

Homework this week:

01: Sign up for Khan Academy with coach code 4CG5S2.

02: Read sections 5.1 and 5.2 in your textbook

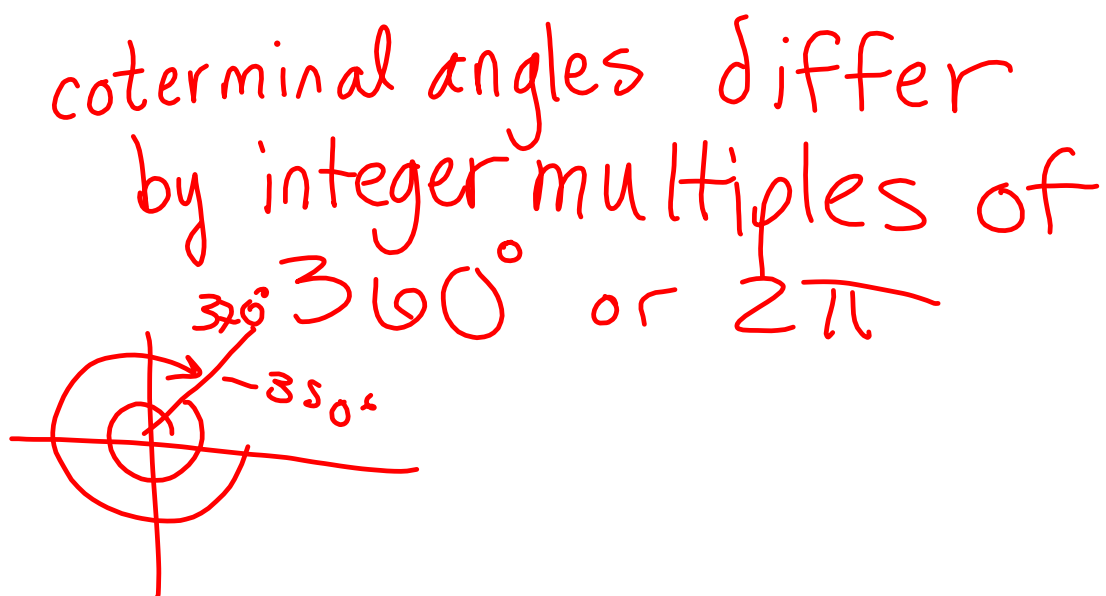
03: Textbook problems

5.1 #1, 2, 7-18 all, 31-73 odd

5.2: #1-6 all; 15-41 odd; 59-75 odd (NO CALCULATOR!)

This will mostly be completed in class and will be due this Friday.

See syllabus for proper formatting of written homework assignments.



Arc Length, Linear Speed, & Angular Speed

$$s = r\theta$$

arc length = radius \cdot angle

$$v = \frac{s}{t} \quad \text{linear speed} = \frac{\text{linear dist.}}{\text{time}}$$

$$\omega = \frac{\theta}{t} \quad \text{angular speed} = \frac{\text{angle}}{\text{time}}$$

$$v = r\omega \quad \text{linear speed} = \text{radius} \cdot \text{angular speed}$$

2. An earth satellite in circular orbit 1200 km high makes one complete revolution every 90 minutes. What is its linear speed in km/min, given that the earth's radius is 6400 km?

$$r = 1200 + 6400$$

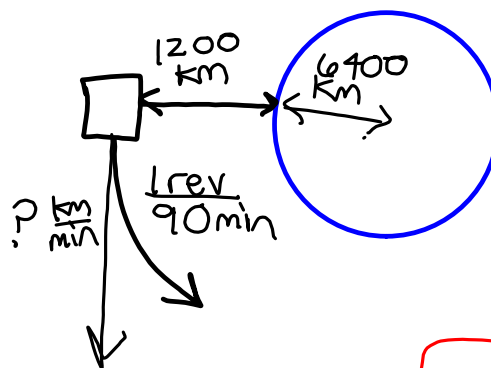
$$r = 7600 \text{ km}$$

$$\omega = \frac{1 \text{ rev}}{90 \text{ min}}$$

$$v = ? \frac{\text{km}}{\text{min}}$$

$$v = r\omega$$

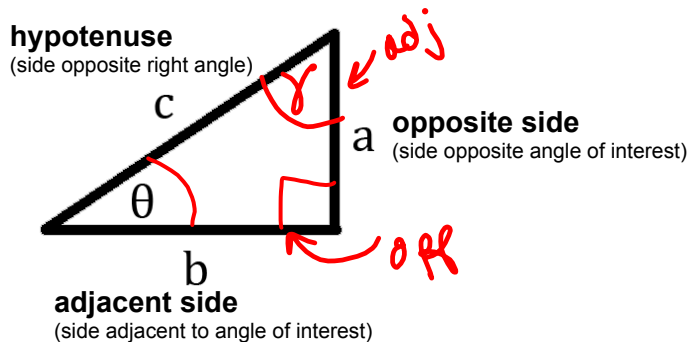
$$v = \frac{7600 \text{ km}}{1} \cdot \frac{1 \text{ rev}}{90 \text{ min}} \cdot \frac{2\pi}{1 \text{ rev}} = \boxed{\frac{1520\pi \text{ km}}{9 \text{ min}}}$$



5.1 Trigonometric Functions of Acute Angles

An acute angle is an angle between 0° and 90°.

A right triangle is a triangle with a 90° angle.



ω omega
 θ theta
 α alpha
 β beta
 γ gamma

The six basic trigonometric functions are ratios of sides of a right triangle.

sine $\sin \theta = \frac{\text{length of side opposite } \theta}{\text{length of hypotenuse}} = \frac{\text{opp}}{\text{hyp}}$

cosine $\cos \theta = \frac{\text{length of side adjacent to } \theta}{\text{length of hypotenuse}} = \frac{\text{adj}}{\text{hyp}}$

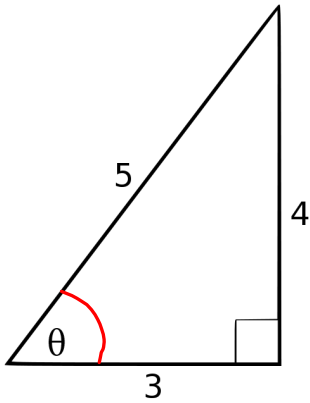
tangent $\tan \theta = \frac{\text{length of side opposite } \theta}{\text{length of side adjacent to } \theta} = \frac{\text{opp}}{\text{adj}}$

SohCahToa

secant $\sec \theta = \frac{\text{hyp}}{\text{adj}} = \frac{1}{\cos \theta}$

cosecant $\csc \theta = \frac{\text{hyp}}{\text{opp}} = \frac{1}{\sin \theta}$

cotangent $\cot \theta = \frac{\text{adj}}{\text{opp}} = \frac{1}{\tan \theta}$



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

$$\cos \theta = \frac{3}{5}$$

$$\tan \theta = \frac{4}{3}$$

$$\sec \theta = \frac{5}{3}$$

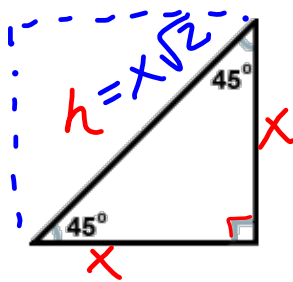
$$\csc \theta = \frac{5}{4}$$

$$\cot \theta = \frac{3}{4}$$

Two special right triangles:

Isosceles Right Triangle aka 45-45-90

Half of an equilateral triangle aka 30-60-90

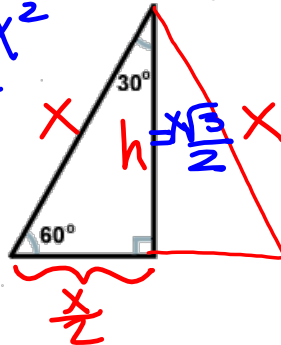


$$h^2 = x^2 + x^2$$

$$h^2 = 2x^2$$

$$h = \sqrt{2x^2}$$

$$h = x\sqrt{2}$$



$$\left(\frac{x}{2}\right)^2 + h^2 = x^2$$

$$h^2 = x^2 - \frac{x^2}{4}$$

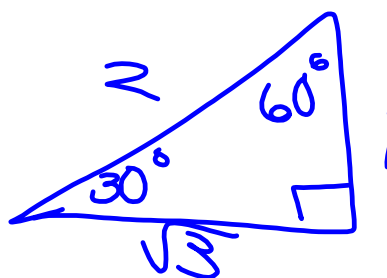
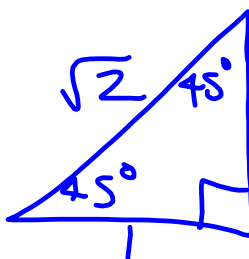
$$h^2 = \frac{4x^2}{4} - \frac{x^2}{4}$$

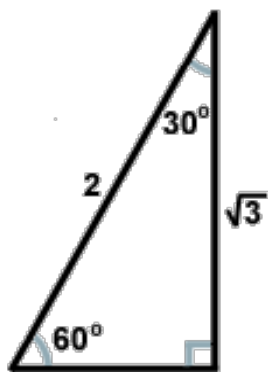
$$h^2 = \frac{3x^2}{4}$$

$$h = x\frac{\sqrt{3}}{2}$$

Pythagorean Theorem:

$$a^2 + b^2 = c^2$$





The function of an angle is equal to the cofunction of its complement.

$\sin 30^\circ = \frac{1}{2}$	$\sin 60^\circ = \frac{\sqrt{3}}{2}$
$\cos 30^\circ = \frac{\sqrt{3}}{2}$	$\cos 60^\circ = \frac{1}{2}$
$\tan 30^\circ = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$	$\tan 60^\circ = \sqrt{3}$
$\sec 30^\circ = \frac{2}{\sqrt{3}}$	$\sec 60^\circ = 2$
$\csc 30^\circ = 2$	$\csc 60^\circ = \frac{2}{\sqrt{3}}$
$\cot 30^\circ = \sqrt{3}$	$\cot 60^\circ = \frac{1}{\sqrt{3}}$

Given that $\csc \beta = 5$, find the other trigonometric function values of β .

$$x^2 + 1^2 = 5^2$$

$$x^2 = 25 - 1$$

$$x^2 = 24$$

$$x = \sqrt{24} = \sqrt{4 \cdot 6}$$

$$x = 2\sqrt{6}$$

$$\cot \beta = 2\sqrt{6}$$

$$\sec \beta = \frac{5}{2\sqrt{6}}$$

$$\sin \beta = \frac{1}{5}$$

5.2 Applications of Right Triangles

A botanist stands 40 ft. from the base of a tree and estimates the angle of elevation to the tree's peak to be 70 degrees. How tall is the tree?

**** Angles of elevation and depression**
are always measured from the horizontal

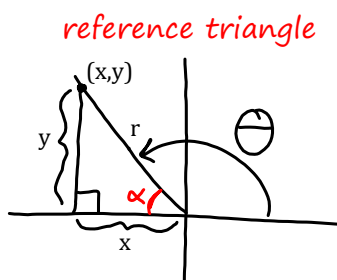
$$\tan 70^\circ = \frac{h}{40}$$

$$40 \tan 70^\circ = h$$

ft

5.3 - Trigonometric Functions of Any Angle

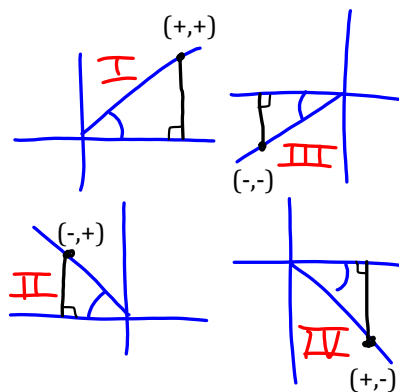
For an angle in standard position, the reference angle is the acute angle between the terminal side of the angle and the x-axis.



$$\sin \theta = \frac{y}{r}$$

$$\cos \theta = \frac{x}{r}$$

$$\tan \theta = \frac{y}{x}$$

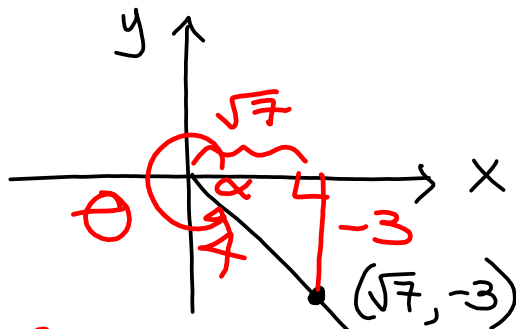


* note that the hypotenuse r is always positive, so that the x- and y-coordinates determine whether the trig function is positive or negative

II S tudents only s ine (and its reciprocal)	I A ll all functions are positive
T ake only t an (and its reciprocal)	C alculus only c osine (and its reciprocal)
III	IV

Tells us which functions are positive in which quadrants.

Find the 6 trigonometric function values of an angle whose terminal side passes through the given point.



$$\begin{aligned}
 h^2 &= (\sqrt{7})^2 + 3^2 \\
 &= 7 + 9 = 16
 \end{aligned}$$

$$\sin \theta = -\frac{3}{4}$$

$$\tan \theta = -\frac{3}{\sqrt{7}}$$

$$\sec \theta = \frac{4}{\sqrt{7}}$$