

Solving Right Triangles with Sine, Cosine and Tangent

Grade 10 – Geometry math · Worksheet Answer Key · Standards: G-SRT.C.6, G-SRT.C.7, G-SRT.C.8

Every solution lists the ratio chosen, the substitution and the rounded result. Compare your intermediate values too: decimals are shown before rounding so you can find where an error began.

Standards: G-SRT.C.6, G-SRT.C.7, G-SRT.C.8 · **Level:** Grade 10 Geometry

Problem 1 Naming the Ratios

Opposite A is BC = 40, adjacent is AC = 9, hypotenuse is AB = 41.

$$\sin A = \frac{40}{41}, \cos A = \frac{9}{41}, \tan A = \frac{40}{9}.$$

$$\sin A = 40/41, \cos A = 9/41, \tan A = 40/9$$

Problem 2 Ratios for the Other Angle

From angle B, the opposite side is AC = 8 and the adjacent side is BC = 15.

$$\sin B = \frac{8}{17}, \cos B = \frac{15}{17}, \tan B = \frac{8}{15}.$$

$$\sin B = 8/17, \cos B = 15/17, \tan B = 8/15$$

Problem 3 Complementary Angles

Sine and cosine of complementary angles are equal.

$$(a) \cos 67^\circ = \sin(90^\circ - 67^\circ) = \sin 23^\circ.$$

$$(b) x = 90 - 28 = 62.$$

$$(c) 24^\circ + 66^\circ = 90^\circ, \text{ so } \cos 66^\circ = \sin 24^\circ \approx 0.4067.$$

$$(a) \sin 23^\circ \quad (b) x = 62 \quad (c) 0.4067$$

Problem 4 Missing Leg with Tangent

Opposite is x , adjacent is 14, so $\tan 35^\circ = \frac{x}{14}$.

$$x = 14 \cdot \tan 35^\circ \approx 14 \cdot 0.7002 = 9.8.$$

$$\mathbf{x \approx 9.8}$$

Problem 5 Hypotenuse with Cosine

Adjacent is 11 and the hypotenuse is x : $\cos 52^\circ = \frac{11}{x}$.

$$x = \frac{11}{(\cos 52^\circ)} \approx \frac{11}{0.6157} \approx 17.87.$$

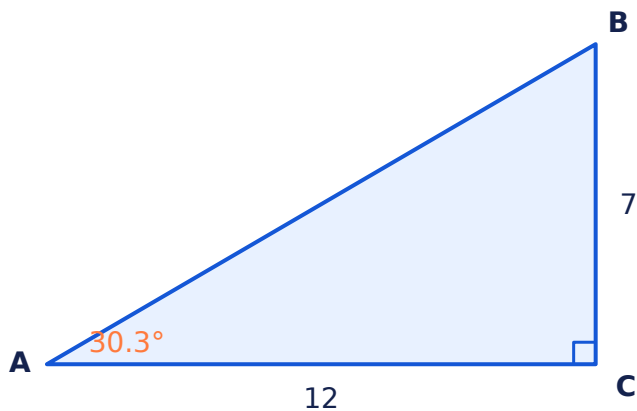
$$\mathbf{x \approx 17.9}$$

Problem 6 Leg with Sine

BC is opposite angle A. $\sin 41^\circ = \frac{BC}{23}$, so $BC = 23 \cdot \sin 41^\circ \approx 23 \cdot 0.6561 = 15.09$.

$$\mathbf{BC \approx 15.1}$$

Problem 7 Angle from Two Legs



Angle $\theta \approx 30.3^\circ$.

$$\tan \theta = \frac{7}{12}, \text{ so } \theta = \tan^{-1}(7/12) \approx 30.26^\circ.$$

$$\mathbf{\theta \approx 30.3^\circ}$$

Problem 8 Angle from a Sine Ratio

$$\sin \theta = \frac{13}{19} \approx 0.6842, \text{ so } \theta = \sin^{-1}(0.6842) \approx 43.17^\circ.$$

$$\theta \approx 43.2^\circ$$

Problem 9 Isosceles Right Triangle

The sides are in the ratio $1 : 1 : \sqrt{2}$, so the hypotenuse is $14\sqrt{2}$.

$$14 \cdot 1.4142 \approx 19.8.$$

$$14\sqrt{2} \text{ cm} \approx 19.8 \text{ cm}$$

Problem 10 Hypotenuse and Short Leg

The short leg is half the hypotenuse: $22 \div 2 = 11$. The long leg is short leg $\cdot \sqrt{3} = 11\sqrt{3} \approx 19.05$.

$$\text{Short leg } 11 \text{ ft; long leg } 11\sqrt{3} \text{ ft} \approx 19.1 \text{ ft}$$

Problem 11 Starting from the Long Leg

Long leg = short leg $\cdot \sqrt{3}$, so short leg $BC = 12\sqrt{3} \div \sqrt{3} = 12$. Hypotenuse = $2 \cdot 12 = 24$.

$$BC = 12 \text{ in, } AB = 24 \text{ in}$$

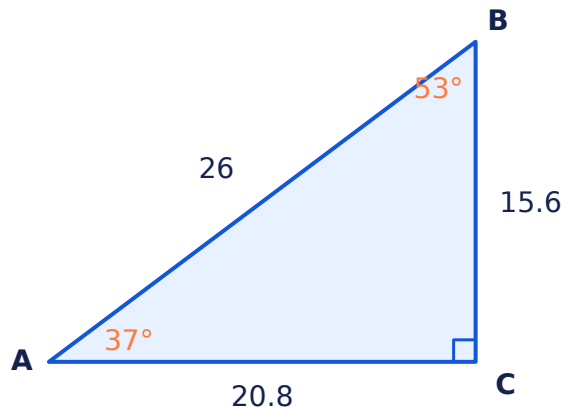
Problem 12 Solving from Two Legs

$$AB = \sqrt{(20^2 + 21^2)} = \sqrt{841} = 29.$$

$\tan A = \frac{21}{20}$, so $A = 46.4^\circ \approx 46.4^\circ$. Then $B = 90^\circ - 46.4^\circ = 43.6^\circ$ (check: $\tan^{-1}(20/21) \approx 43.6^\circ$).

$$AB = 29, A \approx 46.4^\circ, B \approx 43.6^\circ$$

Problem 13 Angle and Hypotenuse



Solved triangle.

$$B = 90^\circ - 37^\circ = 53^\circ.$$

$$BC = 26 \cdot \sin 37^\circ \approx 26 \cdot 0.6018 = 15.65. \quad AC = 26 \cdot \cos 37^\circ \approx 26 \cdot 0.7986 = 20.76.$$

B = 53°, BC ≈ 15.6, AC ≈ 20.8

Problem 14 Angle and One Leg

$A = 90^\circ - 62^\circ = 28^\circ$. From angle B , BC is adjacent and AC is opposite.

$$AC = 9.5 \cdot \tan 62^\circ \approx 9.5 \cdot 1.8807 = 17.87. \quad AB = \frac{9.5}{(\cos 62^\circ)} \approx 20.24.$$

A = 28°, AC ≈ 17.9 m, AB ≈ 20.2 m

Problem 15 Surveying a Water Tower

The part above eye level: $120 \cdot \tan 34^\circ \approx 120 \cdot 0.6745 = 80.94$ ft. Add the eye height: $80.94 + 5.5 = 86.44$.

≈ 86.4 ft

Problem 16 Boat Below the Cliff

The angle at the boat equals 18° (alternate interior angles). The 210 ft side is opposite, the distance d is adjacent: $\tan 18^\circ = \frac{210}{d}$.

$$d = \frac{210}{(\tan 18^\circ)} \approx 646.31.$$

≈ 646 ft

Problem 17 Wheelchair Ramp

Rise is opposite the angle. Ramp length (hypotenuse): $\frac{2.5}{(\sin 4.8^\circ)} \approx 29.88$ ft. Horizontal distance (adjacent): $\frac{2.5}{(\tan 4.8^\circ)} \approx 29.77$ ft.

Ramp $\approx$ 29.9 ft long, covering $\approx$ 29.8 ft horizontally

Problem 18 Ladder and Window

(a) Height = $16 \cdot \sin 74^\circ \approx 16 \cdot 0.9613 = 15.38$ ft.

(b) Base distance = $16 \cdot \cos 74^\circ \approx 16 \cdot 0.2756 = 4.41$ ft.

(c) 15.38 is less than 15.5, so the ladder falls short of the sill.

(a) $\approx$ 15.4 ft (b) $\approx$ 4.4 ft (c) No

Problem 19 Two Sightings of a Tower

Let h be the height and d the first distance. Then $h = d \cdot \tan 25^\circ$ and $h = (d - 90) \cdot \tan 40^\circ$.

$d \cdot \tan 25^\circ = (d - 90) \cdot \tan 40^\circ$ gives $d(\tan 40^\circ - \tan 25^\circ) = 90 \cdot \tan 40^\circ$.

$\tan 40^\circ \approx 0.8391$, $\tan 25^\circ \approx 0.4663$, so $d \approx 75.52 \div 0.3728 \approx 202.6$. Then $h \approx 202.6 \cdot 0.4663 \approx 94.5$.

$\approx$ 94 ft

Problem 20 Roof Rafters

Each side covers half of the span: 15 ft horizontally.

(a) Height = $15 \cdot \tan 33^\circ \approx 15 \cdot 0.6494 = 9.74$ ft.

(b) Roof length = $\frac{15}{(\cos 33^\circ)} \approx \frac{15}{0.8387} \approx 17.89$ ft. Add the overhang: $17.89 + 1.5 = 19.39$ ft.

(a) $\approx$ 9.7 ft (b) $\approx$ 19.4 ft