

GRAPHS OF THE TRIGONOMETRIC RATIO FUNCTIONS

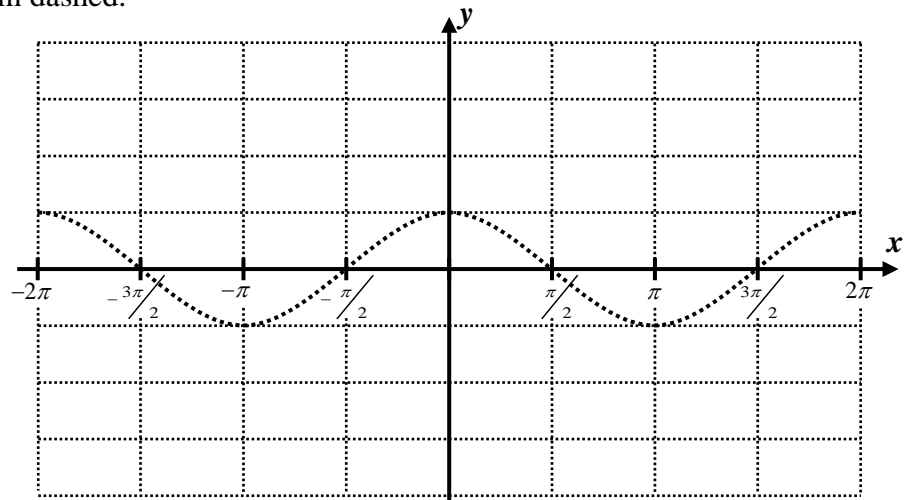
ALGEBRA 2 WITH TRIGONOMETRY

The four additional trigonometric functions we saw in the last lesson are sometimes known as the **trigonometric ratio functions** because they involve ratios of the sine and cosine functions. Their graphs are complex and interesting. Their behavior will only be explored in this lesson. Higher-level discussion and exploration should be treated in a pre-calculus course.

Exercise #1: Consider the function $y = \sec(x)$. From our last lesson we know that $\sec(x) = \frac{1}{\cos(x)}$. The

graph below shows the basic cosine curve in dashed.

(a) At what values of x on the interval $-2\pi \leq x \leq 2\pi$ is $\cos(x) = 0$. Circle these locations on the graph.



(b) What will be true of $\sec(x)$ at these values of x ? Draw a dashed vertical line at each of these x -values.

(c) Using your calculator, sketch a graph of $y = \sec(x)$ on the grid. As a suggestion, have your calculator graph both $\sec(x)$ and $\cos(x)$.

(d) Algebraically explain why the secant function fails to have any x -intercepts.

Exercise #2: Which of the following represents the period of $y = \sec(x)$?

- | | |
|------------|---------------------|
| (1) π | (3) $\frac{\pi}{2}$ |
| (2) 2π | (4) 4π |

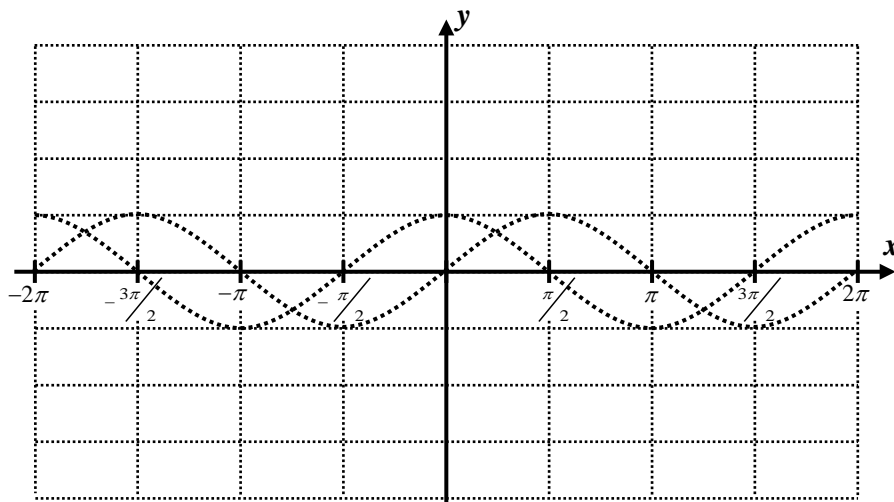
Exercise #3: Which of the following could *not* be a value of $\sec(x)$?

- | | |
|-------------------|--------------------|
| (1) 1 | (3) $\frac{3}{2}$ |
| (2) $\frac{1}{2}$ | (4) $-\frac{5}{4}$ |



Exercise #4: Consider the function $y = \tan(x) = \frac{\sin(x)}{\cos(x)}$. On the graph below are shown both the basic sine and cosine curves, both dashed.

(a) At what values of x on the interval $-2\pi \leq x \leq 2\pi$ will tangent be undefined? Explain and then draw vertical lines on your graph at these locations.



(b) At what values of x on the interval $-2\pi \leq x \leq 2\pi$ will the tangent have x -intercepts. Explain why and then place points at these intercepts.

(c) Use your calculator to sketch $y = \tan(x)$ on the grid provided.

Exercise #5: Which of the following represents the period of $y = \tan(x)$?

- | | |
|------------|---------------------|
| (1) π | (3) $\frac{\pi}{2}$ |
| (2) 2π | (4) 4π |

Exercise #6: Over the interval $-2\pi \leq x \leq 2\pi$ the equation $\tan(x) = 3$ would have how many solutions?

- | | |
|-------|-------|
| (1) 1 | (3) 3 |
| (2) 2 | (4) 4 |

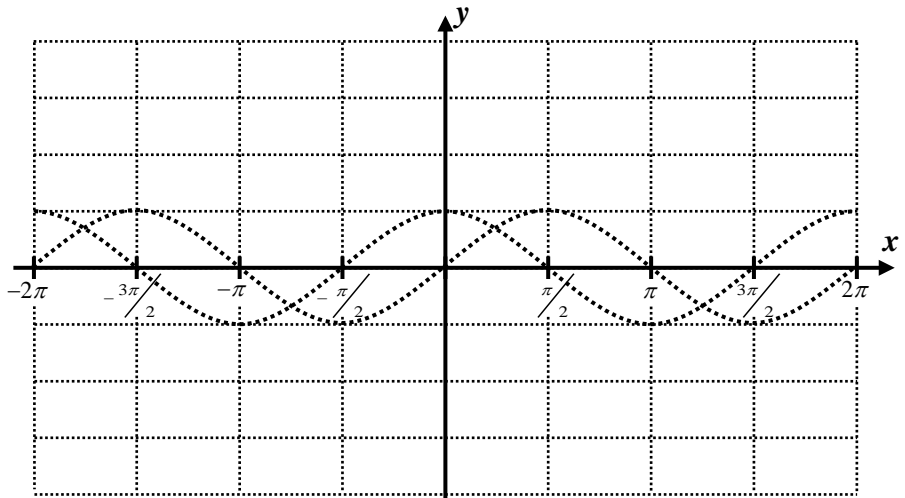
Exercise #7: At how many values of x on the interval $0 \leq x \leq \pi$ is $\tan(x) = \cos(x)$?

- | | |
|-------|-------|
| (1) 1 | (3) 3 |
| (2) 2 | (4) 0 |



5. Consider the function $y = \cot(x) = \frac{\cos(x)}{\sin(x)}$. On the graph below are both the sine and cosine curves.

(a) At what values of x on the interval $-2\pi \leq x \leq 2\pi$ will the cotangent be undefined? Explain your choice and then draw vertical lines on your graph at these locations.



(b) At what values of x on the interval $-2\pi \leq x \leq 2\pi$ will the cotangent have x -intercepts? Explain why and then place points at these intercepts.

(c) Use your calculator to sketch $y = \cot(x)$ on the grid provided.

6. Which of the following represents the period of $y = \cot(x)$?

- (1) 90° (3) 360°
 (2) 60° (4) 180°

7. On the interval $-\pi/2 \leq x \leq \pi/2$ the equation $\cot(x) = 2$ would have how many solutions?

- (1) 1 (3) 3
 (2) 2 (4) 4

REASONING

8. Is anyone of the six trigonometric functions one-to-one? Explain graphically.

