GRADE 7 ACCELERATED · UNIT 6 · LESSON 3

Pythagorean Theorem

MA.8.GR.1.1

I can find a missing side of a right triangle — the hypotenuse, or a leg.

Warm-Up

1. Can sides of 4 inches, 7 inches and 12 inches make a triangle?
2. A printer prints 18 pages a minute. Pages in 4.5 minutes?
3. Find the value: $\sqrt{196}$
4. Find the value: $10^2 - 6^2$

Warm-Up

1. Can sides of 4 inches, 7 inches and 12 inches make a triangle?

   No — 4 + 7 = 11 < 12

2. A printer prints 18 pages a minute. Pages in 4.5 minutes?

   81 pages

3. Find the value: $\sqrt{196}$ **14**

4. Find the value: $10^2 - 6^2$ **64**

Vocabulary

Pythagorean Theorem

in every right triangle, leg² + leg² = hypotenuse²: $a^2 + b^2 = c^2$

hypotenuse

c — the side across from the right angle, always the longest side

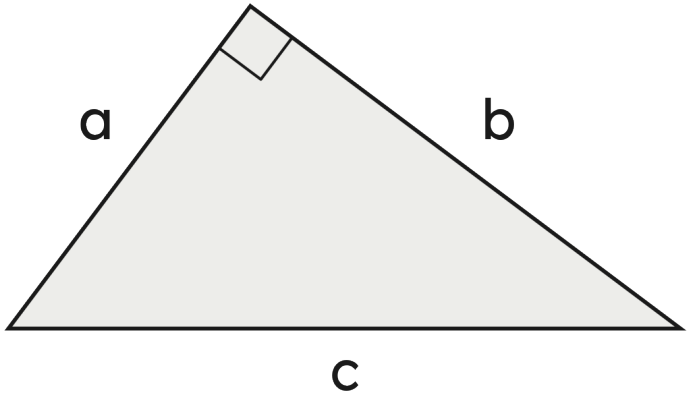
square root

the number that, times itself,

makes the number under the root sign: $\sqrt{64} = 8$

Notes

I. The square corner first; c is across from it



$$a^2 + b^2 = c^2$$

The legs' squares add up to the hypotenuse's square. c is across from the right angle — always the longest side.

Notes

II. The hypotenuse: square, add, then the root

$$6^2 + 8^2 = 36 + 64 = 100$$

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

Legs 3 and 5: $3^2 + 5^2 = 34$, $c = \sqrt{34} \approx 5.8$

Exact: $\sqrt{34}$. To the nearest tenth: 5.8.

Notes

III. A leg: subtract the squares

$$a^2 + 15^2 = 17^2$$

$$a^2 = 289 - 225 = 64$$

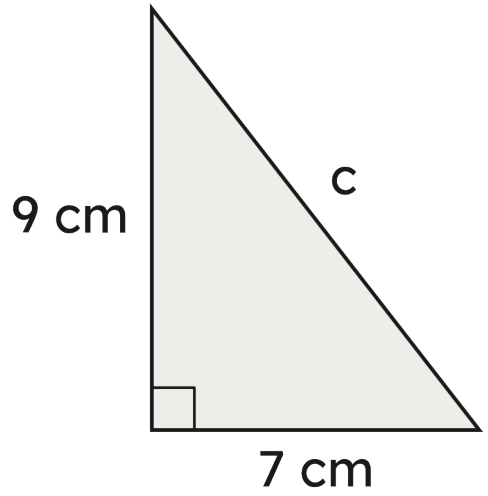
$$a = \sqrt{64} = 8$$

For a leg, subtract: $a^2 = c^2 - b^2$.

Check: a leg is shorter than the hypotenuse.

Example 1

A right triangle has legs of 7 cm and 9 cm.



How long is the hypotenuse? Give it exactly and to the nearest tenth.

Example 1

$$c^2 = 7^2 + 9^2 = 49 + 81 = 130$$

$$c = \sqrt{130} \approx 11.4$$

Answer: $c = \sqrt{130}$ cm ≈ 11.4 cm

Your Turn

A right triangle has legs of 5 inches and 11 inches.

How long is the hypotenuse, exactly and to the nearest tenth?

Your Turn

A right triangle has legs of 5 inches and 11 inches.

How long is the hypotenuse, exactly and to the nearest tenth?

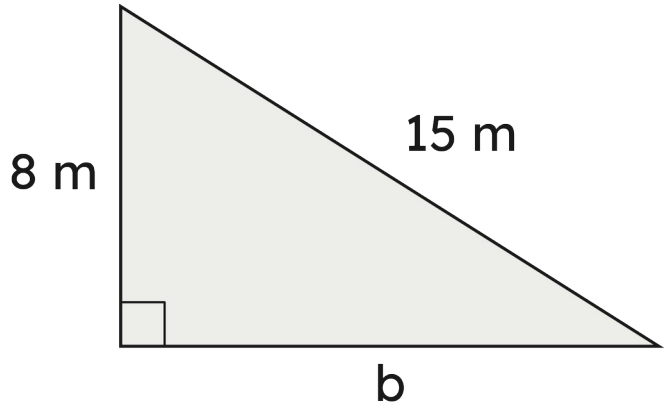
$$c^2 = 5^2 + 11^2 = 25 + 121 = 146$$

$$c = \sqrt{146} \approx 12.1$$

Answer: $c = \sqrt{146}$ in ≈ 12.1 in

Example 2

A right triangle has a hypotenuse of 15 m and one leg of 8 m.



How long is the other leg? Give it exactly and to the nearest tenth.

Example 2

the hypotenuse is 15: $b^2 + 8^2 = 15^2$

subtract: $b^2 = 225 - 64 = 161$

a leg, shorter than 15: $b = \sqrt{161} \approx 12.7$

Answer: $b = \sqrt{161}$ m $\approx$ 12.7 m

Your Turn

A right triangle has a hypotenuse of 11 ft and one leg of 6 ft.

How long is the other leg, exactly and to the nearest tenth?

Your Turn

A right triangle has a hypotenuse of 11 ft and one leg of 6 ft.

How long is the other leg, exactly and to the nearest tenth?

$$b^2 = 11^2 - 6^2 = 121 - 36 = 85$$

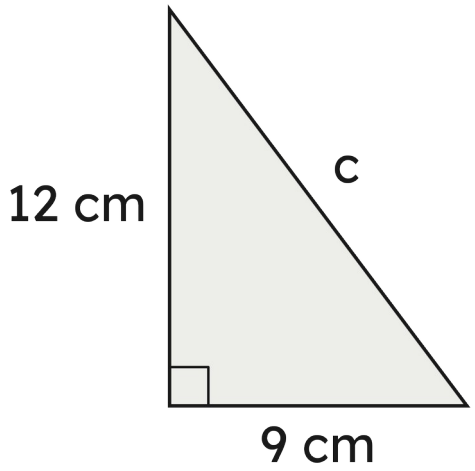
$$b = \sqrt{85} \approx 9.2$$

Answer: $b = \sqrt{85}$ ft ≈ 9.2 ft

Whiteboards · Question 1 of 9

A right triangle has legs of 9 cm and 12 cm.

How long is the hypotenuse?

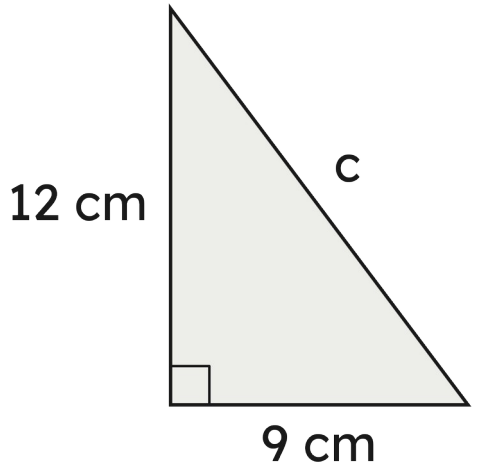


Answer it.

Whiteboards · Question 1 of 9

A right triangle has legs of 9 cm and 12 cm.

How long is the hypotenuse?



$c^2 = 81 + 144 = 225$

$c = \sqrt{225} = 15$

Answer: 15 cm

Whiteboards · Question 2 of 9

A right triangle has legs of 4 inches and 9 inches.

How long is the hypotenuse, to the nearest tenth?

Answer it.

Whiteboards · Question 2 of 9

A right triangle has legs of 4 inches and 9 inches.

How long is the hypotenuse, to the nearest tenth?

$$c^2 = 16 + 81 = 97$$

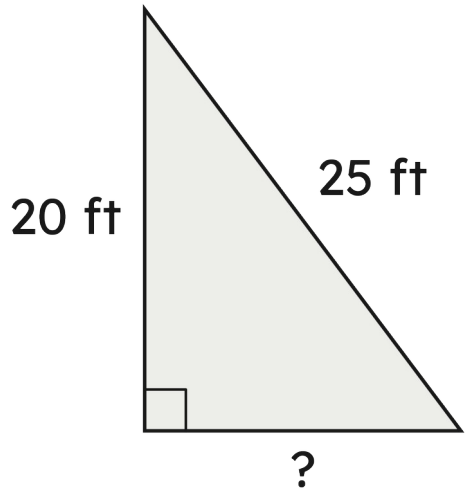
$$c = \sqrt{97} \approx 9.8$$

Answer: $\sqrt{97}$ in $\approx$ 9.8 in

Whiteboards · Question 3 of 9

A right triangle has a hypotenuse of 25 ft and one leg of 20 ft.

How long is the other leg?

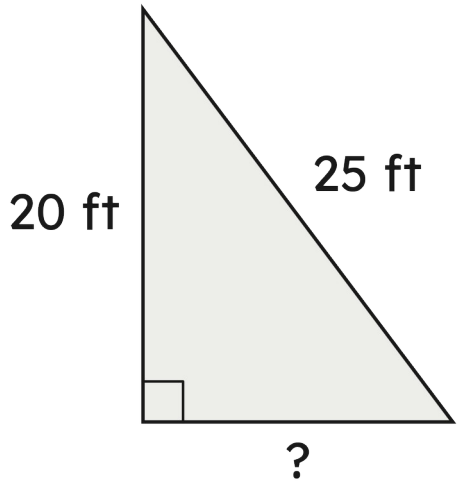


Answer it.

Whiteboards · Question 3 of 9

A right triangle has a hypotenuse of 25 ft and one leg of 20 ft.

How long is the other leg?



$b^2 = 625 - 400 = 225$

$b = \sqrt{225} = 15$

Answer: 15 ft

Whiteboards · Question 4 of 9

A right triangle has a hypotenuse of 41 m and one leg of 40 m.

How long is the other leg?

A. 9 m

B. 81 m

C. 1 m

D. 57.3 m

Answer it.

Whiteboards · Question 4 of 9

A right triangle has a hypotenuse of 41 m and one leg of 40 m.

How long is the other leg?

$$b^2 = 1{,}681 - 1{,}600 = 81$$

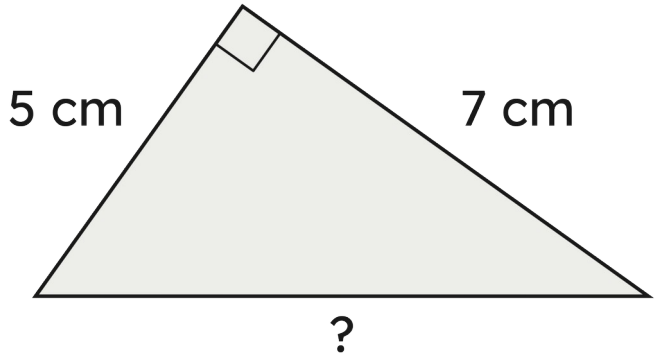
$$b = \sqrt{81} = 9$$

Answer: A — 9 m

Whiteboards · Question 5 of 9

Two sides of this right triangle are 5 cm and 7 cm.

How long is the third side, to the nearest tenth?

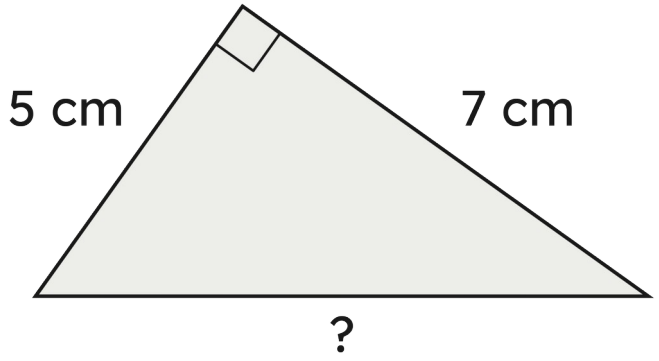


Answer it.

Whiteboards · Question 5 of 9

Two sides of this right triangle are 5 cm and 7 cm.

How long is the third side, to the nearest tenth?



$c^2 = 25 + 49 = 74$

$c = \sqrt{74} \approx 8.6$

Answer: $\sqrt{74}$ cm ≈ 8.6 cm

Whiteboards · Question 6 of 9

A right triangle's hypotenuse is 20 inches; its legs are 16 inches and x.

Which equation finds x?

A. $16 + x = 20$

B. $16^2 + 20^2 = x^2$

C. $16^2 + x^2 = 20$

D. $16^2 + x^2 = 20^2$

Answer it.

Whiteboards · Question 6 of 9

A right triangle's hypotenuse is 20 inches; its legs are 16 inches and x.

Which equation finds x?

$$x^2 = 400 - 256 = 144$$

$$x = \sqrt{144} = 12$$

Answer: D: $16^2 + x^2 = 20^2$, so x = 12 in

Whiteboards · Question 7 of 9

A right triangle has a hypotenuse of 14 m and one leg of 9 m.

How long is the other leg, to the nearest tenth?

Answer it.

Whiteboards · Question 7 of 9

A right triangle has a hypotenuse of 14 m and one leg of 9 m.

How long is the other leg, to the nearest tenth?

$$b^2 = 196 - 81 = 115$$

$$b = \sqrt{115} \approx 10.7$$

Answer: $\sqrt{115}$ m ≈ 10.7 m

Whiteboards · Question 8 of 9

A pennant is cut as a right triangle with legs of 8 inches and 11 inches. The fabric costs 6 dollars.

How long is its longest side, to the nearest tenth?

Answer it.

Whiteboards · Question 8 of 9

A pennant is cut as a right triangle with legs of 8 inches and 11 inches. The fabric costs 6 dollars.

How long is its longest side, to the nearest tenth?

$$c^2 = 64 + 121 = 185$$

$$c = \sqrt{185} \approx 13.6$$

Answer: $\sqrt{185}$ in $\approx$ 13.6 in

Whiteboards · Question 9 of 9

Jo finds a leg of a right triangle. The hypotenuse is 13 cm and the other leg is 5 cm.

She writes $\sqrt{5^2 + 13^2} \approx 13.9$.

What went wrong? How long is the leg?

Write your answer in sentences.

Whiteboards · Question 9 of 9

Jo finds a leg of a right triangle. The hypotenuse is 13 cm and the other leg is 5 cm.

She writes $\sqrt{5^2 + 13^2} \approx 13.9$.

What went wrong? How long is the leg?

$$b^2 = 169 - 25 = 144$$

$$b = \sqrt{144} = 12$$

Answer: She added the squares; a leg must be shorter than 13 cm. Subtract: the leg is 12 cm.

Independent Set

1. A right triangle has legs of 12 m and 5 m. How long is the hypotenuse?

2. A right triangle has legs of 3 ft and 8 ft. How long is the hypotenuse, exactly and to the nearest tenth?

3. A right triangle has a hypotenuse of 39 cm and one leg of 36 cm. How long is the other leg?

4. A right triangle has a hypotenuse of 11 inches and one leg of 4 inches. How long is the other leg, exactly and to the nearest tenth?

5. The right triangle on your paper has legs of 6 m and 11 m. How long is its hypotenuse, to the nearest tenth?

6. A right triangle has a hypotenuse of 25 yd and one leg of 24 yd. The other leg is x. Write the equation that finds x, then find x.

IXL

1. Open IXL and start today's skills.
2. Work on paper where the question needs work. The answer box does not show it.
3. Every skill listed is required, to a SmartScore of 67. Due by the Unit 6 test.

Today's skills — all required

Pythagorean theorem: find the missing leg or hypotenuse length — MTM