IM1H Book 2 Selected Answers

IM1H Dream Team

February 4, 2026

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) $\angle 2 + \angle 4 = 180°$
   (b) $\angle 2 + \angle 1 + \angle 3 = 180°$
   (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 then lines are parallel.
   (e) $\angle KHB + \angle HKD = 180°$
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) $\angle a + \angle b + \angle c = 180°$

    (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) $x = 98°$
    (b) $y = 73°$
    (c) $w = 108°$
    (d) $u = 26°$

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. $\angle ABC = 68°$
    $\angle BCA = 56°$

40. –

41.

$$
\begin{aligned}
a &= 124^\circ \\
b &= 56^\circ \\
c &= 56^\circ \\
d &= 38^\circ \\
e &= 38^\circ \\
f &= 76^\circ \\
g &= 66^\circ \\
h &= 104^\circ \\
k &= 76^\circ \\
n &= 86^\circ
\end{aligned}
$$

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) $x = 50°$
$y = 95°$

(b) $x = 60°$
$y = 140°$

(c) $x = 30°$
$y = 30°$

(d) $x = 9$

(e) $x = 7$
$y = -3$

(f) $x = 6$
$y = 4$

(g) $x = 50°$

(h) $x = 51°$
$y = 112°$

(i) $x = 30$
$y = 10$

(j) $x = 6$

(k) $x = 50°$

(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. $36° - 36° - 108°$
$45° - 45° - 90°$
$36° - 72° - 72°$

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	$1,080°$
Decagon	–	10	7	8	$1,440°$
Dodecagon	–	12	9	10	$1,800°$
n-gon	–	n	$n-3$	$n-2$	$180°(n-2)$

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

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) $\left(\frac{60}{13}, \frac{20}{13}, \frac{15}{13}\right)$

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) $x = 60°$
     $y = 140°$

     (d) $x = 6$
     $y = \frac{13}{2}$

     (e) $z = 65°$

     (f) $x = 40$

101. Interior angles: 140°
     $\angle PAN = 100°$

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) $36°, 36°, 108°$

     (b) –

110. 20

111. 15

112. 17

113. 20

114. 15

115. 18

116. 20°

117. (a) $\angle ANB = 84°$
     $\angle NBF = 6°$

(b) $\angle ANB = 96°$
$\angle NBF = 6°$

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. $\left[3, 1 - \frac{9}{4}\right]$

125. Need a protractor or trig. The point is that we can't use the Sentry Theorem because of the definition of exterior angles of a polygon.

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. $90°$