Pythagorean Theorem:

*applies to only right triangles

Pythagorean theorem: $leg^2 + leg^2 = hypotenuse^2$
$$a^2 + b^2 = c^2$$

Examples:

$8^2 + 6^2 = x^2$
$64 + 36 = x^2$
$\sqrt{100} = \sqrt{x^2}$
$\boxed{x = 10}$

$3^2 + x^2 = 5^2$
$3^2 - 3^2 + x^2 = 5^2 - 3^2$
$x^2 = 25 - 9$
$\sqrt{x^2} = \sqrt{16}$
$\boxed{x = 4}$

$x^2 + x^2 = 8\sqrt{2}$
$2x^2 = 8\sqrt{x}$
$2x^2 = 128$
$\sqrt{x^2} = \sqrt{64}$
$\boxed{x = 8}$

converse of the Pythagorean Theorem: If $a^2 + b^2 = c^2$, the $\triangle ABC$ is a right triangle

$3^2 + 4^2 = 5^2$ ✓

using Pythagorean to Prove if a triangle is Acute, obtuse, or Right:

$a^2 + b^2 = c^2$ (Right)

$a^2 + b^2 > c^2$ (acute)

$a^2 + b^2 < c^2$ (obtuse)

Geometric Mean: The geometric mean of a and b is found by finding x in $\frac{a}{x} = \frac{x}{b}$
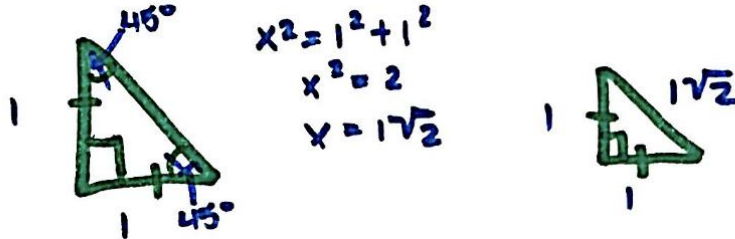
Example: 4 and 9

$\frac{4}{x} = \frac{x}{9}$
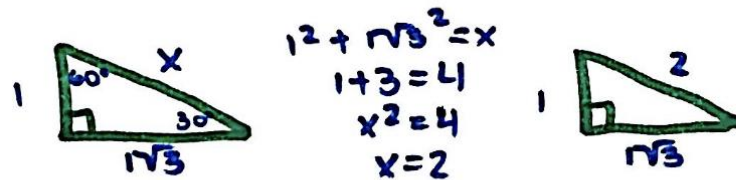
$\sqrt{x^2} = \sqrt{36} \rightarrow \boxed{x = 6}$

Special Right Triangles:

45° - 45° - 90° Triangles: Isosceles Right Triangles

$$x^2 = 1^2 + 1^2$$
$$x^2 = 2$$
$$x = 1\sqrt{2}$$

In a 45-45-90 triangle, the hypotenuse is $\sqrt{2}$ times as long as each leg.

30° - 60° - 90° Triangles:

$$1^2 + \sqrt{3}^2 = x$$
$$1 + 3 = 4$$
$$x^2 = 4$$
$$x = 2$$

In a 30-60-90 triangle, the hypotenuse is twice as long as the shorter leg, and the longer leg is $\sqrt{3}$ times as long as the shorter leg.

Trigonometric Ratios:

❋ You need a graphing calculator for this!

Trig Ratios - relationship between the sides and angles of right triangles

Need to know:
  opposite means - side opposite the given angle

  adjacent means - side next to the given angle

sine
SOH
sine = $\dfrac{\text{opposite}}{\text{hypotenuse}}$

$\dfrac{\sin 72°}{1} = \dfrac{x}{18}$

$x = .9511 \cdot 18$

$x = 17.1198$

17.12

cosine
CAH
cosine = $\dfrac{\text{adjacent}}{\text{hypotenuse}}$
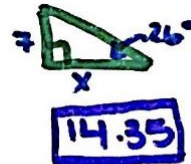
$\dfrac{\cos 15}{1} = \dfrac{x}{12}$

$x = .9659 \cdot 12$

$x = 11.5908$

11.59

tangent
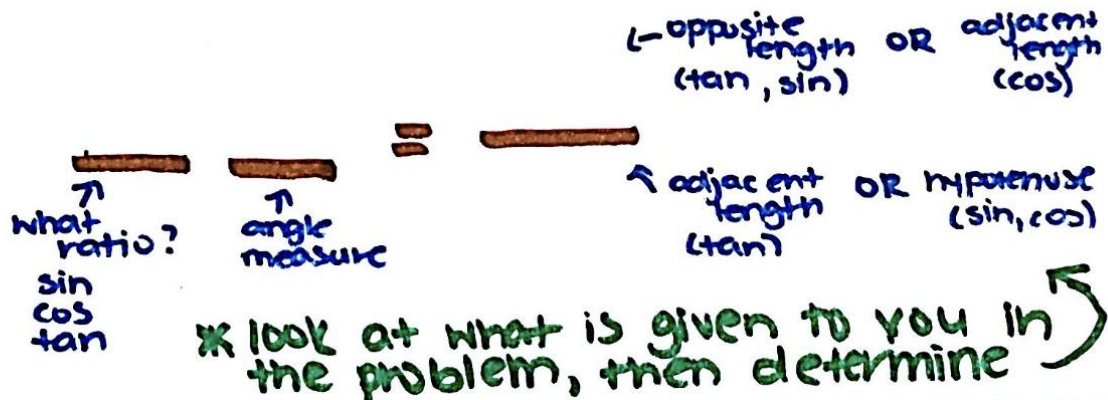### TOA
tangent = $\dfrac{\text{opposite}}{\text{adjacent}}$

$\dfrac{\tan 26}{1} = \dfrac{7}{x}$

$.4877x = 7$

$x = 14.3531$

14.35

To solve you need to know...

$$\underset{\substack{\uparrow \\ \text{what} \\ \text{ratio?} \\ \text{sin} \\ \text{cos} \\ \text{tan}}}{\rule{2cm}{1pt}} \quad \underset{\substack{\uparrow \\ \text{angle} \\ \text{measure}}}{\rule{2cm}{1pt}} = \underset{\substack{\uparrow \text{adjacent} \\ \text{length} \\ \text{(tan)}}}{\rule{3cm}{1pt}}$$

↳ opposite length OR adjacent length
  (tan, sin)   (cos)

↑ adjacent length OR hypotenuse
  (tan)   (sin, cos)

❋ look at what is given to you in the problem, then determine ⤷

Inverse Trig. Ratios:

*You need a graphing calculator!

Inverse sine
$\sin^{-1} x$

2nd $\sin^{-1}\left(\dfrac{\text{opposite}}{\text{hypotenuse}}\right)$

2nd $\sin^{-1}\left(\dfrac{6}{14}\right)$

$\angle A = \boxed{25°}$

Inverse cosine
$\cos^{-1} x$

2nd $\cos^{-1}\left(\dfrac{\text{adjacent}}{\text{hypotenuse}}\right)$

2nd $\cos^{-1}\left(\dfrac{19}{28}\right)$

$\angle E = \boxed{47°}$

Inverse tangent
$\tan^{-1} x$

2nd $\tan^{-1}\left(\dfrac{\text{opposite}}{\text{adjacent}}\right)$

2nd $\tan^{-1}\left(\dfrac{18}{11}\right)$

$\angle P = \boxed{59°}$