Pythagorean Theorem:

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

The Converse Pythagorean Theorem

If the square of the length of the $\text{longest}$ side of a triangle is equal to the $\text{sum}$ of the squares of the lengths of the other two sides, then the triangle is a $\text{right}$ triangle.

If $a^2 + b^2 = c^2$, then $\triangle ABC$ is a $\text{right}$ triangle.

Classifying Triangles:

If $c^2 \leq a^2 + b^2$, then $\angle C$ is a(n) $\text{right}$ angle and $\triangle ABC$ is a(n) $\text{right}$ $\triangle$.

If $c^2 > a^2 + b^2$, then $\angle C$ is a(n) $\text{obtuse}$ angle and $\triangle ABC$ is a(n) $\text{obtuse}$ $\triangle$.

If $c^2 \leq a^2 + b^2$, then $\angle C$ is a(n) $\text{acute}$ angle and $\triangle ABC$ is a(n) $\text{acute}$ $\triangle$.

$\text{hypotenuse}$ is always the length of the longest side.
Always check to make sure it's a triangle first!!!

How do we do this?

Examples:

3, 4, 5

\[ 3 + 4 > 5 \checkmark \]

\[ 3 + 5 > 4 \checkmark \]

\[ 4 + 5 > 3 \checkmark \]

Yes, it is a triangle.

5, 8, 3

\[ 5 + 8 > 3 \checkmark \]

\[ 5 + 3 > 8 \times \]

No, not a triangle.

If a triangle is formed with the given lengths, is it acute, right or obtuse?

1) \[ 2, 2\sqrt{3}, 4 \]

\[ 2^2 + (2\sqrt{3})^2 = 4 \]

\[ 4 + 12 = 16 \]

\[ 16 < 16 \]

Right triangle

2) \[ 8, 9, 12 \]

\[ 8^2 + 9^2 = 12^2 \]

\[ 64 + 81 = 144 \]

\[ 145 < 144 \]

Acute triangle

3) \[ 5, 5, 5\sqrt{3} \]

\[ 5^2 + 5^2 = (5\sqrt{3})^2 \]

\[ 25 + 25 < 75 \]

Obtuse triangle

4) \[ 5, 11, 16 \]

\[ 5 + 11 > 16 \]

No

Not a triangle

If each diagram were drawn to scale, which angle(s) would be right angles?

5) \[ \triangle ABC \]

\[ 16^2 + 17^2 = 30^2 \]

\[ 289 + 289 = 841 \]

\[ 578 < 900 \]

\[ 116^2 + 30^2 = 34^2 \]

\[ 25\cdot\overline{6} + 900 = 115\overline{6} \]

\[ 115\overline{6} < 115\overline{6} \]

6) \[ \square FGH \]

\[ 12^2 + 5^2 = 13^2 \]

\[ 144 + 25 = 169 \]

\[ 169 < 169 \]

\[ 12 \cdot \angle FGH \]

\[ 5 \cdot \angle EIH \]

\[ 13 \cdot \angle FIE \]
Similarity in Right Triangles; The Pythagorean Theorem

Simplify.
1. \( \sqrt{100} = \frac{10}{2.5} \)
2. \( 2\sqrt{50} = \frac{10\sqrt{2}}{\sqrt{3}} \)
3. \( \sqrt{20} \cdot \sqrt{6} = \frac{\sqrt{120}}{\sqrt{30}} \)
4. \( \frac{2\sqrt{3}}{\sqrt{5}} \)
5. \( \frac{\sqrt{13}}{3} \)
6. \( \left( \frac{\sqrt{3}}{3} \right)^2 = \frac{1}{3} \)

Find the value of \( x \).
12. \( \frac{x}{9} = \frac{12}{15} \)
13. \( \frac{x}{13} = \frac{5}{12} \)
14. \( \frac{x}{24} = \frac{16}{8\sqrt{5}} \)
15. \( \frac{x}{12} = \frac{16}{20} \)
16. \( \frac{x}{5} = \frac{5\sqrt{2}}{5} \)
17. \( \frac{x}{10} = \frac{\sqrt{3}}{3} \)

18. A rectangle has length 2.4 m and width 0.7 m. Find the length of a diagonal. \( 2.5 \) m
19. A square has perimeter 12 cm. Find the length of a diagonal. \( 3\sqrt{2} \) cm
20. The diagonals of a rhombus have lengths 12 and 16. Find the perimeter of the rhombus. \( 40 \) cm

21.) Alex leaned a 17 foot ladder against the house. The bottom of the ladder is 8 feet from the house. How high up the side of the house is the top of the ladder? \( 15 \) ft

22.) The measures of three sides of a triangle are 9, 16, and 20. Determine whether the triangle is a right triangle.

23.) George rides his bike 9 KM south and then 12 KM east. How far is he from his starting point? \( 15 \) km