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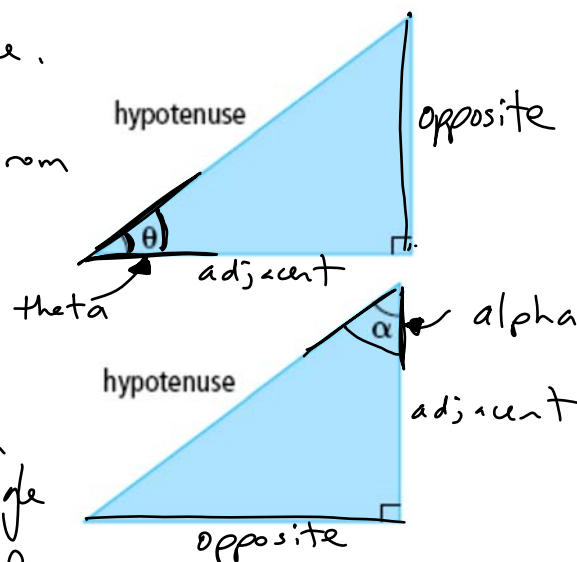
Unit 1: Right Angle Trigonometry1.1 The Tangent Ratio

Right Triangle: A triangle with a 90° angle.

Hypotenuse: The side opposite (across) from the right angle.
The longest side.

Opposite Side: The side across from the acute angle being considered.
The side that does not form one of the arms of the angle.

Adjacent Side: The side that forms one of the arms of the angle being considered (but not the hypotenuse).



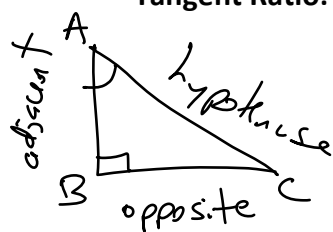
A trigonometric ratio is a ratio of the measures of two sides of a right triangle.

Tangent Ratio:

$$\text{Tangent } A = \frac{\text{length of side opposite } \angle A}{\text{length of side adjacent } \angle A}$$

$$\boxed{\tan A = \frac{\text{opp}}{\text{adj}}}$$

* in data booklet



Ex. Write a Tangent Ratio

Write each trigonometric ratio.

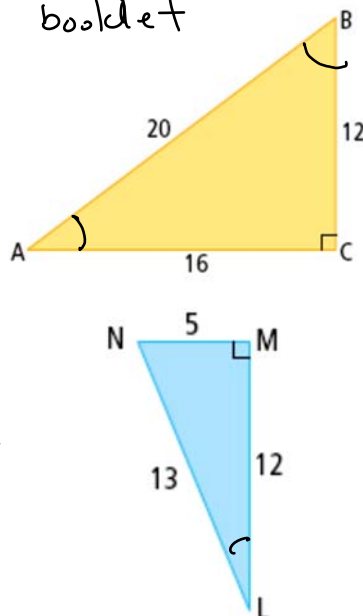
$$\begin{aligned} \text{a) } \tan A &= \frac{12}{16} \\ &= \frac{3}{4} \\ \text{or} \\ &= 0.75 \end{aligned}$$

$$\begin{aligned} \text{b) } \tan B &= \frac{16}{12} \\ &= \frac{4}{3} \\ \text{or} \\ &= 1.\bar{3} \end{aligned}$$

Calculate each trigonometric ratio.

$$\text{a) } \tan L = \frac{5}{12}$$

$$\text{b) } \tan N = \frac{12}{5}$$



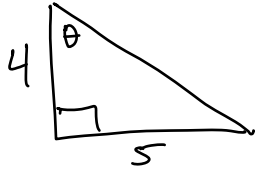
Ex. Calculate a Tangent and an Angle

* Degree mode

a) Calculate $\tan 25^\circ$ to four decimal places.

$$\tan 25^\circ = 0.4663$$

b) Draw a triangle to represent $\tan \theta = \frac{5}{4}$. Calculate the angle θ to the nearest tenth of a degree.



$$\begin{aligned} \tan \theta &= \frac{5}{4} \\ \text{angle} \quad \quad \text{ratio} \\ \theta &= \tan^{-1}\left(\frac{5}{4}\right) \\ &= \boxed{51.3^\circ} \end{aligned}$$

$$* \frac{\tan^{-1}}{\text{arctan}}$$

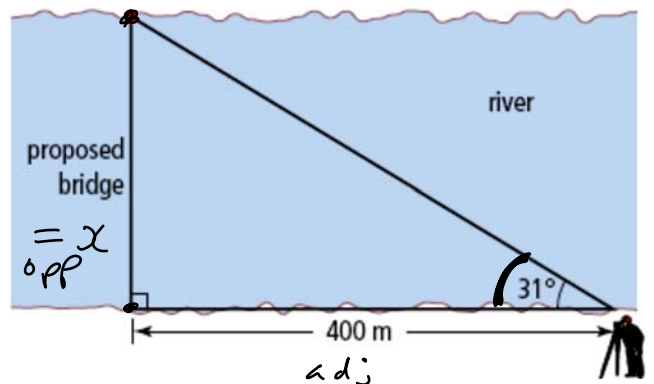
Use your particular calculator to calculate each tangent ratio (to four decimal places) and angle (to the nearest degree).

θ	Tan θ
27°	0.5095
45°	1
57°	1.5399

θ	Tan θ
27°	0.5095
29°	0.5543
56°	1.4653

Ex. Determine a Distance Using the Tangent Ratio

A surveyor wants to determine the width of a river for a proposed bridge. The distance from the surveyor to the proposed bridge site is 400 m. The surveyor uses a theodolite to measure angles. The surveyor measures a 31° angle to the bridge site across the river. What is the width of the river, to the nearest metre?

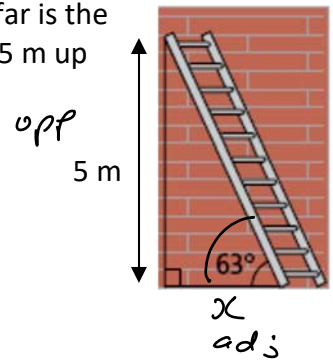


$$\frac{\tan 31^\circ}{1} = \frac{x}{400}$$

$$\begin{aligned} x &= 400 \cdot \tan 31^\circ \\ &= \boxed{240\text{m}} \end{aligned}$$

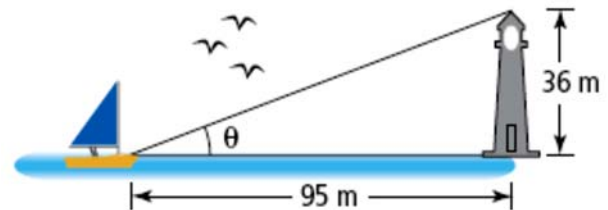
A ladder leaning against a wall forms an angle of 63° with the ground. How far is the foot of the ladder from the wall (to the nearest tenth) if the ladder reaches 5 m up the wall?

$$\begin{aligned}\tan 63 &= \frac{5}{x} \\ x &= \frac{5}{\tan 63} \\ &= \boxed{2.5 \text{ m}}\end{aligned}$$



Ex. Determine an Angle Using the Tangent Ratio

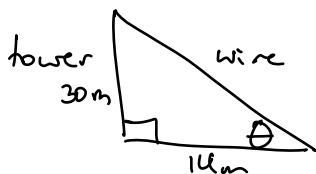
A small boat is 95 m from the base of a lighthouse that has a height of 36 m above sea level. Calculate the angle from the boat to the top of the lighthouse. Express your answer to the nearest degree.



$$\begin{aligned}\tan \theta &= \frac{36}{95} \\ \theta &= \tan^{-1} \left(\frac{36}{95} \right) \\ &= \boxed{21^\circ}\end{aligned}$$

~~$$\frac{36}{95} \tan^{-1}$$~~

A radio transmission tower is to be supported by a guy wire. The wire reaches 30 m up the tower and is attached to the ground a horizontal distance of 14 m from the base of the tower. What angle does the guy wire form with the ground, to the nearest tenth of a degree?



$$\begin{aligned}\tan \theta &= \frac{30}{14} \\ \theta &= \tan^{-1} \left(\frac{30}{14} \right) \\ &= \boxed{65.0^\circ}\end{aligned}$$