

Student Study and Solutions Manual

TRIGONOMETRY

9e



Ron Larson

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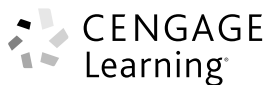
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Trigonometry

NINTH EDITION

Ron Larson

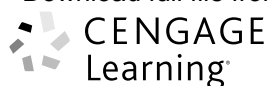
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CHAPTER P

Prerequisites

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CHAPTER P

Prerequisites

Section P.1 Review of Real Numbers and Their Properties

1. irrational

3. absolute value

5. terms

7. $-9, -\frac{7}{2}, 5, \frac{2}{3}, \sqrt{2}, 0, 1, -4, 2, -11$

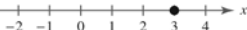
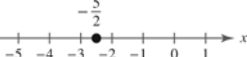
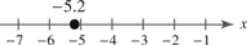
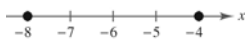
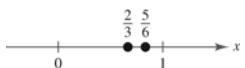
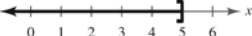
(a) Natural numbers: 5, 1, 2

(b) Whole numbers: 0, 5, 1, 2

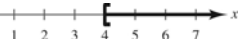
(c) Integers: $-9, 5, 0, 1, -4, 2, -11$ (d) Rational numbers: $-9, -\frac{7}{2}, 5, \frac{2}{3}, 0, 1, -4, 2, -11$ (e) Irrational numbers: $\sqrt{2}$ 9. $2.01, 0.666\dots, -13, 0.010110111\dots, 1, -6$

(a) Natural numbers: 1

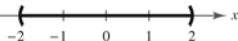
(b) Whole numbers: 1

(c) Integers: $-13, 1, -6$ (d) Rational numbers: $2.01, 0.666\dots, -13, 1, -6$ (e) Irrational numbers: $0.010110111\dots$ 11. (a) (b) (c) (d) 13. $-4 > -8$ 15. $\frac{5}{6} > \frac{2}{3}$ 17. (a) The inequality $x \leq 5$ denotes the set of all real numbers less than or equal to 5.(b) 

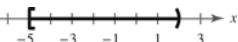
(c) The interval is unbounded.

19. (a) The interval $[4, \infty)$ denotes the set of all real numbers greater than or equal to 4.(b) 

(c) The interval is unbounded.

21. (a) The inequality $-2 < x < 2$ denotes the set of all real numbers greater than -2 and less than 2 .(b) 

(c) The interval is bounded.

23. (a) The interval $[-5, 2)$ denotes the set of all real numbers greater than or equal to -5 and less than 2 .(b) 

(c) The interval is bounded.

25. $y \geq 0; [0, \infty)$ 27. $10 \leq t \leq 22; [10, 22]$ 29. $W > 65; (65, \infty)$ 31. $|-10| = -(-10) = 10$ 33. $|3 - 8| = |-5| = -(-5) = 5$ 35. $|-1| - |-2| = 1 - 2 = -1$ 37. $\frac{-5}{|-5|} = \frac{-5}{-(-5)} = \frac{-5}{5} = -1$ 39. If $x < -2$, then $x + 2$ is negative.

$$\text{So, } \frac{|x + 2|}{x + 2} = \frac{-(x + 2)}{x + 2} = -1.$$

41. $|-4| = |4|$ because $|-4| = 4$ and $|4| = 4$.43. $-|-6| < |-6|$ because $|-6| = 6$ and $-|-6| = -(6) = -6$.45. $d(126, 75) = |75 - 126| = 51$ 47. $d\left(-\frac{5}{2}, 0\right) = \left|0 - \left(-\frac{5}{2}\right)\right| = \frac{5}{2}$

$$49. d\left(\frac{16}{5}, \frac{112}{75}\right) = \left|\frac{112}{75} - \frac{16}{5}\right| = \frac{128}{75}$$

$$53. d(y, a) = |y - a| \text{ and } d(y, a) \leq 2, \text{ so } |y - a| \leq 2.$$

$$51. d(x, 5) = |x - 5| \text{ and } d(x, 5) \leq 3, \text{ so } |x - 5| \leq 3.$$

Receipts, R	Expenditures, E	R - E
55. \$1880.1	\$2292.8	$ 1880.1 - 2292.8 = \412.7 billion
57. \$2524.0	\$2982.5	$ 2524.0 - 2982.5 = \458.5 billion

$$59. 7x + 4$$

Terms: $7x, 4$

Coefficient: 7

$$61. 4x^3 + \frac{x}{2} - 5$$

Terms: $4x^3, \frac{x}{2}, -5$

Coefficients: $4, \frac{1}{2}$

$$63. 4x - 6$$

$$(a) 4(-1) - 6 = -4 - 6 = -10$$

$$(b) 4(0) - 6 = 0 - 6 = -6$$

$$71. x(3y) = (x \cdot 3)y \quad \text{Associative Property of Multiplication}$$

$$= (3x)y \quad \text{Commutative Property of Multiplication}$$

$$73. \frac{5}{8} - \frac{5}{12} + \frac{1}{6} = \frac{15}{24} - \frac{10}{24} + \frac{4}{24} = \frac{9}{24} = \frac{3}{8}$$

$$75. \frac{2x}{3} - \frac{x}{4} = \frac{8x}{12} - \frac{3x}{12} = \frac{5x}{12}$$

$$77. (a) \text{ Because } A > 0, -A < 0.$$

The expression is negative.

$$(b) \text{ Because } B < A, B - A < 0.$$

The expression is negative.

$$(c) \text{ Because } C < 0, -C > 0.$$

The expression is positive.

$$(d) \text{ Because } A > C, A - C > 0.$$

The expression is positive.

$$65. -x^2 + 5x - 4$$

$$(a) -(-1)^2 + 5(-1) - 4 = -1 - 5 - 4 = -10$$

$$(b) -(1)^2 + 5(1) - 4 = -1 + 5 - 4 = 0$$

$$67. \frac{1}{(h+6)}(h+6) = 1, h \neq -6$$

Multiplicative Inverse Property

$$69. 2(x+3) = 2 \cdot x + 2 \cdot 3$$

Distributive Property

$$79. \text{ False. Because 0 is nonnegative but not positive, not every nonnegative number is positive.}$$

$$81. (a)$$

n	0.0001	0.01	1	100	10,000
$5/n$	50,000	500	5	0.05	0.0005

$$(b) (i) \text{ As } n \text{ approaches 0, the value of } 5/n \text{ increases without bound (approaches infinity).}$$

$$(ii) \text{ As } n \text{ increases without bound (approaches infinity), the value of } 5/n \text{ approaches 0.}$$

Section P.2 Solving Equations

$$1. \text{ equation}$$

$$3. \text{ extraneous}$$

$$5. \quad x + 11 = 15$$

$$x + 11 - 11 = 15 - 11$$

$$x = 4$$

$$7. \quad 7 - 2x = 25$$

$$7 - 7 - 2x = 25 - 7$$

$$-2x = 18$$

$$\frac{-2x}{-2} = \frac{18}{-2}$$

$$x = -9$$

9. $4y + 2 - 5y = 7 - 6y$

$4y - 5y + 2 = 7 - 6y$

$-y + 2 = 7 - 6y$

$-y + 6y + 2 = 7 - 6y + 6y$

$5y + 2 = 7$

$5y + 2 - 2 = 7 - 2$

$5y = 5$

$\frac{5y}{5} = \frac{5}{5}$

$y = 1$

11. $x - 3(2x + 3) = 8 - 5x$

$x - 6x - 9 = 8 - 5x$

$-5x - 9 = 8 - 5x$

$-5x + 5x - 9 = 8 - 5x + 5x$

$-9 \neq 8$

No solution

13. $\frac{3x}{8} - \frac{4x}{3} = 4$ or $\frac{3x}{8} - \frac{4x}{3} = 4$

$\frac{9x}{24} - \frac{32x}{24} = 4$ $24\left(\frac{3x}{8} - \frac{4x}{3}\right) = 24(4)$

$-\frac{23x}{24} = 4$ $9x - 32x = 96$

$-23x = 96$

$-\frac{23x}{24}\left(-\frac{24}{23}\right) = 4\left(-\frac{24}{23}\right)$ $x = -\frac{96}{23}$

$x = -\frac{96}{23}$

The second method is easier. The fractions are eliminated in the first step.

21. $\frac{2}{(x-4)(x-2)} = \frac{1}{x-4} + \frac{2}{x-2}$ Multiply both sides by $(x-4)(x-2)$.

$2 = 1(x-2) + 2(x-4)$

$2 = x - 2 + 2x - 8$

$2 = 3x - 10$

$12 = 3x$

$4 = x$

A check reveals that $x = 4$ is an extraneous solution—it makes the denominator zero. There is no real solution.

23. $\frac{1}{x-3} + \frac{1}{x+3} = \frac{10}{x^2-9}$

$\frac{1}{x-3} + \frac{1}{x+3} = \frac{10}{(x+3)(x-3)}$ Multiply both sides by $(x+3)(x-3)$.

$1(x+3) + 1(x-3) = 10$

$2x = 10$

$x = 5$

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

$3(5x-4) = 2(5x+4)$

$15x - 12 = 10x + 8$

$5x = 20$

$x = 4$

17. $10 - \frac{13}{x} = 4 + \frac{5}{x}$

$\frac{10x-13}{x} = \frac{4x+5}{x}$

$10x - 13 = 4x + 5$

$6x = 18$

$x = 3$

19. $\frac{x}{x+4} + \frac{4}{x+4} + 2 = 0$

$\frac{x+4}{x+4} + 2 = 0$

$1 + 2 = 0$

$3 \neq 0$

Contradiction; no solution