



# TRIGONOMETRIC RATIOS

## RIGHT TRIANGLES

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## TOPIC OUTLINE

Sine

Cosine

Tangent

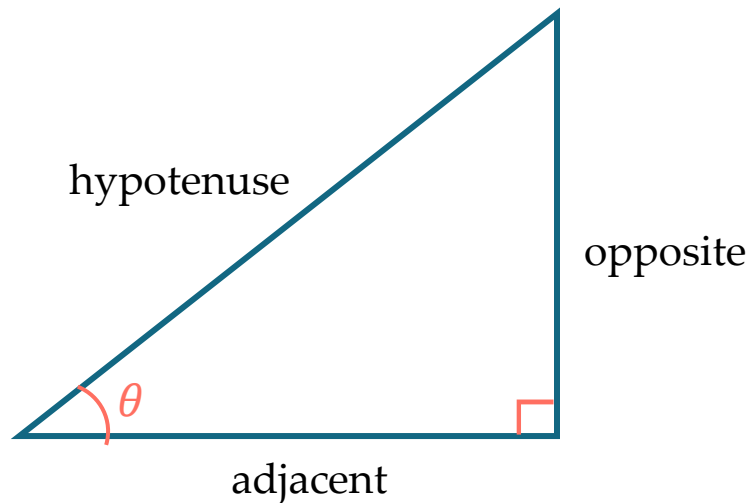


# TRIGONOMETRIC RATIOS



# TRIGONOMETRIC RATIOS

Consider a right triangle with  $\theta$  as one of its acute angles.



## Trigonometric Ratios

$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\csc \theta = \frac{\text{hypotenuse}}{\text{opposite}}$$

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

$$\sec \theta = \frac{\text{hypotenuse}}{\text{adjacent}}$$

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

$$\cot \theta = \frac{\text{adjacent}}{\text{opposite}}$$



# RECIPROCAL IDENTITIES

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$$\sin \theta = \frac{1}{\csc \theta}$$

$$\csc \theta = \frac{1}{\sin \theta}$$

$$\cos \theta = \frac{1}{\sec \theta}$$

$$\sec \theta = \frac{1}{\cos \theta}$$

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

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

## Trigonometric Ratios

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$$\sec \theta = \frac{\text{hypotenuse}}{\text{adjacent}}$$

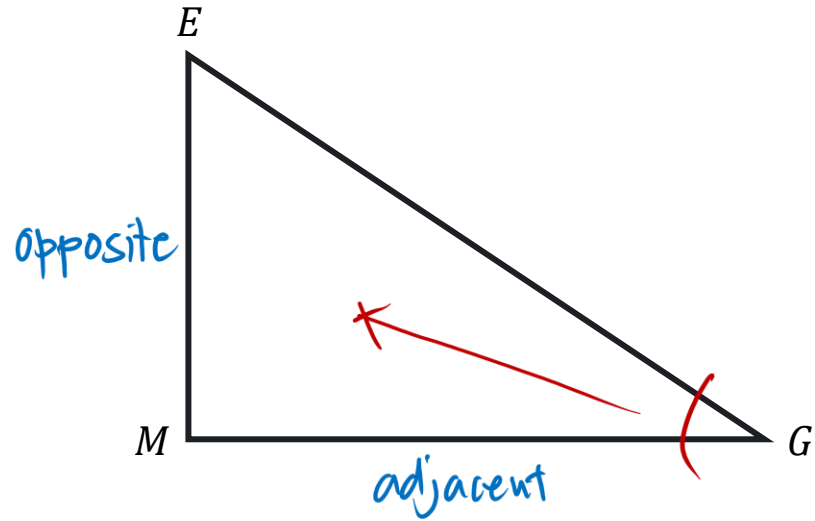
$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$

$$\cot \theta = \frac{\text{adjacent}}{\text{opposite}}$$



## EXERCISE

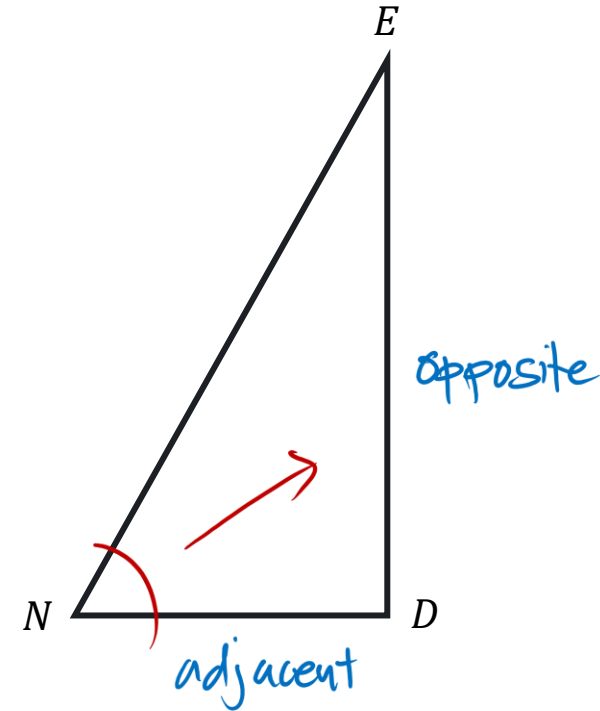
Relative to angle  $G$ , which side is the adjacent side of  $\triangle EMG$ ?



$$\boxed{\text{adjacent} = \overline{MG}}$$

ans

Relative to angle  $N$ , which side is the opposite side of  $\triangle END$ ?

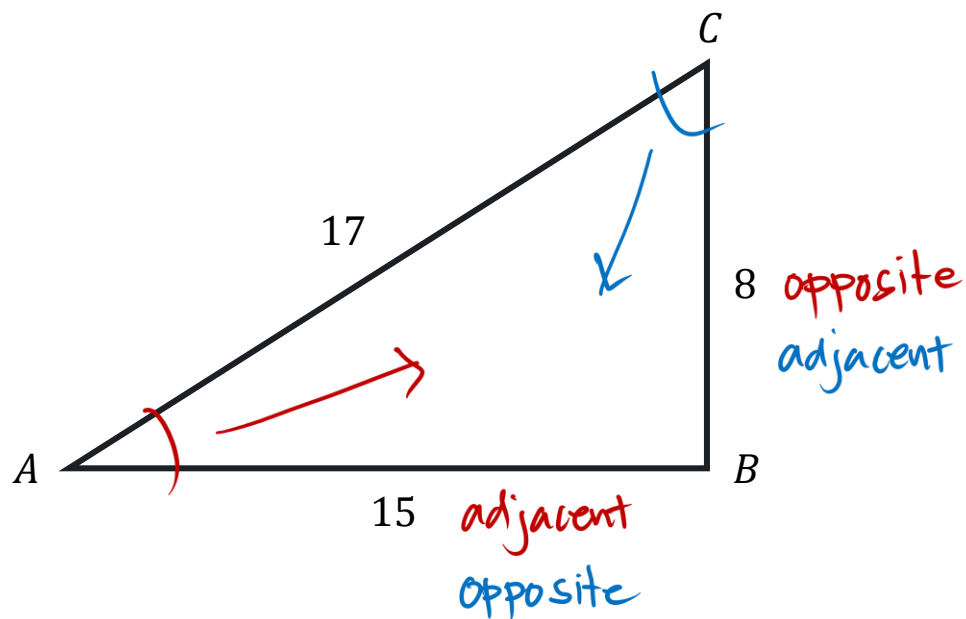


$$\boxed{\text{opposite} = \overline{DE}}$$

ans

## EXERCISE

In the given triangle, find  $\sin A$ ,  $\cos C$ ,  $\csc A$ , and  $\tan C$ .



Solution

Relative to  $A$

$$\sin A = \frac{o}{h}$$

$$\sin A = \frac{8}{17}$$

ans

$$\csc A = \frac{1}{\sin A}$$

$$\csc A = \frac{17}{8}$$

ans

Relative to  $C$

$$\cos C = \frac{a}{h}$$

$$\cos C = \frac{8}{17}$$

ans

$$\tan C = \frac{o}{a}$$

$$\tan C = \frac{15}{8}$$

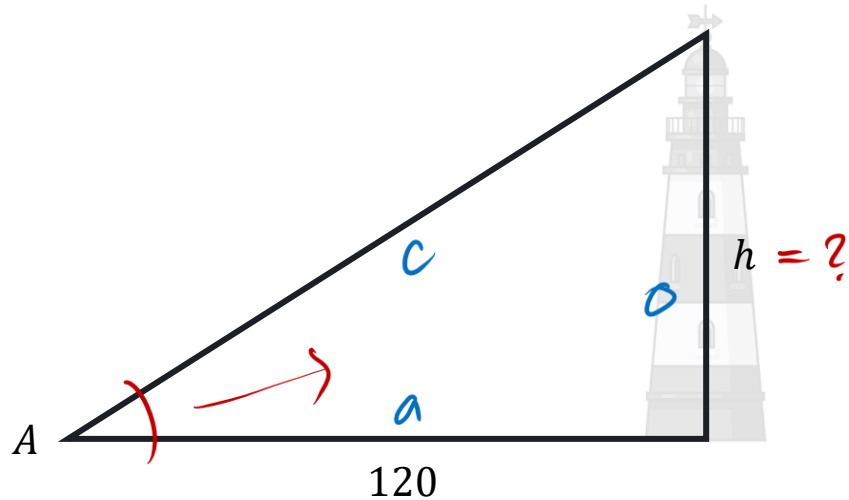
ans

## EXERCISE

A surveyor wants to determine the height of a lighthouse. Standing 120 feet away from its base, he measures the angle of elevation to the top and find that:

$$\tan A = \frac{2}{3}$$

Using this information, calculate the height of the lighthouse.



Solution

$$\tan A = \frac{o}{a}$$
$$\tan A = \frac{h}{120}$$

$$\frac{2}{3} = \frac{h}{120}$$

$$\frac{2(120)}{3} = \frac{3h}{3}$$

$$h = 80 \text{ ft}$$

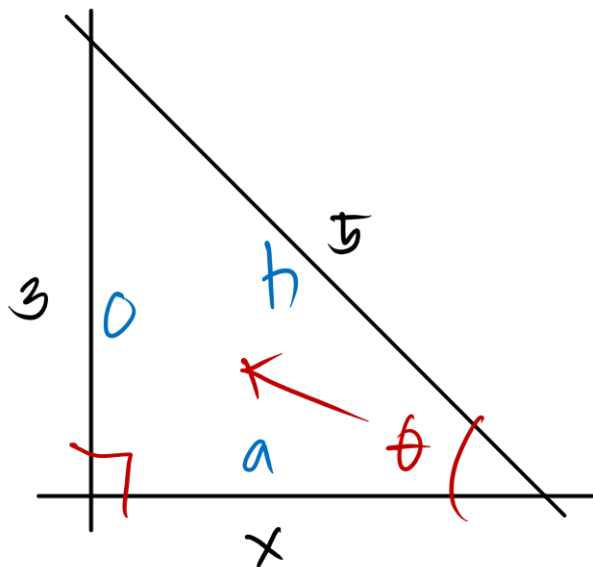
ans



## EXERCISE

Find the cosine of an angle if its sine is  $3/5$ .

$$\sin \theta = \frac{o}{h} = \frac{3}{5}$$



Solution

$$h^2 = a^2 + o^2$$

$$5^2 = x^2 + 3^2$$

$$25 = x^2 + 9$$

$$-9$$

$$-9$$

$$16 = x^2$$

$$x = \sqrt{16}$$

$$x = 4$$

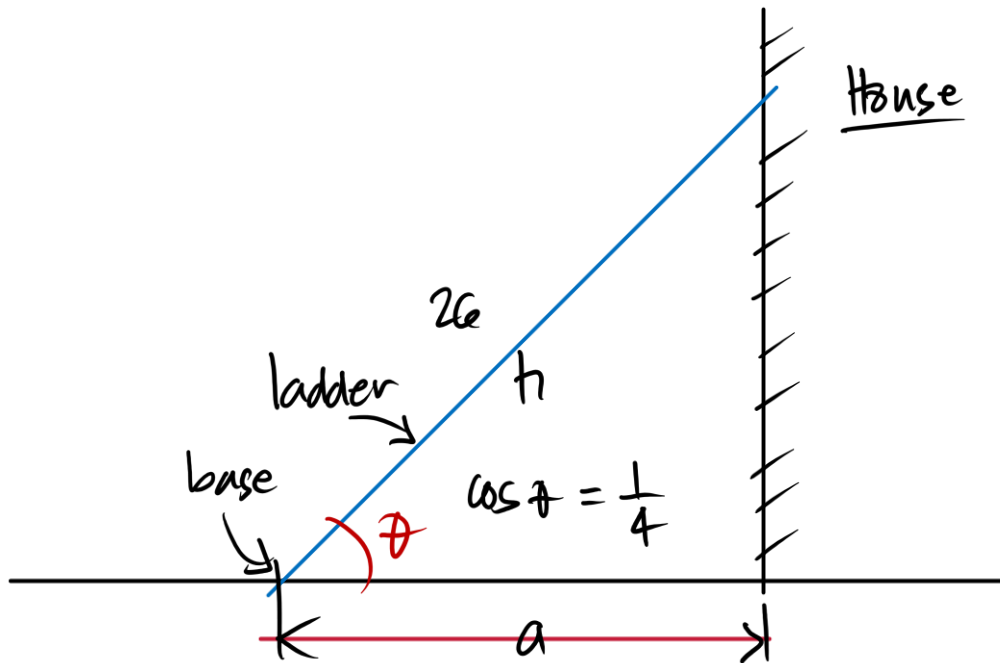
$$\cos \theta = \frac{a}{h}$$

$$\cos \theta = \frac{4}{5}$$

ans

## EXERCISE

A ladder is leaning against the side of a house. The ladder is 26 feet long and forms an angle with the ground such that the cosine of the angle is  $\frac{1}{4}$ . How far is the base of the ladder from the house?



Solution

$$\cos \theta = \frac{a}{h}$$
$$\cos \theta = \frac{1}{4} = \frac{a}{26}$$

$$\frac{1}{4} = \frac{a}{26}$$

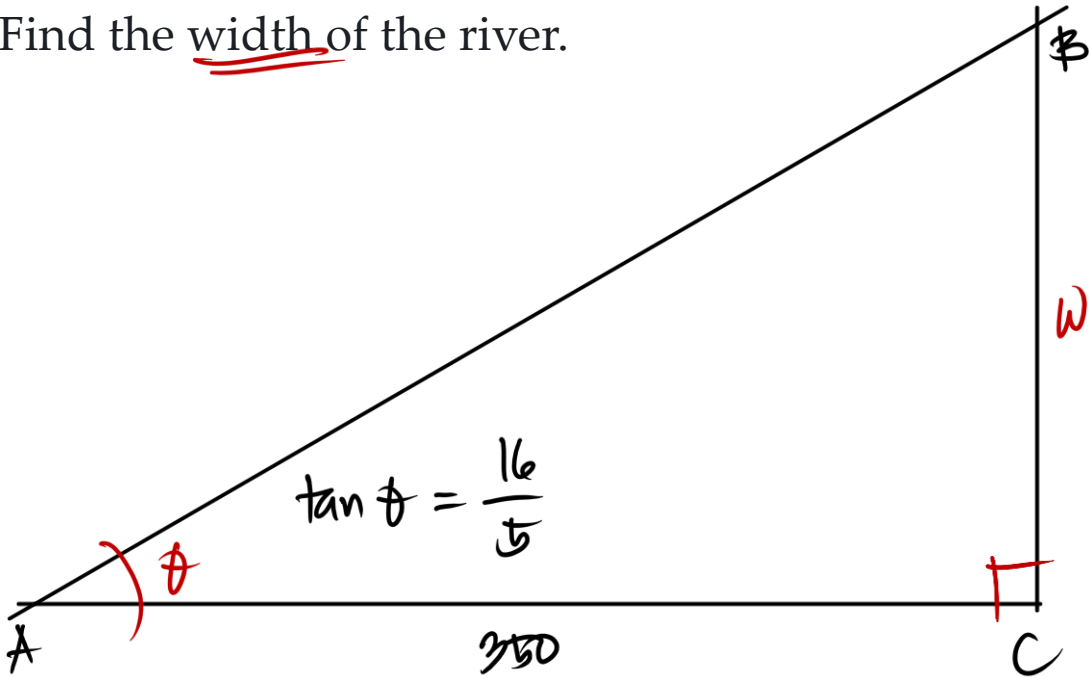
$$\frac{26}{4} = \frac{a}{1}$$

$$a = 6.5 \text{ ft}$$

ans

## EXERCISE

A base line AC 350 ft. in length is laid along one bank of a river. On the opposite bank a point B is located so that CB is perpendicular to AC. The tangent of the angle CAB is then measured and found to be  $\frac{16}{5}$ . Find the width of the river.



Solution

$$\tan \theta = \frac{O}{A}$$

$$\tan \theta = \frac{\frac{16}{5}}{350} = \frac{W}{350}$$

$$\frac{16}{5} = \frac{W}{350}$$

$$\frac{16(350)}{5} = W$$

$$W = 1120 \text{ ft}$$

ans

# SEATWORK

