

The Pythagorean Theorem: practice solutions, Grade 8 – download the PDF

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

1 Hypotenuse of a 6-8 triangle



The hypotenuse is c , so $c^2 = 6^2 + 8^2 = 36 + 64 = 100$.

$$c = \sqrt{100} = 10.$$

The hypotenuse is 10 cm long.

2 A longer triple



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

The hypotenuse is 25 in long.

3 Find a missing leg



Subtract, since the hypotenuse is known: $a^2 = 26^2 - 10^2 = 676 - 100 = 576$.

$$a = \sqrt{576} = 24.$$

The other leg is 24 m long.

4 True or false?



She is not right. She added the legs instead of adding their squares.

$$c^2 = 4^2 + 5^2 = 16 + 25 = 41, \text{ so } c = \sqrt{41} \approx 6.40 \text{ cm.}$$

Also, a hypotenuse is always shorter than the sum of the legs, so 9 cm is too long. **False:** the hypotenuse is about 6.40 cm.

5 Complete the table



a. $c^2 = 64 + 225 = 289$, so $c = 17$.

b. $c^2 = 81 + 1600 = 1681$, so $c = 41$.

c. $c^2 = 144 + 1225 = 1369$, so $c = 37$.

6 A hypotenuse that is not a whole number



$$c^2 = 3^2 + 5^2 = 9 + 25 = 34.$$

Exact value: $c = \sqrt{34}$ ft. Since $5.83^2 \approx 33.99$, we get $c \approx 5.83$ ft.

7 Right triangle or not?



a. The longest side is 15. $9^2 + 12^2 = 81 + 144 = 225 = 15^2$. Yes, it is a right triangle.

b. The longest side is 10. $7^2 + 8^2 = 49 + 64 = 113$, but $10^2 = 100$. No, it is not a right triangle.

8 The leaning ladder



The ladder is the hypotenuse (15 ft) and the distance on the ground is one leg (9 ft).

$$h^2 = 15^2 - 9^2 = 225 - 81 = 144, \text{ so } h = 12.$$

The ladder reaches 12 ft up the wall (about 3.66 m).

9

A shortcut across a field

★★★

Diagonal: $d^2 = 24^2 + 32^2 = 576 + 1024 = 1600$, so $d = 40$ m.

Along two sides: $24 + 32 = 56$ m.

Savings: $56 - 40 = 16$. The shortcut saves 16 m.

10

Height of an isosceles triangle

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The height splits the base into two parts of 5 cm and forms a right triangle with hypotenuse 13 cm.

$h^2 = 13^2 - 5^2 = 169 - 25 = 144$, so $h = 12$ cm.

Area = $\frac{1}{2} \times 10 \times 12 = 60$. The height is 12 cm and the area is 60 cm².

11

Distance between two points

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The legs are $9 - 1 = 8$ and $17 - 2 = 15$.

$AB = \sqrt{8^2 + 15^2} = \sqrt{64 + 225} = \sqrt{289} = 17$.

$AB = 17$ units.

12

Distance with negative coordinates

★★★

The horizontal change is $8 - (-4) = 12$ and the vertical change is $-2 - 3 = -5$, which has length 5.

$PQ = \sqrt{12^2 + 5^2} = \sqrt{144 + 25} = \sqrt{169} = 13$.

$PQ = 13$ units.

13 A triangle with decimal sides



The longest side is 2.5 cm. $1.5^2 + 2^2 = 2.25 + 4 = 6.25$ and $2.5^2 = 6.25$.

The equation holds, so the triangle is right. **The right angle is opposite the 2.5 cm side.**

14 Flight of a drone



a. The east and north legs are perpendicular, so

$$d^2 = 120^2 + 50^2 = 14,400 + 2,500 = 16,900 \text{ and } d = 130 \text{ m.}$$

b. Total: $120 + 50 + 130 = 300$. The trip is 300 m long.

15 Will the rod fit in the box?



a. Base diagonal: $\sqrt{12^2 + 16^2} = \sqrt{400} = 20$ in. Space diagonal:

$$\sqrt{20^2 + 21^2} = \sqrt{400 + 441} = \sqrt{841} = 29 \text{ in.}$$

b. The longest straight rod is 29 in. Since $28 < 29$, the 28 in rod fits. Since $30 > 29$, the 30 in rod does not fit.

16 The broken tree



The standing part has length x , and the fallen part has length $16 - x$ and is the hypotenuse.

$$x^2 + 8^2 = (16 - x)^2, \text{ so } x^2 + 64 = 256 - 32x + x^2.$$

The x^2 terms cancel: $64 = 256 - 32x$, so $32x = 192$ and $x = 6$.

Check: the fallen part is 10 ft and $6^2 + 8^2 = 100 = 10^2$. **The tree broke 6 ft above the ground.**

17 Area and perimeter from a hypotenuse

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Other leg: $\sqrt{25^2 - 7^2} = \sqrt{625 - 49} = \sqrt{576} = 24$ cm.

Perimeter: $7 + 24 + 25 = 56$ cm.

Area: $\frac{1}{2} \times 7 \times 24 = 84$ cm².

18 A right angle in the coordinate plane

★★★

$$AB^2 = 4^2 + 3^2 = 25. AC^2 = (-3)^2 + 4^2 = 25.$$

$$BC^2 = (-3 - 4)^2 + (4 - 3)^2 = 49 + 1 = 50.$$

Since $AB^2 + AC^2 = 50 = BC^2$, the converse applies. The triangle is right, with the right angle at A . It is also isosceles because $AB = AC = 5$.

19 Diagonal of a square

★★★

The two sides and the diagonal form a right triangle: $s^2 + s^2 = 14^2$, so $2s^2 = 196$ and $s^2 = 98$.

Exact side: $s = \sqrt{98} = 7\sqrt{2} \approx 9.90$ cm.

The area is $s^2 = 98$ cm², half of the square of the diagonal.

20 Height of an equilateral triangle

★★★

The height cuts the base into two segments of 5 cm: $h^2 = 10^2 - 5^2 = 100 - 25 = 75$.

$$h = \sqrt{75} = 5\sqrt{3} \approx 8.66 \text{ cm.}$$

Area = $\frac{1}{2} \times 10 \times 8.66 \approx 43.30$ cm². The height is about 8.66 cm and the area is about 43.30 cm².

21

Distance in 3D coordinates

The differences are $3 - 1 = 2$, $6 - 2 = 4$ and $7 - 3 = 4$.

$$PQ = \sqrt{2^2 + 4^2 + 4^2} = \sqrt{4 + 16 + 16} = \sqrt{36} = 6.$$

$PQ = 6$ units.

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