IM1H Book 1 Selected Answers

IM1H Dream Team

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1. (a) $A_{ABCD} = 25,\ A_{BCEF} = 9$
   (b) –
   (c) –
   (d) $A = 34$
   (e) $l = \sqrt{34}$
   (f) –
2. $l = 4\sqrt{5}$
3. Yes
4. –
5. –
6. $AB = \sqrt{41}$
7. $l = 5\sqrt{2}$
8. $l = \sqrt{5},$ No
9. 12
10. $(12, 2), (2, 2)$
11. No
12. $d = 10\sqrt{2}$
13. (a) $C = (5, 0)$. Answers may vary.
    (b) $D = (5, 1)$. Answers may vary.
    (c) $x = 5$
    (d) –
14. (a) 13, 17, 13, 17
    (b) –

15. (a) $AP = BP = 2\sqrt{5}$
    (b) $(3,5), (2,2), (4,8)$. Answers may vary.
    (c) No
    (d) $y = 3(x-2)+2$

16. $(10,3), (-6,3)$

17. –

18. (a) $(0,0), (6,0)$. Answers may vary.
    (b) $(0,4), (4,2)$. Answers may vary.
    (c) $(0,4), (2,2)$. Answers may vary.

19. $AB = BC = \sqrt{10}$

20. $C = (6,3)$. Infinite. Answers may vary for C.

21. $(0,0), (\sqrt{13},0)$. Answers may vary.

22. $(0,0), (2,3)$

23. $(0,0), (\sqrt{13},0), (2+\sqrt{13},3), (\sqrt{13},6), (0,6), (-2,3)$. Answers may vary.

24. $24-12\sqrt{2},\ 24\sqrt{2}-24$

25. There are an infinite number of different ways.

26. 208m

27. $AP = BP = 5\sqrt{2}$.
    2 more equidistant points: $Q = (2,2),\ R = (5,3)$. Answers may vary.
    All equidistant points: $y = \frac{1}{3}(x-2)+2$.

28. Short leg: $21-7\sqrt{5}$
    Long leg: $42-14\sqrt{5}$
    Hypotenuse: $21\sqrt{5}-35$

29. $\frac{5}{12}$

30. $(0, 5+4\sqrt{2}), (0, 5-4\sqrt{2})$

31. (a) $(0,0), (4,1)$. Answers may vary.
    (b) No.

32. Yes.

33. (a) Yes.
    (b) $\overline{KL}$
    (c) $\angle KLM$

(d) $\angle BAC$

(e) They're congruent.

34. They sum to $90°$.

35. It's a right angle.

36. (a) –

    (b) $\frac{b}{a}$ is the negative reciprocal of $\frac{-a}{b}$.

37. –

38. –

39. A line with an undefined slope is perfectly vertical while a line with a slope of 0 is perfectly horizontal.

40. $n = \frac{49}{4}$

41. $x = 1$. Answers may vary.

42. $y = 1$. Answers may vary.

43. They're the same line. $-50x + 30y = 90$.

44. –

45. No.

46. (a) $y = \frac{1}{2}(x - 5) + 5$

    (b) $4x - 5y = 8$

47. Yes.

48. $\left(\frac{15}{8}, \frac{15}{8}\right)$

49. $m = -1$

50. Yes.

51. (a) –

    (b) $\angle Q$; CPTC

52. $\triangle ACT \cong \triangle ION$
    $\triangle ATC \cong \triangle INO$
    $\triangle CAT \cong \triangle OIN$
    $\triangle CTA \cong \triangle ONI$
    $\triangle TAC \cong \triangle NIO$
    $\triangle TCA \cong \triangle NOI$

53. $\triangle BAL \cong \triangle GEL$
$\triangle ELB \cong \triangle ALG$
$\triangle GEA \cong \triangle BAE$
$\triangle ABG \cong \triangle EGB$

54. $\angle ABC$ or $\angle CBA$ or $\angle B$ (different ways of writing the same thing).

55. $\overline{AB}$

56. (a) $PNMRQ$
(b) $\angle Q$

57. (a) $d_{AP} = \sqrt{(x+1)^2 + (y-5)^2}$
(b) $d_{BP} = \sqrt{(x-5)^2 + (y-2)^2}$
(c) $\sqrt{(x+1)^2 + (y-5)^2} = \sqrt{(x-5)^2 + (y-2)^2}$
(d) $4x - 2y = 1$
(e) $(2, 3.5)$
(f) $m_{AB} = -\frac{1}{2};\ m_P = 2$
(g) –

58. (a) The distance between (x, y) and $(3, 5)$ is equal to the distance between (x, y) and $(7, -1)$.
(b) $2x - 3y = 4$

59. (a) –
(b) –
(c) $(6, 9.5)$
(d) $(6.2, 9.8)$

60. (a) $10x - 8y = -35$
(b) $(4.5, 10)$. Answers may vary.
(c) $\overline{PA} = \overline{PB}$

61. (a) $(21, 16)$
(b) $(30, 22)$
(c) $(3 + 3t, 4 + 2t)$

62. –

63. $x = 1 + t;\ y = 2 + 3t$. Answers may vary.

64. $(-3.5, -0.5)$

65. $(0, 16.9)$

66. (a) –
    (b) $\frac{\Delta y \text{ from a 1 unit increase in } t}{\Delta x \text{ from a 1 unit increase in } t}$
    (c) $y = \frac{11}{3} + \frac{2}{3}x$

67. –

68. (a) $[7, 2]$
    (b) $[14, 8]$
    (c) $[-7, -4]$
    (d) $[7, 4]$

69. (a) $[3, 6]$
    (b) $[3, -2]$
    (c) $[-100, 40]$

70. (a) 12 miles east and 16 miles north
    (b) 20 miles
    (c) 10 miles/hour

71. (a) 48 miles
    (b) 4.8 hours
    (c) 28.8 miles east and 38.4 miles north of his departure point.

72. (a) $A' = (6, 5),\ B' = (8, -2),\ C' = (11, 4)$
    (b) $B'' = (-1, 0),\ C'' = (2, 6)$

73. $K' = (5, 3),\ L' = (9, 0),\ M' = (6, -4)$. Each vertex slides $\sqrt{29}$.

74. It depends on whether the triangle is supposed to be right.

75. (a) 5 units/second
    (b) $[3, 4]$
    (c) $(-3 + 3t, 1 + 4t)$
    (d) $\frac{4}{3}$

76. Yes, yes, yes, no.

77. (a) $[4, -12]$
    (b) $[-4, 12]$

78. $(a + 2, b - 4)$

79. Answers may vary. $(0, 0),\ (7, 1),\ (12, 6),\ (5, 5)$

80. (a) 132 miles east and 110 miles north

(b) $(-3 + 90t, 5 + 70t)$

81. $[8, 06]$

82. –

83. –

84. (a) –

    (b) –

    (c) SSA doesn't always imply congruence because in scenarios like (b) there are two incongruent triangles that satisfy SSA.

85. –

86. –

87. –

88. –

89. –

90. –

91. –

92. –

93. –

94. (a) 2 AM

    (b) It means that Kirby's position is determined by time.

    (c) $(-6, 1.5)$

    (d) $(-4t, -3t + 6)$

95. (a) If point P is equidistant from the coordinate axes, then point P is on the line $y = x$.

    (b) No, $(-1, 1)$ is a counterexample.

    (c) Answers may vary. If $ABCD$ is a square, then $ABCD$ is a rectangle.

    (d) Answers may vary. If A, B, and C are not colinear, then A, B, and C form a triangle.

96. If a triangle has side lengths a, b, and c such that $a^2 + b^2 = c^2$, then the triangle has a right angle, and the side with length c is the hypotenuse.

97. –

98. (a) –

(b) $d = \sqrt{(3-2t)^2 + (4+t)^2}$

(c) $(\frac{8}{5}, \frac{21}{5})$

(d) $(\frac{4}{5}, \frac{23}{5})$

99. –

100. (a) $s = 3\sqrt{5}$ miles/minute

(b) $4\sqrt{10}$ miles

(c) $t = 8$ minutes

101. (a) –

(b) $\sqrt{13}$

102. (a) $(2, 1)$

(b) $[-12, 5]$

(c) $(x, y) = (2 - 24t, 1 + 10t)$

103. (a) $[-6, 8]$

(b) $[-\frac{3}{5}, \frac{4}{5}]$

(c) $[\frac{3}{5}, -\frac{4}{5}]$

(d) $[6, -8]$

(e) $[\frac{3}{5}c, -\frac{4}{5}c]$

104. (a) $[60, -15]$

(b) $[5, 5\sqrt{2}]$

(c) $[\frac{3}{8}, \frac{-1}{3}]$

(d) $[\frac{p^2}{q}, p]$

105. (a) 5

(b) 10,080

(c) 2016

(d) $5t$

106. –

107. –

108. –

109. They are congruent.

110. –

111. –

112. (a) $x = \frac{3}{5}t + 9;\ y = \frac{4}{5}t - 2$
(b) $x = \frac{3}{20}t + 9;\ y = \frac{1}{5}t - 2$
(c) $x = -\frac{3}{5}t + 9;\ y = -\frac{4}{5}t - 2$
(d) $x = -3t + 9;\ y = -4t - 2$

113. –

114. –

115. –

116. (a)

$$P_3 = (-17, 19)$$
$$P_2 = (-9, 12)$$
$$P_{-2} = (23, -16)$$
$$P_{1.5} = (-5, \frac{17}{2})$$

(b) $y = \frac{33}{8} - \frac{7}{8}x$
(c) Both the x- and y-coordinates are changing at a constant rate.

117. (a) $\vec{AB} = [2, -9]$
(b) $\vec{AB} = [3t, -4t]$

118. (a) $[-\frac{8}{5}, \frac{14}{5}]$
(b) $[4, -7]$
(c) $[\frac{4}{\sqrt{65}}, -\frac{7}{\sqrt{65}}]$
(d) $[8, -14]$
(e) $[7, 4]$
(f) $[-\frac{4c}{\sqrt{65}}, \frac{7c}{\sqrt{65}}]$

119. (a) It moves 3 meters to the left and 4 meters up every second.
(b) It moves 180 meters to the left and 240 meters up every second.
(c)

$$x = -2 - 180t$$
$$y = 6 + 240t$$

120. (a) $t = 1\text{s}$
(b) The bug is on the line to the right of the x-intercept.

121. (a) $m = -4$

(b) $s = \sqrt{17}$ units/minute

(c) $t = 3$ minutes

(d) $t = 3$ minutes

(e) -95 or 194 seconds

122. y-intercept: $(0, -\frac{26}{3})$
x-intercept: $(\frac{13}{2}, 0)$

123. I would find the length of all 4 sides and make sure there were two distinct pairs of congruent adjacent sides.

124. –

125. –

126. –

127. –

128. (a) $(5, \frac{71}{12})$

(b) 7.58

129. –

130. –

131. 68 cm^2

132. (a) –

(b) No

133. $(-\frac{1}{3}, 2), (\frac{4}{3}, 3)$

134. $(-5, 6)$. Answers may vary.

135. $(\frac{48}{13}, \frac{32}{13})$

136. $(\frac{96}{13}, \frac{40}{13})$

137. $(4, -1)$

138. (a) $(2, 3)$

(b) $t = \frac{37}{18}$

(c) The value of t at which P_t intersects $4x + 3y = 18$.

(d) $(\frac{13}{6}, \frac{28}{9})$

(e) $(-\frac{5}{2}, 0)$

139. The opposite sides have the same slope, so they must be parallel.

140. (a) The direction vector has the same slope as the line.

(b) Answers may vary. $[5, -2], [15, -6]$.

(c) They all have the same slope. In other words, they're all multiples of $[5, -2]$.

141. (a) $m = -\frac{a}{b}$

(b) $[a, b]$ has a slope of $\frac{b}{a}$, and every direction vector has a slope of $-\frac{a}{b}$, so their slopes are opposite reciprocals.

142. $[2, -3]$

143. $(x, y) = (-19 + 8t, -7 + 6t)$

144. (a) $(x, y) = (1 + 4t, 5 + 12t)$

(b) $(-6, -16)$

(c) $4\sqrt{10}$ units/hour

145. $x = \frac{4}{11}$

146. –

147. –

148. $\triangle A \cong \triangle B \cong \triangle C \cong \triangle E$

149. $45°$

150. Answers may vary. $[\frac{12}{13}, -\frac{18}{13}]$.

151. $(-1, -7)$

152. (a) $(3, 0), (0, 2)$

(b) $[2, 3]$

(c) $(x, y) = (6 + 2t, 3 + 3t)$

(d) $t = -\frac{15}{13}$

(e) $(\frac{48}{13}, -\frac{6}{13})$

(f) $(\frac{48}{13}, -\frac{6}{13})$

153. (a) $[8, -6]$

(b) $[-\frac{9}{2}, -6]$

154. (a) 2

(b) $-\frac{1}{2}$

(c) They are perpendicular.

(d) $\sqrt{5}$

155. $y = \frac{2}{3}(x - 1) + 5$

156. (a) It's isosceles.
(b) It's equilateral.

157. (a) There's a typo in this question. It should say $\overline{BA} > \overline{BE}$.
(b) –
(c) $\overline{BA} + \overline{CA} > \overline{BE} + \overline{CA} > \overline{BE} + \overline{CE} = \overline{BC}$

158. $\sqrt{5}$

159. (a) –
(b) Reflect $\triangle KLM$ over $y = 2x$.
(c) $(3, -4)$

160. (a) –
(b) $(\frac{72}{13}, \frac{30}{13})$
(c) Rotate $\triangle ARM$ counterclockwise.

161. The positions are moving in the same direction, but they start at different points, and one is moving three times faster than the other.

162. (a) $[2, 1]$
(b) $(x, y) = (2t, t)$
(c) $Q = (\frac{8}{5}, \frac{4}{5})$
(d) $\overrightarrow{AQ} = [\frac{8}{5}, \frac{4}{5}]$
(e) $B = (\frac{16}{5}, \frac{8}{5})$
(f) $t = \frac{8}{5}$

163. $Q = (1, 2)$

164. $P = (1, 2)$

165. $F \to$ midpoint of $\overline{GH} \to D$. There are 4 possible paths.

166. P_t is on the perpendicular bisector of $\overline{AB}$ because the path defined by P_t runs through the midpoint of $\overline{AB}$ and has an opposite reciprocal slope.

167. $(\frac{49}{25}, \frac{68}{25})$

168. –

169. (a) –
(b) –
(c) $T = (7 - \frac{21}{\sqrt{65}}, 7 - \frac{12}{\sqrt{65}})$
$D = (8 - \frac{24}{\sqrt{65}}, 1 - \frac{3}{\sqrt{65}})$

170. –

171. –

172. –

173. –

174. (a) $y = -2(x-2)+5$
(b) $y = -7(x-\frac{5}{2})+\frac{13}{2}$
(c) $(3,3)$

175. (a) It reflects any inputted point over the line $y = x$.
(b) –
(c) $P' = (3,1), Q' = (5,2), R' = (5,6)$
(d) –
(e) Counterclockwise

176. (a) $(5,7)$
(b) $(\frac{60}{13}, \frac{79}{13})$

177. $(\frac{43}{13}, \frac{72}{13})$

178. (a) The vector $[-3,2]$ is not perpendicular to $y = 2x$. To find the reflection of the point, we have to move along a perpendicular vector.
(b) $(-\frac{12}{5}, \frac{16}{5})$

179. (a) Translation – $P' = (4,-1), Q' = (4,0), R' = (6,-1)$
(b) Reflection – $P' = (3,-1), Q' = (4,-1), R' = (3,1)$
(c) Rotation – $P' = (1,3), Q' = (1,2), R' = (-1,3)$

180. (a) $A' = (0,0), B' = (0,10), C' = (-3,8)$
(b) Rotation
(c) –

181. $S' = (0,0), H' = (4,3), A' = (-3,4)$
$M' = (-7.4,3.2), O' = (0,0), R' = (-5,5)$
Morgan was correct.

182. (a) $A' = (0,7), B' = (-3,8)$
(b) Translates by vector $[-2,4]$
(c) Yes

183. Shane was correct.

184. (a) $A' = (-4,-2), B' = (2,4)$
(b) It doubles the point's distance from the origin.

(c) $3\sqrt{2}$

(d) $6\sqrt{2}$

(e) No

185. $y = 3(x-2)+3$

186. $(\frac{11}{5}, \frac{23}{5})$

187. Answers may vary. $(5,5)$

188. –

189. –

190. $P = (9,0)$ or $(16,0)$

191. There are 3 shortest routes. For example, The ant calls straight to the point $G + \frac{1}{3}\overrightarrow{GC}$ and then straight to the point D.

192. 12

193. $\frac{31}{50}$ hours

194. (a) –

(b) $(-1,8)$

(c) Brett: $\sqrt{5}$ units per minute
Jordan $\sqrt{2}$ units per minute

(d) They do not. Brett gets there first.

195. $[7,12]$

196. $(\frac{14}{5}, -\frac{2}{5})$