

10.3 Applications of the Pythagorean Theorem

Learning Target:

I can solve application problems using the Pythagorean Theorem.

Recall the Pythagorean Theorem:

If $\triangle ABC$ is a right triangle with right angle C, then $a^2 + b^2 = c^2$

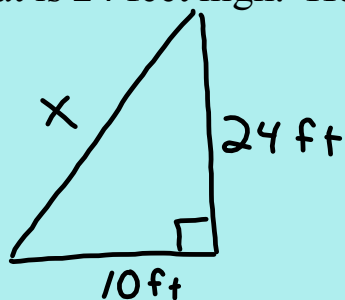
We typically use this if we KNOW we have a right triangle and we are missing a side we want to find.

Recall the Converse:

If ABC is a triangle with $a^2 + b^2 = c^2$, then $\triangle ABC$ is a right triangle with right angle C .

We typically use this if we have ALL 3 SIDES of a triangle and we want to know if the triangle is a right triangle.

Ex 1] A ladder is leaning against a wall. The bottom of the ladder is 10 feet from the base of the building, and the ladder reaches a point on the wall that is 24 feet high. How long is the ladder? (Sketch a diagram.)



26 ft

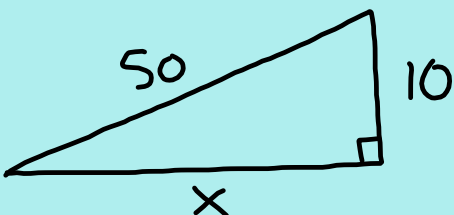
$$10^2 + 24^2 = x^2$$

$$676 = x^2$$

$$\sqrt{676} = x$$

$$26 = x$$

Ex 2] The surface of a ramp is 50 feet long. If the ramp travels a vertical distance of 10 feet, what is the horizontal length of the ramp? (Sketch a diagram.)



Handwritten calculations for Ex 2:

$$x^2 + 10^2 = 50^2$$

$$x^2 + 100 = 2500$$

$$x^2 = 2400$$

$$x = \sqrt{2400}$$

$$x \approx 49.0 \text{ Rounded}$$

Prime factorization of 2400:

$$\sqrt{2400}$$

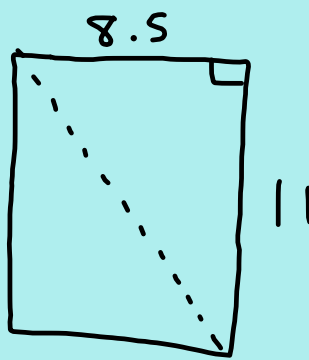
$$60 \cdot 40$$

$$6 \cdot 10 \cdot 10 \cdot 4$$

$$2 \cdot 3 \cdot 2 \cdot 2$$

Exact answer: $20\sqrt{6}$ exact

Ex 3] A standard letter-sized piece of paper is 8.5 inches by 11 inches. How long is the diagonal of a sheet this size?



Handwritten calculations for Ex 3:

$$8.5^2 + 11^2 = c^2$$

$$72.25 + 121 = c^2$$

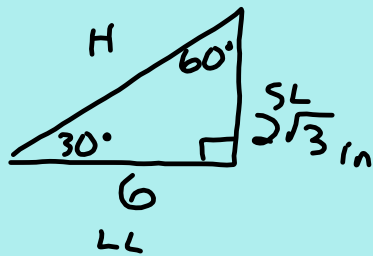
$$193.25 = c^2$$

$$\sqrt{193.25} = c$$

$$13.9 \approx c$$

Answer: 13.9 inches

Ex 4] Mr. Wood cuts a triangular wedge out of a piece of pine. The two smaller angles of the triangle measure 30° and 60° . If the side opposite the 60° angle measures exactly 6 inches, what are the exact lengths of the other sides of the wedge?



$$H = 2 \cdot SL$$

$$SL = \frac{LL}{\sqrt{3}}$$

$$H = 2 \cdot 2\sqrt{3}$$

$$\boxed{H = 4\sqrt{3} \text{ in}}$$

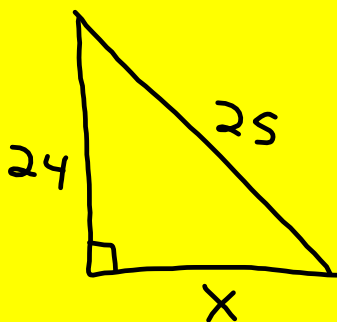
$$SL = \frac{6}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{26\sqrt{3}}{3} = \boxed{2\sqrt{3}}$$

Ex 5] A 13 foot ladder is leaning against a wall such that it extends 11 feet up the wall while the bottom of the ladder is 5 feet from the wall. If we assume that the ground is horizontal, can we conclude that the wall is vertical? Explain.

Ex 6] Smithtown is 7 miles directly north of Allentown. Brownsburg is 25 miles east-northeast of Allentown. If Smithtown and Brownsburg are 24 miles apart, is Brownsburg directly east of Smithtown? Explain.

Worksheet 10.3

Only do 1, 4



$$x^2 + 24^2 = 25^2$$

$$x^2 + 576 = 625$$

$$x^2 = 49$$

$$x = 7$$

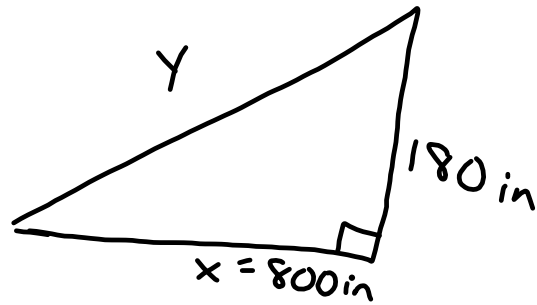
7 ft



$$\frac{180}{9} = \frac{x}{40}$$

$$9x = 7200$$

$$x = 800$$



$$800^2 + 180^2 = y^2$$

$$32400 + 640000 = y^2$$

$$672,400 = y^2$$

$$820 = y$$

820 in