IM2 Book 2 Selected Answers

IM2 Dream Team

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1. $P_{original} = 32\ in.$
   $A_{original} = 64\ in.^2$
   $P_{cut} = 32\ in.$
   $A_{cut} = 48\ in.^2$

2. $P = 20\ m$

3. 45-45-90: 1, $\sqrt{2}$
   30-60-90: $\sqrt{3}$, 2

4. (a) $w = \pi r$; $h = r$
   (b) $A = \pi r^2$
   (c) $A = \pi r^2$

5. (a) yes
   (b) no
   (c) no
   (d) yes

6. 320 sugar cubes. $V = 320\ cm^3$

7. $BA = 80\ cm^2$
   $h = 4\ cm$
   $V = BA \cdot h$

8. (a) $V = 800\ in.^3$
   (b) $V = 800\ in.^3$
   (c) No

9. $P = 6x + 18$
   $A = 2x^2 + 9x + 8$

10. (a) $AC = 4$, $BC = 4\sqrt{3}$
    (b) $\frac{16\sqrt{2}}{2}$, $\frac{16\sqrt{2}}{2}$
    (c) $\sqrt{2}$, $2\sqrt{2}$

(d) $x = 2,\ y = 2\sqrt{3},\ z = 2\sqrt{6}$

11. $4\sqrt{3}$

12. $24\sqrt{3}$

13. They all have the same area.

14. (a) $A_{shaded} = 40\pi\ cm^2$
    (b) $A_{shaded} = 12\pi$

15. –

16. Cylinder

17. Cereal box, Toblerone box, Pringles can

18. (a) 32
    (b) 24

19. –

20. Yes: 9, 8, 7, 6, 5, 4
    No: 1, 2, 3

21. $A_{shaded} = 50\ m^2$

22. (a) $50\ in.^2$
    (b) $75\sqrt{3}\ in.^2$

23. (a) –
    (b) $A = 192\sqrt{3} + 384 = 716.6\ cm^2$
    (c) $A = 192\tan 75° = 716.6\ cm^2$

24. (a) One is a scaled version of the other.
    (b) Diagonals: 2 : 1
    Perimeters: 2 : 1
    (c) 4 : 1

25. –

26. –

27. $V = 5.91\ in.^3$. The volume doesn't change when we shift the cards.

28. They have the same volume.

29. 18%

30. $V(x) = x^3$
    Domain: $x \in (0, \infty)$

31. Base area and height
$V = BA \cdot h$

32. (a) One circle is just a scaled version of the other.
    (b) Diameters: 3 : 1
    Circumferences: 3 : 1
    (c) 9 : 1

33. (a) One circle is a scaled version of the other.
    (b) 8 : 3
    (c) I'd expect it to be 8 : 3 because the ratio of corresponding 1-D measurements in similar shapes appears to be constant.
    (d) $AB = 6$, $PQ = 16$, $PQ : AB = 8 : 3$
    (e) 64 : 9

34. (a) –
    (b) 72 bars
    (c) $V_{bar} = \frac{\sqrt{3}}{2}\ in.^3$
    $V_{box} = 36\sqrt{3}\ in.^3$

35. 1280π

36. (a) $1{,}000\ m^3$
    (b) $250\sqrt{3}\ cm^3$
    (c) $1{,}920\sqrt{3}\ ft^3$

37. $2{,}400 + 2{,}400\sqrt{3}$ cubic feet of grain

38. The midpoint is closest to the center.

39. 64 m

40. 9 : 25

41. $r^2 : 1$

42. 14 prisms
$V = 56\sqrt{77}$

43. $V = 90\pi$

44. $A = \frac{s^2\sqrt{3}}{4}$

45. (a) Rectangular prism
    (b) Hexagonal prism
    (c) Cylinder

46. 108π in.

47. –

48. $SA = 88\ in.^2$

49. (a) $SA = 132$ ft^2
    (b) $SA = 144 + 48\sqrt{3}$ ft^2

50. $20\sqrt{2} - 20$

51. (a) 120 ft^2
    (b) 144 ft^2

52. (a) All cubes are similar. They have congruent angles and their side lengths are proportional.
    (b) 2 : 1
    (c) 4 : 1
    (d) 8 : 1

53. r^3

54. (a) True
    (b) True

55. (a) $\sqrt{157}$
    (b) $4\sqrt{5}$
    (c) $6\sqrt{2}$

56. 24π in^2

57. First, calculate the circumference of the base. Second, multiply the circumference by the height.

58. (a) 700 m^2
    (b) $300 + 50\sqrt{3}$ cm^2

59. $4\sqrt{3}$ cm

60. $P = 125.5$ cm
    $A \approx 1250$ cm^2

61. $V = 384\pi$ ft^3
    $SA = 224\pi$ ft^2

62. 3 : 1

63. (a) $SA = 156\pi$
    $V = 360\pi$

(b) $SA = 1{,}260\ \text{m}^2$
$V = 2{,}040\ \text{m}^3$

64. $V = 320$
$SA = 64 + 160\sqrt{2}$

65. $r = \frac{1}{2}$ in.
$V = \frac{3\sqrt{3}}{2}$ in.^{3}

66. –

67. $8.125\ in.$

68. 243π

69. (a) Answers may vary.
(b) $SA = 2s^2 + \frac{6{,}000}{s}$
(c) $s \approx 11.45\ in.$
$SA \approx 786.22\ in.$
(d) –

70. (a) 2.939
(b) 3.090
(c) $A(n) = n \sin\left(\frac{180}{n}\right) \cos\left(\frac{180}{n}\right)$

71. If you don't actually draw these shapes, I'm going to throw a temper tantrum.

72. Cone

73. (a) $28\pi\ mi.^2$
(b) –
(c) $14\pi\ mi.$
(d) –

74. (a) $y = \frac{3}{2}x$
(b) Yes
(c) –

75. First cube: $12.910\ cm$
Second cube: $6.455\ cm$

76. –

77. (a) –
(b) –

78. –

79. (a) Height: $\sqrt{7}$
Slant height: 4
(b) No

80. (a) $\sqrt{119}$
(b) $\sqrt{\frac{611}{3}}$
(c) $\sqrt{351}$

81. (a) Thickness $= R - r$
Area $= \pi(R^2 - r^2)$
(b) Width $= \pi(R + r)$
(c) Circumference $\approx \pi(R + r) \rightarrow 2\pi R$

82. (a) $(x-2)^2 + (y+4)^2 = 50$
(b) Inside

83. (a) Triangular pyramid
(b) Square pyramid
(c) Cone

84. –

85. 843 cm^2

86. (a) 18π
(b) 9π
(c) 12π

87. (a) 6π
(b) 3π
(c) 4π

88. $\frac{64}{3}$

89. (a) $\frac{1}{3}$
(b) $V_{pyramid} = \frac{1}{3}BA \cdot h$
(c) No

90. –

91.

Yes	Yes	Yes	No
No	No	Yes	Yes
Yes	Yes	No	Yes

92. $324 + 108\sqrt{5}\ cm^2$

93. (a) Center: $(-3,5)$
Radius: $2\sqrt{11}$

(b) Center: $(-1,4)$
Radius: 3

94. $\frac{2}{3}\pi$

95. $\frac{2}{n}\pi$

96. Yes

97. $\frac{400}{3}\ in.^3$

98. (a) $(x-2)^2+(y-3)^2=65$

(b) No

99. (a) $12\pi\ cm^3$

(b) $5\ cm$

100. (a) $8\pi-16$

(b) $16\sqrt{3}-8\pi$

101. (a) $8\pi-16$

(b) $16\sqrt{3}-8\pi$

102. Fraction: $\frac{s}{2\pi r}$
Area: $\frac{sr}{2}$

103. (a) $\frac{64}{3}\pi$ cm^2

(b) 8 cm

(c) $\frac{8}{3}$ cm

104. (a) Cone

(b) 32π

105. 64

106. 134,136

107. $100+100\sqrt{3}$ m^2

108. –

109. (a) Radius: 12 cm
Arc Length: 10π cm

(b) $\frac{5}{12}$

(c) 60π cm^2

110. (a) Center: $(2,0)$
Radius: $\sqrt{14}$

(b) Center: $(3,-\frac{1}{2})$
Radius: $\frac{7}{2}$

111. $18\sqrt{2}$

112. $V = \frac{x^3\sqrt{2}}{12}$
Domain: $x \in (0,\infty)$

113. (a) Cylinder, circle

(b) Cone, circle

(c) Sphere, circle

114. (a) Circle

(b) Triangle

115. (a) –

(b) $\frac{r}{l}$

(c) $\pi r l$

116. $V = \frac{578\pi\sqrt{38}}{3}$ cm^3
$SA = 646$ cm^2

117. $4,021$ ft^2

118. (a) 72°

(b) 72°

(c) 288°

119. 3π

120. Angular size: 106.3°
Arc length: 18.5 in.

121. $\frac{64\pi\sqrt{3}}{3}$

122. 48π

123. $AB : AC = 3 : 7$
$BC : AC = 4 : 7$

124. angular size = 112.9°
arc length = 23.6 in.

128. (a) $r = 30$ cm
$\theta = 216°$

(b) –

(c) 37.70 cm

(d) 35.27 cm

129. $AB : BC = 3 : 7$
$BC : AC = 7 : 10$

130. $\angle ABC = 90°$

131. (a) 135°

(b) 270°

(c) The measure of the arc is twice the measure of the interior angle.

(d) Answers may vary.

132.

$$\text{Area} = \frac{\theta}{360}\pi r^2$$
$$\text{Arc Length} = \frac{\theta \pi r}{180}$$
$$\text{Perimeter} = \frac{\theta \pi r}{180} + 2r$$

133. $r_1 = 3$
$r_2 = 8$
$r_3 = 5$

134. $\frac{10\sqrt{3}}{3}$

135. (a) 4 : 25

(b) 4 : 21

136. $\frac{12{,}400\pi}{3} + 800\sqrt{3}\ ft^2$

137. (a) 46°

(b) 46°

138. –

139. –

140. $\frac{\pi}{4}$

141. (a) 1 : 8

(b) 7 : 8

142. 12.5

143. (a) $2k$

(b) $2k$

(c) –

144. $\angle BCA = 20°$, $\angle CAB = 110°$, $\widehat{AC} = 100°$, major arc $\widehat{BC} = 220°$

145. –

146. –

147. –

148. –

149. –

150. (a) $\frac{1}{2}$
(b) $\frac{1}{8}$
(c) $100\pi\ cm^3$
(d) $\frac{25\pi}{2}\ cm^3$

151. $\angle R = 67°$, $\angle P = 126°$

152. –

153. –

154. –

155. $1 : \sqrt[3]{2}$

156. $V = \frac{485\pi}{3}$, $LA = 55\sqrt{2}$

157. 104°, 76°

158. $\frac{9}{4}$

159. $\frac{13.6}{\sin 63°}$

160. –

161. –

162. $864\pi\ cm^2$

163. $2\sqrt{2}\ in.$

164. 90°

165. –

166. (a) 8 : 27
(b) 2 : 3
(c) –

167. $2\pi - 3\sqrt{3}$

168. $16\ cm$

169. (a) $70°$
     (b) $180 - k°$

170. (a) $\frac{12.1}{\sin 48°}$
     (b) $\frac{a}{\sin A}$

171. $\frac{5\sqrt{3}}{3}$

172. –

173. $144\pi\ cm^2$

174. $\frac{250\pi}{3}$

175. 21, 1

176. 30

177. –

178. Minor arc length = 11.07; major arc length = 20.34; $A_1 = 17.68$; $A_2 = 60.86$

179. $\frac{2\pi r^3}{3}$

180. (a) $39\pi\ cm^2$
     (b) $39\pi\ cm^2$

181. –

182. $V_1 = \frac{1{,}280\pi}{3} - 320\sqrt{3},\ V_2 = \frac{2{,}560\pi}{3} + 320\sqrt{3}$

183. $15, \sqrt{505}$

184. $L = 16, A_1 = 48, A_2 = 120$

185. –

186. tangent line: $y - 12 = \frac{1}{8}(x - 6)$

187. $2\pi - 4$

188. (a) $16h\pi - h^2\pi\ cm^2$
     (b) $16h\pi - h^2\pi\ cm^2$
     (c) –
     (d) –
     (e) $\frac{1{,}024\pi}{3}\ cm^3$

(f) $\frac{2{,}048\pi}{3}\ cm^3$

189. $\sqrt{r^2-d^2}$

190. –

191. $\frac{29}{4}$

192. 66.33

193. (a) 120
(b) $25r$
(c) $\frac{24}{5}$

194. (a) –
(b) –
(c) 1

195. 4, 9, 13, 12

196. (a) $2\pi rh-\pi h^2\ cm^2$
(b) $2\pi rh-\pi h^2\ cm^2$
(c) –
(d) –
(e) $\frac{2\pi r^3}{3}\ cm^3$
(f) $\frac{4\pi r^3}{3}\ cm^3$

197. $8\ in.$

198. $2.21\ cm$

199. –

200. (a) –
(b) $R-r$
(c) –

201. $1.5-\frac{\sqrt[3]{19}}{2}\ cm$

202. (a) $\frac{1}{3}$
(b) $\frac{2}{3}$

203. $8\sqrt{3}$

204. $12\pi+36\ in.$

205. $V=9\sqrt{3}\pi,\ SA=27\pi$

206. (a) $4.52\ in.^2$
(b) $452\ in.^2$

207. $x^3 - y^3$

208. –

209. (a) $h = 8,\ V = 72\pi$
(b) $V(r) = 2\pi r^2\sqrt{25 - r^2}$
(c) 302.30

210. (a) –
(b) $\frac{2}{3}$ (Assume the sphere is tangent to both bases and the lateral surface of the cylinder)

211. (a) –
(b) $y = -\frac{4}{3}(x-4) + 3$
(c) $\left(\frac{25}{4}, 0\right)$
(d) $y = \frac{4}{3}(x-4) - 3$

212. –

213. (a) $\frac{4}{3}\pi(R^3 - r^3)$
(b) –
(c) –
(d) $BA = \frac{4}{3}\pi(R^2 + Rr + r^2)$
(e) $4\pi R^2$
(f) $SA = 4\pi R^2$

214. $3{,}364\pi cm^2$

215. (a) 67%
(b) $LA = 12\pi r^2,\ SA = 12\pi r^2$

216. (a) 3 : 2
(b) 9 : 4
(c) 27 : 8

217. (a) 3
(b) $r = \frac{w\sqrt{100 - w^2}}{10 + w}$
(c) –

218. π

219. –

220. –

221. 57.30, 6

222. $y = -\frac{5}{12}(x-13)$ or $y = \frac{5}{12}(x-13)$

223. 80

224. $10\pi + 4\sqrt{3}$

225. Skip

226. 125 : 343

227. –

228. –

229. (a) $2\pi r$
    (b) πr
    (c) r

230. (a) $\frac{3}{2}$
    (b) $\left(\frac{270}{\pi}\right)^\circ$

231. 15 in.

232. $\left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$, $\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

233. –

234. –

235. –

236. $A_{sector} = \frac{\theta r^2}{2}$, Arc length $= \theta r$

237. $\sin\left(\frac{\pi}{4}\right) = \frac{\sqrt{2}}{2}$, $\cos\left(\frac{\pi}{4}\right) = \frac{\sqrt{2}}{2}$

238. $\sin\left(\frac{\pi}{6}\right) = \frac{1}{2}$, $\cos\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{2}$

239. $\frac{\pi}{6} = 30°$, $\frac{\pi}{4} = 45°$, $\frac{\pi}{3} = 60°$, $\frac{\pi}{2} = 90°$