Answers for Lesson 11-1, pp. 601–603 Exercises

1. 4, 6, 4; M, N, O, P; $\overline{MN}, \overline{MP}, \overline{MO}, \overline{NO}, \overline{NP}, \overline{OP}$; $\triangle MNP$, $\triangle MOP$, $\triangle MNO$, $\triangle PNO$

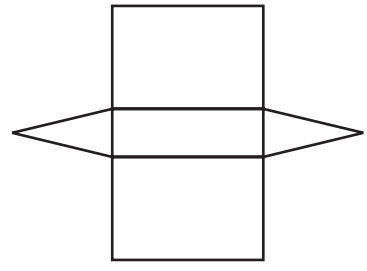
2. 8, 12, 6; A, B, C, D, E, F, G, H; $\overline{AB}, \overline{BC}, \overline{CD}, \overline{DA}, \overline{AE}, \overline{BF}, \overline{CG}, \overline{DH}, \overline{EF}, \overline{FG}, \overline{GH}, \overline{HE}$; quadrilaterals $ABCD$, $ABFE$, $BCGF$, $CDHG$, $DHEA$, $EFGH$

3. 10, 15, 7; $P, Q, R, S, T, U, V, W, X, Y$; $\overline{UV}, \overline{VX}, \overline{XY}, \overline{YW}, \overline{WU}, \overline{UP}, \overline{VQ}, \overline{XS}, \overline{YT}, \overline{WR}, \overline{PQ}, \overline{QS}, \overline{ST}, \overline{TR}, \overline{RP}$; quadrilaterals $UPQV$, $VQSX$, $XSTY$, $YTRW$, $UWRP$ and pentagons $UVXYW$ and $PQSTR$

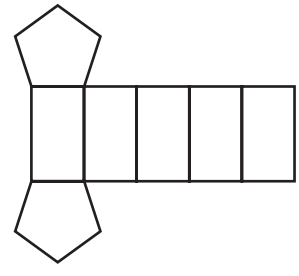
4. 8 **5** 12 **6.** 12

7 8 **8** 5 **9.** 9

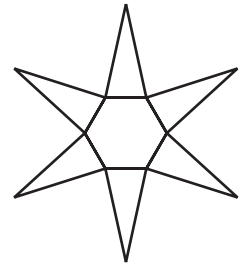
10. $5 + 6 = 9 + 2$;



11. $7 + 10 = 15 + 2$;



12. $7 + 7 = 12 + 2$;

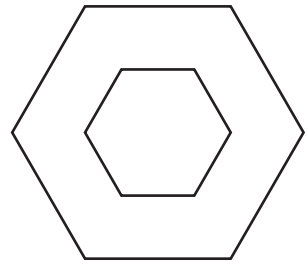


13. two concentric circles

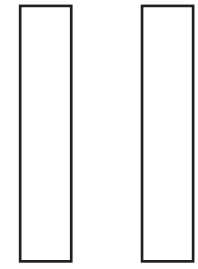
14. triangle

15. rectangle

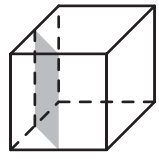
16. a.



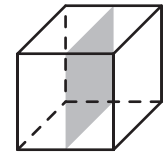
b. Sample:



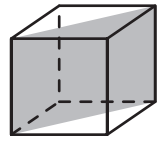
17. rectangle



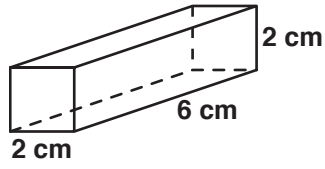
18. square

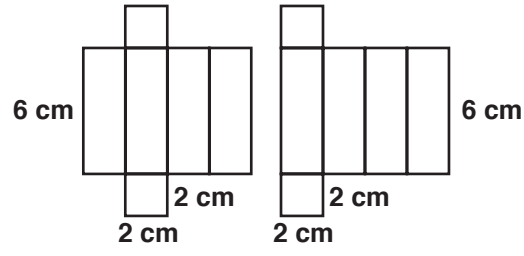


19. rectangle

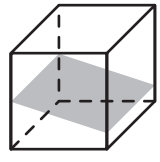


20. a–b. Answers may vary. Sample:

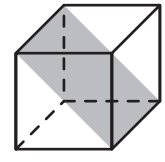




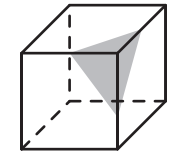
21. rectangle



22. rectangle



23. triangle



24. triangle

25. circle

26. 2 trapezoids

27. cone

28. sphere

29. cylinder attached to a cone

30. 60

31. $18 + 32 = 48 + 2$

32. $4 + 6 = 9 + 1$

33. $6 + 4 = 9 + 1$

34. $5 + 5 = 9 + 1$

35. Check students' work.

36. **a.** A. icosahedron
B. octahedron
C. tetrahedron
D. hexahedron
E. dodecahedron

b. regular triangular pyramid, cube

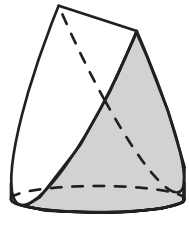
c. $4 + 4 = 6 + 2$
$6 + 8 = 12 + 2$
$8 + 6 = 12 + 2$

37. A

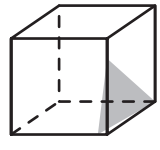
38–43. Check students' work.

44. Check students' work.

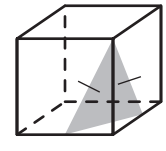
45.



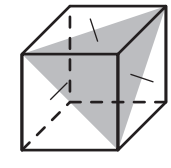
46.

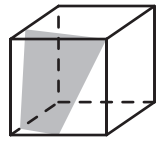


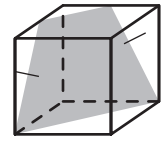
47.

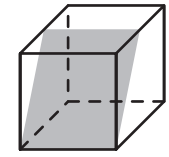


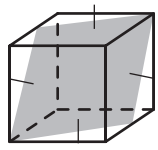
48.

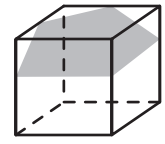


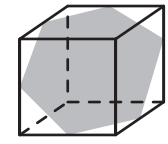
49. 

50. 

51. 

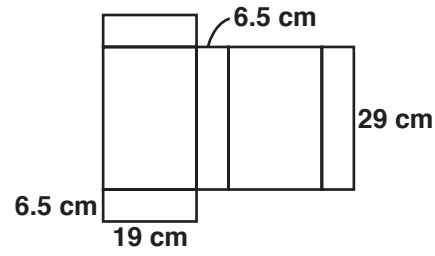
52. 

53. 

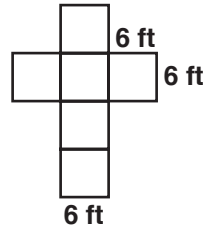
54. 

Answers for Lesson 11-2, pp. 611–614 Exercises

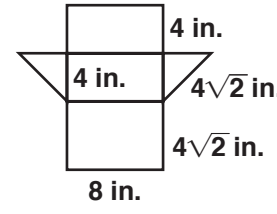
1. 1726 cm^2



2. 216 ft^2



3. $(80 + 32\sqrt{2})$ $in.^2$ or about 125.3 $in.^2$



4. **a.** right hexagonal prism

b. 240 cm^2

c. $48\sqrt{3}$ cm^2

d. $\left(240 + 48\sqrt{3}\right)$ cm^2

5. 120 ft^2; 220 ft^2

6. 96 $in.^2$; 108 $in.^2$

7. 880 cm^2; 1121 cm^2

8. 40π cm^2

9. 16.5π cm^2

10. 101.5π $in.^2$

11. 36.8 cm^2

12. 236 $in.^2$

13. 107 $in.^2$

14. 226 m^2

15. 1407 cm^2

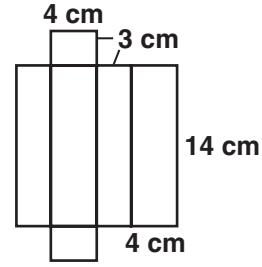
16. 20 cm

17. 150 cm^2

18. A cylinder and a prism both have two $\cong$ $\|$ bases. The bases of a cylinder are circles, and the bases of a prism are polygons.

19. 4080 mm^2

20. Answers may vary. Sample:



21. **a.** 94 $units^2$

b. 376 $units^2$

c. 4:1

d. 438 $units^2$; 1752 $units^2$; 4 : 1

e. The surface area becomes 4 times as large.

22. A **23.** 47.5 $in.^2$ **24.** about 75.5 $in.^2$

25. **a.** 7 units

b. 196π $units^2$

26. **a.** $A(3, 0, 0)$; $B(3, 5, 0)$; $C(0, 5, 0)$; $D(0, 5, 4)$

b. 5

c. 3

d. 4

e. 94 $units^2$

27. cylinder of radius 4 and height 2; 48π $units^2$

28. cylinder of radius 2 and height 4; 24π $units^2$

29. cylinder of radius 2 and height 4; 24π $units^2$

30. cylinder of radius 4 and height 2; 48π $units^2$

31. a. Lateral area is doubled.

b. Surface area is more than doubled.

c. S.A. $= 2\pi r^2 + 2\pi rh$; if r doubles:
S.A. $= 2(4\pi r^2 + 2\pi rh)$. Since r is squared, surface area is more than doubled.

32. a. $r \approx 1.2$ in.; $h = 6$ in.

b. about 54.0 in.^{2}

33. $(148 + 66.5\pi)$ cm^2

34. $(84 + 20\pi)$ m^2

35. $(220 - 8\pi)$ in.^{2}

36. $h = 6$ m; $r = 3$ m

37. a. 0, 8, 12, 6, 1

b. 1728 in.^{2}

Answers for Lesson 11-3, pp. 620–622 Exercises

1. 408 in.^2

2. 138 m^2

3. 179 in.^2

4. 204 m^2

5. 354 cm^2

6. 51 m^2

7. 834,308 ft^2

8. 144π cm^2

9. 33π ft^2

10. 119π cm^2

11. 1044 in.^2

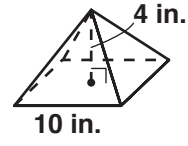
12. 31 m^2

13. 47 cm^2

14. Answers may vary. Sample: $PT < PR$, since PR is a hyp. in $\triangle PTR$. $m\angle PCR = m\angle PBR$ (since $\triangle PCB$ is isosc.) and $m\angle PBR < m\angle PRC$, so $m\angle PCR < m\angle PRC$. Therefore, $PR < PC$.

15. Altitude; altitude; the altitude is shorter because it is one leg of a right $\triangle$ with the lateral edge as the hyp., and is steeper because it rises the same vert. distance over less horiz. distance.

16. 228.1 in.^2



17. 8 ft

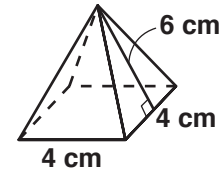
18. 478 cm^2

19. 62 cm^2

20. 28 in.^2

21. 4 in.

22. Answers may vary. Sample:



64 cm^2

23. 1580.6 ft^2

24. Cylinder: the lateral area of the 2 cones is 30π in.^{2} and the lateral area of the cylinder is 48π in.^{2}.

25. $(\ell + r)r\pi = \pi r\ell + \pi r^2$, which is the lateral area plus the circular base area. This formula may require fewer keystrokes and doesn't use exponents.

26. a. $\ell = \frac{\text{S.A.}}{\pi r} - r$

b. $r = \frac{-\pi\ell + \sqrt{\pi^2\ell^2 + 4\pi(\text{S.A.})}}{2\pi}$

27. A

28. 58 m^2

29. 471 ft^2

30. 45 m^2

31. L.A. = 30 in.^{2}, $h \approx 4.8$ in., $\ell = 5$ in.

32. $s = 12$ m, L.A. = 240 m^2, S.A. = 384 m^2

33. $s = 2$ ft, $h \approx 4.9$ ft, S.A. = 24 ft^2

34. $s = 8$ cm, $\ell \approx 7.4$ cm, $h \approx 6.2$ cm

35. 21.2 cm

36. about 613.5 cm^2

37. cone with $r = 4$ and $h = 3$; 36π

38. cone with $r = 3$ and $h = 4$; 24π

39. cylinder with cone-shaped hole; 60π

40. cylinder with cone-shaped hole; 48π

41. $100\sqrt{5}$ cm^2; $100\sqrt{5} + 100$ cm^2

42. $25\pi\sqrt{5}$ cm^2; $25\pi\sqrt{5} + 25\pi$ cm^2

43. 129.6

Answers for Lesson 11-4, pp. 627–630 Exercises

1. 216 ft^3

2. 80 $in.^3$

3. 180 m^3

4. 14 cm^3

5. about 280.6 cm^3

6. 22.5 ft^3

7. 720 mm^3

8. 22.5 $in.^3$

9. 288π $in.^3$; 904.8 $in.^3$

10. 40π cm^3; 125.7 cm^3

11. 37.5π m^3; 117.8 m^3

12. 144 cm^3

13. 3445 $in.^3$

14. **a.** 28 ft^3

b. 1747 lb

15. 501 $in.^3$

16. Answers may vary. Sample: 2 cm by 4 cm by 10 cm; 4 cm by 4 cm by 5 cm

17. $\frac{26}{9}$ cm

18. 5 in.

19. 6 ft

20. about 11.4 ft^3

21. 28–42 pots

22. 96 ft^3

23. **a.** 809,137 ft^3

b. 1,398,188,736 $in.^3$

c. 6,052,765 gal

24. Reword as "If two plane figures have the same height and the same width at every level, then they have the same area."

25. 80 $units^3$ **26.** 24 cm **27.** 3 cm **28.** A

29. Bulk; cost of bags $\approx$ \$1167, cost of bulk is $\approx$ \$1161.

30. cylinder with $r = 2$ and $h = 4$; 16π $units^3$

31. cylinder with $r = 4$ and $h = 2$; 32π units^3

32. cylinder with $r = 2$ and $h = 4$; 16π units^3

33. cylinder with $r = 5$, $h = 2$, and a hole of radius 1; 48π units^3

34. 125.7 cm^3

35. 140.6 in.^{3}

36. **a.** 730 in.^{2}

b. 528 in.^{2}

c. 756 in.^{3}

d. 476 in.^{3}

37. **a.** circumference $8\frac{1}{2}$ in. and height 11 in.: $V \approx 63.2$ in.^{3}; circumference 11 in. and height $8\frac{1}{2}$ in.: $V \approx 81.8$ in.^{3}; one is about 0.8 times the volume of the other.

b. about 6.5 in. by 13.0 in.

38. 2827 cm^3

39. 4 units

40. The volume of B is twice the volume of A.

Answers for Lesson 11-5, pp. 634–636 Exercises

1. about 233,333 ft^3

2. 200 cm^3

3. 1296 $in.^3$

4. 50 m^3

5. about 443.7 cm^3

6. 300 $in.^3$

7. 2048 m^3

8. about 363.6 m^3

9. about 3714.5 mm^3

10. about 562.9 ft^3

11. $\frac{16}{3}\pi$ ft^3; 17 ft^3

12. $\frac{22}{3}\pi$ $in.^3$; 23 $in.^3$

13. 36.75π $in.^3$; 115 $in.^3$

14. about 66.4 cm^3

15. about 4.7 cm^3

16. 123 $in.^3$

17. 312 cm^3

18. 10,368 ft^3

19. They are equal; both volumes are $\frac{1}{3}\pi r^2 h$.

20. **a.** 6,312,000 ft^3

b. 284 ft

21. 6 **22.** 3 **23.** $3\sqrt{2}$ **24.** 73 cm^3

25. B

26. cube: 8 $units^3$, cone: $\frac{2}{3}\pi$ $units^3$, pyramid: $\frac{8}{3}$ $units^3$

27. **a.** 120π ft^3

b. 60π ft^3

c. 240π ft^3

28. cone: 234.6 $in.^3$; prism: 240 $in.^3$; pyramid: 256 $in.^3$

29. cone with $r = 4$ and $h = 3$; 16π

30. cone with $r = 3$ and $h = 4$; 12π

31. cylinder with $r = 4, h = 3$, with a cone of $r = 4$, $h = 3$ removed from it; 32π

32. cone with $r = 4, h = 5\frac{1}{3}$, with a cone of $r = 1, h = 1\frac{1}{3}$ cut off the top, and a cylinder of $r = 1, h = 4$ cut out of its center; 24π

33. **a.** The frustum has vol. $V = \frac{1}{3}\pi R^2 H - \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(R^2 H - r^2 h)$. Now if $h_1 = H - h$ is the frustum's height, $V = \frac{1}{3}\pi(R^2(h_1 + h) - R^2 h) = \frac{1}{3}\pi(R^2 h_1 + h(R^2 - r^2))$. By similar $\triangle$s, $\frac{h}{r} = \frac{h_1 + h}{R}$, or $h = \frac{rh_1}{R - r}$. Simplifying, $V = \frac{1}{3}\pi h_1(r^2 + rR + R^2)$.

b. about 784.6 in.^{3}

34. **a.** about 47.1 m

b. about 176.7 m^2

c. about 389.6 m^3

35. about 16.2 cm

36. about 8.8 cm

Answers for Lesson 11-6, pp. 640–643 Exercises

1. 900π m^2

2. 400π in.^{2}

3. 1024π mm^2

4. $40{,}000\pi$ yd^2

5. 4624π mm^2

6. 576π cm^2

7. $\frac{121}{16}\pi$ in.^{2}

8. 62 cm^2

9. 232 in.^{2}

10. 20 cm^2

11. 154 in.^{2}

12. $\frac{500}{3}\pi$ ft^3; 524 ft^3

13. 288π cm^3; 905 cm^3

14. $\frac{1125}{2}\pi$ in.^{3}; 1767 in.^{3}

15. $\frac{2048}{3}\pi$ cm^3; 2145 cm^3

16. 2304π yd^3; 7238 yd^3

17. 98.784π m^3; 310 m^3

18. 451 in.^{2}

19. 1006 m^2

20. 130 cm^2

21. S.A. $\approx$ 108 cm^2; $V \approx$ 108 cm^3

22. **a.** sphere of radius 4

b. $\frac{256}{3}\pi$ units^3

c. 64π units^2

23. Yes; the volume of the frozen yogurt is $\frac{256}{3}\pi$ cm^3, and the volume of the cone is 64π cm^3.

24. C

25. Answers may vary. Sample: (5, 0, 0), (0, 5, 0), (0, 0, 5), (−5, 0, 0), (0, −5, 0), (0, 0, −5)

26. *A*: on; *B*: inside; *C*: outside

27. 1.7 lb

28. 8 in. sphere; the volume of the three spheres is 13.5π and of the large sphere is $85\frac{1}{3}\pi$.

29. $\frac{4}{3}\pi$ m^3

30. 36π in.^{3}

31. $\frac{9}{2}\pi$ ft^3

32. $\frac{500}{3}\pi$ mm^3

33. $\frac{125}{6}\pi$ yd^3

34. 288π cm^3

35. $\frac{343}{6}\pi$ m^3

36. $\frac{1125}{2}\pi$ mi^3

37. **a.** $457\frac{1}{3}\pi$ in.^{3}

b. $228\frac{2}{3}\pi$ in.^{3}

c. 11 in.

38. **a.** about 8.9 in.^{2}

b. The answer is less than the actual surface area since the dimples on the golf ball add to the surface area.

39. Answers may vary. Sample: sphere radius 3 in.; cylinder radius 3 in., height 4 in.

40. 22π cm^2; $\frac{46}{3}\pi$ cm^3

41. 26π cm^2; $\frac{62}{3}\pi$ cm^3

42. 22π cm^2; $\frac{14}{3}\pi$ cm^3

43. Answers may vary. Sample: You could lift the small ball because it weighs about 75 lb. The big ball would be much harder to lift since it weighs about 253 lb.

44. **a.** $6\sqrt{3}$ in.; $3\sqrt{3}$ in.

b. 371.7 in.^{3}

45. $r \approx 7.1$ cm, $h \approx 14.1$ cm

46. $r \approx 8.2$ cm, $h \approx 11.4$ cm

47. 707 cm^2

48. **a.** Cube; explanations may vary. Sample:

If $s^3 = \frac{4}{3}\pi r^3$, then $s = \sqrt[3]{\frac{4\pi}{3}}r$. So $6s^2 = 6\left(\sqrt[3]{\frac{4\pi}{3}}r\right)^2 \approx 15.6r^2 > 4\pi r^2$.

b. Answers may vary. Sample: Spheres are difficult to stack.

49. 3 m

50. 15 m

51. 2 : 3

Answers for Lesson 11-7, pp. 648–651 Exercises

1. no **2.** yes; 3 : 2 **3.** yes; 2 : 3 **4.** no

5. yes; 2 : 3 **6.** no **7.** 5 : 6 **8.** 6 : 7

9. 3 : 4 **10.** 2 : 5 **11.** 240 $in.^3$ **12.** 180 m^3

13. 24 ft^3 **14.** 175 $in.^2$ **15.** 112 m^2 **16.** 325 yd^2

17. 6000 toothpicks **18.** 74 oz

19. **a.** It is 64 times the smaller prism.

b. It is 64 times the smaller prism.

20. **a.** 2:5

b. 4:25

c. 8:125

21. No; explanations may vary. Sample: If "size" refers to the vol., then the new clock should be at $\frac{1}{10}$ the weight.

22. Yes; 60; $\frac{80}{60} = \frac{40}{30} = \frac{60}{45} = \frac{4}{3}$.

23. about 1000 cm^3

24. No; an increase in the lengths of sides does not create prop. ratios unless the box is a cube.

25. Answers may vary. Sample: A sphere has only one measure, *r*, so there's only one possible ratio.

26. 27 ft^3

27. **a.** 3 : 1

b. 9 : 1

28. **a.** 11 : 14

b. 121 : 196

29. 864 $in.^3$ **30.** 1 : 4; 1 : 8

31. 9 : 25; 27 : 125

32. 7 : 9; 343 : 729

33. 5 : 8; 25 : 64

34. **a.** 144 coats

b. 1728 meals

35. **a.** 100 times

b. 1000 times

c. His weight is 1000 times the weight of an average person, but his bones can only support 600 times the weight.

36. **a.** 384 cm^3

b. 16 : 1

c. pyramid A: 384 cm^2; pyramid B: 24 cm^2

37. **a.** 4 : 1; 8 : 1

b. Let r = radius, ℓ = slant height of small cone.
$3\ell + 5r : 4\ell + 4r$; $3\ell + 5r : \ell + r$

c. 7 : 8; 7 : 1