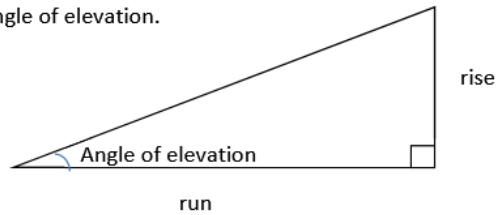


Exploring Wheel Chair Ramps

Your job in this activity is to take a look at some different wheel chair ramp designs. The idea is that we can determine some rules relating to wheel chair ramps that will allow us to make conclusions about any right triangle.

Each wheel chair ramp has a rise, a run and an angle of elevation.



Think. Some wheel chair ramps might be steeper than others. What might we look at when determining how steep a wheel chair ramp is?

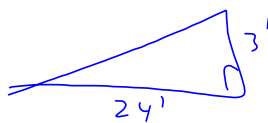
$$\frac{\text{rise}}{\text{run}} \quad \text{angle of elevation}$$

WARMUP PROBLEM – SIMILAR TRIANGLES

Tommy wants to build a wheel chair ramp for the front entrance of his house. He wants to make sure the ramp isn't too steep!

To get an idea of how steep a wheel chair ramp should be Tommy measures one at a local post office. He finds the ramp has a rise of 3 feet and a run of 24 feet. He decides his ramp shouldn't be any steeper than this one.

The front entrance of Tommy's house has a rise of 2.2 feet off the ground. How much "run" will his wheel chair ramp need to have? How long will it need to be?



$$\frac{3}{24} = \frac{2.2}{x}$$

$$x \doteq 17.6'$$

$$c^2 = 17.6^2 + 2.2^2$$

$$c \doteq 17.73'$$

Can you think of a way to calculate the angle of elevation of both ramps?

Using a protractor and ruler, draw the following ramps on paper and complete the table. Complete your drawings on graph paper using the scale of 1 foot = 1 cm ~~1 square~~

Angle of Elevation	Rise (feet)	Run (feet)	Slope of the Ramp $= \frac{\text{rise}}{\text{run}}$ (round to 4 decimal places)
10°	2	10 feet	0.19
10°	4	20 feet	0.19
15°		10 feet	0.26
15°		15 feet	
30°		15 feet	0.55
30°		20 feet	
45°		10 feet	1
45°		12 feet	
20°	5 feet	15 feet	0.33
	1 foot	3 feet	0.33

It should be clear that there is a relationship between the angle of elevation and the slope of any wheel chair ramp.

If a wheel chair ramp has an angle of elevation of 10° , we know that it will have a slope of 0.19.

If a wheel chair ramp has an angle of elevation of 15° , we know that it will have a slope of 0.26.

If a wheel chair ramp has an angle of elevation of 18° , we know that it will have a slope of 0.33.
 $\approx 20^\circ$

If a wheel chair ramp has an angle of elevation of 30° , we know that it will have a slope of 0.55.

If a wheel chair ramp has an angle of elevation of 45° , we know that it will have a slope of 1.

Wouldn't it be nice if we knew what the slope of any wheel chair ramp was given its angle of elevation? Or vice versa? Since wheel chair ramps are really just right triangles this is actually a very important relationship in mathematics.

So what about other angles?? Use graph paper to complete the table below.

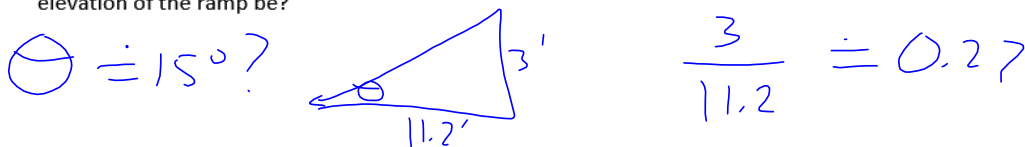
Angle of Elevation	Rise	Run	$\frac{\text{rise}}{\text{run}}$
5°			0.078
10°			0.19
15°			0.26
20°			0.38
25°			0.45
30°			0.55
35°			0.68
40°			0.86
45°			1
50°			1.2
55°			1.4
60°			1.71

89°

What happens to the slope of the ramp after 45° ? Why?

> 1 rise $>$ run $\frac{\text{rise}}{\text{run}}$

If you were to design a wheel chair ramp with a rise of 3 feet and a run of 11.2 feet then what would the angle of elevation of the ramp be?

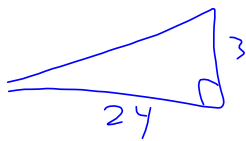


If you were to build a ramp with a rise of 1 m and a run of 2.75m, then what would the angle of elevation of the ramp be?

$$\frac{1}{2.75} = 0.36$$

$$\theta \doteq 20^\circ$$

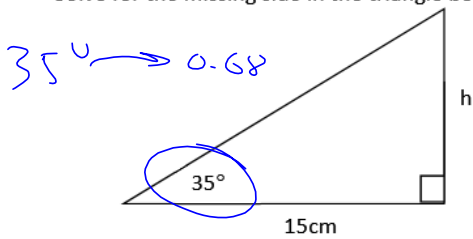
Can you tell what the angle of elevation of Tommy's wheel chair ramp would be?



$$\text{slope} = 0.125$$

$$\theta = 5 - 10^\circ?$$

Solve for the missing side in the triangle below (using results from the table).

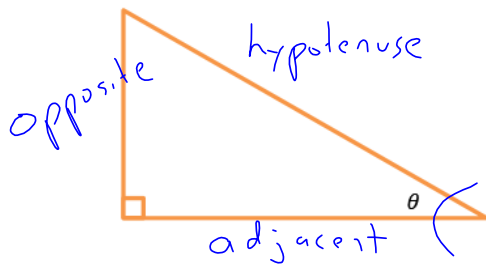


$$\frac{h}{15} = 0.68$$

$$h = 15(0.68)$$

$$h \doteq 10.2\text{cm}$$

Definition of the Tangent Ratio



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

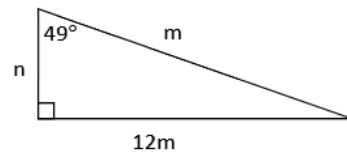
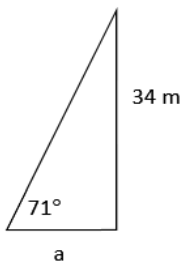
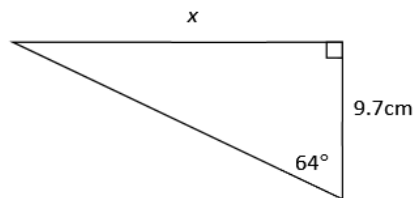
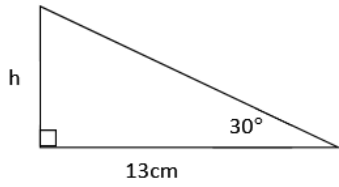
The tan button on your calculator is used to "look up" these ratios.

Try the following.....

$\tan 10^\circ$	$\tan 40^\circ$	$\tan 80^\circ$
$\doteq 0.1763$	$\doteq 0.8391$	$\doteq 5.671$

Using the Tangent Ratio to Solve for Sides

Examples



Text page 331 #6, 7, 8, 11 – 13, 17-18