lll}
 \text{(a)} \quad \begin{cases} x + y = 1 \\ 2x - y = 8 \end{cases} & \text{(b)} \quad \begin{cases} 5x - 2y = 10 \\ 2x - 7y = 14 \end{cases} & \text{(c)} \quad \begin{cases} 2x + y = 4 \\ 2x - 3y = 1 \end{cases} \\
 \text{(d)} \quad \begin{cases} x - y = 3 \\ 2x - y = 8 \end{cases} & \text{(e)} \quad \begin{cases} 3x - 2y = 1 \\ 2x - 5y = -4 \end{cases} & \text{(f)} \quad \begin{cases} 2x + 5y = 4 \\ -2x + 3y = 1 \end{cases}
 \end{array}$$

16. Write a system of linear equations in order to solve the following questions:

- (a) The sum of two numbers is 57. The difference between three times one of them and twice the other is one. Find the numbers.
- (b) Ojanay has 39 coins. If she has a total of \$6.30 and the coins are only dimes and quarters, how many of each type of coin does she have?

IV. Inequalities.

17. Solve and graph the solution set of the inequalities:

$$\begin{array}{lll}
 \text{(a)} \quad x \leq -5 & \text{(b)} \quad x < -5 & \text{(c)} \quad x - 3 > 2 \\
 \text{(d)} \quad 3(x - 2) \geq -2(x - 7) & \text{(e)} \quad 10x - 1 \leq x + 80 & \text{(f)} \quad 6x - 5 \geq 2x + 3 \\
 \text{(g)} \quad 10(x - 2) > -4(x + 1) - 2 & \text{(h)} \quad 2x - 7 \leq 5x - 1 & \text{(i)} \quad -x + 7 > 5x - 17
 \end{array}$$

18. Graph the solution set of the following inequalities:

$$\begin{array}{lll}
 \text{(a)} \quad x - y < 2 & \text{(b)} \quad x + y > 5 & \text{(c)} \quad 5x + 2y \geq 10 \\
 \text{(d)} \quad x - 3y < 6 & \text{(e)} \quad 2x - 3y > -12 & \text{(f)} \quad y \geq -2x - 4
 \end{array}$$

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V. Operations with polynomials and properties of powers.

19. Simplify by using the properties of powers:

$$\begin{array}{lll}
 \text{(a)} \quad (5x^5)(4x^4) & \text{(b)} \quad -3x^{-3} & \text{(c)} \quad \frac{-3x^{-3}}{y^{-5}} \\
 \text{(d)} \quad \frac{-6x^5}{3y^4} & \text{(e)} \quad (3x^7y^{-6})(5x^2y^9) & \text{(f)} \quad (3x^7y^{-6})(5x^2y^2) \\
 \text{(g)} \quad (-2x^2y^4)^2 & \text{(h)} \quad \frac{-18x^5y^2}{9x^3y^7} & \text{(i)} \quad \frac{(4xy)^2}{8x^{-2}y^{-4}} \\
 \text{(j)} \quad \frac{-24x^{-6}y^{-2}}{x^{-10}y^5} & \text{(k)} \quad \frac{16x^8y^3}{9x^{13}y^7} & \text{(l)} \quad \frac{(-4x^3y)^2}{8x^{-1}y^{-5}}
 \end{array}$$

20. Perform the indicated operations and reduce like terms:

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| (a) $(3x - 1)(4x + 5)$ | (b) $(2x - 3)^2$ |
| (c) $(2x - 1)(x^2 - x + 2)$ | (d) $(y^2 - 3y + 5) - (2y^2 + y - 5)$ |
| (e) $(-3x^2 + 10x + 2) - (-x^2 + 9x - 2)$ | (f) $(x^2 - 3x + 1)(x^2 + 2x - 3)$ |
| (g) $7m^2n - 2mn^2 + m^2n + mn^2$ | (h) $(x - 2)(x + 1) - (x + 3)(x - 2)$ |
| (i) $\frac{4x^7 - 16x^5 + 24x^4}{-4x^3}$ | (j) $\frac{-8x^{12} + 10x^{10} - 6x^7}{-2x^7}$ |
| (k) $(x + y)(x^2 - xy + y^2)$ | (l) $(x - y)(x^2 + xy + y^2)$ |
| (m) $(y^2 - 3y + 5) + (2y^2 + y - 5)$ | (n) $\frac{-7x^4 + 7x^3 - 7x^2}{7x^2}$ |

21. Factor completely:

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|--------------------------|---------------------------------|------------------------------|
| (a) $4p^2q^5 - 12p^2q^3$ | (d) $4x^2 - 36$ | (c) $y^4 - 16$ |
| (d) $-45x^3 + 5x$ | (e) $15ax + 18ay + 40bx + 48by$ | (f) $4x + 10xy - 6y - 15y^2$ |

22. Factor completely the polynomials:

- | | | |
|--------------------------|----------------------|-----------------------|
| (a) $2x^3 - x - 45$ | (b) $3x^2 + 4x - 4$ | (c) $45x^2y - 20y^3$ |
| (d) $2x^2 - x - 10$ | (e) $x^2 - 12x - 28$ | (f) $2y^2 + y - 1$ |
| (g) $6x^5 + x^4 - 12x^3$ | (h) $x^2 - 15x + 56$ | (h) $2x^2 - 21x - 50$ |

23. Find all solutions for the polynomial equations:

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|-----------------------|----------------------------|------------------|----------------------|
| (a) $-20x^3 + 5x = 0$ | (b) $x(x - 3)(2x + 1) = 0$ | (c) $3x^3 = 48x$ | (d) $x(x^2 - 4) = 0$ |
|-----------------------|----------------------------|------------------|----------------------|

VI. Operations with radicals.

24. Simplify the following radical expressions:

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|-----------------|--------------------|------------------|-------------------|------------------------------|--------------------------|
| (a) $\sqrt{75}$ | (b) $\sqrt[3]{54}$ | (c) $2\sqrt{18}$ | (d) $-5\sqrt{12}$ | (e) $\sqrt[3]{\frac{8}{27}}$ | (f) $\sqrt{\frac{1}{2}}$ |
|-----------------|--------------------|------------------|-------------------|------------------------------|--------------------------|

25. Perform the indicated operations and express the answers in simplest radical form:

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| (a) $3 + \sqrt{7} + 3\sqrt{7} + 1$ | (b) $5\sqrt{3} + \sqrt{5} - 7\sqrt{3} + 8\sqrt{5}$ | (c) $2\sqrt{8} + 5\sqrt{2}$ |
| (d) $4\sqrt{3} + 3\sqrt{300}$ | (e) $-3\sqrt{50} + 2\sqrt{27} + \sqrt{8}$ | (f) $(-3\sqrt{12})(12\sqrt{3})$ |
| (g) $\sqrt{7}(\sqrt{28} - \sqrt{7})$ | (h) $(\sqrt{5} - \sqrt{3})(\sqrt{5} + \sqrt{3})$ | (i) $\sqrt{7}(\sqrt{42} + 5\sqrt{7})$ |
| (j) $\frac{\sqrt{2}\sqrt{98}}{\sqrt{7}}$ | (k) $(3 - 2\sqrt{2})^2$ | (l) $(3 - 4\sqrt{7})(7 + 4\sqrt{7})$ |

VII. Quadratic Equations.

26. Find all solutions to the equations.

(a) $x^2 - 10x + 9 = 0$

(b) $x^2 + 7x + 10 = 0$

(c) $3x^2 - 6x = 24$

(d) $x^2 - 8 = 0$

(e) $x^2 = 12$

(f) $x^2 + 2x + 1 = 0$

(g) $6x^2 + x = 2$

(h) $2x^2 + 11x + 15 = 0$

(i) $6x^2 = -5x + 4$

27. The legs of a right triangle are $a = 6$ and $b = 4$. What is the length of the hypotenuse as a simplified radical?

28. The hypotenuse of a right triangle is $c = \sqrt{13}$ and one of the legs is $a = 2$. What is the length of the other leg? Simplify your answer.

29. The hypotenuse of a right triangle is $c = \sqrt{13}$ and one of the legs is $a = \sqrt{5}$. What is the length of the other leg? Simplify your answer.

30. The legs of a right triangle are $a = \sqrt{2}$ and $b = \sqrt{10}$. Find the length of the hypotenuse c .

31. Sketch the graphs of each of the given quadratic functions, indicating the x and y intercepts, the vertex and the axis of symmetry.

(a) $y = x^2 - 5$

(b) $y = x^2 + 4x$

(c) $y = 4 - x^2$

(d) $y = x^2 - 2x - 6$

(e) $y = x^2 + 4x - 5$

(f) $y = 2x^2 + 8x - 10$