1. Sketch the following angles from the positive $x$-axis on the circle below. Remember anything without the ° is in radians. Estimate anything you can’t draw exactly.

   (a) $270°$
   (b) $\frac{13\pi}{4}$
   (c) $\pi$
   (d) $3\pi$
   (e) $-\frac{\pi}{2}$
   (f) $\frac{5\pi}{6}$
   (g) 9
   (h) 1.5

2. In terms of circles, what does a radian represent? How is it related to other quantities on the circle?

   (a) On a circle, an arc of length $\pi$ is swept out by an angle of 2 radians. What is the radius of the circle?

   (b) On a circle of radius 4, an arc of length 12 is swept out by an angle $\theta$. What is $\theta$ exactly?

   i. Thinking of $\theta$ on the unit circle, what is $\cos \theta$ close to? What about $\sin \theta$?
3. Let $\alpha$ be an angle in the second quadrant.

(a) Given the trig value below, find the others.

i. $\sin \alpha =$ 

ii. $\cos \alpha =$ 

iii. $\tan \alpha =$ 

iv. $\csc \alpha = \frac{2}{\sqrt{3}}$

v. $\sec \alpha =$ 

vi. $\cot \alpha =$ 

(b) What is $\alpha$ in degrees? In radians?

4. Let $\alpha$ be an angle in the third quadrant.

(a) Given the trig value below, find the others.

i. $\sin \alpha =$ 

ii. $\cos \alpha =$ 

iii. $\tan \alpha =$ 

iv. $\csc \alpha =$ 

v. $\sec \alpha =$ 

vi. $\cot \alpha = \frac{12}{5}$

5. (a) Use the Pythagorean Theorem and your knowledge of trig functions to show $\sin^2 \theta + \cos^2 \theta = 1$.

(b) Use the above identity to prove $\tan^2 \theta + 1 = \sec^2 \theta$. Hint: how can you get $\tan \theta$ from $\sin \theta$?

(c) Use the first identity to prove $1 + \cot^2 \theta = \csc^2 \theta$. 


6. A crop duster is flying at an elevation of 500 feet. Measuring from your feet, the angle
of elevation between you and the plane be \( \theta \). Draw this situation.

(a) On your picture, label the distance between you and the plane \( L \). Label the
distance between you and the point directly beneath the plane \( b \).

(b) Find a function for \( L \) and \( b \) in terms of \( \theta \)

(c) Find a function for \( b \) and \( \theta \) in terms of \( L \) (you can leave \( \theta \) inside a trig function).

7. A boat is pulled into a dock by a rope attached to the bow of a boat and passing through
a pulley on the dock that is 1 m higher than the bow of the boat. Draw a picture.

(a) On your picture, label the length of the rope \( L \), the angle between the rope and
where the bow of the boat is \( \theta \), and the distance between the boat and the dock
\( b \).

(b) Find a function for \( L \) and \( \theta \) in terms of \( b \) (you can leave \( \theta \) inside a trig function).

(c) Find a function for \( b \) and \( L \) in terms of \( \theta \).
8. Find all important information and graph

\[ f(x) = \frac{5x^2(x^2 - 9)}{(2x - 12)(3x - 18)(x - 1)(2x + 6)} \]
9. Draw a unit circle (circle of radius 1). Add a right triangle with one side on the positive \( x \)-axis and the hypotenuse as a radius of the circle in the first quadrant. Mark the point at the intersection of the hypotenuse and the circle as \((x, y)\). Mark the angle at the origin as \( \theta \)

(a) Use your triangle definition of sin and cos to find \( x \) and \( y \) in terms of \( \theta \). We call this the unit circle definition.

(b) Use the unit circle definition to explain in which quadrants sin \( \theta \), cos \( \theta \), and tan \( \theta \) are positive.

(c) Explain why the unit circle definition immediately gives you that sin\((-x) = -\sin(x)\).

(d) Similarly, explain why cos\((-x) = \cos(x)\).
10. (a) What is the domain of \( \sin x \) and \( \cos x \)? What is the range of \( \sin x \) and \( \cos x \)? How did you decide this?

(b) Use the unit circle definition to make rough sketches of \( \sin x \) and \( \cos x \).

(c) What is the domain of \( \tan x \)?

**An Ending Thought:** *Don’t worry about moving slowly, worry about standing still.*

– Chinese proverb