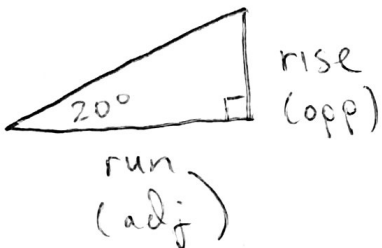
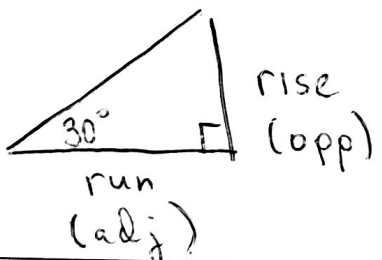
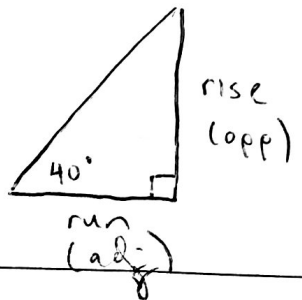


The Tangent Ratio | MPM2D

Today we are going to look at ratios within similar right angle triangles. Specifically, the ratio given by the slope (rise/run). Mr. Smith will put some similar triangles up on the screen, and you will calculate some ratios.

Angle of 20°			
Visual: 	Rise (opposite)	Run (adjacent)	Slope Ratio
	2.7	7.42	0.3639
	3.45	9.48	0.3639
	1.21	3.34	0.3623

Angle of 30°			
Visual: 	Rise (opposite)	Run (adjacent)	Slope Ratio
	3.76	6.52	0.5767
	5.35	9.28	0.5765
	1.48	2.56	0.5781

Angle of 40°			
Visual: 	Rise (opposite)	Run (adjacent)	Slope Ratio
	5.01	5.98	0.8378
	7.35	8.77	0.838
	2.52	3.01	0.8372

The Tangent Ratio | MPM2D

Given a certain angle, this slope ratio is the same, no matter how big or small the triangle. We give this slope ratio a special name: The Tangent Ratio.

Based on our above calculations, we would say...

The tangent ratio of 20° is approximately = 0.36

The tangent ratio of 30° is approximately = 0.58

The tangent ratio of 40° is approximately = 0.84

We said approximately here, because our measurements were not quite precise. We can find precise values of these tangent ratios by evaluating the following (to 4 decimal places):

$$\tan 20^\circ = 0.3640$$

$$\tan 30^\circ = 0.5774$$

$$\tan 40^\circ = 0.8391$$

Find the tangent ratios for other angles using your calculator (to 4 decimal places):

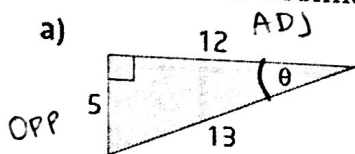
$$\tan 45^\circ = 1$$

$$\tan 61^\circ = 1.8040$$

$$\tan 82^\circ = 7.1154$$

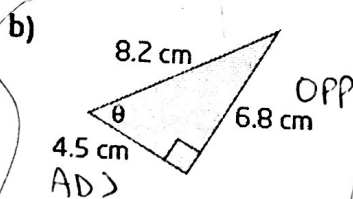
Example:

Find $\tan \theta$ for each triangle, expressed as a fraction and as a decimal correct to four decimal places.



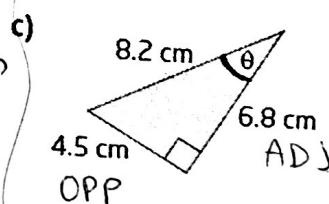
$$\tan \theta = \frac{5}{12}$$

$$\theta = 0.4167$$



$$\tan \theta = \frac{6.8}{4.5}$$

$$= 1.5111$$



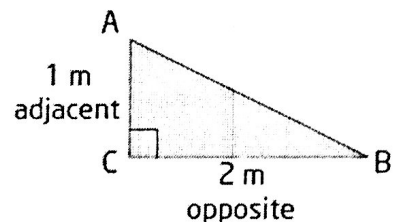
$$\tan \theta = \frac{4.5}{6.8}$$

$$= 0.6618$$

The Tangent Ratio | MPM2D

We can find angles in triangles using the tangent ratio!!!

Example: Fiona is building a skateboarding ramp. She wants the ramp to rise 1 m in a horizontal distance of 2 m. At what acute angles should she cut the wood, rounded to the nearest degree?



The diagram here is given to you, in practice you may need to draw it out. Let's find angle A first:



$$\tan \theta = \frac{\text{opp}}{\text{adj}}$$

$$\tan \theta = \frac{2}{1}$$

$$\tan \theta = 2$$

$$\theta = \tan^{-1}(2)$$

$$\boxed{\theta = 63.4^\circ}$$

Literacy Connections

Tangent and inverse tangent are opposite operations, like addition and subtraction. For example,

$$\tan 60^\circ \approx 1.7321$$

$$\tan^{-1}(1.7321) \approx 60^\circ$$

The second statement is read as "the inverse tangent of 1.7321 is approximately equal to 60 degrees."

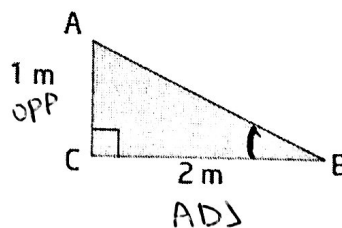
Now that we have found angle A, let's find angle B two ways:

a) By using the fact angles add to 180°

b) Using the tangent ratio

$$\angle B = 180 - 90 - 63.4$$

$$\boxed{\angle B = 26.6^\circ}$$



$$\tan \theta = \frac{\text{opp}}{\text{adj}}$$

$$\tan B = \frac{1}{2}$$

$$\tan B = 0.5$$

$$B = \tan^{-1}(0.5)$$

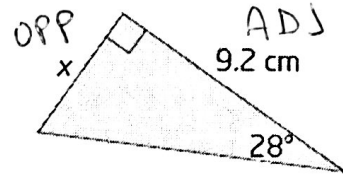
$$\boxed{B \approx 26.6^\circ}$$

The Tangent Ratio | MPM2D

We can find side lengths using the tangent ratio as well. All we need is one side, and one acute angle!

Example:

Find the length, x , in the diagram, rounded to the nearest tenth of a centimetre.



$$\tan \theta = \frac{\text{OPP}}{\text{adj}}$$

$$\tan 28^\circ = \frac{x}{9.2}$$

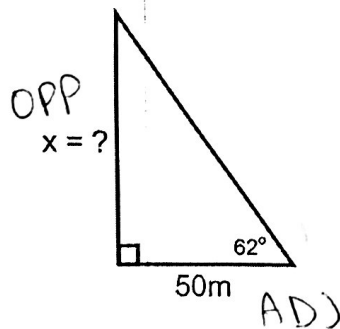
$$x = 9.2 \times \tan 28^\circ$$

$$x = 9.2 (0.5317)$$

$$\boxed{x = 4.9 \text{ cm}}$$

You try it: Using the tangent ratio, find the lengths of the indicated sides

a)



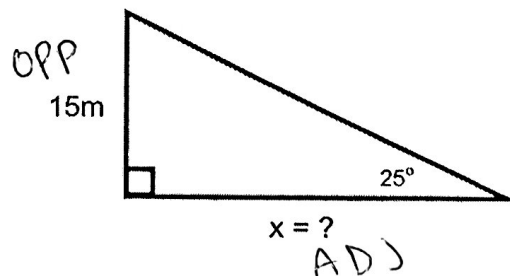
$$\tan \theta = \frac{\text{OPP}}{\text{adj}}$$

$$\tan 62^\circ = \frac{x}{50}$$

$$x = 50 \tan 62^\circ$$

$$\boxed{x = 94 \text{ m}}$$

b)



$$\tan \theta = \frac{\text{OPP}}{\text{adj}}$$

$$\tan 25^\circ = \frac{15}{x}$$

$$x = \frac{15}{\tan 25^\circ}$$

$$\boxed{x = 32.2 \text{ m}}$$