A Survey of Mathematics with Applications 12th edition Angel Solutions Manual

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Chapter One: Critical Thinking Skills

Section 1.1: Inductive and Deductive Reasoning

1. Natural
2. Divisible
3. Counterexample
4. Hypothesis
5. Inductive
6. Deductive
7. Deductive
8. Inductive
9. $5 \times 5 = 25$
10. $19 \times 10 = 190$
11. $1 \quad \underset{(1+4)}{5} \quad \underset{(4+6)}{10} \quad \underset{(4+6)}{10} \quad \underset{(1+4)}{5} \quad 1$
12. $100{,}000 = 10^5$
13. 
14. 
15. 
16. 
17. 9, 11, 13 (Add 2 to previous number.)
18. 16, 19, 22 (Add 3 to the previous number.)
19. 16, –32, 64 (Multiply previous number by –2.)
20. -243, 729, -2187 (Multiply by –3.)
21. $\frac{1}{5}, \frac{1}{6}, \frac{1}{7}$ (Increase denominator value by 1.)
22. $\frac{9}{10}, \frac{11}{12}, \frac{13}{14}$ (Increase denominator and numerator values by 2.)
23. 34, 55, 89 (Each number in the sequence is the sum of the previous two numbers.)
24. 76, 123, 199 (Each number in the sequence is the sum of the previous two numbers.)
25. The product of two odd numbers is an odd number.
26. The product of an even number and an odd number is an even number.
27. The sum of two even numbers is an even number
28. The sum of two odd numbers is an even number.
29. a) Answers will vary.
    b) Products involving 10 and natural numbers will have a ones digit 0.
30. a) Answers will vary.
    b) The sum of the digits is 9.
    c) The sum of the digits in the product when a one- or two-digit number is multiplied by 9 is divisible by 9.
31. a) 36, 49, 64
    b) Square the numbers 6, 7, 8, 9 and 10.
    c) $8 \times 8 = 64, 9 \times 9 = 81$; 72 is not a square number since it falls between the two square numbers 64 and 81.
32. a) 28 and 36
    b) To find the 7th triangular number, add 7 to the 6th triangular number.
    To find the 8th triangular number, add 8 to the 7th triangular number.
    To find the 9th triangular number, add 9 to the 8th triangular number.
    To find the 10th triangular number, add 10 to the 9th triangular number.
    To find the 11th triangular number, add 11 to the 10th triangular number.
    c) $36 + 9 = 45, 45 + 10 = 55, 55 + 11 = 66; 66 + 12 = 78$; 72 is not a triangular number since it falls between the consecutive triangular numbers 66 and 78.
33. Blue: 1, 5, 7, 10, 12; Purple: 2, 4, 6, 9, 11; Yellow: 3, 8
34. a) 19 (Each new row has two additional triangles.)
    b) $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 = 100$

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35. a) \$3700
    b) We are using observation of specific cases to make a prediction.
36. a) \$415
    b) We are using observation of specific cases to make a prediction.
37. a) You should obtain the original number.
    b) You should obtain the original number.
    c) Conjecture: The result is always the original number.
38. a) You should obtain twice the original number.
    b) You should obtain twice the original number.
    c) Conjecture: The result is always twice the original number.
39. a) You should obtain the number 5.
    b) You should obtain the number 5.
    c) Conjecture: The result is always the number 5.
40. a) You should obtain the number 8.
    b) You should obtain the number 8.
    c) Conjecture: The result is always the number 8.
41. $n \to 3n \to 3n+6 \to \frac{3n+6}{3} = \frac{3n}{3} + \frac{6}{3} = n+2 \to n+2-2 = n$
42. $n \to 4n \to 4n+6 \to \frac{4n+6}{2} = \frac{4n}{2} + \frac{6}{2} = 2n+3 \to 2n+3-3 = 2n$
43. $n \to n+1 \to n+(n+1) = 2n+1 \to 2n+1+9 = 2n+10 \to \frac{2n+10}{2} = \frac{2n}{2} + \frac{10}{2} = n+5 \to n+5-n = 5$
44. $n \to n+5 \to n+(n+5) = 2n+5 \to 2n+5+11 = 2n+16 \to \frac{2n+16}{2} = \frac{2n}{2} + \frac{16}{2} = n+8 \to n+8-n = 8$
45. $3 \times 5 = 15$ is a counterexample.
46. $10 + 11 + 12 = 33$, which is not a three-digit number.
47. Two is a counting number. The sum of 2 and 3 is 5. Five divided by two is $\frac{5}{2}$, which is not an even number.
48. 900 is a three-digit number. The product of 900 and 900 is 810,000, which is not a five-digit number.
49. One and two are counting numbers. The difference of 1 and 2 is $1 - 2 = -1$, which is not a counting number.
50. The sum of the odd numbers 1 and 5 is 6, which is not divisible by 4.
51. a) The sum of the measures of the interior angles should be $180°$.
    b) Yes, the sum of the measures of the interior angles should be $180°$.
    c) Conjecture: The sum of the measures of the interior angles of a triangle is $180°$.
52. a) The sum of the measures of the interior angles should be $360°$.
    b) Yes, the sum of the measures of the interior angles should be $360°$.
    c) Conjecture: The sum of the measures of the interior angles of a quadrilateral is $360°$.
53. Inductive reasoning: a general conclusion is obtained from observation of specific cases.
54. Inductive reasoning: a general conclusion is obtained from observation of specific cases.
55. 129; The numbers in the positions of each inner 4×4 square is determined as follows.

$$\begin{matrix} a & b \\ c & a+b+c \end{matrix}$$

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56. 1881, 8008, 8118 (They look the same when looked at in a mirror.)

57. c

Section 1.2: Estimation Techniques

Answers in this section will vary depending on how you round your numbers. The answers may differ from the answers in the back of the textbook. However, your answers should be something near the answers given. All answers are approximate.)

1. Estimation

2. Equal

3. $39.7 + 60.3 + 18 + 1.8$
$\approx 40 + 60 + 20 + 0 = 120$

4. $86 + 47.2 + 289.8 + 532.4 + 12.8$
$\approx 90 + 50 + 290 + 530 + 10 = 970$

5. $197{,}500 \div 4.063 \approx 200{,}000 \div 4.000 =$
$50{,}000$

6. $\frac{1{,}032{,}645}{49{,}827} \approx \frac{1{,}000{,}000}{50{,}000} = 20$

7. $1776 \times 0.0098 \approx 1800 \times 0.01 = 18$

8. $0.63 \times 1523 \approx 0.6 \times 1500 = 900$

9. $23.97 - 7.05 \approx 24 - 7 = 17$

10. $400.15 - 297.87 \approx 400 - 300 = 100$

11. $22\% \times 9116 \approx 20\% \times 9000 = 0.20 \times 9000$
$= 1800$

12. 11% of $8221 \approx 10\%$ of $8000 = 0.10 \times 8000$
$= 800$

13. $\frac{\$91.35}{3} \approx \frac{\$90}{3} = \$30$

14. $\frac{\$210}{8} \approx \frac{\$200}{8} = \$25$

15. 12 months $\times \$47 \approx 12 \times \$50 = \$600$

16. 19 gallons $\times \$3.11 \approx 20 \times \$3 = \$60$

17. $\$7.99 + \$4.23 + \$16.82 + \$3.51 + \$20.12 \approx \$8 + \$4 + \$17 + \$4 + \$20 = \$53$

18. $\$1.29 + \$6.86 + \$12.43 + \$25.62 + \$8.99 \approx \$1 + \$7 + \$12 + \$26 + \$9 = \$55$

19. $95\text{lb} + 127\text{lb} + 210\text{lb} \approx 100 + 100 + 200 = 400\text{lb}$

20. $\frac{\$400}{\$23} \approx \frac{\$400}{\$25} = 16$

21. 20% of $\$49.47 \approx 20\%$ of $\$50 = 0.20 \times \$50 = \$10$

22. 15% of $\$160.36 \approx 15\%$ of $\$160 = 0.15 \times \$160 = \$24$

23. 396 miles with 20.1 gallons $\approx \frac{400}{20} = 20$ miles per gallon

24. 207 miles with 3.8 gallons $\approx \frac{200}{4} = 50$ miles per gallon

25. $\$22 \times 18 \approx \$20 \times 20 = \$400$

26. $\$29 \times 42 \approx \$30 \times 40 = \$1200$

27. $\$4.95 \times 6 \times 52 \approx \$5 \times 6 \times 50 = \$1500$

28. $\$22 \times 28 \times 48 \approx \$20 \times 30 \times 50 = \$30{,}000$

29. $\$595 + \$289 + \$120 + \$110 + 230 \approx \$600 + \$300 + \$100 + \$100 + \$200 = \$1300$

30. Team A: $189 + 172 + 191 \approx 190 + 170 + 190 = 550$
Team B: $183 + 229 + 167 \approx 180 + 230 + 170 = 580$
$580 - 550 = 30$ lb

31. 14 min, 55 sec/mi $\times 3.1$ mi ≈ 15 min/mi $\times 3$ mi $= 45$ min;

32. 10 min, 5 sec/mi $\times 26.2$ mi ≈ 10 min/mi $\times 26$ mi $= 260$ min; $\frac{260 \text{ min}}{60 \text{ min}} \approx 4\frac{1}{3}$ hours $= 4$ hr 20 min

33. $\frac{599 \text{ Mexican pesos}}{20.14 \text{ Mexican pesos/U.S. dollars}} \approx \frac{600}{20} = \$30$

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34. $\frac{1605 \text{ Egyptian pounds}}{19.15 \text{ Egyptian pounds/U.S. dollars}} \approx \frac{1600}{20} = \$80$

35. $\$1619 + \$980 + \$140 \times 2 + \$70 \times 3 = \$1600 + \$1000 + \$300 + \$200 = \$3100$

36. $$\begin{aligned} \$973 + 6(\$61) + 6(\$97) + 6(\$200) &\approx \$970 + 6(\$60) + 6(\$100) + 6(\$200) \\ &= \$970 + \$360 + \$600 + \$1200 \\ &= \$3130 \end{aligned}$$

37. 90 miles

38. 75 miles

39. a) $23\% \text{ of } 700 \approx 25\% \text{ of } 700 = 0.25 \times 700 = 175$
    b) $12\% \text{ of } 700 \approx 10\% \text{ of } 700 = 0.10 \times 700 = 70$
    c) $21\% \text{ of } 700 \approx 20\% \text{ of } 700 = 0.20 \times 700 = 140$

40. a) $18\% \text{ of } 2987 \approx 18\% \text{ of } 3000 = 0.18 \times 3000 = 540$
    b) $42\% \text{ of } 2987 \approx 42\% \text{ of } 3000 = 0.42 \times 3000 = 1260$
    c) $7\% \text{ of } 2987 \approx 7\% \text{ of } 3000 = 0.07 \times 3000 = 210$

41. a) 5 million
    b) 98 million
    c) $98 \text{ million} - 37 \text{ million} = 61 \text{ million}$
    d) $19 \text{ million} + 79 \text{ million} + 84 \text{ million} + 65 \text{ million} + 33 \text{ million} = 280 \text{ million}$

42. a) 19%
    b) 25%
    c) $20\% \text{ of } 179 \text{ lb} \approx 20\% \text{ of } 180 = 0.2 \times 180 = 36 \text{ lb}$

43. a) 85%
    b) $68\% - 53\% = 15\%$
    c) $85\% \text{ of } 70 \text{ million acres} = 59{,}500{,}000 \text{ acres}$
    d) No, since we are not given the area of each state.

44. a) $2(410) + 4(545) \approx 2(400) + 4(500) = 800 + 2000 = 2800 \text{ calories}$
    b) Running: $4(920) \approx 4(900) = 3600 \text{ calories}$
    Walking: $4(330) \approx 4(300) = 1200 \text{ calories}$
    Difference: $3600 - 1200 = 2400 \text{ calories}$
    c) $3(545) + 3(545) \approx 3(550) + 3(550) = 1650 + 1650 = 3300 \text{ calories per week}$
    $3300 \text{ calories per week}(52 \text{ weeks}) \approx 3000 \times 50 = 150{,}000 \text{ calories}$

45. 20

46. 25

47. 120 bananas

48. 100 grapes

49. 150°

50. 315°

51. 10%

52. 25%

53. 9 square units

54. 12 square units

55. 160 feet

56. $4(60) = 240 \text{ in. or } \frac{240}{12} \approx 20 \text{ ft}$

57. Answers will vary.

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58. Cost of one vitamin C tablet: $\frac{\$24.99}{500} \approx \frac{\$25}{500} = \$0.05$

Cost of one fish oil tablet: $\frac{\$47.99}{120} \approx \frac{\$48}{120} = \$0.40$

Cost of one vitamin D tablet: $\frac{\$17.99}{180} \approx \frac{\$18}{180} = \$0.10$

Cost of one multivitamin tablet: $\frac{\$19.99}{80} \approx \frac{\$20}{80} = \$0.25$

Roberto's daily cost: $5 \times \$0.05 + 2 \times \$0.40 + 1 \times \$0.10 + 1 \times \$0.25 = \$1.40$

59. There are 118 ridges around the edge.

60. a) Answers will vary.

b) 11.6 days. There are $24 \cdot 60 \cdot 60 = 86{,}400$ seconds in a day, and $1{,}000{,}000/86{,}400 = 11.5\overline{740}$.

61. Answers will vary.

62. Answers will vary.

63. Answers will vary.

Section 1.3: Problem-Solving Procedures

1. $\frac{1 \text{ in.}}{12 \text{ mi}} = \frac{4.25 \text{ in.}}{x \text{ mi}}$

$x = 12(4.25)$

$x = 51 \text{ mi}$

2. $\frac{1 \text{ in.}}{2.5 \text{ yd}} = \frac{22.4 \text{ in.}}{x \text{ yd}}$

$1x = 2.5(22.4)$

$x = 56 \text{ yd}$

3. $\frac{3 \text{ ft}}{1.2 \text{ ft}} = \frac{x \text{ ft}}{15.36 \text{ ft}}$

$3(15.36) = 1.2x$

$\frac{46.03}{1.2} = \frac{1.2x}{1.2}$

$x = \frac{46.03}{1.2} = 38.4 \text{ ft}$

4. $\frac{6 \text{ ft person}}{2 \text{ ft shadow}} = \frac{x \text{ ft turbine}}{95 \text{ ft shadow}}$

$2x = 6(95)$

$x = \frac{570}{2} = 285 \text{ ft}$

5. $4 \times \$113 = \$452$

9.25% of $\$452 = 0.0925 \times \$452 = \$41.81$

$\$452 + \$41.81 = \$493.81$

6. $2 \times \$187 = \$374$

9.5% of $\$374 = 0.095 \times \$374 = \$35.53$

$\$374 + \$35.53 = \$409.53$

7. a) $\frac{165 \text{ ft}^2}{12 \text{ ft}^2} = 13.75$, so 14 bags.

b) $\$3.97 \times 14 = \$55.58$

c) 7% of $\$55.58 = 0.07 \times \$55.58 = \$3.8906$; $\$55.58 + \$3.89 = \$59.47$

8. a) $\frac{184 \text{ ft}^2}{3 \text{ ft}^2} = 61.33$, so 62 bags.

b) $\$6.98 \times 62 = \$432.76$

c) 9% of $\$432.76 = 0.09 \times \$432.76 = \$38.95$; $\$432.76 + \$38.95 = \$471.71$

9. a) Transportation: 16.0% of $\$2600 = 0.160 \times \$2600 = \$416.00$

Food: 11.9% of $\$2600 = 0.119 \times \$2600 = \$309.40$

$\$416.00 - \$309.40 = \$106.60$

b) Housing: 34.9% of $\$12600 = 0.349 \times \$2600 = \$907.40$

Healthcare: 8.4% of $\$12600 = 0.084 \times \$2600 = \$218.40$

$\$907.40 - \$218.40 = \$689.00$

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10. a) Business: 19% of $2{,}038{,}431 = 0.19 \times 2{,}038{,}431 = 387{,}302$
Health Professions: 12.6% of $2{,}038{,}431 = 0.126 \times 2{,}038{,}431 = 256{,}842$
$387{,}302 - 256{,}842 = 130{,}460$ degrees

b) Engineering: 6.3% of $2{,}038{,}431 = 0.063 \times 2{,}038{,}431 = 128{,}421$
Psychology: 5.9% of $2{,}038{,}431 = 0.059 \times 2{,}038{,}431 = 120{,}267$
$128{,}421 - 120{,}267 = 8154$ degrees

11. a) $\frac{\$100}{\$21} = 4.76$, so 4 units of 24-pack are affordable $4 \times \$21 = \$84$

$\$100 - \$84 = \$16$, so 1 unit of 12-pack is affordable

number of golf balls $= 4 \times 24 + 12 = 96 + 12 = 108$

b) $\$84 + \$14 = \$98$

12. a) $\frac{\$87}{\$14} = 6.21$, so 6 large pizzas are affordable $6 \times \$14 = \$84$

$\$87 - \$84 = \$3$, so medium pizza is not affordable

$6 \times (12 \text{ slices}) = 72$ slices

b) $\$84$

13. $\$250 + \$130(18) = \$250 + \$2340 = \$2590$
Savings: $\$2590 - \$2500 = \$90$

14. $\$560 + \$55(48) = \$560 + \$2640 = \$3200$
Savings: $\$3200 - \$2800 = \$400$

15. 15-year mortgage: $\$887.63(12)(15) = \$159{,}773.40$
30-year mortgage: $\$572.90(12)(30) = \$206{,}244.00$
Savings: $\$206{,}244.00 - \$159{,}773.40 = \$46{,}470.60$

16. 4 years: $\$795$ per month $\times$ 4 years $= \$795$ per month $\times 4(12 \text{ months}) = \$795 \times 48 = \$38{,}160$

5 years: $\$650$ per month $\times$ 5 years $= \$650$ per month $\times 5(12 \text{ months}) = \$650 \times 60 = \$39{,}000$

Savings: $\$39{,}000 - \$38{,}160 = \$840$

17. Points needed for 90 average: $90(5) = 450$ points
Carissa's points so far: $88 + 96 + 91 + 83 = 358$ points
Grade needed on fifth test: $450 - 358 = 92$

18. Points needed for 80 average: $80(5) = 400$ points
Wallace's points so far: $79 + 93 + 91 + 68 = 331$ points
Grade needed on fifth exam: $400 - 331 = 69$

19. a) $\frac{460}{25} = 18.4$ min
b) $\frac{1550}{50} = 31$ min
c) $\frac{1400}{35} = 40$ min
d) $\frac{2200}{80} = 27.5$ min

20. a) $\frac{460+350}{35} = 23.14$ min
b) $\frac{1400+2200}{50} = 72$ min
c) $\frac{1550+350}{25} = 76$ min
d) $\frac{1550+2200}{80} = 46.88$ min

21. a) $102{,}910.2 \text{ mi} - 102{,}477.1 \text{ mi} = 433.1 \text{ mi}$; $\frac{433.1 \text{ mi}}{14.2 \text{ gal}} \approx 30.5$ mpg

b) $\frac{2(115 \text{ miles})}{30.5 \text{ mpg}} = 7.54$ gal

c) $(7.54 \text{ gal})(\$3.29 \text{ per gallon}) = \$24.81$

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22. a) $72{,}555.4 \text{ mi} - 72{,}257.8 \text{ mi} = 297.6 \text{ mi}; \frac{297.6 \text{ mi}}{19.2 \text{ gal}} \approx 15.5 \text{ mpg}$

    b) $\frac{2(124 \text{ miles})}{15.5 \text{ mpg}} = 16 \text{ gal}$

    c) $(16 \text{ gal})(\$4.23 \text{ per gallon}) = \$67.68$

23. By mail: $(\$52.80 + \$5.60 + \$8.56) \times 4 = \$66.96 \times 4 = \$267.84$
    Tire store: $\$324 + 0.08 \times \$324 = \$324 + \$25.92 = \$349.92$
    Savings: $\$349.92 - \$267.84 = \$82.08$

24. 15,000 ft -3000 ft = 12,000 ft decrease in elevation. Temperature increases $2.4°F$ for every 1000 ft decrease in elevation.
    $12 \times 2.4°F = 28.8°F$ and $-6°F + 28.8°F = 22.8°$F; The precipitation at the airport will be snow.

25. a) 7.5% of \$56.28 is $0.075(\$56.28) = \$4.22$; $\$56.28 + \$4.22 = \$60.50$

    b) 20% of \$56.28 is $0.20(\$56.28) = \$11.26$;

    c) $\$60.50 + \$11.26 = \$71.76$

26. a) $\$175(3) = \$525$

    b) 8.5% of \$525 is $0.085(\$525) = \$44.63$;

    c) $\$75(3) = \$225$

    d) $\$525 + \$44.63 + \$225 = \$794.63$

27. a) $1 \times 60 \times 24 \times 365 = 525{,}600$ oz and $\frac{525{,}600 \text{ oz}}{128} = 4106.25$ gal

    b) $\frac{4106.25}{1000} \times \$11.20 = 4.10625 \times \$11.20 = \$45.99$

28. a) $0.1 \times 60 \times 60 \times 24 \times 365 = 3{,}153{,}600 \text{ cm}^3$

    b) $\frac{\text{Volume of basin}}{\text{Daily water loss}} = \frac{(30 \text{ cm})(20 \text{ cm})(20 \text{ cm})}{0.1 \times 60 \times 60 \times 24} = \frac{12{,}000 \text{ cm}^3}{8640 \text{ cm}^3} \approx 1.4$; It would take about 1.4 days.

29. a) $\frac{20{,}000}{20.8} - \frac{20{,}000}{21.6} \approx 961.538 - 925.926 = 35.612 \approx 35.61$ gal

    b) $35.61 \times \$3.00 = \$106.83$

    c) $140{,}000{,}000 \times 35.61 = 4{,}985{,}400{,}000$ gal

30. a) Parking: $\$30 \times 6 = \$180$
    Tax: 9.5% of $\$180 = 0.095 \times \$180 = \$17.10$
    Total: $\$180 + \$17.10 = \$197.10$

    b) Parking: $\$17.95 \times 6 = \$107.70$
    Tax: 8.75% of $\$107.70 = 0.0875 \times \$107.70 \approx \$9.42$
    Total: $\$107.70 + \$9.42 = \$117.12$

    c) She can save $\$197.10 - \$117.12 = \$79.98$.

31. Cost after 1 year: $\$4.29 + 0.05(\$4.29) = \$4.29 + \$0.21 = \$4.50$

    Cost after second year: $\$4.50 + 0.05(\$4.50) = \$4.50 + \$0.23 = \$4.73$

32. Value after first year: $\$1000 + 0.10(\$1000) = \$1000 + \$100 = \$1100$

    Value after second year: $\$1100 - 0.10(\$1100) = \$1100 - \$110 = \$990$

    \$990 is less than the initial investment of \$1000.

33. After paying the \$100 deductible, Yungchen must pay 20% of the cost of x-rays.

    First x-ray: $\$100 + 0.20(\$620) = \$100 + \$124 = \$224$

    Second x-ray: $0.20(\$980) = \$196$

    Total: $\$224 + \$196 = \$420$

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34. a) $\$130 + \$215 + \$55 = \$400$

b) $\$25 + \$215(100\% - 90\%) + \$55(100\% - 80\%) = \$25 + \$215(10\%) + \$55(20\%) =$
$\$25 + \$215(0.1) + \$55(0.2) = \$25 + \$21.5 + \$11.0 = \$57.5$

35. a) $\frac{\$425}{\$240} = 1.77;$ 1 box of 20
$\$425 - \$240 = \$185;$ 1 box of 12
1 box of 20 and 1 box of 12.

b) $\$240 + \$180 = \$420$

36. a) $\frac{\$1100}{\$240} = 4.58;$ 4 boxes of 20 can be purchased, the remaining amount is:
$\$1100 - \$240(4) = \$1100 - \$960 = \$140,$ which is not enough for box of 12;
In case of purchasing 3 boxes of 20, remaining amount is:
$\$1100 - \$240(3) = \$1100 - \$720 = \$380; \frac{\$380}{180} = 2.11;$ 2 boxes of 12.
3 boxes of 20 and 2 boxes of 12.

b) $\$240(3) + \$180(2) = \$1080$

37. $1\ \text{ft}^2 = 12\ \text{in.} \times 12\ \text{in.} = 144$ square inches

38. $1\ \text{ft}^3 = 12\ \text{in.} \times 12\ \text{in.} \times 12\ \text{in.} = 1728$ cubic inches

39. Area of original rectangle: lw
Area of new rectangle: $(2l)(2w) = 4(lw)$
Thus, if the length and width of a rectangle are doubled, the area is 4 times as large.

40. $20\text{ft} \times 20\text{ft} = 400\text{ft}^2; 5\text{ft} \times 5\text{ft} = 25\ \text{ft}^2; \frac{400\text{ft}^2}{25\text{ft}^2} = 16\text{squares}$

41. Volume of original cube: lwh
Volume of new cube: $(2l)(2w)(2h) = 8(lwh)$
Thus, if the length, width, and height of a cube are doubled, the volume is 8 times as large.

42. 11 ft is one-sixth of the pole, so the length is $6 \times 11\ \text{ft} = 66\ \text{ft}$.

43. a) Chili powder: $(3\ \text{tsp}) \times \frac{4}{6} = 2\ \text{tsp}$

Cayenne pepper: $\left(\frac{1}{4}\ \text{tsp}\right)\frac{4}{6} = \frac{1}{6}\ \text{tsp}$

b) $\frac{3\ \text{tsp}}{6\ \text{servings}} = \frac{5\ \text{tsp}}{x\ \text{servings}};\ x = \frac{5\ \text{tsp}(6\ \text{servings})}{3\ \text{tsp}} = 10\ \text{servings}$

44. a) Chopped garlic: $(1\ \text{tbs}) \times \frac{3}{4} = \frac{3}{4}\ \text{tbs}$

Chopped red onion: $(5\ \text{tbs})\frac{3}{4} = \frac{15}{4}\ \text{tbs} = 3\frac{3}{4}\ \text{tbs}$

b) Chopped garlic: $\frac{1\ \text{tbs}}{4\ \text{avocados}} = \frac{x\ \text{tbs}}{6\ \text{avocados}};\ x = \frac{1\ \text{tbs}\ (6\ \text{avocados})}{4\ \text{avocados}} = \frac{6}{4}\ \text{tbs} = 1\frac{1}{2}\ \text{tbs}$

Chopped red onion: $\frac{5\ \text{tbs}}{4\ \text{avocados}} = \frac{x\ \text{tbs}}{6\ \text{avocados}};\ x = \frac{5\ \text{tbs}\ (6\ \text{avocados})}{4\ \text{avocados}} = \frac{30}{4}\ \text{tbs} = 7\frac{1}{2}\ \text{tbs}$

45.

Left side	Right side
$1(-6) = -6$	$1(2) = 2$
$2(-2) = -4$	$1(3) = 3$
	$(6) = 6$
$-6 + (-4) = -10$	$2 + 3 + 6 = 11$

Place it at –1, so the left side would total $-10 + (-1) = -1$.

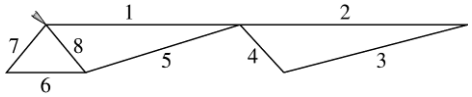
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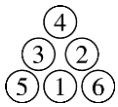
46. There are 10 palindromes: 2002, 2112, 2222, 2332, 2442, 2552, 2662, 2772, 2882, 2992.

47. a) refresh
    b) workout

48. Answers will vary.



49.



50. Eight pieces

51.

8	6	16
18	10	2
4	14	12

52.

10	5	6
3	7	11
8	9	4

53. $8 + 6 + 2 + 4 = 20$; $3 + 7 + 5 + 1 = 16$; $10 + 14 + 12 + 8 = 44$
The sum of the four corner entries is 4 times the number in the center of the middle row.

54. 45,36,99; Multiply the number in the center of the middle row by 9.

55. $3 \times 2 \times 1 = 6$ ways

56. $35 - 15 = 20$ cubes

57. Other answers are possible, but 1 and 8 must appear in the center.

	7	
3	1	4
5	8	6
	2	

58. Each salesperson shakes hands with four people.

59. a) Since \$10,256 is less than \$11,000, the federal income taxes Horace must pay is
$\$10{,}256 \times 10\% = \$10{,}256 \times 0.10 = \$1025.60$

    b) Since \$63,478 is greater than \$44,726 and less than \$95,375, the federal income taxes Shelby must pay is $\$5147 + (\$63{,}478 - \$44{,}725) \times 22\% = \$5147 + \$18{,}752 \times 0.22 = \$5147 + \$4125{,}44 = \$9272.66$

60. a) Since \$37,851 is greater than \$11,000 and less than \$44,725, the federal income taxes Destani must pay is $\$1100 + (\$37{,}851 - \$11{,}000) \times 12\% = \$1100 + \$26{,}851 \times 0.12 = \$1100 + \$3222.12 = \$4322.12$

    b) Since \$671,425 is greater than \$578,126, the federal income taxes Katina must pay is $\$174{,}238.25 + (\$671{,}425 - \$578{,}125) \times 37\% = \$174{,}238.25 + \$93300 \times 0.37 = \$174{,}238.25 + \$34521 = 208{,}759.25$

61. a) Since \$876 is less than $10\% \times \$11{,}000 = \$1100$, Shenile's tax was 10% of her taxable income. Her taxable income was $\frac{\$876}{0.10} = \$8760$.

    b) Since \$2017.50 is greater than \$1100 and less than \$4472.50, Logan's taxable income was in the 12% bracket. Since $\$2017.50 - \$1100.00 = \$917.50$ was 12% of his taxable income above \$11,000, he made an additional $\frac{\$917.50}{0.12} = \$7645.83$. His taxable income was $\$11{,}000 + \$7645.83 = \$18{,}645.83$.

62. a) Since \$7132.28 is greater than \$5147 and less than \$16,290, Desmond's taxable income was in the 22% bracket. Since $\$7132.28 - \$5147 = \$1985.28$ was 22% of his taxable income above \$44,725, he made an additional $\frac{\$1985.28}{0.22} = \$9024$. His taxable income was $\$44{,}725 + \$9024 = \$53{,}749$.

    b) Since \$46,721 is greater than \$37,104 and less than \$52,832, Yasmine's taxable income was in the 32% bracket. Since $\$46{,}721 - \$37{,}104 = \$9617$ was 32% of his taxable income above \$182,100, she made an additional $\frac{\$9617}{0.32} = \$30{,}053.13$. Her taxable income was $\$182{,}100 + \$30{,}053.13 = \$212{,}153.13$

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63. Other answers are possible.

1	2	3	4	5
2	3	4	5	1
3	4	5	1	2
4	5	1	2	3
5	1	2	3	4

64. With umbrella policy:

Mustang reduced premium: $\$1648 - \$90 = \$1558$

Focus reduced premium: $\$1530 - 0.12(\$1530) = \$1530 - \$183.60 = \$1346.40$

Total for umbrella policy: $\$1558 + \$1346.40 + \$450 = \$3354.40$

Without umbrella policy: $\$1648 + \$1530 = \$3178$

Net amount for umbrella policy: $\$3354.40 - \$3178 = \$176.40$

65. Mark plays the drums.

66. $16 + 16 + 4 + 4 + 4 = 44$

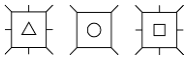
67. The areas of the colored regions are $1 \times 1, 1 \times 1, 2 \times 2, 3 \times 3, 5 \times 5, 8 \times 8, 13 \times 13, 21 \times 21$.

$1 + 1 + 4 + 9 + 25 + 64 + 169 + 441 = 714$ square units

68. Thomas would have opened the box labeled *grapes and cherries*. Because all the boxes are labeled incorrectly, whichever fruit he pulls from the box of grapes and cherries, will be the only fruit in that box. If he pulled a grape, he labeled the box *grape*. If he pulled a cherry, he labeled the box *cherries*. That left two boxes whose original labels were incorrect. Because all labels must be changed, there was only one way for Thomas to assign the two remaining labels.

69. no short answer

Review Exercises

1. 23, 28, 33 (Add 5 to previous number.)
2. 16, 13, 10 (Subtract 3 from previous number)
3. 64, –128, 256 (Multiply previous number by –2.)
4. 25, 32, 40 $(19 + 6 = 25, 25 + 7 = 32, 32 + 8 = 40)$
5. 10, 4, –3 (Subtract 1, then 2, then 3, …)
6. $\frac{3}{8}, \frac{3}{16}, \frac{3}{32}$ (Multiply previous number by $\frac{1}{2}$.)
7. 
8. 
9. c
10. a) The final number is twice the original number.
    b) The final number is twice the original number.
    c) Conjecture: The final number is twice the original number.
    d) $n \to 10n \to 10n + 5 \to \frac{10n+5}{5} = \frac{10n}{5} + \frac{5}{5} = 2n + 1 \to 2n + 1 - 1 = 2n$
11. This process will always result in an answer of 3.

    $n \to n + 5 \to 6(n + 5) = 6n + 30 \to 6n + 30 - 12 = 6n + 18 \to \frac{6n+18}{2} = \frac{6n}{2} + \frac{18}{2} = 3n + 9 \to \frac{3n+9}{3} = \frac{3n}{3} + \frac{9}{3} = n + 3 \to, n + 3 - n = 3$
12. $1^2 + 2^2 = 5$ and 5 is an odd number. Other answers are possible.

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Answers for Exercises 13–25 will vary depending on how you round your numbers. The answers may differ from the answers in the back of the textbook. However, your answers should be something near the answers given. All answers are approximate.

13. $205{,}123 \times 4002 \approx 200{,}000 \times 4000$
$= 800{,}000{,}000$

14. $215.9 + 128.752 + 3.6 + 861 + 792$
$\approx 200 + 100 + 0 + 900 + 800 = 2000$

15. 21% of $2095 \approx 20\%$ of 2000
$= 0.20 \times 2000 = 400$

16. Answers will vary.

17. 48 bricks $\times \$3.97 \approx 50 \times 4 = \$200$

18. 8% of $\$21{,}000 \approx 8\%$ of $20{,}000$
$= 0.08 \times 20{,}000 = \$1600$

19. $\frac{1.1 \text{ mi}}{22 \text{ min}} \approx \frac{1 \text{ mi}}{20 \text{ min}} = \frac{3 \text{ mi}}{60 \text{ min}} = 3$ mph

20. $\$2.49 + \$0.79 + \$1.89 + \$0.10 + \$2.19 + \$6.75$
$\approx \$2 + \$1 + \$2 + \$0 + \$2 + \$7 = \$14.00$

21. $5 \text{ in.} = \frac{20}{4} \text{ in.} = 20\left(\frac{1}{4}\right) \text{ in.} = 20(0.1) \text{ mi}$
$= 2$ mi

22. Approximately $70°F - 30°F = 40°F$

23. Approximately $90°F - 80°F = 10°F$

24. 13 square units

25. Length: 1.75 in., $1.75(1.25) = 21.875 \approx 22$ ft
Height: 0.625 in., $0.625(12.5) = 7.8125 \approx 8$ ft

26. $\$50 + \$40(12) = \$530$
Savings:$\$530 - \$500 = \$30$

27. $4(\$1.99) = \$7.96$ for four six-packs
Savings: $\$7.96 - \$4.99 = \$2.97$

28. Freemac: $\$15 \times 4 \times 2 = \$120$
Sylvan: $\$25 \times 4$ hours $= \$100$
$\$120 - \$100 = \$20$
Sylvan Rental is less expensive by $20.

29. Cost per person with 5 people: $\frac{\$445}{5} = \$89$
Cost per person with 5 people: $\frac{\$510}{6} = \$85$
Savings: $\$89 - \$85 = \$4$

30. a) $\frac{30 \text{ lb}}{2500 \text{ ft}^2} = \frac{x}{24{,}000 \text{ ft}^2}$
$x = \frac{30 \times 24{,}000}{2500}$
$x = 288$ lb

b) $\frac{150\text{lb}}{30\text{lb/bag}} = 5$ bags; $5 \times 2500 = 12{,}500$ ft^2

31. 10% of $\$1030 = 0.10 \times \$1030 = \$103$
$7 \times \$103 = \$721$
Savings: $\$721 - \$60 = \$661$

32. $\frac{1.5 \text{ mg}}{10 \text{ lb}} = \frac{x \text{ mg}}{52 \text{ lb}}$
$10x = 52(1.5)$
$\frac{10x}{10} = \frac{78}{10}$
$x = 7.8$ mg

33. $\$5500 - 0.30(\$5500) = \$5500 - \$1650 = \$3850$ take-home; 28% of $\$3850 = 0.28 \times \$3850 = \$1078$

34. 9 A.M. Eastern is 6 A.M. Pacific, from 6 A.M. Pacific to 1:35 P.M. Pacific is 7 hr 35 min,
7 hr 35 min − 50 min stop = 6 hr 45 min.

35. 3 P.M. $-$ 4 hr $=$ 11 A.M.; July 26, 11:00 A.M.

36. a) $\frac{65\text{mi}}{1\text{hr}} \times \frac{1.6\text{km}}{\text{mi}} = \frac{104\text{km}}{1\text{hr}} \approx 104\text{km/hr}$
b) $\frac{90\text{km}}{1\text{hr}} \times \frac{1\text{mi}}{1.6\text{km}} = \frac{90\text{mi}}{1.6\text{km}} \approx 56.25\text{mi/hr}$

37. Each figure has an additional two dots. To get the hundredth figure, 97 more figures must be drawn, $97(2) = 194$ dots added to the third figure. Thus, $194 + 7 = 201$.

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38.

21	7	8	18
10	16	15	13
14	12	11	17
9	19	20	6

39.

23	25	15
13	21	29
27	17	19

40. 59 min 59 sec; Since it doubles every second, the jar was half full 1 second earlier than 1 hour.

41. 6

42. Nothing. Each friend paid \$9 for a total of \$27; \$25 to the hotel, \$2 to the clerk. \$25 for the room + \$3 for each friend + \$2 for the clerk = \$30

43. Let x =the score on the fifth exam

$$\frac{93+88+81+86+x}{5} = 80$$

$$\frac{348+x}{5} = 80,$$

$$348+x = 400,$$

$$x = 52$$

44. a) $\$79.43 \times 7\% = \$79.43 \times 0.07 = \$5.56$; $\$79.43 + \$5.56 = \$84.99$

b) $\$79.43 \times 25\% = \$79.43 \times 0.25 = \$19.86$

c) $\$79.43 + \$5.56 + \$19.86 = \$104.85$

45. $6 \text{ cm} \times 6 \text{ cm} \times 6 \text{ cm} = 216 \text{ cm}^3$

46. Place six coins in each pan with one coin off to the side. If it balances, the heavier coin is the one on the side. If the pan does not balance, take the six coins on the heavier side and split them into two groups of three. Select the three heavier coins and weigh two coins. If the pan balances, it is the third coin. If the pan does not balance, you can identify the heavier coin.

47. $1 + 500 = 501, 2 + 499 = 501, \ldots$; There are 250 such pairs and $250(501) = 125{,}250$.

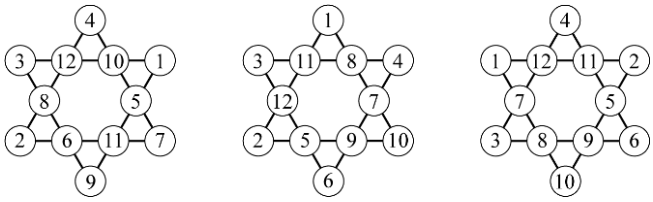
48. 4 green weigh the same as 8 blue, 2 yellow weigh the same as 5 blue, 2 white weigh the same as 3 blue, $8 + 5 + 3 = 16$ blue

49. There are 90 such numbers: 101, 111, 121, 131, 141, 151, 161, 171, 181, 191, 202, …, 292, 303, …, 393, 404, …, 494, 505, …, 595, 606, …, 696, 707, …, 797, 808, …, 898, 919, …, 999.

50. The fifth figure will be an octagon with sides of equal length. Inside the octagon will be a seven-sided figure with sides of equal length. The figure will have one antenna.

51. 61 orange tiles will be required. The sixth figure will have 6 rows of 6 tiles and 5 rows of 5 tiles $(6 \times 6 + 5 \times 5 = 36 + 25 = 61)$.

52. Some possible answers are given below. There are other possibilities.



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53. a) 2
    b) There are 3 choices for the first spot. Once that person is standing, there are 2 choices for the second spot and 1 for the third. Thus, $3 \times 2 \times 1 = 6$.
    c) $4 \times 3 \times 2 \times 1 = 24$
    d) $5 \times 4 \times 3 \times 2 \times 1 = 120$
    e) $n(n-1)(n-2)\cdots 1$, (or $n!$), where $n =$ the number of people in line.

Chapter Test

1. 26, 32, 38 (Add 6 to previous number.)
2. $\frac{1}{5}, \frac{1}{6}, \frac{1}{7}$ (Add 1 to the denominator of the previous number.)
3. a) The result is the original number plus 1.
   b) The result is the original number plus 1.
   c) Conjecture: The result will always be the original number plus 1.
   d) $n \to 5n \to 5n + 10 \to \frac{5n+10}{5} = \frac{5n}{5} + \frac{10}{5} = n + 2 \to n + 2 - 1 = n + 1$
4. $0.51 \times 96{,}000 \approx 0.5 \times 100{,}000 = 50{,}000$
5. $\frac{188{,}000}{0.11} \approx \frac{200{,}000}{0.1} \approx 2{,}000{,}000$
6. 9 square units
7. a) $\$1.50 \times 2 \times 23 = \$69$
   b) $\$4.99 \times 7\% = \$4.99 \times 0.07 = \$0.35$; $\$4.99 + \$0.35 = \$5.34$
   c) $\$5.34 + \$1.07 \times 2 \times 23 = \$5.34 + \$49.22 = \$54.56$
   d) $\$69 - \$54.56 = \$14.44$
8. a) 325,000 visitors
   b) 100,000 visitors
9. $\$50.40 - \$35.00 = \$15.40$; $\frac{\$15.40}{\$0.20} = 77$ miles
10. Since $\frac{\$15}{\$2.59} \approx 5.79$, a maximum of 5 six-packs can be purchased. There will be $\$15.00 - (5 \times \$2.59) = \$15.00 - \$12.95 = \$2.05$ remaining, so $\frac{\$2.05}{\$0.80} = 2.5625$, or two additional individual cans can be purchased. The following table was created using similar calculations for the other possible number of six-packs.

Six-packs	Individual cans	Number of cans
5	2	$6 \times 5 + 2 = 32$
4	5	$6 \times 4 + 5 = 29$
3	9	$6 \times 3 + 9 = 27$
2	12	$6 \times 2 + 12 = 24$
1	15	$6 \times 1 + 15 = 21$
0	18	$6 \times 0 + 18 = 18$

    The maximum number of cans is 32.
11. $3 \text{ cuts} \times \frac{2.5 \text{ min}}{1 \text{ cut}} = 7\frac{1}{2} = 7.5 \text{ min}$
12. $10 \times \frac{3}{4} = 10 \times 0.75 = 7.5$ miles
    $\$652.25 - \$701.25 = -\$49.00$
    She was underpaid by \$49.00.
13. $\$12.75 \times 40 = \$510$
    $\$12.75 \times 1.5 \times 10 = \$191.25$
    $\$510 + \$191.25 = \$701.25$

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14.

40	15	20
5	25	45
30	35	10

15. Mary drove the first 15 miles at 60 mph which took $\frac{15}{60} = \frac{1}{4}$ hour and drove the second 15 miles at 30 mph took $\frac{15}{30} = \frac{1}{2}$ hour for a total time of $\frac{3}{4}$ hour, or 45 minutes. If she drove the entire 30 miles at 45 mph, the trip would take $\frac{30}{45} = \frac{2}{3}$ hour, or 40 minutes, which is less than $\frac{3}{4}$ hour.

16. $\frac{6\text{lb}}{2\text{lb}} = 3; 3 \times \frac{1}{2}\text{tsp} = \frac{3}{2}\text{tsp}$ or $1\frac{1}{2}\text{tsp} = \frac{1}{2}$ tbsp

17. Area of lawn including walkway: $(10 + 2) \times (12 + 2) = 12 \times 14 = 168m^2$
Area of lawn only: $10 \times 12 = 120m^2$
Area of walkway: $168 - 120 = 48m^2$

18. 243 jelly beans; $260 - 17 = 243$, $234 + 9 = 243$, and $274 - 31 = 243$

19. a) $3 \times \$3.99 = \$11.97$
b) $9(\$1.75 \times 0.75) = 11.8125 \approx \$11.81$
c) $\$11.97 - \$11.81 = \$0.16$; Using the coupon is least expensive by \$0.16.

20. $4 \times 3 \times 2 \times 1 = 24$; The first position can hold any of four letters, the second any of the three remaining letters, and so on.

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