

## NOTES: Section 14.1 – Graph Sine, Cosine, and Tangent Functions

Goals: #1 - I can graph  $y = \sin x$  and  $y = \cos x$

#2 - I can identify the function's domain, range, amplitude, cycle, period, x-intercepts, and y-intercepts

#3 - I can graph  $y = \tan x$

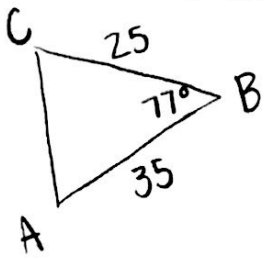
#4 - I can identify the function's domain, range, vertical asymptotes, cycle, period, x-intercepts, and y-intercepts



### Homework: Lesson 14.1 Worksheet

#### Warm Up:

1. Solve  $\triangle ABC$ . Round answers to the nearest tenth.



a.  $B = 77^\circ, a = 25, c = 35$

$$b^2 = 25^2 + 35^2 - 2(25)(35)\cos 77^\circ$$

$$b^2 \approx 1456.33$$

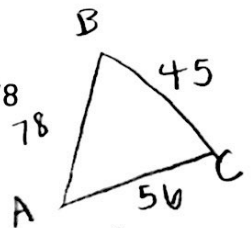
$$b \approx 38.2$$

$$\frac{38.2}{\sin 77^\circ} = \frac{25}{\sin A}$$

$$\angle A \approx 39.6^\circ$$

$$\angle C \approx 63.4^\circ$$

b.  $a = 45, b = 56, c = 78$



$$78^2 = 56^2 + 45^2 - 2(56)(45)\cos C$$

$$923 = -5040 \cos C$$

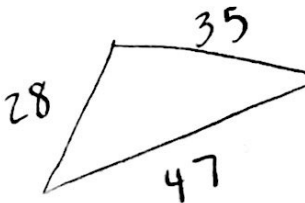
$$\angle C \approx 100.6^\circ$$

$$\frac{78}{\sin 100.6^\circ} = \frac{45}{\sin A}$$

$$\angle A \approx 34.5^\circ$$

$$\angle B \approx 44.9^\circ$$

2. What is the area of a triangular banner with sides of length 28 cm, 35 cm, and 47 cm?



$$A = \sqrt{55(55-28)(55-35)(55-47)}$$

$$A \approx 487.4 \text{ cm}^2$$

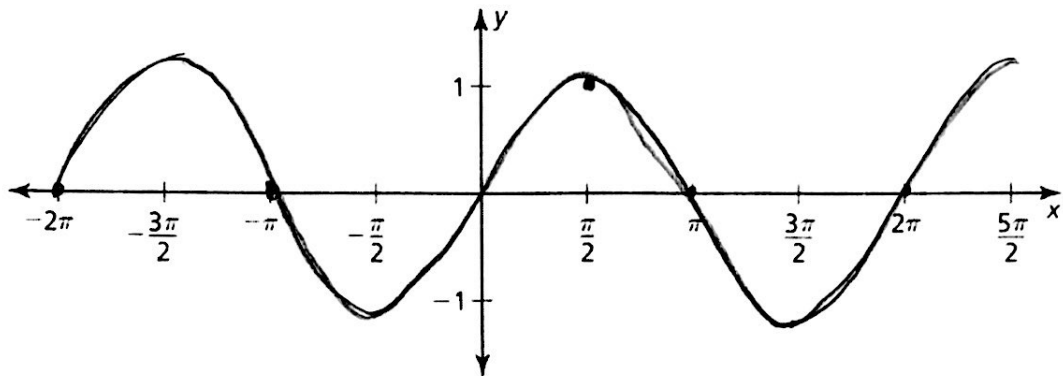
$$S = \frac{1}{2}(28+35+47)$$

$$S = 55$$

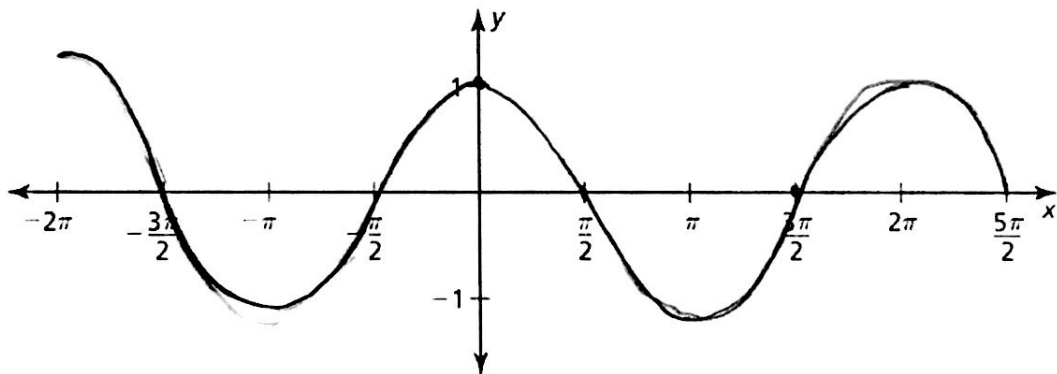
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**Exploration #1:**

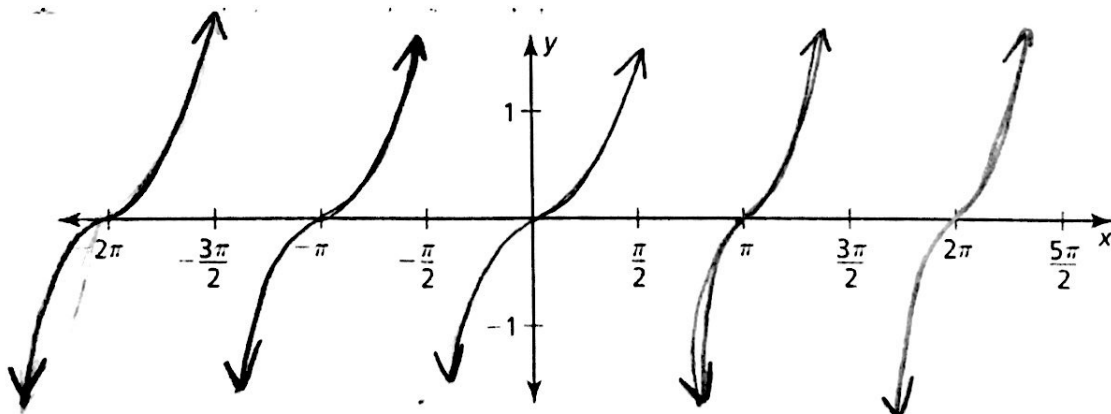
1. Sketch the general shape that the ORANGE DOT is making. Try and be precise!



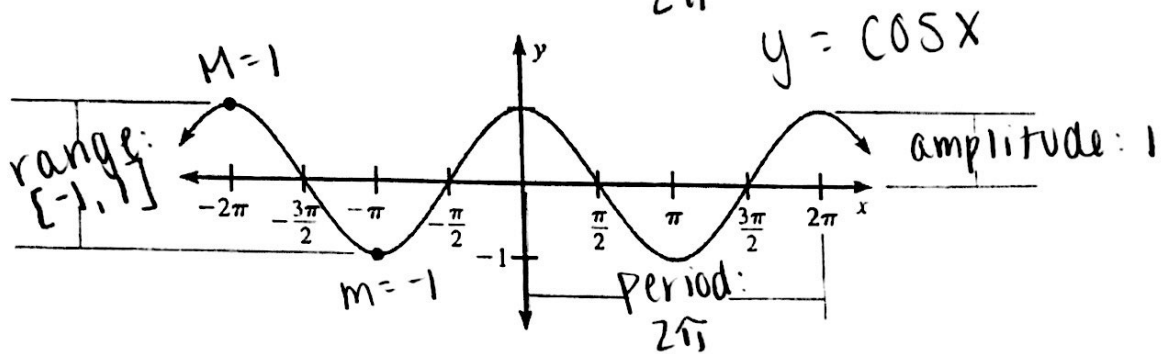
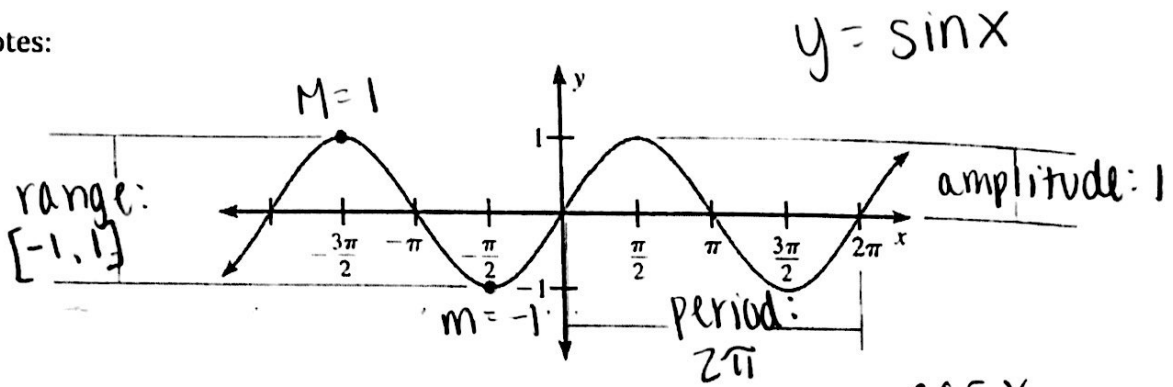
2. Sketch the general shape that the PURPLE DOT is making. Try and be precise!



3. Sketch the general shape that the RED DOT is making. Try and be precise!



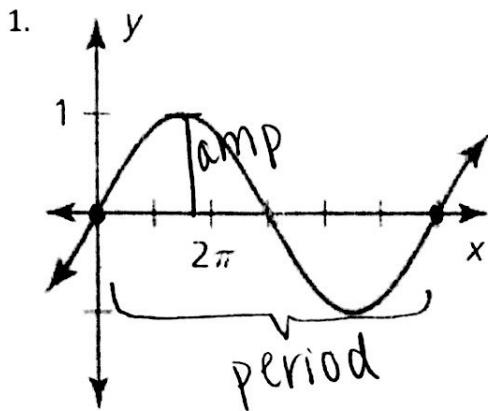
Notes:



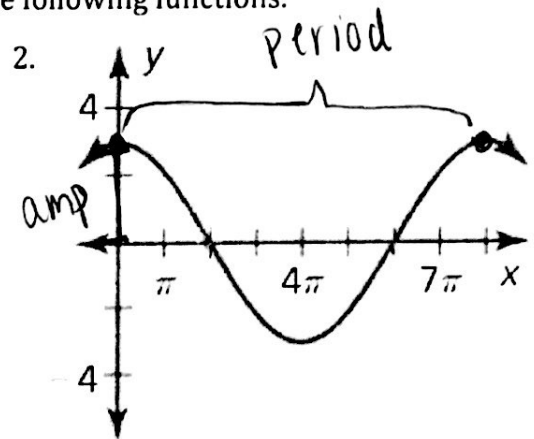
Characteristics of  $y = \sin x$  and  $y = \cos x$ :

- The domain of each function is all real #s.
- The range of each function is  $[-1, 1]$  or  $-1 \leq y \leq 1$ 
  - Therefore, the minimum value is  $m = -1$ .
  - And the maximum value is  $M = 1$ .
- The amplitude of each function's graph is half the difference of the minimum and the maximum.
- Each function is periodic, meaning it has a repeating pattern.
  - The shortest repeating portion of the graph is called the cycle.
  - The horizontal length of each cycle is called the period.
  - Each graph shown above has a period of  $2\pi$ .
- The  $x$ -intercepts for  $y = \sin x$  occur when  $x = 0, \pm\pi, \pm 2\pi, \pm 3\pi, \dots$ .
- The  $x$ -intercepts for  $y = \cos x$  occur when  $x = \pm\frac{\pi}{2}, \pm\frac{3\pi}{2}, \pm\frac{5\pi}{2}, \dots$ .

Example #1: Identify the amplitude and the period of the following functions.

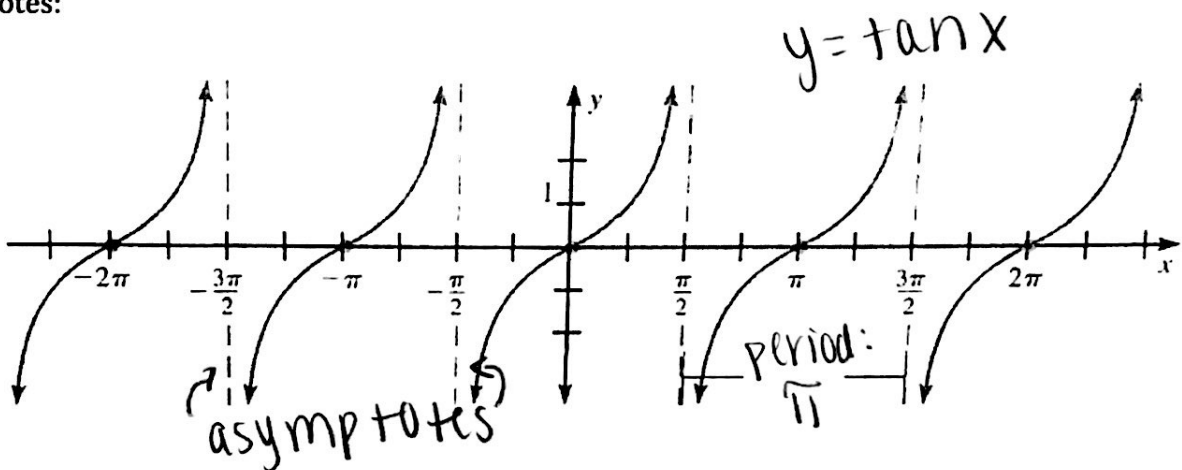


amplitude: 1  
period:  $6\pi$



amplitude: 3  
period:  $8\pi$

Notes:



Characteristics of  $y = \tan x$ :

- The domain of each function is  $\mathbb{R}, x \neq \pm\frac{\pi}{2}, \pm\frac{3\pi}{2}, \pm\frac{5\pi}{2}, \dots$ 
  - At these  $x$ -values, the graph has vertical asymptotes.
- The range of each function is all real #s.
  - Therefore, there is no max value, min value, or amplitude.
- The graph has a period of  $\pi$ .
- The  $x$ -intercepts for  $y = \tan x$  occur when  $x = 0, \pm\pi, \pm2\pi, \pm3\pi, \dots$ .

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To graph:

$$y = a \sin bx$$

$$y = a \cos bx$$

To graph the above functions, we will look at the Amplitude and the period of the function.

Amplitude:  $|a|$

Period:  $\frac{2\pi}{|b|}$

$$y = a \tan bx$$

To graph the above function, we will look at the Asymptotes and the period of the function.

Vertical Asymptotes:  $\frac{\pi}{2|b|}$

Period:  $\frac{\pi}{|b|}$

Example #2: Identify the function's amplitude or vertical asymptote and period.

1.  $y = 3 \cos\left(\frac{1}{2}x\right)$

amplitude: 3

$$\frac{2\pi}{\frac{1}{2}}$$

period:  $4\pi$

$$\frac{\pi}{2(2)}$$

asymptotes:  $\frac{\pi}{4}$

2.  $y = 2 \tan(2x)$

period:  $\frac{\pi}{2}$

$$\frac{\pi}{2}$$

$$\frac{\pi}{2}$$

You practice: Identify the function's amplitude or vertical asymptote and period.

1.  $y = 2 \sin(4x)$

amplitude: 2

$$\frac{2\pi}{4}$$

period:  $\frac{\pi}{2}$

$$\frac{\pi}{2(\frac{1}{2})}$$

asymptotes:  $\pi$

2.  $y = 4 \tan\left(\frac{1}{2}x\right)$

period:  $2\pi$

$$\frac{\pi}{\frac{1}{2}}$$

$$2\pi$$

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**Example #1:** Graph one period of the function. Identify its domain, range, amplitude, period, and x- and y-intercepts.

1.  $y = 4 \sin x$

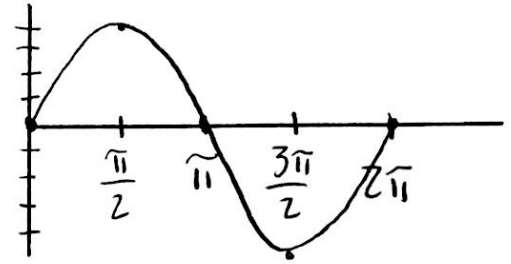
domain:  $\mathbb{R}$

range:  $[-4, 4]$

amplitude: 4

period:  $2\pi$

x-int:  $0, \pi, 2\pi, \dots$       y-int:  $(0, 0)$



2.  $y = \frac{1}{2} \cos 2\pi x$

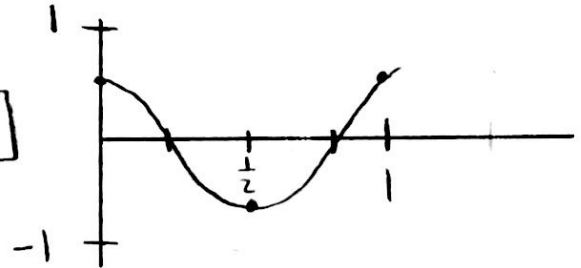
domain:  $\mathbb{R}$

range:  $[-\frac{1}{2}, \frac{1}{2}]$

amplitude:  $\frac{1}{2}$

period: 1

x-int:  $\frac{1}{4}, \frac{3}{4}, \dots$       y-int:  $(0, \frac{1}{2})$



**You practice:** Graph one period of the function. Identify its domain, range, amplitude, period, and x- and y-intercepts.

1.  $y = \frac{1}{4} \sin \pi x$

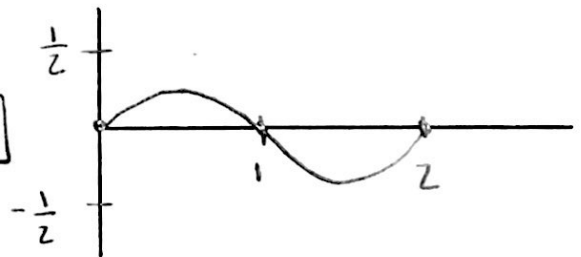
domain:  $\mathbb{R}$

range:  $[-\frac{1}{4}, \frac{1}{4}]$

amplitude:  $\frac{1}{4}$

period: 2

x-int:  $1, 2, \dots$       y-int:  $(0, 0)$



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**Example #2:** Graph one period of the function. Identify its domain, range, amplitude, period, and x- and y-intercepts.

1.  $y = 2 \tan 3x$

domain:  $\mathbb{R}, x \neq \pm \frac{\pi}{6}$

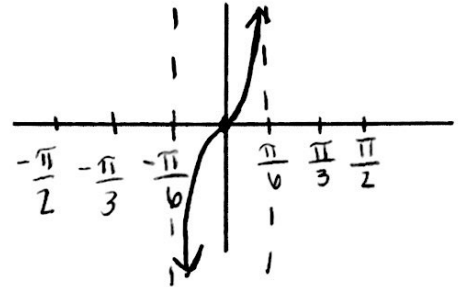
asymptotes:  $\pm \frac{\pi}{6}$

x-int:  $(0, 0)$

range:  $\mathbb{R}$

period:  $\frac{\pi}{3}$

y-int:  $(0, 0)$



**You practice:** Graph one period of the function. Identify its domain, range, amplitude, period, and x- and y-intercepts.

1.  $y = \tan 4x$

domain:  $\mathbb{R}, x \neq \pm \frac{\pi}{8}$

asymptotes:  $\pm \frac{\pi}{8}$

x-int:  $(0, 0)$

range:  $\mathbb{R}$

period:  $\frac{\pi}{4}$

y-int:  $(0, 0)$

