

IM1H Book 2 Selected Answers

IM1H Dream Team

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1.
 - (a) $\angle 2, \angle 3, \angle 5, \angle 8$
 - (b) $\angle 1, \angle 4, \angle 6, \angle 7$
 - (c) $\angle 3, \angle 5$
 $\angle 2, \angle 8$
 - (d) $\angle 4, \angle 6$
 $\angle 1, \angle 7$
 - (e) Answers may vary. $\angle 1, \angle 5$
2.
 - (a) $\angle 2 + \angle 4 = 180^\circ$
 - (b) $\angle 2 + \angle 1 + \angle 3 = 180^\circ$
 - (c) $\angle 4 = \angle 1 + \angle 3$
 - (d) –
 - (e) –
3.
 - (a) If P is not equidistant from the coordinate axes, then P is not on the line $y = x$.
 - (b) Yes. Always.
4. –
5. Exactly one
6. –
7.
 - (a) $\angle AHK \cong \angle HKD$
 - (b) $\angle AHK \cong \angle EHB$
 - (c) $\angle EHB \cong \angle HKD$
 - (d) If two lines are cut by a transversal such that two corresponding angles are congruent, then the lines are parallel.
 - (e) $\angle KHB + \angle HKD = 180^\circ$
8.
 - (a) $\overline{RU} \parallel \overline{AT}$
 - (b) None

- (c) $\overline{RU} \parallel \overline{AT}$
 $\overline{RN} \parallel \overline{OT}$
 - (d) $\overline{RU} \parallel \overline{AT}$
 $\overline{AU} \parallel \overline{NT}$
 - (e) $\overline{AU} \parallel \overline{NT}$
 - (f) None
 - (g) $\overline{AU} \parallel \overline{NT}$
 - (h) None
9. –
10. –
11. No. Two lines on the same plane that never intersect.
12. It's constant. No.
13. –
14. (a) $\angle a + \angle b + \angle c = 180^\circ$
(b) $\angle x = \angle a$
 $\angle y = \angle b$
15. (a) $B(6, 0, 0)$
 $C(6, 3, 0)$
 $D(0, 3, 0)$
 $E(0, 0, 2)$
 $F(6, 0, 2)$
 $H(0, 3, 2)$
(b) $\overline{AH} = \sqrt{13}$
 $\overline{AC} = 3\sqrt{5}$
 $\overline{AF} = 2\sqrt{10}$
 $\overline{AG} = 7$
16. (a) $\overline{FD} \parallel \overline{BC}$
 $\overline{AG} \parallel \overline{CD}$
(b) $\overline{HS} \parallel \overline{YO}$
 $\overline{XO} \parallel \overline{SN}$
17. (a) $0 < x < 110$
(b) $81 < x < 143$
18. –
19. –
20. –

21. –
22. (a) $\overline{AB} : y = -\frac{1}{3}x$
 $\overline{BC} : y = -2x$
 (b) $\overline{KA} = 5$
 $\overline{KB} = 5$
 $\overline{KC} = 5$
 (c) –
 (d) –
 (e) Find the intersection of the perpendicular bisectors of any two side lengths.
23. (a) $4\sqrt{6}$
 (b) $4\sqrt{5}$
24. (a) $\vec{w} = [7, 6]$
 (b) $\vec{w} = [-5, 8]$
25. (a) $\overrightarrow{AB} = [3, 4]$
 $\overrightarrow{BC} = [9, -9]$
 $\overrightarrow{AB} + \overrightarrow{BC} = [12, -5]$
 (b) $\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC}$
26. (a) $\sqrt{17}$
 (b) $\sqrt{a^2 + b^2 + c^2}$
27. $[1, 2, 3]$
 $l = \sqrt{14}$
28. (a) $4 \times 5 \times 3$
 (b) $5\sqrt{2}$
29. 15°
30. (a) 12
 (b) 48
 (c) $y = \frac{1}{3}x$
 (d) $y = -3x + 24$
 (e) $F = (\frac{36}{5}, \frac{12}{5})$
 (f) $\frac{12}{5}\sqrt{10}$
 (g) 96
 (h) It's twice the area because it's base times height.
 (i) $\frac{12}{5}\sqrt{10}$

31. (a) $y = \frac{3}{7}(x + 2)$
 (b) $y = -\frac{3}{5}(x - 6)$
 (c) $G = (\frac{8}{3}, 2)$
 (d) Yes, M , G , and C are collinear.
 (e) –
32. –
33. (a) $x = 98^\circ$
 (b) $y = 73^\circ$
 (c) $w = 108^\circ$
 (d) $u = 26^\circ$
34. (a) $x = 0$
 $y = -\frac{2}{3}x + 4$
 $y = x + 4$
 (b) $(0, 4)$
35. –
36. (a) –
 (b) –
 (c) K is equidistant from all three vertices.
 (d) Yes, they are.
37. $x = \pm 6$
38. (a) –
 (b) By C.P.C.T.C., $\overline{DP} \cong \overline{DQ}$, so D is equidistant from \overline{AB} and \overline{BC} .
 Since we showed this for an arbitrary point D on the angle bisector,
 it must be true for any point on the angle bisector.
39. $\angle ABC = 68^\circ$
 $\angle BCA = 56^\circ$
40. –

41.

$$a = 124^\circ$$

$$b = 56^\circ$$

$$c = 56^\circ$$

$$d = 38^\circ$$

$$e = 38^\circ$$

$$f = 76^\circ$$

$$g = 66^\circ$$

$$h = 104^\circ$$

$$k = 76^\circ$$

$$n = 86^\circ$$

42. (a) –

(b) $\overline{AB} \parallel \overline{CD}$ by A.I.A.T.

(c) –

(d) $\overline{AD} \parallel \overline{BC}$ by A.I.A.T.

(e) If both pairs of opposite sides in a quadrilateral are congruent, then the quadrilateral is a parallelogram.

(f) If a quadrilateral is a parallelogram, then both pairs of opposite sides are congruent.

43. If a quadrilateral is a parallelogram, then its diagonals bisect each other.

44. $3 = \sqrt{x^2 + y^2 + z^2}$ or $9 = x^2 + y^2 + z^2$. The configuration of all such points is a sphere centered at the origin with a radius of 3.

45. –

46. –

47. The sum of the three exterior angles is 360° .

48. If both pairs of opposite angles in a quadrilateral are congruent, the quadrilateral is a parallelogram.

49. If all adjacent angles in a quadrilateral are supplementary, then the quadrilateral is a parallelogram.

50. (a) 107°

(b) 107°

(c) 107°

51. (a) $D = (1, -2)$

- (b) It appears to be a parallelogram.
 (c) If a quadrilateral has a pair of opposite, congruent, and parallel sides, it's a parallelogram

52. –

53. –

54.

$$\vec{u} + \vec{v} = [6, -1]$$

$$\vec{u} - \vec{v} = [4, 5]$$

$$\vec{u} + 2\vec{v} = [7, -4]$$

$$2\vec{u} - 3\vec{v} = [7, 13]$$

55. $\overline{AB} \parallel \overline{DC}$
 $\overline{AD} \cong \overline{BC}$

56. –

57. $(90 - \frac{r}{2})^\circ$

58. No, they intersect in a way that creates one acute angle and one obtuse angle. In #57, we saw that those angles are $(90 - \frac{r}{2})^\circ$ and $(90 + \frac{r}{2})^\circ$. The only way for them to intersect perpendicularly is for r to equal 0° which is impossible in a triangle.

59. –

60. –

61. –

62. (a) $\overrightarrow{BA} = -\vec{u}$

(b) $\overrightarrow{CA} = -\vec{u} - \vec{v}$

(c) $\overrightarrow{MN} = \frac{1}{2}\vec{u} + \frac{1}{2}\vec{v}$

63. $[5, -3, 6] \cdot [3, 7, 1] = 15 - 21 + 6 = 0$

64. (a) $\overrightarrow{AC} = \vec{u} + \vec{v}$

(b) $\overrightarrow{CX} = -\frac{1}{2}\vec{u} - \frac{1}{2}\vec{v}$

(c) $\overrightarrow{DB} = \vec{u} - \vec{v}$

(d) $\overrightarrow{XM} = \frac{1}{2}\vec{v}$

65. (a) $\overrightarrow{PS} = [c, d]$
 $\overrightarrow{PQ} = [a, b]$

- (b) $R = (a + c, b + d)$
66. A 3×4 rectangle.
67. $C = (10, 5)$
 $C = (-4, 3)$
68. Yes, there is. Draw diagonals \overline{AC} and \overline{PR} . You can show that they create two pairs of congruent triangles across the two quadrilaterals.
69. $[5, -3, 6] \cdot [3, 7, 1] = 15 - 21 + 6 = 0$
70. $[4, 0, -5]$
71. $\left[\frac{7}{\sqrt{10}}, -\frac{21}{\sqrt{10}}, 0\right]$
72. $-$
73. (a) $x = 50^\circ$
 $y = 95^\circ$
- (b) $x = 60^\circ$
 $y = 140^\circ$
- (c) $x = 30^\circ$
 $y = 30^\circ$
- (d) $x = 9$
- (e) $x = 7$
 $y = -3$
- (f) $x = 6$
 $y = 4$
- (g) $x = 50^\circ$
- (h) $x = 51^\circ$
 $y = 112^\circ$
- (i) $x = 30$
 $y = 10$
- (j) $x = 6$
- (k) $x = 50^\circ$
- (l) $x = -1, 10$

74.

$$\angle 1 = 80^\circ$$

$$\angle 2 = 165^\circ$$

$$\angle 3 = 15^\circ$$

$$\angle 4 = 25^\circ$$

$$\angle 5 = 75^\circ$$

$$\angle 6 = 65^\circ$$

$$\angle 7 = 40^\circ$$

$$\angle 8 = 140^\circ$$

$$\angle 9 = 100^\circ$$

$$\angle 10 = 80^\circ$$

75. (a) $\overrightarrow{AB} + \overrightarrow{BC}$

(b) $\overrightarrow{AB} + \overrightarrow{AD}$

(c) $-\overrightarrow{AB} + \overrightarrow{AD}$

76. $\overrightarrow{PQ} = -\vec{v} + \vec{w}$
 $\overrightarrow{BC} = -3\vec{v} + 3\vec{w}$

77. (a) $\vec{a} + \vec{c}$

(b) $-\vec{b} + \vec{c}$

(c) $\vec{a} + \vec{b} + \vec{c}$

(d) $-\vec{a} + \vec{b} + \vec{c}$

78. 22°

79. 90°

80. $-$

81. $-$

82. (a) $-$

(b) $-$

(c) Yes

83. (a) 60

(b) 30

(c) 20

84. No

85. 36°

86. $36^\circ - 36^\circ - 108^\circ$
 $45^\circ - 45^\circ - 90^\circ$
 $36^\circ - 72^\circ - 72^\circ$

87. (a) 360°
(b)

Polygon	Sketch	Number of sides	Number of diagonals from 1 vertex	Number of triangles	Interior angle sum
Triangle	—	3	0	1	180°
Quadrilateral	—	4	1	2	360°
Pentagon	—	5	2	3	540°
Hexagon	—	6	3	4	720°
Heptagon	—	7	4	5	900°
Octagon	—	8	5	6	$1,080^\circ$
Decagon	—	10	7	8	$1,440^\circ$
Dodecagon	—	12	9	10	$1,800^\circ$
n -gon	—	n	$n - 3$	$n - 2$	$180^\circ(n - 2)$

88. (a) Multiply 180° by the number of sides minus 2.
(b) $3,240^\circ$

89. 75°

90. —

91. (a) $\overrightarrow{BC} = \vec{v} - \vec{u}$
 $\overrightarrow{MN} = \frac{1}{2}\vec{v} - \frac{1}{2}\vec{u}$
(b) $\overrightarrow{MN} = \frac{1}{2}\overrightarrow{BC} \implies \overline{MN} \parallel \overline{BC}$

92. 360°

93. (a) $(12, 4, 3)$
(b) $(\frac{60}{13}, \frac{20}{13}, \frac{15}{13})$

94. —

95. 90°

96. (a) 30°
(b) Yes

97. $x = \frac{240}{7}$

98. –
99. One
100. (a) $x = 8$
 $y = 10$
 $z = 10$
 (b) $x = 10$
 (c) $x = 60^\circ$
 $y = 140^\circ$
 (d) $x = 6$
 $y = \frac{13}{2}$
 (e) $z = 65^\circ$
 (f) $x = 40$
101. Interior angles: 140°
 $\angle PAN = 100^\circ$
102. –
103. 104°
104. One of them must be 90° .
105. It's the converse of the result in #104.
106. 360°
107. 360°
108. –
109. (a) $36^\circ, 36^\circ, 108^\circ$
 (b) –
110. 20
111. 15
112. 17
113. 20
114. 15
115. 18
116. 20°
117. (a) $\angle ANB = 84^\circ$
 $\angle NBF = 6^\circ$

- (b) $\angle ANB = 96^\circ$
 $\angle NBF = 6^\circ$
118. 60°
119. Yes, it's regular.
120. (a) $\overline{GM} \cong \overline{MP}$
 $\overline{BM} \cong \overline{MC}$
 (b) –
121. 4, 7, 9, 12, 15
122. –
123. It's a parallelogram in both cases.
124. $[3, 1 - \frac{9}{4}]$
125. 360°
126. (a) 36°
 (b) 10
127. (3, 2)
128. (a) –
 (b) Parallelogram
 (c) $\overline{PC}, \overline{GQ}$
 (d) –
 (e) –
129. (a) $\frac{15}{2}, \frac{3}{2}\sqrt{73}, 3\sqrt{13}$
 (b) $5, \sqrt{73}, 2\sqrt{13}$
130. Length of medians: $3\sqrt{3}$
 Distance from centroid to vertices: $2\sqrt{3}$
131. (a) $(8, \frac{19}{3})$
 (b) $(\frac{a+b+c}{3}, \frac{p+q+r}{3})$
132. $(0, \frac{-7}{3})$
133. (a) –
 (b) 8 in.
 (c) 104 in.^2
134. Yes, $\triangle APQ$ is equilateral.

135. No, the proofs are identical.
136. 90°
137. $\frac{120}{17}$
138. $-$
139. (a) $\frac{16}{3}$
(b) $\frac{25}{4}$
140. (a) $-$
(b) If a quadrilateral's diagonals are the same length, it is a rectangle.
(c) No
141. (a) $\frac{1}{2}\vec{v} - \vec{u}$
(b) $\frac{1}{2}\vec{u} + \frac{1}{2}\vec{v}$
(c) $\frac{1}{3}\vec{v} + \frac{1}{3}\vec{u}$
(d) We just proved it with vectors.
142. No
143. Yes
144. $2\sqrt{5}$
145. (a) $-$
(b) $-$
(c) Yes
146. (a) The diagonals must have the same length.
(b) The diagonals must be perpendicular.
147. $4 < d < 42$
148. (a) $\angle B \cong \angle C$
 $\angle A \cong \angle D$
(b) Yes
149. Yes
150. 12
151. (a) 8
(b) $\frac{75}{8}$
152. $-$
153. Yes, rectangle

154. Yes, it's an isosceles trapezoid.

155. —

156. 0

157. No

158. It must be a parallelogram.

159. 15