

Chapter 1

Getting Started with Algebra Basics

The basics of pre-calculus consist of reviewing number systems, properties of the number systems, order of operations, notation, and some essential formulas used in coordinate graphs. Vocabulary is important in mathematics because you have to relate a number or process to its exact description. The problems in this chapter reacquaint you with many old friends from previous mathematics courses.

The Problems You'll Work On

In this chapter, you'll work with simplifying expressions and writing answers in the following ways:

- » Identifying which are whole numbers, integers, and rational and irrational numbers
- » Applying the commutative, associative, distributive, inverse, and identity properties
- » Computing correctly using the *order of operations* (parentheses, exponents/powers and roots, multiplication and division, and then addition and subtraction)
- » Graphing inequalities for the full solution
- » Using formulas for slope, distance, and midpoint
- » Applying coordinate system formulas to characterize geometric figures

What to Watch Out For

Don't let common mistakes trip you up; keep in mind that when working with simplifying expressions and communicating answers, your challenges will be

- » Distributing the factor over every term in the parentheses
- » Changing the signs of all the terms when distributing a negative factor
- » Working from left to right when applying operations at the same level
- » Assigning points to the number line in the correct order
- » Placing the change in y over the change in x when using the slope formula
- » Satisfying the correct geometric properties when characterizing figures

Identifying Which System or Systems a Number Belongs To

1–10 Identify which number doesn't belong to the number system.

1. Which is not a rational number?

$4, -\frac{3}{8}, -2, \frac{\sqrt{3}}{7}, 0$

2. Which is not a rational number?

$591, -\frac{163}{164}, -\frac{4}{1}, 3i+1, 11^2$

3. Which is not a natural number?

$83, 27, 0, 14, 2^3$

4. Which is not a natural number?

$1, 1.9, 49, 101, 15$

5. Which is not an integer?

$-3, \sqrt{20}, 0, -153, 9^4$

6. Which is not an integer?

$-23, \frac{49}{7}, -\frac{100}{6}, 27^3, 111$

7. Which is not an irrational number?

$\sqrt{25}, \sqrt[3]{81}, \sqrt[4]{624}, \sqrt{28}, \sqrt{7}$

8. Which is not an irrational number?

$\sqrt{101}, \sqrt{0}, \sqrt[5]{15}, \sqrt[3]{300}, \sqrt{2}$

9. Which is not an imaginary number?

$3i, 2i+1, i^2, 2-3i, 4i+i^2$

10. Which is not an imaginary number?

$6i, 2+i^4, 3-2i, 4i+4i, i^3$

Recognizing Properties of Number Systems

11–20 Identify which property of numbers the equation illustrates.

11. $14 + 11 = 11 + 14$

12. $-19 + (9 - 4) = (-19 + 9) - 4$

13. $\left(\frac{1}{4} \cdot 3\right) \cdot \frac{1}{3} = \frac{1}{4} \cdot \left(3 \cdot \frac{1}{3}\right)$

14. $a + b + 0 = a + b$

15. $-3(x + 7) = -3x - 21$

16. $-11\left(-\frac{1}{11}\right) = 1$

17. $(x + 3)(y + 2) = (x + 3) \cdot y + (x + 3) \cdot 2$

18. $9(20 + 3) = (20 + 3)9$

19. If $x = 3$ and $y = x$, then $y = 3$.

20. $\frac{8}{13} + \left(-\frac{8}{13}\right) = 0$

Simplifying Expressions with the Order of Operations

21–30 Simplify the expression by using the order of operations.

21. $4(3)^2$

22. $\frac{6 + 18}{6}$

23. $\frac{\frac{1}{3} + \frac{1}{6}}{\frac{5}{7} + \frac{19}{21}}$

24. $\frac{\frac{13}{6} - \frac{1}{2}}{\frac{1}{6} + \frac{1}{3}}$

25. $\frac{-4 + \sqrt{4 - 4(2)(-12)}}{4}$

$$26. \frac{-20 - \sqrt{400 - 4(-5)(-15)}}{-10}$$

$$27. \frac{\sqrt{18^2 + 4(19)}}{|-7 + 3|}$$

$$28. \frac{\sqrt{25-16} + \sqrt{9(6-2)}}{\sqrt{61^2 - 60^2}}$$

$$29. \frac{|-4(3) + 2(7)|}{6(17 - 3^2)}$$

$$30. \frac{|3^2 - 4^2| - |4^2 - 5^2|}{(5^2 - 6^2)^2}$$

$$33. 4x + 5y > 20$$

$$34. 3x - 2y < 12$$

$$35. x > 6$$

$$36. x \leq -2$$

$$37. y \geq -4$$

$$38. y \leq 0$$

$$39. y \leq 3x - 7$$

$$40. x \geq 2y + 1$$

Graphing Inequalities

31–40 Graph the inequality.

$$31. x + y \geq 7$$

$$32. 2x - y \leq 4$$

Using Graphing Formulas

41–50 Solve by using the necessary formula.

41. Find the slope of the line through the points $(-2, 3)$ and $(4, 9)$.
42. Find the slope of the line through the points $(-4, -3)$ and $(-6, 2)$.
43. Find the slope of the line through the points $(4, -3)$ and $(4, -7)$.
44. Find the slope of the line through the points $(-2, -9)$ and $(2, -9)$.
45. Find the distance between the points $(-8, -1)$ and $(-2, 7)$.
46. Find the distance between the points $(0, 16)$ and $(7, -8)$.
47. Find the distance between the points $(6, -5)$ and $(-4, 3)$.
48. Find the midpoint of the segment between the points $(-5, 2)$ and $(7, -8)$.
49. Find the midpoint of the segment between the points $(6, 3)$ and $(-4, -4)$.
50. Find the midpoint of the segment between the points $(\frac{1}{3}, -\frac{1}{2})$ and $(\frac{5}{6}, -\frac{1}{4})$.

Applying Graphing Formulas

51–60 Use an appropriate formula to compute the indicated value.

51. Find the perimeter of triangle ABC, whose vertices are A $(1, 1)$, B $(1, 4)$, and C $(5, 1)$.
52. Find the perimeter of the parallelogram DEFG, whose vertices are D $(0, 10)$, E $(9, 13)$, F $(11, 7)$, and G $(2, 4)$.
53. Find the center of the rhombus HJKL, whose vertices are H $(0, 3)$, J $(4, 6)$, K $(8, 3)$, and L $(4, 0)$.

54. Determine which type(s) of triangle ABC is if the vertices are A (1, 1), B (4, 5), and C (9, -5).

55. Determine which type of triangle ABC is if the vertices are A (0, 0), B (0, 12), and C ($6\sqrt{3}$, 6).

56. Find the length of the altitude of triangle ABC, drawn to side AC, with vertices A (0, 0), B (5, 12), and C (21, 0).

57. Find the length of the altitude of triangle DEF, drawn to side DF, with vertices D (2, 3), E (2, 12), and F (42, 3).

58. Find the area of the parallelogram PQRS with vertices P (4, 7), Q (7, 12), R (15, 12), and S (12, 7).

59. Find the area of circle A if the endpoints of its diameter are at (6, 13) and (-8, 21).

60. Find the area of triangle ABC with vertices A (0, 0), B (5, 12), and C (14, 0).