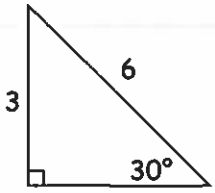
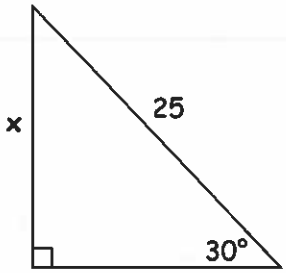
Side Lengths of Right Triangles

- Since similar triangles contain the same angles and have proportional sides, we can use these relationships to solve problems.

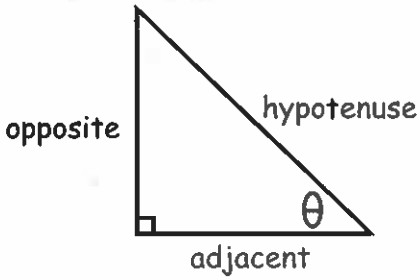




- We can actually do this in a more efficient way with right triangles, since the ratios between their sides always stay the same within just a single triangle.

- To figure out these ratios, we first need to label our sides.

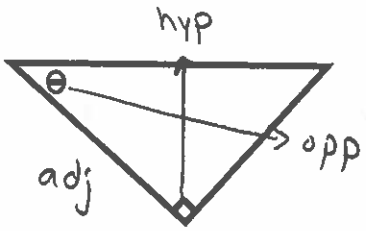
- One of these sides we know, the hypotenuse.
- The other two sides depend on the location of a reference angle. This angle can be a value, 26°, a letter, A, or a symbol, θ.

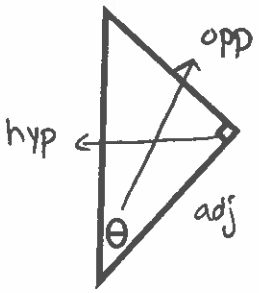


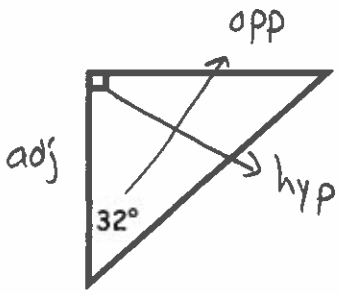
Opposite – side across from the given angle

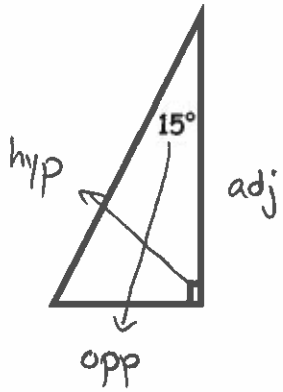
Adjacent – side beside the given angle

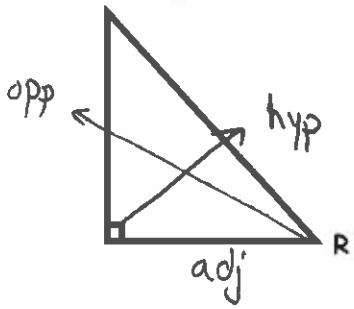
Ex/ Label the sides of the triangles given below.







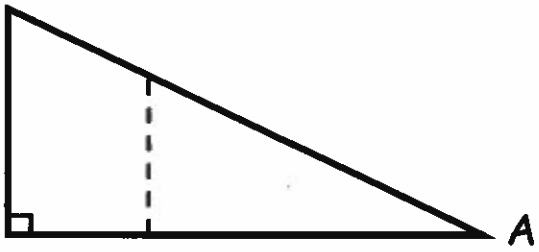




Activity: Finding the ratios between the sides

1) On the triangle you have been given, label the sides with opposite, adjacent and hypotenuse according to A.
2) Measure the length of each side in cm. Write down your measurements to 1 decimal place.
3) Calculate the following ratios:
   a) $\frac{opposite}{hypotenuse}$ b) $\frac{adjacent}{hypotenuse}$ c) $\frac{opposite}{adjacent}$

4) Draw a vertical line extending from the base of the triangle upwards at a 90° angle creating a similar, but smaller triangle.



5) Label the sides of your new triangle with opposite, adjacent and hypotenuse according to A.
6) Measure each of the sides of your new triangle in cm. Write down your measurements to 1 decimal place.
7) Calculate the following ratios:
   a) $\frac{opposite}{hypotenuse}$ b) $\frac{adjacent}{hypotenuse}$ c) $\frac{opposite}{adjacent}$

- There are 3 ratios that we use the most:

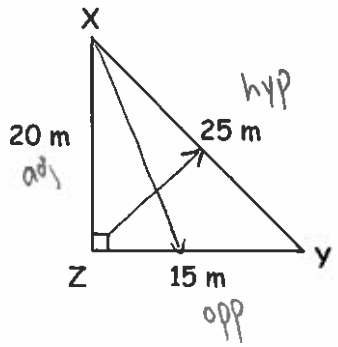
Primary Trigonometric Ratios

$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$ $\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$ $\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$

- These 3 ratios are pre-programmed into our calculators!

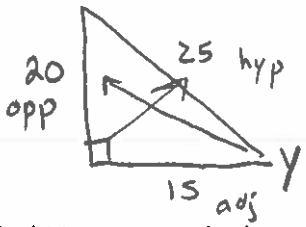
Ex/ Write down the ratios for tan X, sin X and cos X.

$\tan X = \frac{15}{20}$ $\sin X = \frac{15}{25}$ $\cos X = \frac{20}{25}$



have to re-label triangle

Ex/ Use the same triangle to write down the ratios for angle Y.



$\tan Y = \frac{20}{15}$ $\sin Y = \frac{20}{25}$ $\cos Y = \frac{15}{25}$

Ex/ Use your calculator to determine the value of each ratio to 3 decimals.

a) sin36° = 0.588 b) tan78° = 4.705 c) cos12° = 0.978

- We can use a reference angle and known ratio to solve for a missing side.

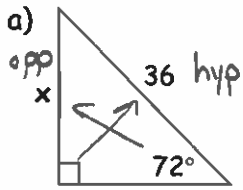
Ex/ Solve the following unknowns.

① label sides with stuff on them

② Find ratio with those sides

SOH/CAH/TOA

a)



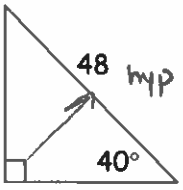
make sure you have angle

$\sin 72 = \frac{x}{36}$ ↓ cross multiply

$x = 36 \sin 72$ ↓ in calculator

$= 34.24$

b)

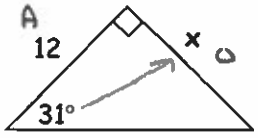


$\cos 40 = \frac{x}{48}$

$x = 48 \cos 40$

$x = 36.77$

c)

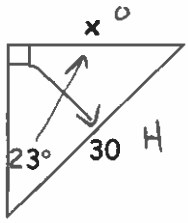


$\tan 31 = \frac{x}{12}$

$x = 12 \tan 31$

$x = 7.21$

d)

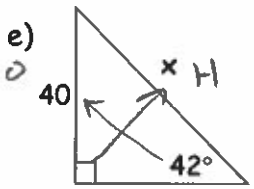


$\sin 23 = \frac{x}{30}$

$x = 30 \sin 23$

$x = 11.72$

e)



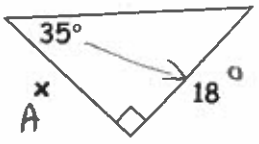
$\sin 42 = \frac{40}{x}$ ↓ cross multiply

$x \sin 42 = 40$ ↓ get x by itself by dividing

$\frac{x \sin 42}{\sin 42} = \frac{40}{\sin 42}$

$x = 59.78$

f)



$\tan 35 = \frac{18}{x}$

$\frac{x \tan 35}{\tan 35} = \frac{18}{\tan 35}$

$x = 25.71$

Practice: Handout - Sides in Right Triangles