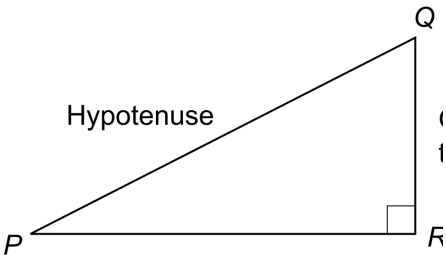
OVERVIEW

This section discusses finding **trigonometric ratios** in any **right triangle,** and their use in **solving problems**.

KEY TERMS AND CONCEPTS

- **Trigonometry**: Triangle measure
- **Trigonometric ratio**: The ratio between the two sides of any right triangle
- **Definition of trigonometric ratios**: Consider the right triangle shown below.



$$\text{sine } \angle P = \frac{\text{length of side opposite } \angle P}{\text{length of hypotenuse}} = \frac{QR}{PQ}$$

$$\text{cosine } \angle P = \frac{\text{length of side adjacent to } \angle P}{\text{length of hypotenuse}} = \frac{PR}{PQ}$$

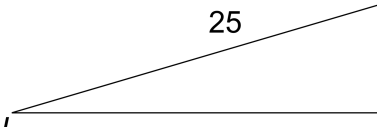
$$\text{tangent } \angle P = \frac{\text{length of side opposite } \angle P}{\text{length of side adjacent to } \angle P} = \frac{QR}{PR}$$

These may be abbreviated as below.

$$\sin P = \frac{\text{opposite}}{\text{hypotenuse}} \qquad \cos P = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan P = \frac{\text{opposite}}{\text{adjacent}}$$

Example: For ΔLMN, find the tangent, cosine, and sine of $\angle L$.



$$\tan L = \frac{\text{opposite}}{\text{adjacent}} = \frac{7}{24}$$

$$\cos L = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{24}{25}$$

$$\sin L = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{7}{25}$$

Use a table containing trigonometric ratios, or a calculator, to find the tangent, cosine, and sine ratios of 25° (approximate to four places of decimals).

Enter 25 in a calculator and press the appropriate key (labeled TAN, COS, or SIN), or find the required ratios against 25 in a table of values.

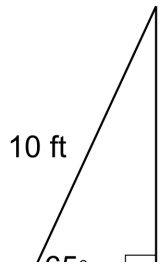
$\tan 25° \approx 0.4663$

$\cos 25° \approx 0.9063$

$\sin 25° \approx 0.4226$

- **Solving problems using ratios**: If one side length and any one acute angle measure in a right triangle are known, then the remaining two side lengths can be found.

Example: The diagram below shows a 10-foot ladder leaning against the side of a building. How far is the ladder's foot from the building?



One angle and the hypotenuse are known. The adjacent side x (with respect to $\angle R$) is to be found.

Apply the cosine ratio.

$$\cos R = \frac{\text{adjacent}}{\text{hypotenuse}}$$

Substitute 65° for R and 10 for hypotenuse.

$$\cos 65^\circ = \frac{x}{10}$$

Multiply both sides by 10.

$10(\cos 65^\circ) = x$

Use a table or a calculator. Round to the closest tenth.

$x \approx 4.2$

The ladder is about 4.2 ft from the building.