

Solving Any Triangle with Sines, Cosines and Area

Grade 10 – Geometry math · Test Answer Key · Standards: G-SRT.D.9, G-SRT.D.10, G-SRT.D.11

Each solution shows the law used, the substitution and the rounded result. The scoring notes show where partial credit is earned for the setup and for the arithmetic.

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Question 1 Triangle Area (2 points)

$$\text{Area} = \frac{1}{2} \cdot 15 \cdot 11 \cdot \sin 47^\circ = 82.5 \cdot 0.7314 = 60.34.$$

≈ 60.3 square units

Scoring: 1 point for the formula with the correct numbers, 1 point for the answer.

Question 2 Find a Side with Sines (2 points)

$$\frac{b}{(\sin 33^\circ)} = \frac{22}{(\sin 81^\circ)}, \text{ so } b = \frac{(22 \sin 33^\circ)}{(\sin 81^\circ)} \approx 12.13.$$

$b \approx 12.1$

Scoring: 1 point for the proportion, 1 point for the answer.

Question 3 Find a Side with Cosines (2 points)

$$c^2 = 19^2 + 14^2 - 2(19)(14) \cos 48^\circ = 557 - 532 \cdot 0.6691 = 201.02.$$

$c \approx 14.2$

Scoring: 1 point for the substitution, 1 point for the answer.

Question 4 Largest Angle (3 points)

$$\text{The largest angle } C \text{ is opposite } 13. \cos C = \frac{(49 + 100 - 169)}{(2 \cdot 7 \cdot 10)} = \frac{(-20)}{140} \approx -0.1429.$$

$$C = \cos^{-1}(-0.1429) \approx 98.21^\circ.$$

$C \approx 98.2^\circ$

Scoring: 1 point for choosing the opposite angle, 1 point for the cosine equation, 1 point for the answer.

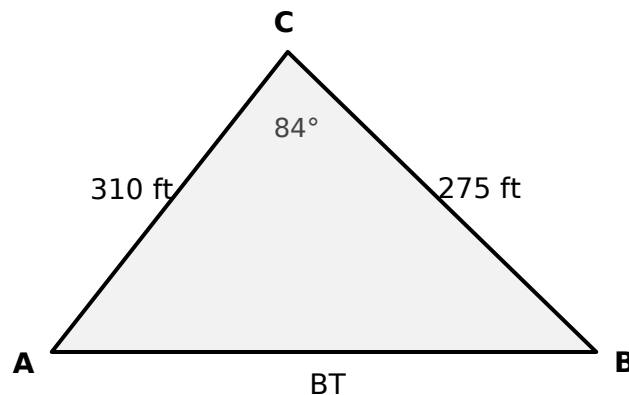
Question 5 Which Law First? (2 points)

- (a) Law of Sines: two angles and a side opposite one of them.
(b) Law of Cosines: all three sides are known and no angle is known.

(a) Sines (b) Cosines

Scoring: 1 point each.

Question 6 Across the Canyon (3 points)



Ranger at the vertex with the 84° angle.

$$BT^2 = 310^2 + 275^2 - 2(310)(275) \cos 84^\circ = 171,725 - 170,500 \cdot 0.1045 = 153903.$$

$$BT \approx 392.3.$$

$$\approx \mathbf{392 \text{ ft}}$$

Scoring: 1 point for the Law of Cosines setup, 1 point for the arithmetic, 1 point for the answer.

Question 7 Two Lookouts (3 points)

$$\text{Angle } F = 180^\circ - 58^\circ - 49^\circ = 73^\circ.$$

$$\text{AF is opposite the } 49^\circ \text{ angle at B: } \frac{AF}{(\sin 49^\circ)} = \frac{5.4}{(\sin 73^\circ)}.$$

$$AF = \frac{(5.4 \sin 49^\circ)}{(\sin 73^\circ)} \approx 4.26.$$

$$\approx \mathbf{4.3 \text{ mi}}$$

Scoring: 1 point for angle F, 1 point for the proportion, 1 point for the answer.

Question 8 Hikers at Different Bearings (3 points)

The angle between the bearings is $115^\circ - 40^\circ = 75^\circ$.

$$d^2 = 9^2 + 14^2 - 2(9)(14) \cos 75^\circ = 277 - 252 \cdot 0.2588 = 211.78.$$

$$d \approx 14.55.$$

$$\approx \mathbf{14.6 \text{ mi}}$$

Scoring: 1 point for the angle, 1 point for the setup, 1 point for the answer.