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}

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