

INSTRUCTOR ANSWERS

COLLEGE MATHEMATICS FOR BUSINESS, ECONOMICS, LIFE SCIENCES, AND SOCIAL SCIENCES

FOURTEENTH EDITION

Raymond Barnett

Merritt College

Michael Ziegler

Marquette University

Karl Byleen

Marquette University

Christopher J. Stocker

Marquette University



The author and publisher of this book have used their best efforts in preparing this book. These efforts include the development, research, and testing of the theories and programs to determine their effectiveness. The author and publisher make no warranty of any kind, expressed or implied, with regard to these programs or the documentation contained in this book. The author and publisher shall not be liable in any event for incidental or consequential damages in connection with, or arising out of, the furnishing, performance, or use of these programs.

Copyright © 2019 by Pearson Education, Inc.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher.



ISBN-13: 978-0-13-467595-4

ISBN-10: 0-13-467595-9

ANSWERS

Diagnostic Prerequisite Test







Section references are provided in parentheses following each answer to guide students to the specific content in the book where they can find help or remediation.

1. (A) $(y + z)x$ (B) $(2 + x) + y$ (C) $2x + 3x$ (A.1)
2. $x^3 - 3x^2 + 4x + 8$ (A.2) 3. $x^3 + 3x^2 - 2x + 12$ (A.2)
4. $-3x^5 + 2x^3 - 24x^2 + 16$ (A.2) 5. (A) 1 (B) 1 (C) 2 (D) 3 (A.2) 6. (A) 3 (B) 1 (C) -3 (D) 1 (A.2) 7. $14x^2 - 30x$ (A.2)
8. $6x^2 - 5xy - 4y^2$ (A.2) 9. $(x + 2)(x + 5)$ (A.3)
10. $x(x + 3)(x - 5)$ (A.3) 11. $7/20$ (A.1) 12. 0.875 (A.1)
13. (A) 4.065×10^{12} (B) 7.3×10^{-3} (A.5) 14. (A) 255,000,000 (B) 0,000 406 (A.5) 15. (A) T (B) F (A.1) 16. 0 and -3 are two examples of infinitely many. (A.1) 17. $6x^5y^{15}$ (A.5) 18. $3u^4/v^2$ (A.5)
19. 6×10^2 (A.5) 20. x^6/y^4 (A.5) 21. $u^{7/3}$ (A.6) 22. $3a^2/b$ (A.6)
23. $\frac{5}{9}$ (A.5) 24. $x + 2x^{1/2}y^{1/2} + y$ (A.6) 25. $\frac{a^2 + b^2}{ab}$ (A.4)
26. $\frac{a^2 - c^2}{abc}$ (A.4) 27. $\frac{y^5}{x}$ (A.4) 28. $\frac{1}{xy^2}$ (A.4) 29. $\frac{-1}{7(7 + h)}$ (A.4)
30. $\frac{xy}{y - x}$ (A.6) 31. (A) Subtraction (B) Commutative (+) (C) Distributive (D) Associative (\cdot) (E) Negatives (F) Identity (+) (A.1)
32. (A) 6 (B) 0 (A.1) 33. $4x = x - 4; x = -4/3$ (I.1) 34. $-15/7$ (I.2) 35. $(4/7, 0)$ (I.2) 36. $(0, -4)$ (I.2) 37. $(x - 5y)(x + 2y)$ (A.3) 38. $(3x - y)(2x - 5y)$ (A.3) 39. $3x^{-1} + 4y^{1/2}$ (A.6)
40. $8x^{-2} - 5y^{-4}$ (A.5) 41. $\frac{2}{5}x^{-3/4} - \frac{7}{6}y^{-2/3}$ (A.6) 42. $\frac{1}{3}x^{-1/2} + 9y^{-1/3}$ (A.6) 43. $\frac{2}{7} + \frac{1}{14}\sqrt{2}$ (A.6) 44. $\frac{14}{11} - \frac{5}{11}\sqrt{3}$ (A.6) 45. $x = 0, 5$ (A.7)
46. $x = \pm\sqrt{7}$ (A.7) 47. $x = -4, 5$ (A.7) 48. $x = 1, \frac{1}{6}$ (A.7)
49. $x = -1 \pm \sqrt{2}$ (A.7) 50. $x = \pm 1, \pm\sqrt{5}$ (A.7)

ANSWERS

Chapter 1

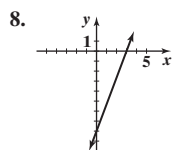
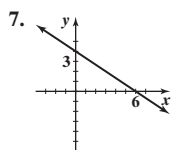
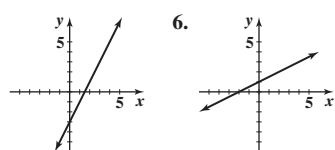
Exercises 1.1

1. $x = 5$ 2. $x = -9$ 3. $x = 2$ 4. $x = -3$ 5. $x = -19$
 6. $x = -2$ 7. $4 \leq x < 13$ 8. $-3 < x \leq 5$ 9. $-2 < x < 7$
 10. $-6 \leq x \leq -1$ 11. $x \leq 4$ 12. $x \geq 9$ 13. $(-8, 2]$ 14. $[-1, 5)$
 15. $(-\infty, 9)$ 16. $[4, \infty)$ 17. $(-7, -5]$ 18. $[-3, 2)$ 19. $x = -\frac{3}{2}$
 20. $m = 14$ 21. $y < -\frac{15}{2}$ 22. $x > -\frac{10}{3}$ 23. $u = -\frac{3}{4}$ 24. $y = \frac{2}{3}$
 25. $x = 10$ 26. $x = 4$ 27. $y \geq 3$ 28. $x \leq 8$ 29. $x = 36$
 30. $y = -6$ 31. $m < \frac{36}{7}$ 32. $u < 16$
 33. $3 \leq x < 7$ or $[3, 7)$ 
 34. $-2 \leq x < 3$ or $[-2, 3)$ 
 35. $-20 \leq C \leq 20$ or $[-20, 20]$ 
 36. $-9 \leq t \leq 9$ or $[-9, 9]$ 
 37. $y = \frac{3}{4}x - 3$ 38. $x = -\frac{3}{2}y + 12$
 39. $y = -(A/B)x + (C/B) = (-Ax + C)/B$ 40. $m = \frac{y-b}{x}$
 41. $C = \frac{5}{9}(F - 32)$ 42. $F = \frac{9}{5}C + 32$ 43. $-2 < x \leq 1$ or $(-2, 1]$


 44. $\frac{14}{3} \leq u \leq 6$ or $[\frac{14}{3}, 6]$
 45. Negative 46. Positive 47. 4,500 \$35

tickets and 5,000 \$55 tickets 48. 30 quarters; 70 dimes 49. Fund A: \$180,000; Fund B: \$320,000 50. Fund A: \$340,000; Fund B: \$160,000 51. \$15,405
 52. \$24,493 53. (A) \$420 (B) \$55 54. (A) \$51 (B) \$160 55. 34 rounds
 56. 12 times 57. \$32,000 58. (A) \$20,000 (B) \$24,493 (C) Choose the payment method with the larger base salary unless you can sell more than \$52,000 per month. 59. 5,851 books 60. 7,132 books 61. (B) 6,180 books
 (C) At least \$11.50 62. (B) 7,480 books (C) At least \$15.60 63. 5,000
 64. $-45 \leq C \leq -10$ 65. 12.6 yr 66. 9.6 to 16.8

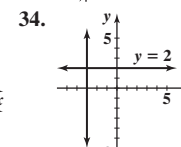
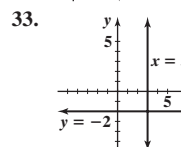
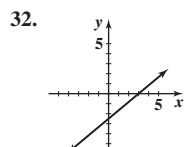
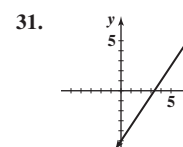
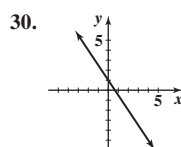
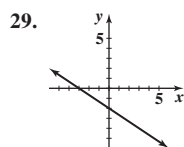
Exercises 1.2

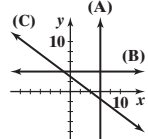
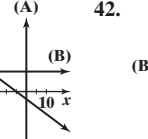
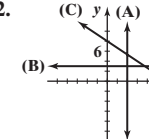
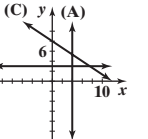
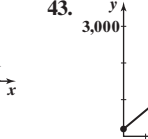
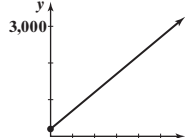
1. (D) 2. (A) 3. (C) 4. (B) 5.

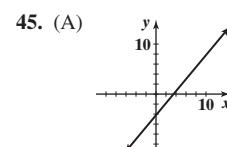
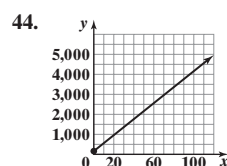


9. Slope = 5; y int. = -7
 10. Slope = 3; y int. = 2
 11. Slope = $-\frac{5}{2}$; y int. = -9
 12. Slope = $-\frac{10}{3}$; y int. = 4

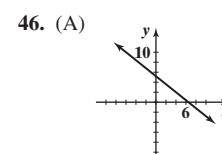
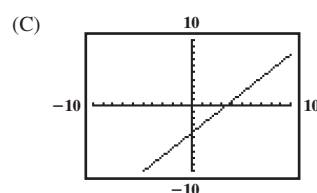
13. Slope = $\frac{1}{4}$; y int. = $\frac{2}{3}$ 14. Slope = $\frac{1}{5}$; y int. = $-\frac{1}{2}$
 15. Slope = 2; x int. = -5 16. Slope = -4; x int. = 3
 17. Slope = 8; x int. = 5 18. Slope = -3; x int. = 2
 19. Slope = $\frac{6}{7}$; x int. = -7 20. Slope = $-\frac{9}{2}$; x int. = $\frac{4}{9}$ 21. $y = 2x + 1$
 22. $y = x + 5$ 23. $y = -\frac{1}{3}x + 6$ 24. $y = \frac{6}{7}x - \frac{9}{2}$
 25. x int.: $\frac{1}{2}$; y int.: 1; $y = -2x + 1$ 26. x int.: 1; y int.: 3; $y = -3x + 3$
 27. x int.: -3; y int.: 1; $y = \frac{x}{3} + 1$ 28. x int.: 2; y int.: -1; $y = \frac{x}{2} - 1$



35. -4 36. 5 37. $-\frac{3}{5}$ 38. $\frac{2}{3}$ 39. 2 40. $\frac{1}{8}$
 41. (C)  (A)  (B) 
 42. (C)  (A) 
 43. 

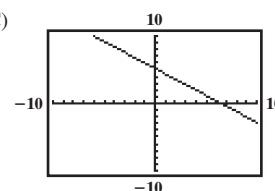


- (B) x int.: 3.5; y int.: -4.2



- (D) x int.: 3.5; y int.: -4.2

- (B) x int.: 6.5; y int.: 5.2 (C)



- (D) x int.: 6.5; y int.: 5.2

47. $x = 4, y = -3$ 48. $x = -5, y = 6$ 49. $x = -1.5, y = -3.5$

50. $x = 2.6, y = 3.8$ 51. $y = 5x - 15$ 52. $y = 4x + 6$

53. $y = -2x + 7$ 54. $y = -10x + 15$ 55. $y = \frac{1}{3}x - \frac{20}{3}$

56. $y = \frac{2}{7}x - 1$ 57. $y = -3.2x + 30.86$ 58. $y = 0.9x + 4.63$

59. (A) $m = \frac{2}{3}$ (B) $-2x + 3y = 11$ (C) $y = \frac{2}{3}x + \frac{11}{3}$

60. (A) $m = \frac{3}{2}$ (B) $3x - 2y = -1$ (C) $y = \frac{3}{2}x + \frac{1}{2}$

61. (A) $m = -\frac{5}{4}$ (B) $5x + 4y = -14$ (C) $y = -\frac{5}{4}x - \frac{7}{2}$

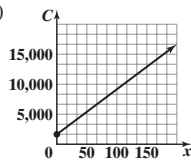
62. (A) $m = -\frac{4}{5}$ (B) $4x + 5y = 23$ (C) $y = -\frac{4}{5}x + \frac{23}{5}$

63. (A) Not defined (B) $x = 5$ (C) None 65. (A) $m = 0$ (B) $y = 5$

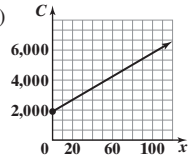
(C) $y = 5$ 66. (A) Not defined (B) $x = 2$ (C) None 67. The graphs

 have the same y int., (0, 2). 68. The graphs have the same slope, -0.5 .

69. $C = 124 + 0.12x$; 1,050 donuts 70. $C = 1,200 + 45x$; 80 picnic tables

71. (A) $C = 75x + 1,647$ (B)  (C) The y int., \$1,647,

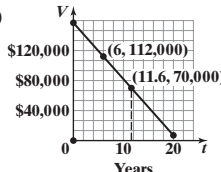
is the fixed cost and the slope, \$75, is the cost per club.

72. (A) $C = 39x + 1,905$ (B)  (C) The y int., \$1,905,

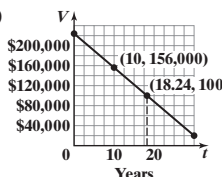
is the fixed cost, and the slope, \$39, is the cost per racket.

73. (A) $R = 1.4C - 7$ (B) \$137 74. (A) $R = 1.5C + 3$ (B) \$158

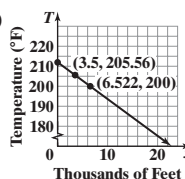
75. (A) $V = -7,500t + 157,000$ (B) \$112,000 (C) During the 12th year

(D)  76. (A) $V = -6,800t + 224,000$

(B) \$156,000 (C) During the 19th year

(D) 

77. (A) $T = -1.84x + 212$ (B) 205.56°F (C) 6,522 ft

(D)  78. (A) $T = 14x - 206.6$ (B) 227.4°F

(C) 28.97 inHg (D) 

79. (A) $T = 70 - 3.6A$ (B) 10,000 ft 80. (A) $T = 3.2A + 200$

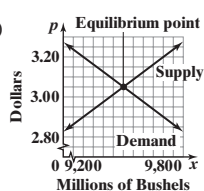
(B) 220.8 mph 81. (A) $N = -0.0063t + 2.76$ (B) 2.45 persons

82. (A) $I = 1,031t + 30,000$ (B) \$71,240 83. (A) $f = -0.49t + 21$

(B) 2028 84. (A) $m = -0.6t + 25.7$ (B) 2031 85. (A) $p = 0.001x + 5.4$

(B) $p = -0.001x + 13$ (C) (3,800, 9.2) (D) 

86. (A) $p = 0.0005x - 1.7$ (B) $p = -0.0005x + 7.8$ (C) (9,500, 3.05)

(D)  87. (A) $s = \frac{2}{5}w$ (B) 8 in. (C) 9 lb

88. (A) $d = -4w + 30$ (B) 30 in. (C) 7.5 lb

Exercises 1.3

1. (A) $w = 49 + 1.7h$ (B) The rate of change of weight with respect to

height is 1.7 kg/in. (C) 55.8 kg (D) 5'6.5" 2. (A) $w = 52 + 1.9h$

(B) The rate of change of weight with respect to height is 1.9 in./kg.

(C) 67.2 kg (D) 5'9.5" 3. (A) $P = 0.445d + 14.7$ (B) The rate of

change of pressure with respect to depth is 0.445 lb/in.² per ft. (C) 37 lb/in.²

(D) 99 ft 4. (A) $P = 0.43d + 14.7$ (B) The rate of change of pressure

with respect to depth is 0.43 lb/in.² per ft. (C) 36.3 lb/in.² (D) 102 ft

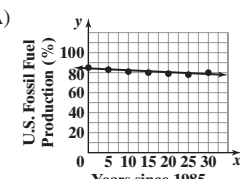
5. (A) $a = 2,880 - 24t$ (B) -24 ft/sec (C) 24 ft/sec

6. (A) $a = -16t + 2,880$ (B) -16 ft/sec (C) 16 ft/sec

7. $s = 0.6t + 331$; the rate of change of the speed of sound with respect

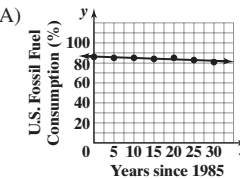
to temperature is 0.6 m/s per °C. 8. $x = 3.9t + 1,403$; the rate of change

of the speed of sound with respect to temperature is 3.9 m/s per °C.

9. (A)  (B) The rate of change of fossil fuel

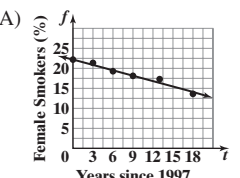
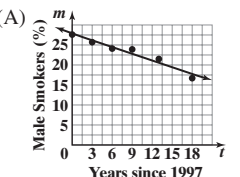
production is -0.19% per year.

(C) 76% of total production (D) 2058

10. (A)  (B) The rate of change of fossil fuel

consumption is -0.14% per year.

(C) 81% (D) 2030

11. (A)  12. (A) 

(B) 2025

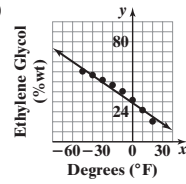
(B) 2029

13. (A)  (B) 1,050,000 (C) 1,359,000

14. (A)  (B) 6,428,000 (C) 10,339,000

15. (A)  (B) \$662 billion

16. (A)
- 
- (B) \$37.2 billion

17. (A)
- 
- (B) 2°F (C) 22.75%

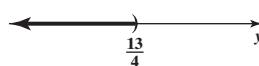
18. (A)
- 
- (B) 7°F (C) 25.9%


19. (A) The rate of change of height with respect to Dbh is 1.37 ft/in. (B) Height increases by approximately 1.37 ft. (C) 18 ft (D) 20 in.
20. (A) The rate of change of height with respect to Dbh is 1.66 ft/in. (B) Height increases by approximately 1.66 ft. (C) 15 ft (D) 18 in.
21. (A) Undergraduate male enrollment is increasing at a rate of 87,000 students per year; undergraduate female enrollment is increasing at a rate of 140,000 students per year. (B) Male: 8.6 million; female: 11.5 million (C) 2026
22. (A) Graduate male enrollment is increasing at a rate of 11,000 students per year; graduate female enrollment is increasing at a rate of 31,000 students per year. (B) Male: 1.3 million; female: 2.1 million (C) 2037
23. $y = 0.061x + 50.703$; 54.67°F
24. $y = 0.051x + 30.166$; 33.48 in.
25. Men: $y = -0.070x + 49.058$; women: $y = -0.085x + 54.858$; yes
26. Men: $y = -0.247x + 119.097$; Women: $y = -0.122x + 128.494$; no
27. Supply: $y = 0.2x + 0.87$; demand: $y = -0.15x + 3.5$; equilibrium price = \$2.37
28. Supply: $y = 1.53x + 2.85$; demand: $y = -2.21x + 10.66$; equilibrium price: \$6.05

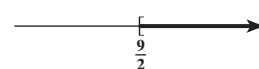
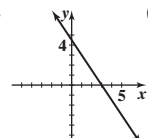
Chapter 1 Review Exercises

- 1.
- $x = 2.8$
- (I.1) 2.
- $x = 2$
- (I.1) 3.
- $y = 1.8 - 0.4x$
- (I.1)

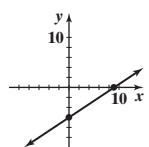
- 4.
- $x = \frac{4}{3}y + \frac{7}{3}$
- (I.1) 5.
- $y < \frac{13}{4}$
- or
- $(-\infty, \frac{13}{4})$

- 
- 6.
- $1 \leq x < 3$
- or
- $[1, 3)$

- 
- 7.
- $x \geq \frac{9}{2}$
- or
- $[\frac{9}{2}, \infty)$

- 
- 8.
- 
- (I.2)

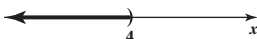
- 9.
- $2x + 3y = 12$
- (I.2) 10.
- x
- int. = 9;
- y
- int. = -6; slope =
- $\frac{2}{3}$
- (I.2)


- 11.
- $y = -\frac{2}{3}x + 6$
- (I.2)
- 

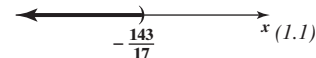
12. Vert. line:
- $x = -6$
- ; hor. line:
- $y = 5$
- (I.2) 13. (A)
- $y = -\frac{2}{3}x$

- (B)
- $y = 3$
- (I.2) 14. (A)
- $3x + 2y = 1$
- (B)
- $y = 5$
- (C)
- $x = -2$
- (I.2)


- 15.
- $x = \frac{25}{2}$
- (I.1) 16.
- $u = 36$
- (I.1) 17.
- $x = \frac{30}{11}$
- (I.1) 18.
- $x = 21$
- (I.1)

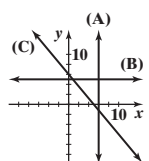
- 19.
- $x = 4$
- (I.1) 20.
- $x < 4$
- or
- $(-\infty, 4)$
- (I.1)
- 

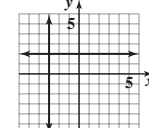
- 21.
- $x \geq 1$
- or
- $[1, \infty)$
- (I.1)
- 

- 22.
- $x < -\frac{143}{17}$
- or
- $(-\infty, -\frac{143}{17})$
- 

- 23.
- $1 < x \leq 4$
- or
- $(1, 4]$
- 

- 24.
- $\frac{3}{8} \leq x \leq \frac{7}{8}$
- or
- $[\frac{3}{8}, \frac{7}{8}]$
- 

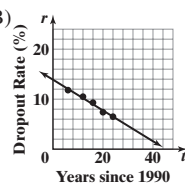
- 25.
- 
- (A) (I.2) 26. The graph of
- $x = -3$
- is a vert. line with
- x
- int. -3, and the graph of
- $y = 2$
- is a hor. line with
- y
- int. 2. (I.2)



27. (A) An oblique line through the origin with slope
- $-\frac{3}{4}$
- (B) A vert. line with
- x
- int.
- $-\frac{4}{3}$
- (C) The
- x
- axis (D) An oblique line with
- x
- int. 12 and
- y
- int.

- 9 (I.2) 28. $\frac{2A - bh}{h}$ (I.1) 29. $\frac{S - P}{St}$ (I.1) 30. $a < 0$ and b any real number (I.1) 31. Less than (I.1) 32. The graphs appear to be perpendicular to each other. (It can be shown that if the slopes of two slant lines are the negative reciprocals of each other, then the two lines are perpendicular.) (I.2)
33. \$75,000 (I.1) 34. 9,375 DVDs (I.1) 35. (A) $m = 132 - 0.6x$ (B) $M = 187 - 0.85x$ (C) Between 120 and 170 beats per minute (D) Between 102 and 144.5 beats per minute (I.3)
36. (A) $V = 224,000 - 15,500t$ (B) \$38,000 (I.2) 37. (A) $R = 1.6C$ (B) \$192 (C) \$110 (D) The slope is 1.6. This is the rate of change of retail price with respect to cost. (I.2)
38. \$400; \$800 (I.1) 39. Demand: $p = 5.24 - 0.00125x$; 1,560 bottles (I.2)

40. (A)
- 
- (B) -30°F (C) 45% (I.3)

41. (A) The dropout rate is decreasing at a rate of 0.308 percentage points per year. (B)
- 
- (C) 2026 (I.3)

42. (A) The CPI is increasing at a rate of 4.295 units per year. (B) 276.62 (I.3)
43. (A) The rate of change of tree height with respect to Dbh is 0.74. (B) Tree height increases by about 0.74 ft. (C) 21 ft (D) 16 in. (I.3)