

Right Triangles and Trigonometry: practice solutions, Grade 10 – download the PDF

Written solutions to the chapter problems. Check each step, then correct yourself.

1 Tablet diagonal



The diagonal is the hypotenuse of a right triangle with legs 6 in and 8 in.

$$d^2 = 6^2 + 8^2 = 36 + 64 = 100, \text{ so } d = 10 \text{ in.}$$

In centimeters: $10 \times 2.54 = 25.4$ cm.

Answer: the diagonal is 10 in, or 25.4 cm.

2 Ladder against a wall



The ladder is the hypotenuse, so $13^2 = 5^2 + h^2$.

$$h^2 = 169 - 25 = 144, \text{ so } h = 12 \text{ ft.}$$

Answer: the ladder reaches 12 ft up the wall.

3 Right triangle or not?



Compare the square of the longest side with the sum of the other two squares.

a. $9^2 + 40^2 = 81 + 1600 = 1681 = 41^2$: right triangle.

b. $10^2 + 24^2 = 100 + 576 = 676 = 26^2$: right triangle.

c. $12^2 + 16^2 = 144 + 256 = 400$ but $22^2 = 484$: not a right triangle (it is obtuse).

4 Square tile



The diagonal cuts the square into two 45-45-90 triangles with legs 8 in.

Hypotenuse = $8\sqrt{2} \approx 11.31$ in.

Answer: the diagonal is $8\sqrt{2} \approx 11.31$ in.

5 Half an equilateral triangle



Short leg $x = 5$. The hypotenuse is $2x = 10$ cm and the long leg is $x\sqrt{3} = 5\sqrt{3} \approx 8.66$ cm.

Answer: hypotenuse 10 cm, long leg $5\sqrt{3} \approx 8.66$ cm.

6 Reading the ratios



Opposite = 9, adjacent = 12, hypotenuse = 15.

$$\sin A = \frac{9}{15} = \frac{3}{5}, \cos A = \frac{12}{15} = \frac{4}{5}, \tan A = \frac{9}{12} = \frac{3}{4}.$$

7 True or false?



- a. True: 20° and 70° are complementary, so $\sin 20^\circ = \cos(90^\circ - 20^\circ) = \cos 70^\circ$.
- b. False: $c^2 = a^2 + b^2 > a^2$, so $c > a$. The hypotenuse is the longest side.
- c. True: in a 45-45-90 triangle the legs are equal, so opposite over adjacent is 1.

8 Guy wire



$$L^2 = 24^2 + 7^2 = 576 + 49 = 625, \text{ so } L = 25 \text{ ft.}$$

In meters: $25 \times 0.3048 = 7.62 \text{ m}$.

Answer: the wire is 25 ft (7.62 m) long.

9 Is the corner square?



- a. $15^2 + 36^2 = 225 + 1296 = 1521 = 39^2$, so by the converse the corner is a right angle.
- b. $8^2 + 10^2 = 164$ and $13^2 = 169$. Since $164 < 169$, the triangle is obtuse.

10 Geometric means



- a. $\sqrt{6 \cdot 24} = \sqrt{144} = 12$.
- b. $\sqrt{5 \cdot 20} = \sqrt{100} = 10$.
- c. $\sqrt{4 \cdot 10} = \sqrt{40} = 2\sqrt{10} \approx 6.32$.

11 Altitude to the hypotenuse



Altitude: $h = \sqrt{3 \cdot 12} = 6$. Hypotenuse: $c = 3 + 12 = 15$.

Leg next to the segment 3: $\sqrt{3 \cdot 15} = \sqrt{45} = 3\sqrt{5} \approx 6.71$.

Leg next to the segment 12: $\sqrt{12 \cdot 15} = \sqrt{180} = 6\sqrt{5} \approx 13.42$.

Check: $45 + 180 = 225 = 15^2$.

12 Flagpole rope



The 15 ft is adjacent to 28° .

Rope (hypotenuse): $\cos 28^\circ = \frac{15}{L}$, so $L = \frac{15}{\cos 28^\circ} \approx 17.0$ ft.

Pole (opposite): $h = 15 \tan 28^\circ \approx 8.0$ ft.

13 Wheelchair ramp



$$\tan \theta = \frac{2}{24} = \frac{1}{12}, \text{ so } \theta = \tan^{-1}\left(\frac{1}{12}\right) \approx 4.8^\circ.$$

14 Height of a tree



Height above eye level: $50 \tan 38^\circ \approx 39.06$ ft.

Add eye height: $39.06 + 5.5 \approx 44.6$ ft.

Answer: the tree is about 44.6 ft tall.

15 Lifeguard tower



The angle between the line of sight and the water is also 15° (alternate interior angles).

a. $\tan 15^\circ = \frac{12}{x}$, so $x = \frac{12}{\tan 15^\circ} \approx 44.8$ ft.

b. $\sin 15^\circ = \frac{12}{d}$, so $d = \frac{12}{\sin 15^\circ} \approx 46.4$ ft.

16 Solving with the Law of Sines



$$C = 180^\circ - 52^\circ - 71^\circ = 57^\circ.$$

$$b = \frac{14 \sin 71^\circ}{\sin 52^\circ} \approx 16.8.$$

$$c = \frac{14 \sin 57^\circ}{\sin 52^\circ} \approx 14.9.$$

17 Solving with the Law of Cosines



$$c^2 = 13^2 + 17^2 - 2(13)(17) \cos 38^\circ = 169 + 289 - 442 \cos 38^\circ \approx 458 - 348.30 = 109.70$$

.

$$c \approx 10.47.$$

18 Three sides



Angle opposite 9: $\cos A = \frac{10^2 + 11^2 - 9^2}{2 \cdot 10 \cdot 11} = \frac{140}{220}$, so $A \approx 50.5^\circ$.

Angle opposite 10: $\cos B = \frac{9^2 + 11^2 - 10^2}{2 \cdot 9 \cdot 11} = \frac{102}{198}$, so $B \approx 59.0^\circ$.

Angle opposite 11: $\cos C = \frac{9^2 + 10^2 - 11^2}{2 \cdot 9 \cdot 10} = \frac{60}{180} = \frac{1}{3}$, so $C \approx 70.5^\circ$.

Check: $50.5 + 59.0 + 70.5 = 180$.

19 Boat from the shore



The angle at the boat is $180^\circ - 48^\circ - 67^\circ = 65^\circ$.

Law of Sines: $AC = \frac{120 \sin 67^\circ}{\sin 65^\circ} \approx 121.9$ m.

Perpendicular distance: $AC \sin 48^\circ \approx 121.89 \times 0.7431 \approx 90.6$ m.

20 Building and flagpole



Height to the top of the pole: $30 \tan 60^\circ \approx 51.96$ m.

Height of the building: $30 \tan 55^\circ \approx 42.84$ m.

Flagpole: $51.96 - 42.84 \approx 9.1$ m.

21 Altitude by areas



a. $c = \sqrt{81 + 144} = 15$.

b. Area = $\frac{1}{2}ab = \frac{1}{2}ch$, so $h = \frac{ab}{c} = \frac{108}{15} = 7.2$.

c. $p = \frac{a^2}{c} = \frac{81}{15} = 5.4$ and $q = \frac{b^2}{c} = \frac{144}{15} = 9.6$. Then $p + q = 15$ and $pq = 51.84 = 7.2^2$.

22 A ship changes course



Law of Cosines:

$$d^2 = 40^2 + 30^2 - 2(40)(30) \cos 125^\circ = 2500 - 2400(-0.5736) \approx 3876.6.$$

$$d \approx 62.3 \text{ mi, which is about } 62.27 \times 1.609 \approx 100.2 \text{ km.}$$



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