

Law of Sines, Law of Cosines and Area

Grade 12 – Precalculus math · Test Answer Key · Standards: G-SRT.D.9, G-SRT.D.10, G-SRT.D.11

Each solution shows the work with a scoring note. Award separate points for choosing the right law, the substitution and the final value, so a rounding slip costs at most one point.

Standards: G-SRT.D.9, G-SRT.D.10, G-SRT.D.11 · **Level:** Grade 12 Precalculus

Question 1 Area of a Triangle (2 points)

$$\text{Area} = \frac{1}{2}(16)(11) \sin 47^\circ = 88 \times 0.7314 \approx \mathbf{64.4 \text{ ft}^2}.$$

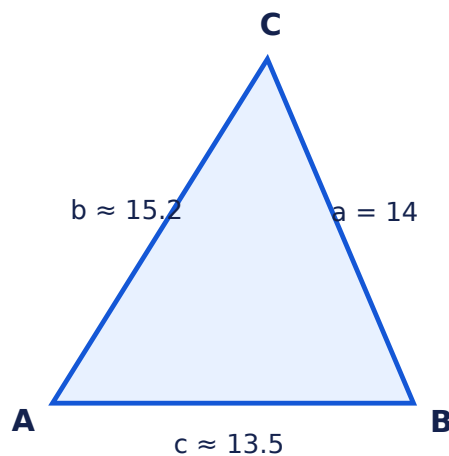
Scoring: 1 point for the correct formula and substitution; 1 point for the answer.

Question 2 Heron's Formula (2 points)

$$s = 48/2 = 24. \text{ Area} = \sqrt{(24 \cdot 14 \cdot 7 \cdot 3)} = \sqrt{7056} = \mathbf{84 \text{ cm}^2}.$$

Scoring: 1 point for s and the substitution; 1 point for the area.

Question 3 Law of Sines in a Triangle (3 points)



Triangle with $A = 58^\circ$, $B = 67^\circ$ and $a = 14$.

- $C = 180^\circ - 58^\circ - 67^\circ = \mathbf{55^\circ}$.
- $b = 14 \sin 67^\circ \div \sin 58^\circ \approx \mathbf{15.2}$.
- $c = 14 \sin 55^\circ \div \sin 58^\circ \approx \mathbf{13.5}$.

Scoring: 1 point per part.

Question 4 Law of Cosines, Then Law of Sines (3 points)

$$c^2 = 81 + 169 - 2(9)(13) \cos 71^\circ = 250 - 234(0.3256) \approx 173.82, \text{ so } c \approx \mathbf{13.2}.$$

$$\sin A = 9 \sin 71^\circ \div 13.18 \approx 0.6455, \text{ and } A \text{ is acute because } a < b, \text{ so } A \approx \mathbf{40.2^\circ}.$$

Scoring: 2 points for c (1 for the setup, 1 for the value); 1 point for A .

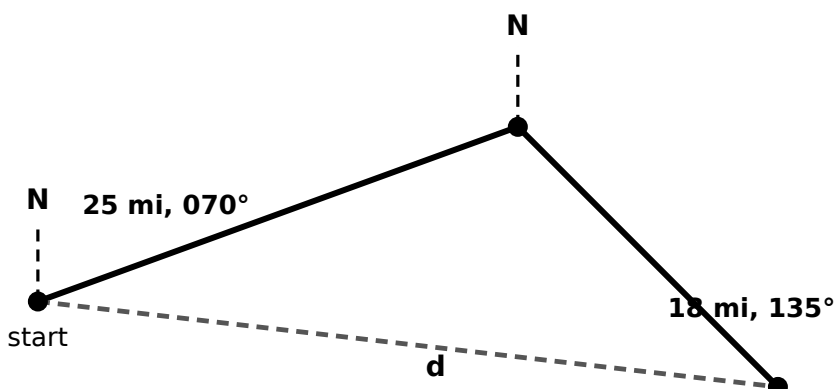
Question 5 Ambiguous Case (2 points)

The height is $10 \sin 36^\circ \approx 5.88$ and $5.88 < 7 < 10$, so **two triangles** fit.

$$\sin B = 10 \sin 36^\circ \div 7 \approx 0.8397, \text{ so } B \approx \mathbf{57.1^\circ} \text{ or } \mathbf{122.9^\circ}.$$

Scoring: 1 point for two triangles with a justification; 1 point for both values of B .

Question 6 Navigation with Bearings (3 points)



a. $180^\circ - (135^\circ - 70^\circ) = \mathbf{115^\circ}.$

b. $d^2 = 25^2 + 18^2 - 2(25)(18) \cos 115^\circ = 949 + 380.4 \approx 1329.4.$

c. $d \approx \mathbf{36.5 \text{ miles}}.$

Scoring: 1 point per part.

Question 7 Largest Angle (2 points)

The largest angle is opposite 14: $\cos C = (64 + 121 - 196)/(2 \cdot 8 \cdot 11) = -11/176 = -0.0625.$

$$C \approx \mathbf{93.6^\circ}.$$

Scoring: 1 point for the Law of Cosines setup; 1 point for the angle.

Question 8 River Crossing Survey (3 points)

$PQ^2 = 480^2 + 360^2 - 2(480)(360) \cos 41^\circ = 360,000 - 345,600(0.7547) \approx 99,172$, so $PQ \approx$ **315 ft.**

Area = $\frac{1}{2}(480)(360) \sin 41^\circ \approx$ **56,684 ft².**

Scoring: 2 points for PQ (1 for the setup, 1 for the value); 1 point for the area.