Reminder

*For **right triangles** there are relationships between the sides, and the angles*

These relationships can remembered by:

$$\boldsymbol{SOH} \qquad \boldsymbol{Sin\theta = \frac{Opp}{Hyp}}$$

$$\boldsymbol{CAH} \qquad \boldsymbol{Cos\theta = \frac{Adj}{Hyp}}$$

$$\boldsymbol{TOA} \qquad \boldsymbol{Tan\theta = \frac{Opp}{Adj}}$$

2.4 The Sine and Cosine Ratios

Lesson Focus

Develop and apply the **sine** and **cosine ratios** to determine angle measures

$$SOH$$
$$CAH$$
$$TOA$$

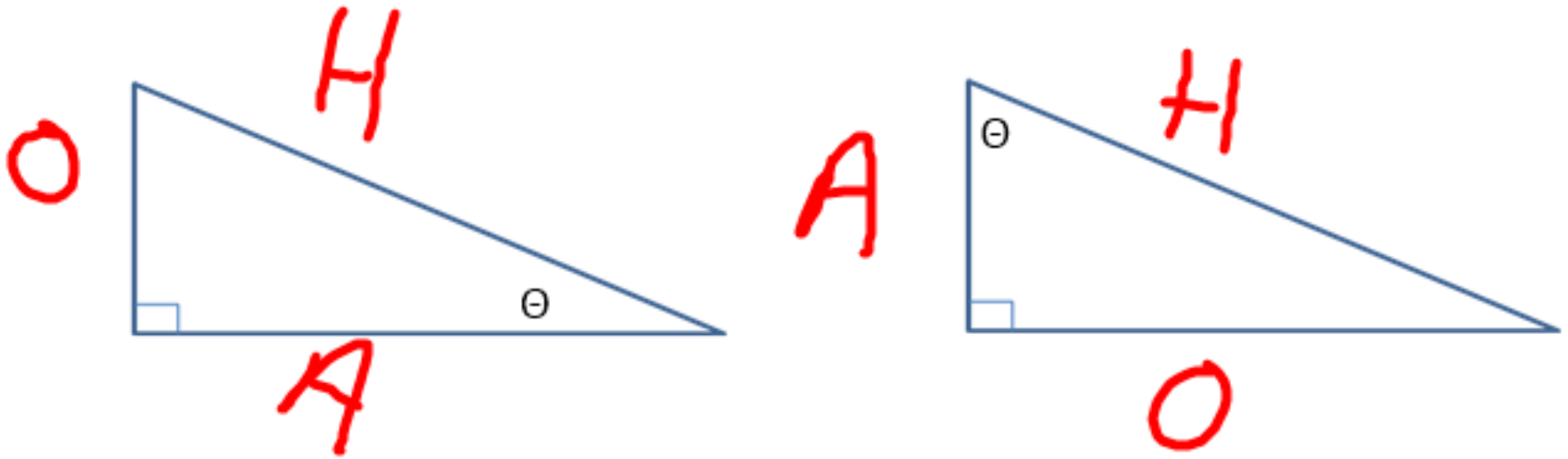
Reminder

Labeling a triangle using:

Hypotenuse

Opposite

Adjacent

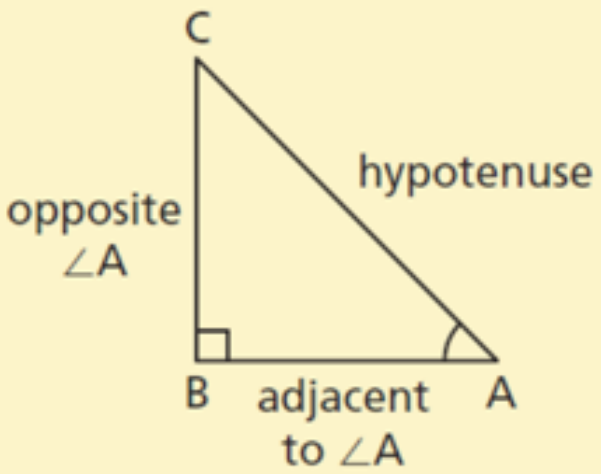


The Sine and Cosine Ratios

The Sine Ratio

If $\angle A$ is an acute angle in a right triangle, then

$$\sin A = \frac{\text{length of side opposite } \angle A}{\text{length of hypotenuse}}$$



The Cosine Ratio

If $\angle A$ is an acute angle in a right triangle, then

$$\cos A = \frac{\text{length of side adjacent to } \angle A}{\text{length of hypotenuse}}$$

Find Angles Using Cos and Sin

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

*Use the **inverse trig ratio** to find the angle:*

$$\theta = \cos^{-1}\left(\frac{adjacent}{hypotenuse}\right) \qquad \theta = \sin^{-1}\left(\frac{opposite}{hypotenuse}\right)$$

Example

To the nearest degree, determine the measure of each $\angle X$.

a) $\sin X = 0.25$

b) $\cos X = 0.64$

c) $\sin X = \frac{6}{11}$

d) $\cos X = \frac{7}{9}$

a) $X = \sin^{-1}(0.25)$

$X \approx 14^0$

b) $X = \cos^{-1}(.64)$

$X \approx 50^0$

c) $x = \sin^{-1}\left(\frac{6}{11}\right)$

$x = 33^\circ$

d) $x = \cos^{-1}\left(\frac{7}{9}\right)$

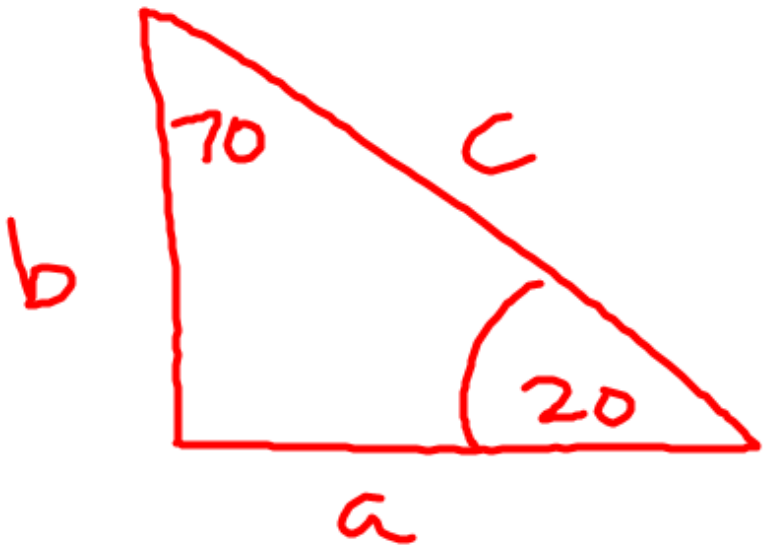
$x = 39^\circ$

$\sin 40^\circ$ $\qquad$ $\cos 50^\circ$

.64

$\sin 20$ $\qquad$ $\cos 70$

.34

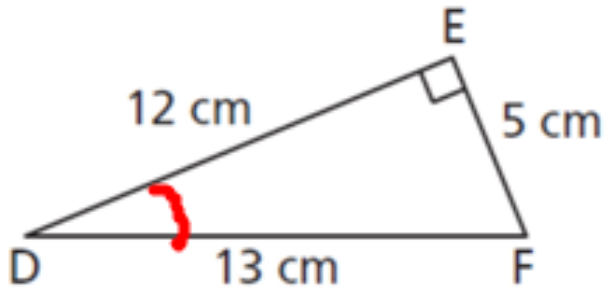


$\sin 20 = \frac{b}{c}$

$\cos 70 = \frac{b}{c}$

Example

a) In $\triangle DEF$, identify the side opposite $\angle D$ and the side adjacent to $\angle D$.

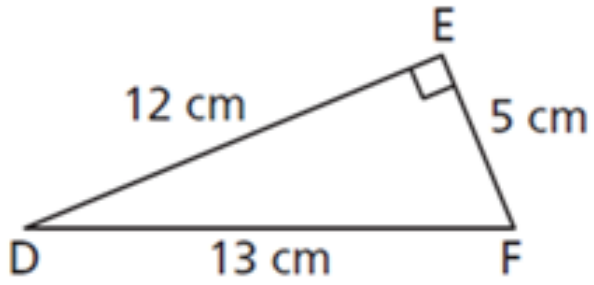


b) Determine sin D and cos D to the nearest hundredth.

$\sin D = \frac{5}{13}$ $\cos D = \frac{12}{13}$

$\sin D = .38$ $\cos D = .92$

Example – Your Turn

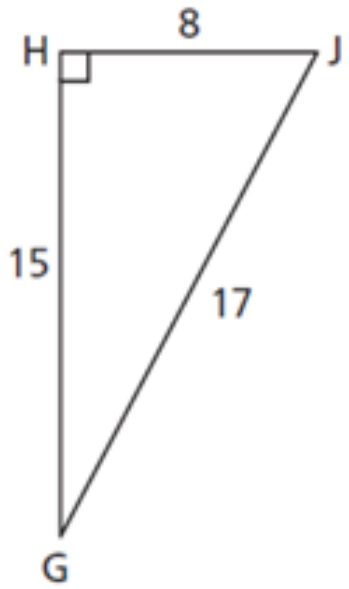


Determine sin F and cos F. How are these values related to sin D and cos D?

Example – Your Turn

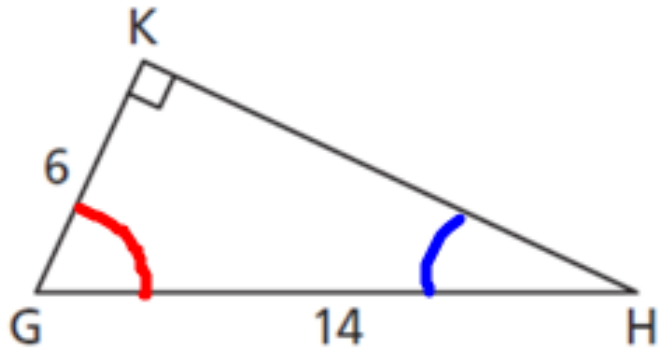
a) In $\triangle GHJ$, identify the side opposite $\angle G$ and the side adjacent to $\angle G$.

b) Determine sin G and cos G to the nearest hundredth.



Example

Determine the measures of $\angle G$ and $\angle H$ to the nearest tenth of a degree.



$$\cos G = \frac{6}{14}$$

$$G = \cos^{-1}\left(\frac{6}{14}\right)$$

$$= 64.6^{\circ}$$

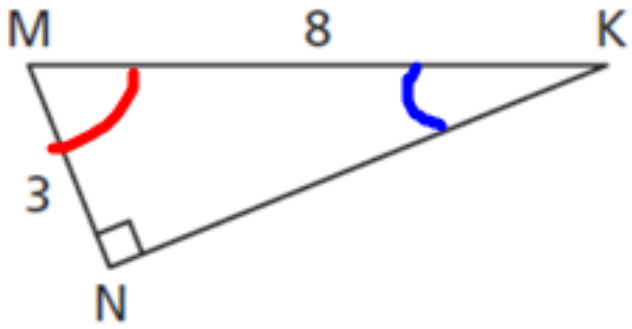
$$\sin H = \frac{6}{14}$$

$$H = \sin^{-1}\left(\frac{6}{14}\right)$$

$$= 25.4^{\circ}$$

Example – Your Turn

Determine the measures of $\angle K$ and $\angle M$ to the nearest tenth of a degree.



$\sin K = \frac{3}{8}$

$K = \sin^{-1}(3/8)$

$K \approx 22.0^\circ$

$\cos m = 3/8$

$m = \cos^{-1}(3/8)$

$m = 68.0^\circ$

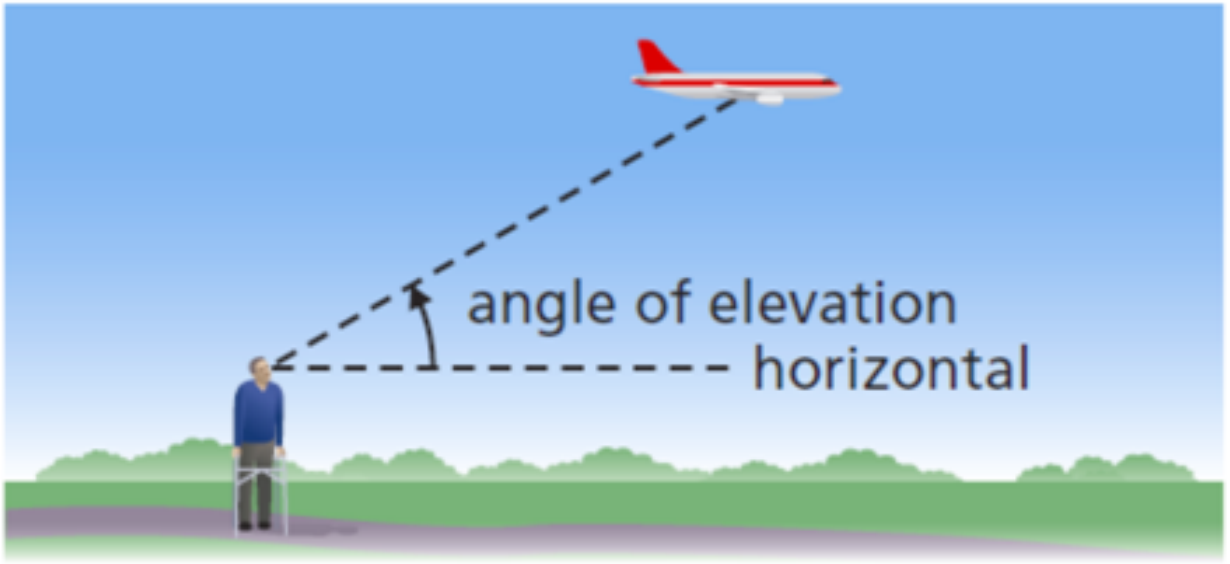
Homework

P. 94-96

 # 4, 7, 8, 10

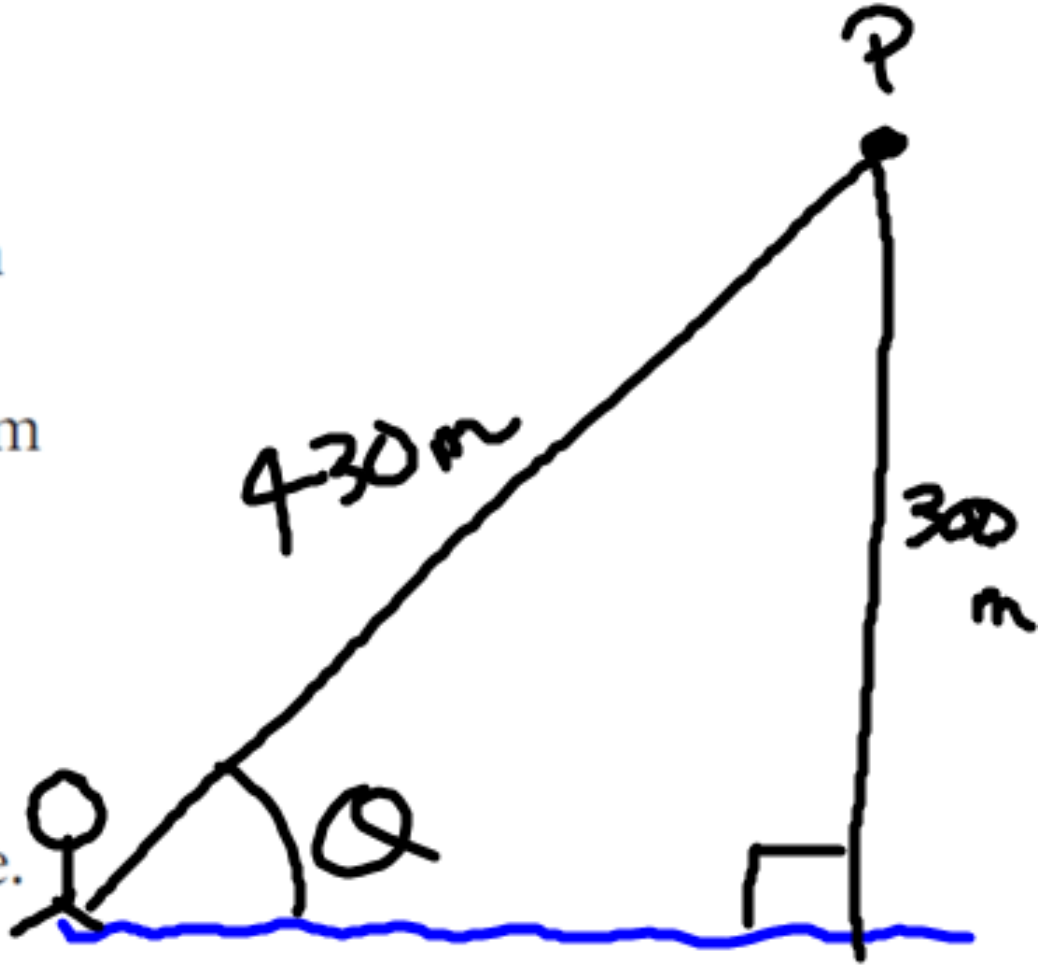
Angle of Elevation

The **angle of elevation** of an object above the horizontal is the angle between the horizontal and the line of sight from an observer.



Example

An observer is sitting on a dock watching a float plane in Vancouver harbour. At a certain time, the plane is 300 m above the water and 430 m from the observer. Determine the angle of elevation of the plane measured from the observer, to the nearest degree.



$$\sin\theta = \frac{300}{430}$$

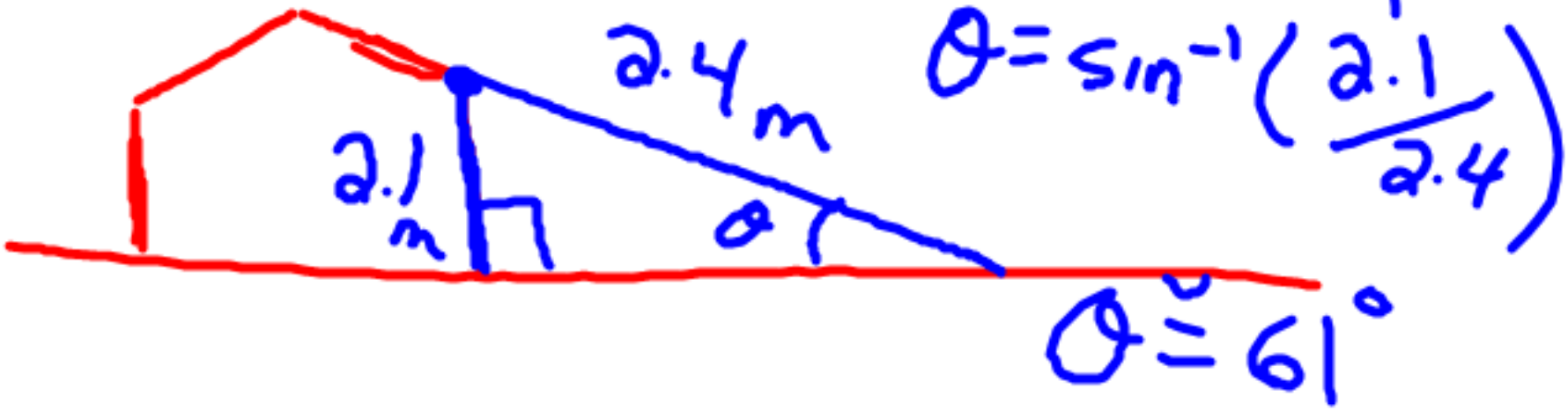
$$\theta = \sin^{-1}\left(\frac{300}{430}\right) \approx 44^\circ$$

Example – Your Turn

A rope that supports a tent is 2.4 m long. The rope is attached to the tent at a point that is 2.1 m above the ground. What is the angle of inclination of the rope to the nearest degree?

$\sin\theta = \frac{2.1}{2.4}$

$\theta = \sin^{-1}\left(\frac{2.1}{2.4}\right)$



$\theta \approx 61^\circ$

Homework

P. 94-96

 # 2,11,12,14,18*

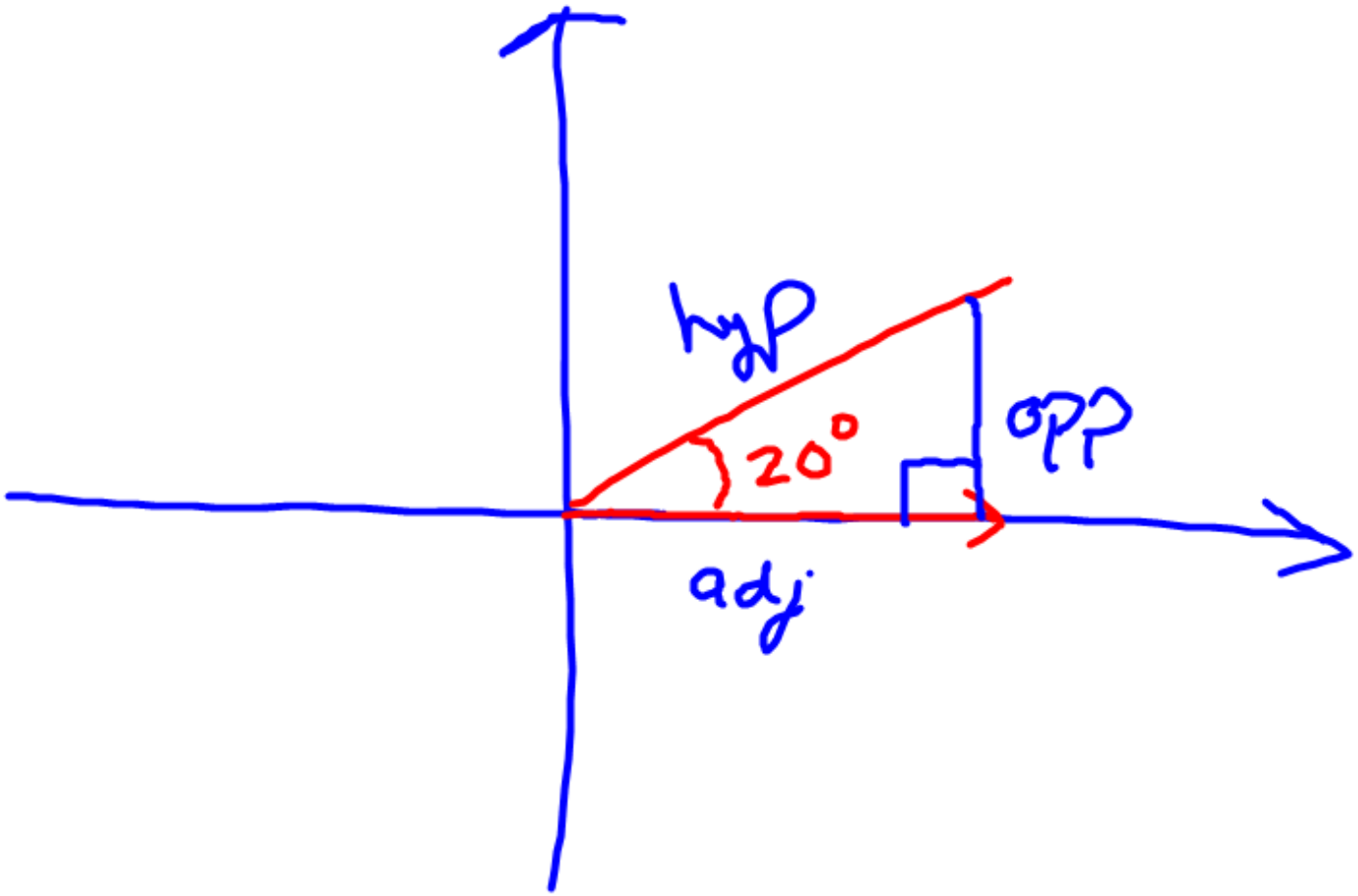
18

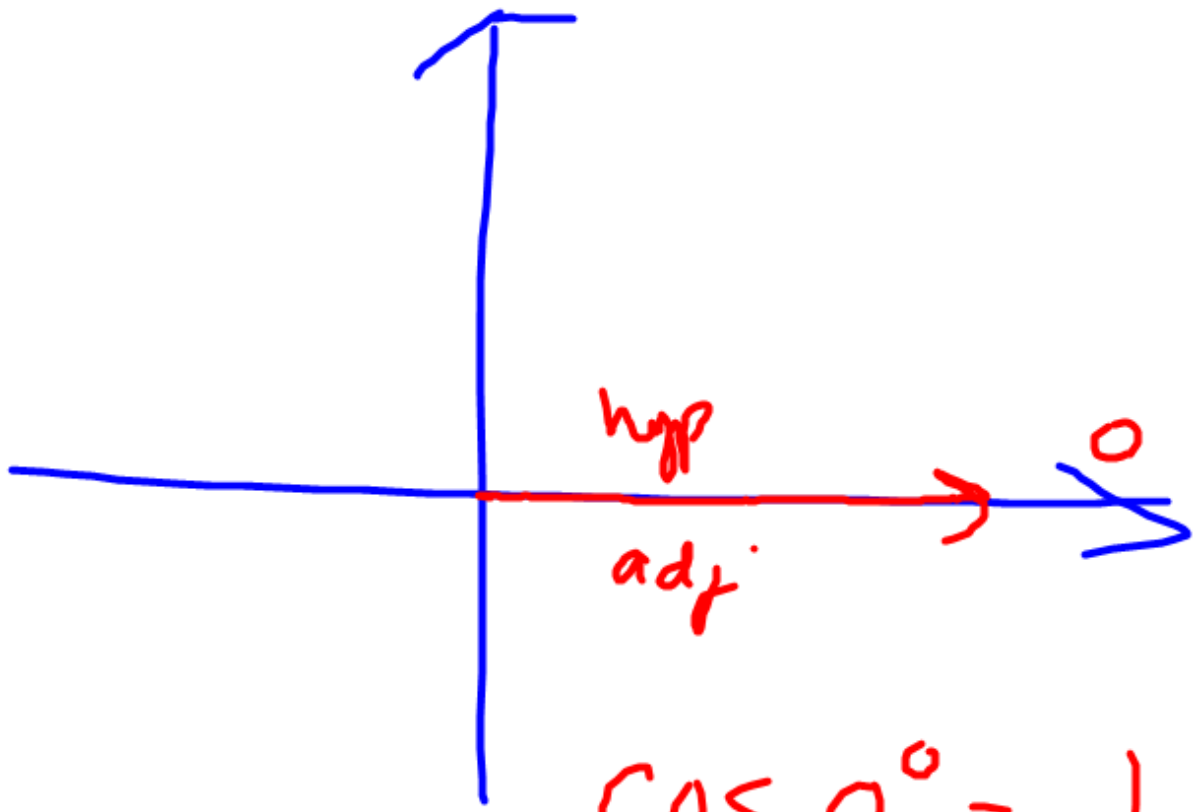
$\sin 90^\circ = 1$

$\sin 0^\circ = 0$

$\cos 90^\circ = 0$

$\cos 0^\circ = 1$


hyp
20°
opp
adj



$$\cos 0^\circ = 1$$

$$\sin 0^\circ = \frac{0}{*}$$