

Answers to Selected Problems

CHAPTER 1 PRELIMINARY INFORMATION

Exercise 1-1, Sets of Numbers

1. a. whole numbers, positive, negative, and 0 b. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 c. integers divisible by 2 d. numbers greater than 0 e. numbers less than 0 f. numbers expressible as a ratio of two integers g. numbers not expressible as a ratio of two integers h. square roots of negative numbers i. numbers on the number line j. positive integers k. positive integers l. numbers not expressible using only a finite number of the operations $+$, $-$, $\times$, $\div$, or $\sqrt[n]{}$ on integers
3. See Chapter 1 Opener.
5. {natural numbers} counting was probably the first thing done with numbers
7. rational 9. 0

Exercise 1-2, The Field Axioms

1. a. 0 b. 1
3. Examples may vary.
Closure:
 $x + y \in \mathcal{R} \quad xy \in \mathcal{R}$
Commutativity:
 $x + y = y + x \quad xy = yx$
Associativity:
 $(x + y) + z = x + (y + z)$
 $(xy)z = x(yz)$
Distributivity:
 $x(y + z) = xy + xz$
Identity elements:
 $x + 0 = x \quad x \cdot 1 = x$
Inverses:
 $x + (-x) = 0 \quad x \cdot \frac{1}{x} = 1$
5. The answer always comes out the same.
7. Calvin is right. Phoebe distributed multiplication over multiplication. 9. a. Associativity for addition b. Closure under multiplication c. Commutativity for addition d. Commutativity for multiplication e. Distributivity of multiplication over addition f. Additive identity g. Additive inverses h. Multiplicative identity i. Multiplicative inverses

Exercise 1-3, Variables and Expressions

1. 47 3. 10 5. 8 7. 7 9. 16
11. a. 7 b. -13 13. a. 1 b. 14
15. a. -17 b. 18 17. a. 0 b. 21
19. a. 2 b. 27 21. a. -5 b. 40
23. a. 1 b. 11 25. $4 - x$
27. $21x - 42$ 29. $4x + 17$
31. 5 33. $32 - 6x$ 35. $3x + 3$
37. $2y^2 - 2xy$ 39. x 41. Phoebe

Exercise 1-4, Polynomials

1. yes, quartic trinomial 3. yes, quadratic binomial 5. no, division by a variable
7. yes, linear binomial 9. no, division by a variable 11. yes, constant monomial
13. yes, four-term cubic 15. yes, quintic binomial 17. no, square root of a variable
19. yes, linear binomial 21. yes, 10th degree binomial 23. yes, monomial, no degree 25. $x^2 + 4x - 21$ 27. $2x^2 + 7x - 4$ 29. $6x^2 - 37x + 56$ 31. $4x^2 - 20x + 25$ 33. $4x^2 - 20x + 25$

Exercise 1-5, Equations

Note: Solutions in parentheses are not in domain.

1. $\{-5\}$ 3. $\emptyset$ (-4) 5. $\{0\}$
7. a. $\left\{-\frac{11}{3}\right\}$ b. $\emptyset$ $\left(-\frac{11}{3}\right)$ 9. a. $\{-4\}$ (4)
- b. $\{4, -4\}$ 11. a. $\left\{\frac{1}{3}, -\frac{1}{3}\right\}$
- b. $\emptyset$ $\left(\frac{1}{3}, -\frac{1}{3}\right)$ 13. $\left\{-3, \frac{2}{3}\right\}$
15. $\{-1, \frac{5}{2}\}$ 17. $\left\{\frac{2}{3}\right\}$ (-3)
19. $\left\{-\frac{3}{2}, 5, -1\right\}$ 21. $\left\{0, \frac{1}{2}, -4\right\}$
23. $\{7, -7\}$ 25. $\emptyset$ 27. $\{2, -8\}$
29. $\left\{3, -\frac{5}{2}\right\}$ 31. $\left\{2, \frac{16}{9}\right\}$
33. a. $S = \left\{-7, \frac{5}{3}\right\}$ for both equations.
b. equivalent 35. a. true b. true c. if $a < b$, then $a + c < b + c$, and if $a > b$, then $a + c > b + c$