

## Agenda

Practice Midterm

Review Quiz 9

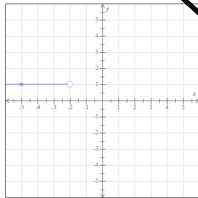
Lecture

Suppose that the function  $h$  is defined, for all real numbers, as

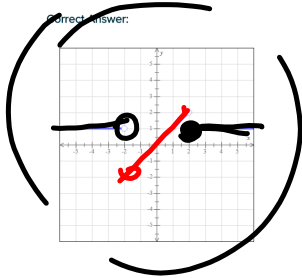
$$h(x) = \begin{cases} 1 & \text{if } x < -2 \\ x & \text{if } -2 \leq x < 2 \\ 1 & \text{if } x \geq 2 \end{cases}$$

Graph the function  $h$ .

Answer Submitted:



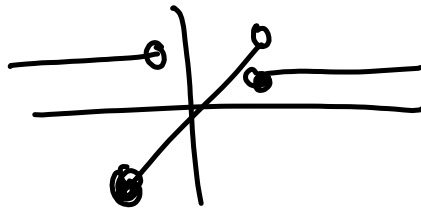
Correct Answer:



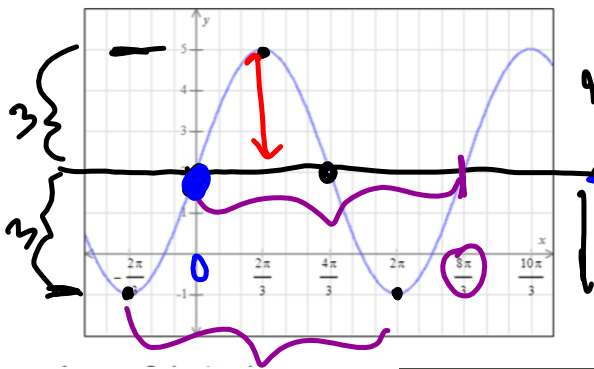
$$y_1 = 1 \quad (x < -2)$$

$$y_2 = x \quad (-2 \leq x) \quad (x < 2)$$

$$y_3 = 1 \quad (x \geq 2)$$

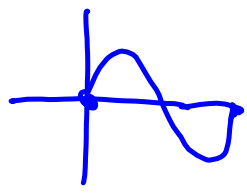


Write the equation of a sine or cosine function to describe the graph.



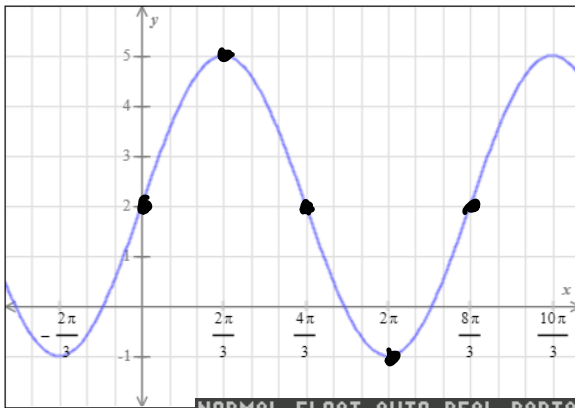
Period:  $\frac{2\pi}{\frac{3}{4}} = \frac{8\pi}{3}$   $b = \frac{3}{4}$

$$y = 3 \sin\left(\frac{3}{4}x\right) + 2$$



```
NORMAL FLOAT AUTO a+bi RADIAN MP
SinReg
y=a*sin(bx+c)+d
a=3
b=.75
c=-7E-14 = 0
d=2
```

Write the equation of a sine or cosine function to describe the graph.



X	Y
0	2
$2\pi/3$	5
$4\pi/3$	2
$2\pi$	-1
$8\pi/3$	2

Answer Submitte

$$y = 3 \sin \left( \frac{3}{4}x \right) + 2$$

NORMAL FLOAT AUTO REAL RADIAN MP

**SinReg**

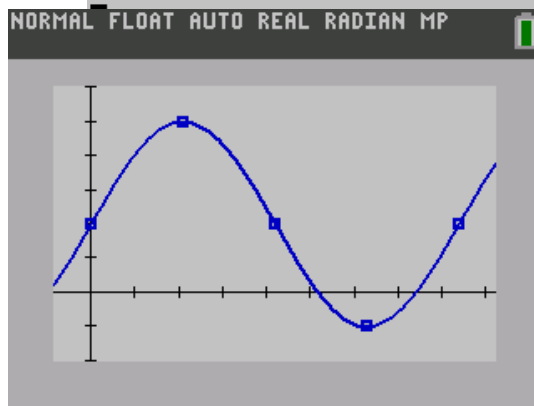
$y = a * \sin(bx + c) + d$

$a = 3$

$b = .75$

$c = 2.857143E-14$

$d = 2$



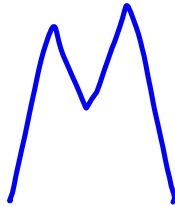
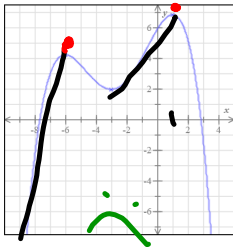
$$y = 3 \sin \left( \frac{3}{4}x \right) + 2$$

$$y = 3 \sin(.75x) + 2$$

# Practice Midterm Review

QUESTION

Below is the graph of a polynomial function  $f$  with real coefficients. Use the graph to answer the questions about  $f$ . All local extrema of  $f$  are shown in the graph.



4 Factors (Not Done)

Degree 4, 6, 8, ...

6 Factors (Not Done)  
6, 8, 10, ...

(a) The function  $f$  is increasing over which intervals? Choose all that apply.

$(-\infty, -6)$    $(-3, 1)$    $(-6, -3)$    $(-6, 1)$    $(1, \infty)$

(b) The function  $f$  has local maxima at which  $x$ -values? If there is more than one value, separate them with commas.

$x = -3$

(c) What is the sign of the leading coefficient of  $f$ ?

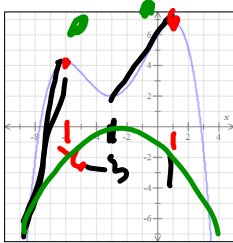
Select One **NEG** (Sad Parabolic)

(d) Which of the following is a possibility for the degree of  $f$ ? Choose all that apply.

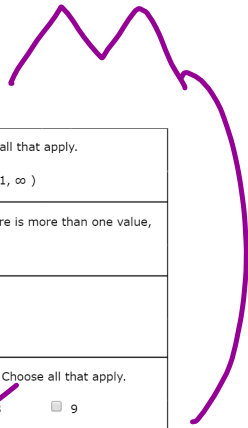
4  5  6  7  8  9

QUESTION

Below is the graph of a polynomial function  $f$  with real coefficients. Use the graph to answer the questions about  $f$ . All local extrema of  $f$  are shown in the graph.



Faces



(a) The function  $f$  is increasing over which intervals? Choose all that apply.  
  $(-\infty, -6)$    $(-6, -3)$    $(-3, 1)$    $(-6, 1)$    $(1, \infty)$

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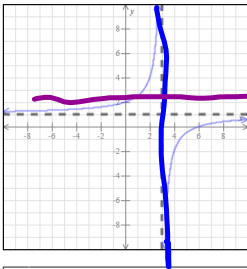
(d) Which of the following is a possibility for the degree of  $f$ ? Choose all that apply.  
 4  5  6  7  8  9

4 faces

QUESTION

The graph of a rational function  $f$  is shown below. Assume that all asymptotes and intercepts are shown and that the graph has no "holes".

Use the graph to complete the following.



Domain:  
R

Range:  
.....

(a) Write the equations for all vertical and horizontal asymptotes. Enter the equations using the "and" button as necessary. Select "None" as necessary.

Vertical asymptote(s):   $x = 3$

Horizontal asymptote(s):   $y = 1$

(b) Find the domain and range of  $f$ . Write each answer as an interval or union of intervals.

Domain:   $(-\infty, 3) \cup (3, \infty)$

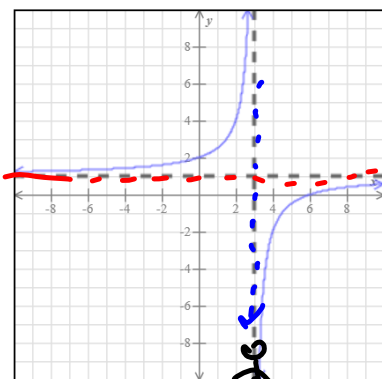
Range:   $(-\infty, 1) \cup (1, \infty)$



QUESTION

The graph of a rational function  $f$  is shown below. Assume that all asymptotes and intercepts are shown and that the graph has no "holes".

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Vertical asymptote(s):

Horizontal asymptote(s):

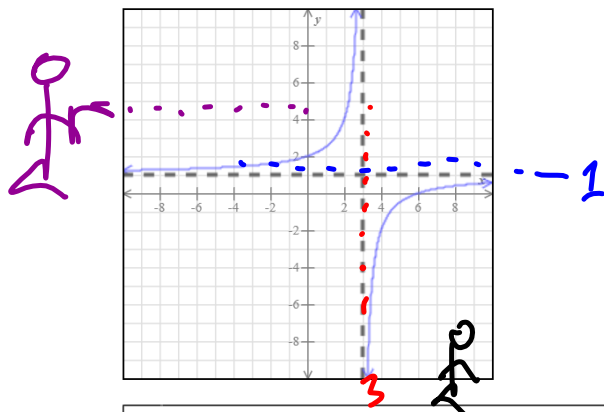
(b) Find the domain and range of  $f$ . Write each answer as an interval or union of intervals.

Domain:

Range:

The graph of a rational function  $f$  is shown below.  
 Assume that all asymptotes and intercepts are shown and that the graph has no "holes".

Use the graph to complete the following.



Domain:  
 $(-\infty, 3) \cup (3, \infty)$   
 Range:  
 $(-\infty, 1) \cup (1, \infty)$

(a) Write the equations for all vertical and horizontal asymptotes. Enter the equations using the "and" button as necessary. Select "None" as necessary.

Vertical asymptote(s):   
 Horizontal asymptote(s):

(b) Find the domain and range of  $f$ . Write each answer as an interval or union of intervals.

Domain:   
 Range:

### Identifying linear, quadratic, and exponential functions given ordered pairs

QUESTION

For each function, state whether it is linear, quadratic, or exponential.

Function 1	
x	y
3	-5
4	-15
5	-21
6	-23
7	-21

Linear  
 Quadratic  
 Exponential  
 None of the above

Function 2	
x	y
2	-768
3	-192
4	-48
5	-12
6	-3

Linear  
 Quadratic  
 Exponential  
 None of the above

Function 3	
x	y
5	8
6	-3
7	-14
8	-25
9	-36

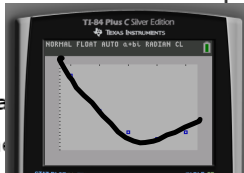
Linear  
 Quadratic  
 Exponential  
 None of the above

## Identifying linear, quadratic, and exponential functions given ordered pairs

### QUESTION

For each function, state whether it is linear, quadratic, or exponential.

Function 1	Function 2	Function 3																																				
<table border="1" style="margin: auto;"> <thead> <tr><th>x</th><th>y</th></tr> </thead> <tbody> <tr><td>3</td><td>-5</td></tr> <tr><td>4</td><td>-15</td></tr> <tr><td>5</td><td>-21</td></tr> <tr><td>6</td><td>-23</td></tr> <tr><td>7</td><td>-21</td></tr> </tbody> </table>	x	y	3	-5	4	-15	5	-21	6	-23	7	-21	<table border="1" style="margin: auto;"> <thead> <tr><th>x</th><th>y</th></tr> </thead> <tbody> <tr><td>2</td><td>-768</td></tr> <tr><td>3</td><td>-192</td></tr> <tr><td>4</td><td>-48</td></tr> <tr><td>5</td><td>-12</td></tr> <tr><td>6</td><td>-3</td></tr> </tbody> </table>	x	y	2	-768	3	-192	4	-48	5	-12	6	-3	<table border="1" style="margin: auto;"> <thead> <tr><th>x</th><th>y</th></tr> </thead> <tbody> <tr><td>5</td><td>8</td></tr> <tr><td>6</td><td>-3</td></tr> <tr><td>7</td><td>-14</td></tr> <tr><td>8</td><td>-25</td></tr> <tr><td>9</td><td>-36</td></tr> </tbody> </table>	x	y	5	8	6	-3	7	-14	8	-25	9	-36
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NORMAL FLOAT AUTO a+b/c RADIAN MP

**QuadReg**

$y = ax^2 + bx + c$   
 $a = 2$   
 $b = -24$   
 $c = 49$   
 $R^2 = 1$

Start  $a=2$  Start  $a=1$   

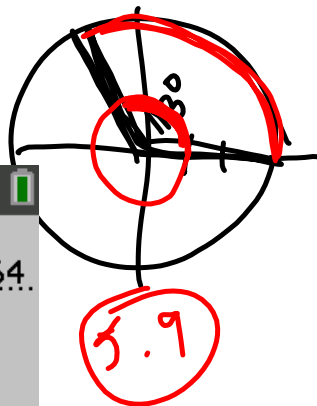
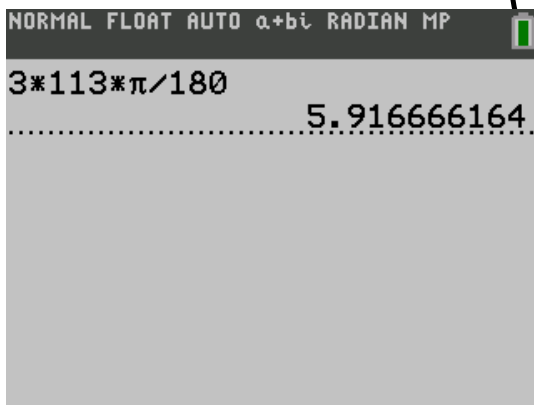
 End  $a=1$

## Arc length and central angle measure

### QUESTION

A circle has a radius of 3 cm. Find the length  $s$  of the arc intercepted by a central angle of  $113^\circ$ .

Do not round any intermediate computations, and round your answer to the nearest tenth.



$$s = r\theta$$
$$\theta = \frac{113^\circ \cdot \pi}{180^\circ}$$
$$3 \cdot \frac{113 \cdot \pi}{180}$$

## Arc length and central angle measure

### ? QUESTION

---

A circle has a radius of 3 cm. Find the length  $s$  of the arc intercepted by a central angle of  $113^\circ$ .

Do not round any intermediate computations, and round your answer to the nearest tenth.

$$\begin{aligned} s &= r\theta \\ &= 3 \cdot 113^\circ \cdot \frac{\pi}{180^\circ} \\ &= \cancel{339} \end{aligned}$$

## Arc length and central angle measure

### QUESTION

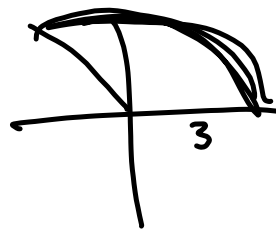
A circle has a radius of 3 cm. Find the length  $s$  of the arc intercepted by a central angle of  $113^\circ$ . Do not round any intermediate computations, and round your answer to the nearest tenth.

$$\cdot \frac{\pi}{180^\circ} =$$

$$r = 3 \text{ cm}$$

$$s = r\theta$$

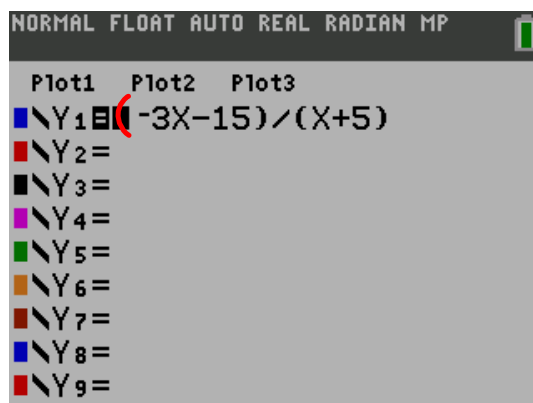
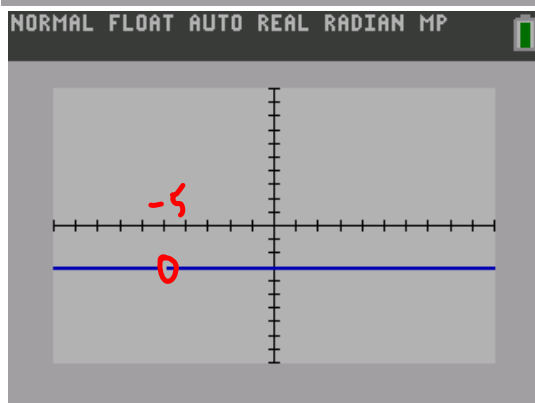
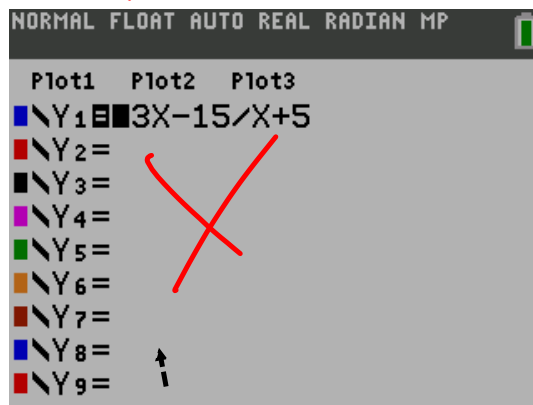
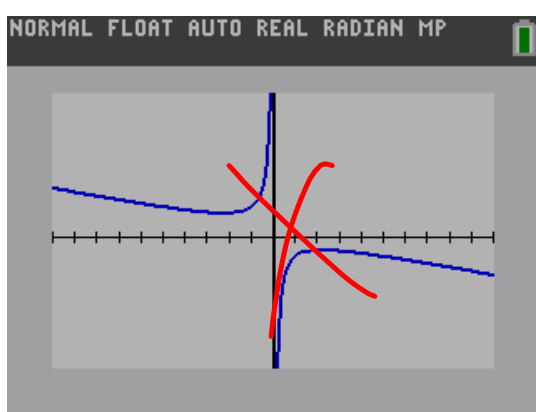
$$= 3 \cdot 113 \cdot \pi / 180 = 5.9$$



## Graphing rational functions with holes

QUESTION

Graph the rational function  $g(x) = \frac{-3x-15}{x+5}$ .  $= \frac{-3(x+5)}{(x+5)} = -3$





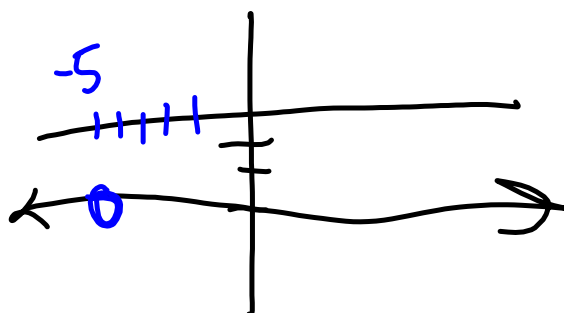
### Graphing rational functions with holes

#### QUESTION

Graph the rational function  $g(x) = \frac{-3x-15}{x+5}$ . =  $\frac{-3(x+5)}{x+5} = -3$  ZN:  $-5$   
ZD:  $-5$

$$\begin{aligned} -3x - 15 &= 0 \\ -3x &= 15 \\ x &= -5 \end{aligned}$$

$$y = -3$$



### Amplitude, period, and phase shift of sine and cosine functions

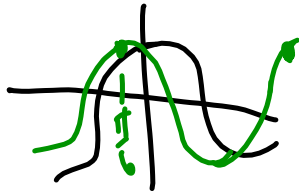
#### QUESTION

Find the period, phase shift, and amplitude of the function.

$$y = -3 - 3 \cos\left(2x + \frac{\pi}{3}\right)$$

Give the exact values, not decimal approximations.

$$y = \boxed{-3} \cdot \cos\left(2x + \frac{\pi}{3}\right) - 3$$



Amplitude: 3



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

P. Shift

$$\begin{aligned} 2x + \frac{\pi}{3} &= 0 \\ 2x &= -\frac{\pi}{3} \\ x &= -\frac{\pi}{6} \end{aligned}$$

### Amplitude, period, and phase shift of sine and cosine functions

#### QUESTION

Find the period, phase shift, and amplitude of the function.

$$y = -3 - 3 \cos\left(2x + \frac{\pi}{3}\right)$$

Give the exact values, not decimal approximations.

$$\text{Amplitude} = |-3| = 3$$

$$\text{Period} = \frac{2\pi}{B} = \frac{2\pi}{2} = \pi$$

$$\text{Phase Shift} = \frac{-\pi/3}{2}$$

$$-3 \cos\left(2x + \frac{\pi}{3}\right) - 3$$

$$2x + \frac{\pi}{3} = 0$$

$$\begin{aligned} 2x &= -\frac{\pi}{3} \\ x &= \frac{-\pi/3}{2} \end{aligned}$$

$$A \cos(Bx + c) + D$$

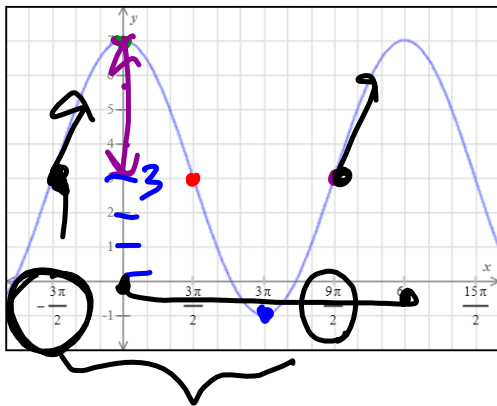
$$A \cos(Bx - c) + D$$

$$\text{Phase } \frac{c}{B}$$

Writing the equation of a sine or cosine function given its graph: Problem type 2

QUESTION

Write the equation of a sine or cosine function to describe the graph.



$-\frac{3\pi}{2}$	7
0	7
$\frac{3\pi}{2}$	3
$3\pi$	-1
$9\pi/2$	3

$A_{mp} = 4$   
 Period =  $6\pi$   
 PS =  $-\frac{3\pi}{2}$

```

SinReg
y=a*sin(bx+c)+d
a=4
b=.3333333333 = 1/3
c=1.570796327 = π/2
d=3
    
```

$$y = 4 \sin\left(\frac{1}{3}x + \frac{\pi}{2}\right) + 3$$

$6\pi = \frac{2\pi}{b}$

$b = \frac{1}{3}$

$= 0$

$\frac{1}{3}x = \frac{\pi}{2}$   
 $x = \frac{3\pi}{2}$

$-\frac{c}{b} = -\frac{3\pi/2}{1/3} = -\frac{9\pi}{2}$

$-\frac{c}{1/3} = -\frac{3\pi}{2}$

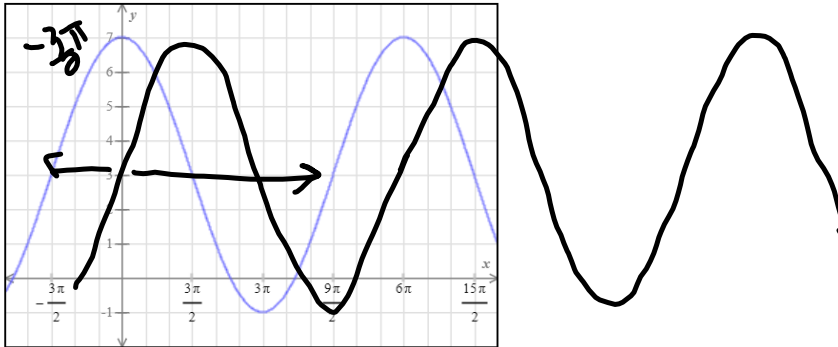
$\pi/2$

$\approx 1.5707$

## Writing the equation of a sine or cosine function given its graph: Problem type 2

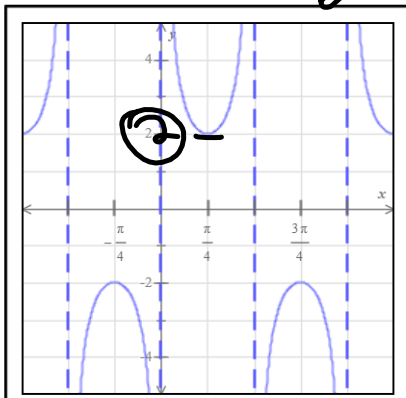
### ? QUESTION

Write the equation of a sine or cosine function to describe the graph.



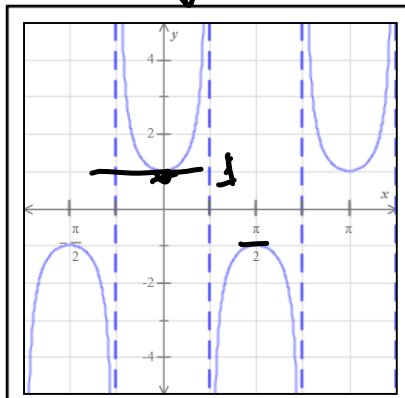
Three graphs are given below.  
 For each, choose its equation from the following.

$y = \tan x$        $y = \tan\left(x + \frac{\pi}{4}\right)$        $y = 2 \csc 2x$   
 $y = \sec\left(2x + \frac{\pi}{2}\right)$        $y = \cot\left(x - \frac{\pi}{4}\right)$        $y = \csc\left(2x + \frac{\pi}{2}\right)$



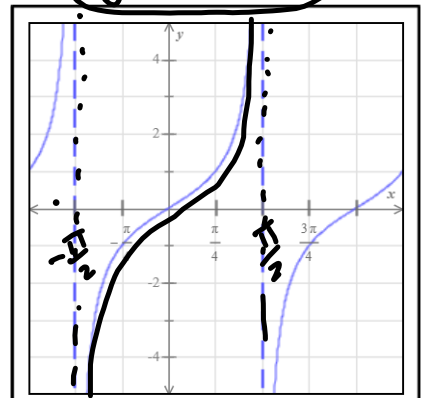
Equation:

(Choose one)



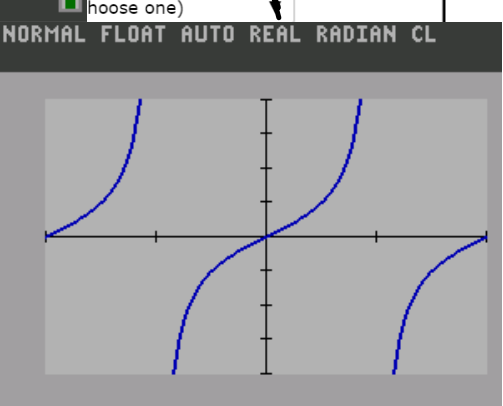
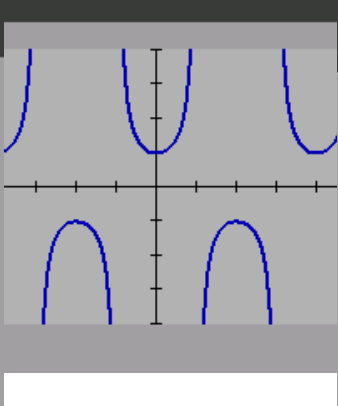
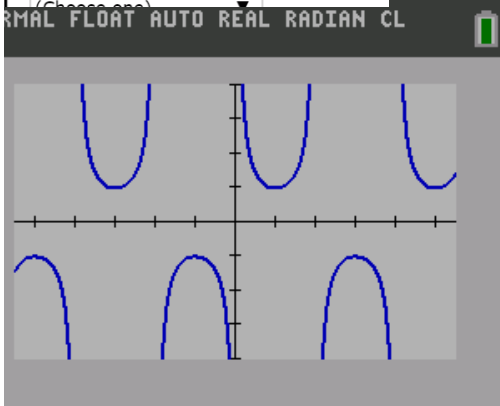
Equation:

(Choose one)



Equation:

(Choose one)



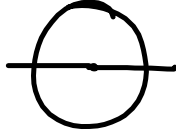
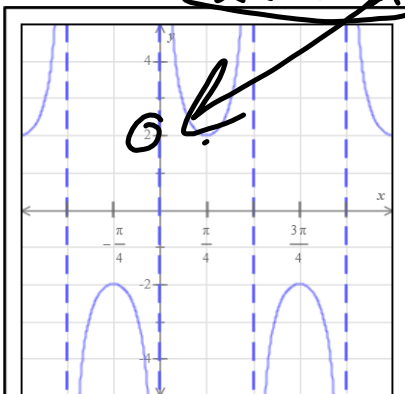
## Matching graphs and equations for secant, cosecant, tangent, and cotangent functions

### ? QUESTION

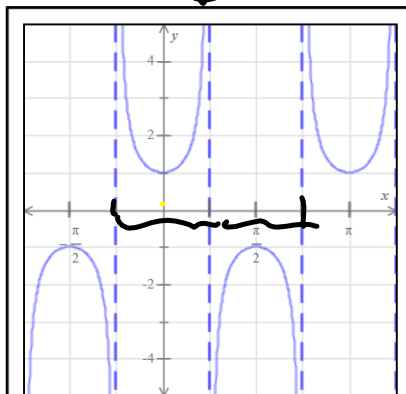
Three graphs are given below.  
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 ~~$y = \sec\left(2x + \frac{\pi}{2}\right)$~~        ~~$y = \cot\left(x + \frac{\pi}{4}\right)$~~        $y = \csc\left(2x + \frac{\pi}{2}\right)$

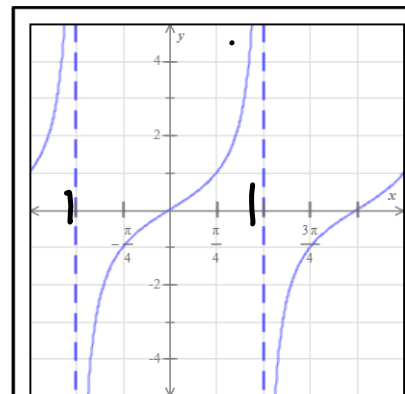
$2 \csc 2x$        $\tan x$  ✓

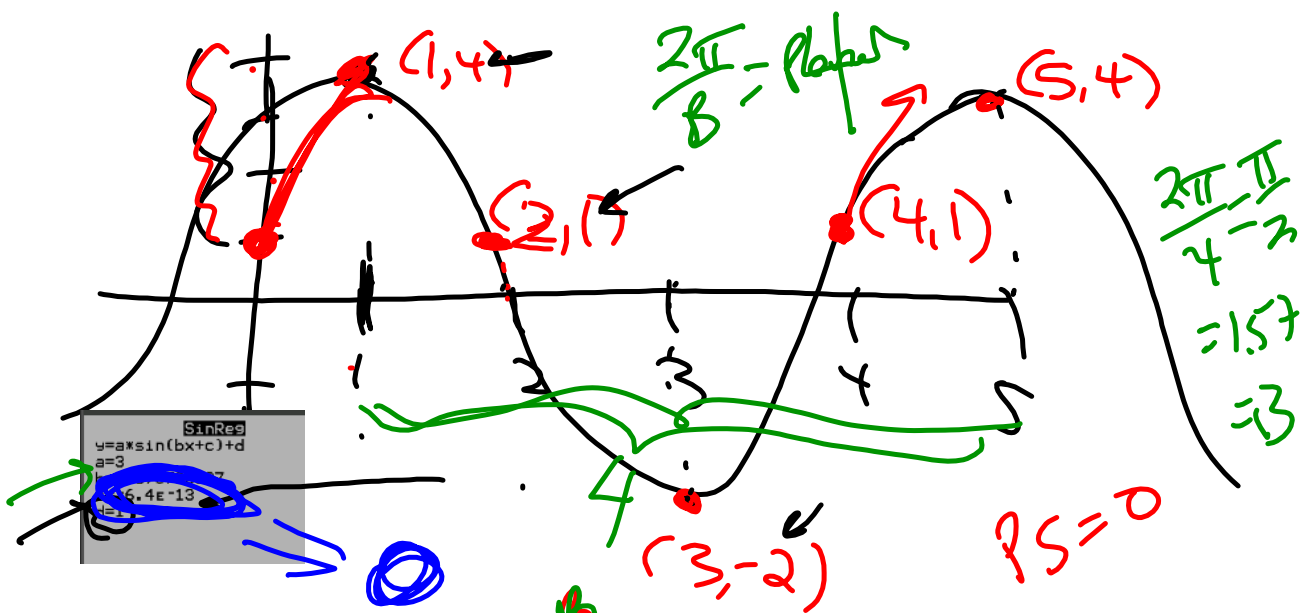
Equation:  
(Choose one) ▼



Equation:  
(Choose one) ▼



Equation:  
(Choose one) ▼



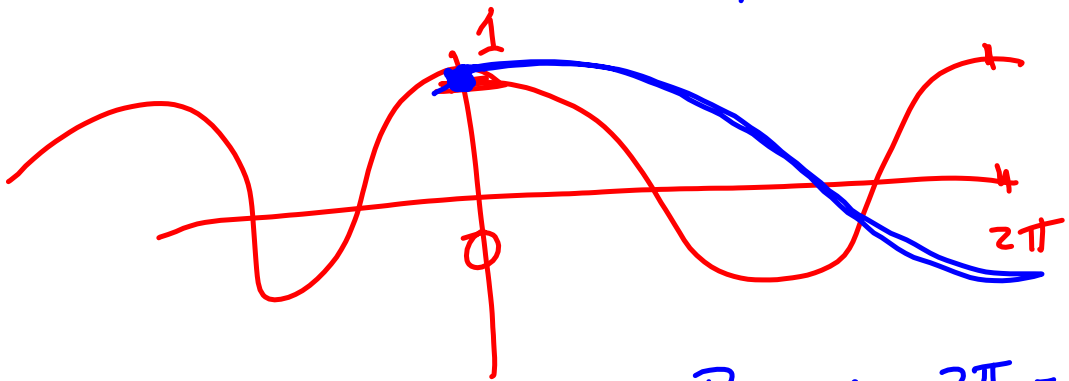
$$y = 3 \sin(1.57 \dots X + 0) + 1$$

.5π or π/2



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

Periods.



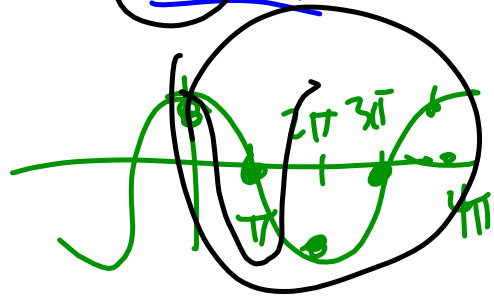
Period  $\frac{2\pi}{1/2} = 4H$

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

← Puls.

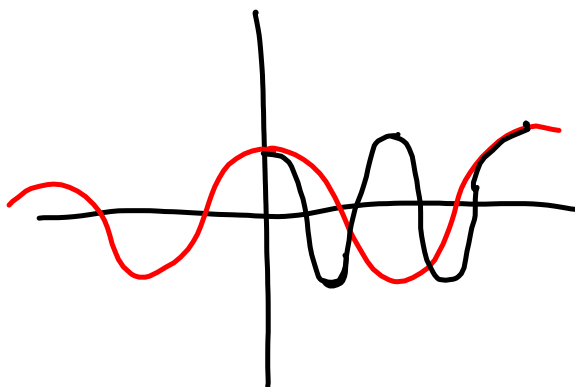
	$\frac{1}{2}x$	$\frac{1}{2}x$	$\cos x$
↖	$0$	$0$	$1$
↘	$\pi$	$\pi/2$	$0$
↙	$2\pi$	$3\pi/2$	$-1$
↗	$3\pi$	$3\pi/2$	$0$
↘	$4\pi$	$2$	$1$

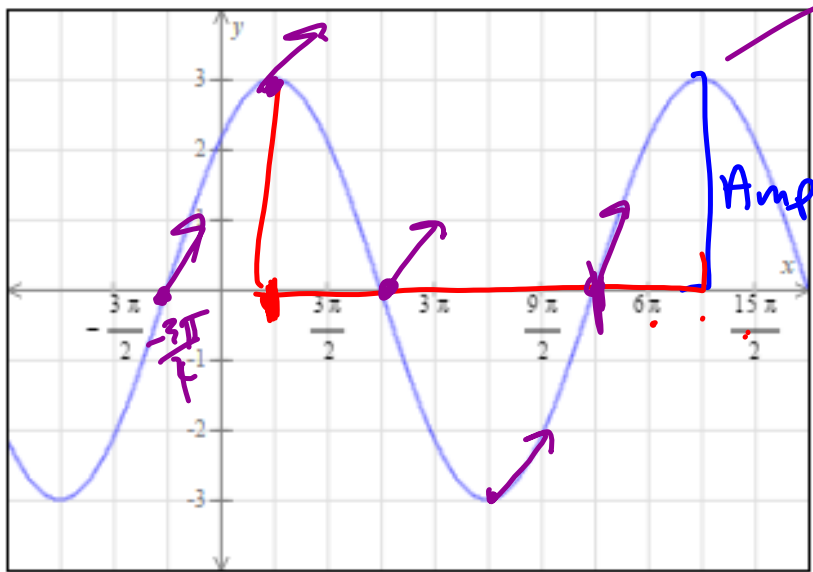
$x$	$\cos x$
$0$	$1$
$\pi/2$	$0$
$\pi$	$-1$
$3\pi/2$	$0$
$2\pi$	$1$



$$y = \cos(\underline{2x})$$

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





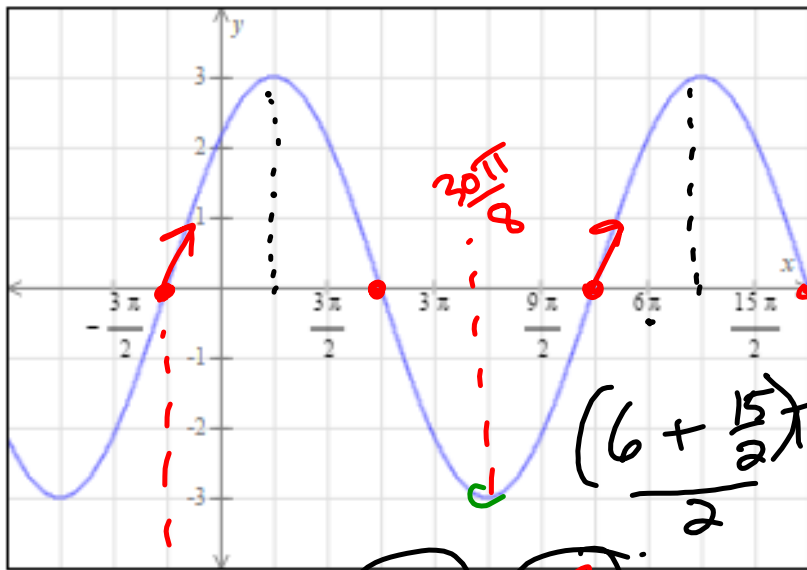
Sine

Period:  $6\pi$

$$\frac{3\pi}{4} \rightarrow 6\pi + \frac{3\pi}{4}$$

$$P.S. \rightarrow -\frac{3\pi}{4}$$

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



$$6 + 7\frac{1}{2} = \frac{13\frac{1}{2}}{2}$$

X	Y
$3\pi/4$	3
$\frac{3}{4} + \frac{3\pi}{6} = \frac{3\pi}{6}$	0
$30\pi/8$	-3
$84\pi/16$	0
$27\pi/4$	3

$$\frac{15 + 23}{9} = \frac{57}{8}$$

Phase Shift

$$\frac{-3\pi}{4} = \frac{-c}{1/3 - B} \rightarrow c = \frac{\pi}{4}$$

$$\frac{-c}{1/3 - B} \rightarrow c = \frac{\pi}{4}$$

Period

$$6\pi = \frac{2\pi}{B}$$

$$B = \frac{1}{3}$$

$$A = 3$$

$$\rightarrow 0 = D$$

SinReg  
 $y = a \sin(bx + c) + d$   
 $a = 3$   
 $b = .3333333333 = \frac{1}{3}$   
 $c = .7853981634$   
 $d = 5.2E-13 = 0$

c .7853981634  
 Ans/π .25  
 $.25 \times \pi = .7853981634$

Graph the function  $y = 1 \sin 3x - 1$

Period  $\frac{2\pi}{3}$

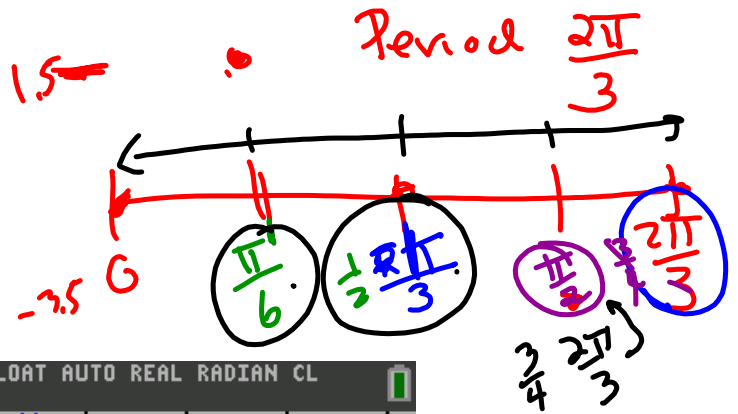
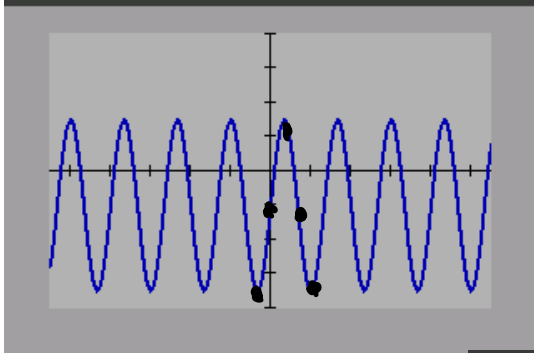
To draw the graph, plot all points corresponding to minima and maxima within one cycle. Then within this cycle, plot all points along the "midline" (that is, points whose y-coordinates are midway between the function's maximum and minimum values). Then click on the graph icon.



NORMAL FLOAT AUTO REAL RADIAN CL

Plot1	Plot2	Plot3
Y1	$2.5\sin(3X) - 1$	
Y2		
Y3		
Y4		
Y5		
Y6		
Y7		
Y8		
Y9		

NORMAL FLOAT AUTO REAL RADIAN CL



NORMAL FLOAT AUTO REAL RADIAN CL

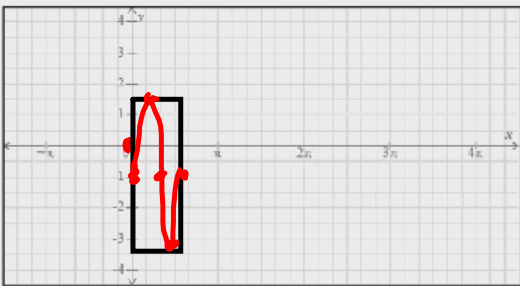
X	Y1			
0	-1			
.5236	1.5			
1.0472	-1			
1.5708	-3.5			
2.0944	-1			

X=

$\frac{\pi}{6}$   
 $\frac{\pi}{3}$   
 $\frac{\pi}{2}$   
 $\frac{2\pi}{3}$

Graph the function  $y = \frac{5}{2} \sin 3x - 1$ .

To draw the graph, plot all points corresponding to minima and maxima within one cycle. Then within this cycle, plot all points along the "midline" (that is, points whose y-coordinates are midway between the function's maximum and minimum values). Then click on the graph icon.



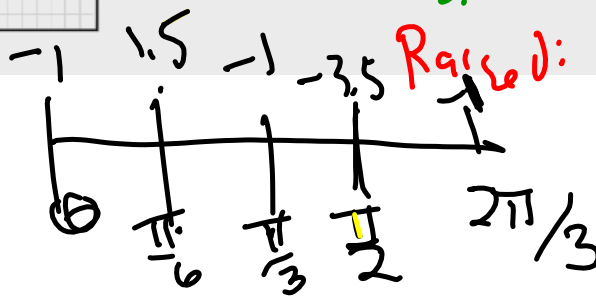
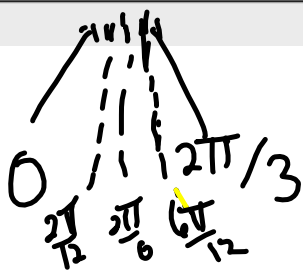
$$3x = 0, \pi/2, \pi, 3\pi/2, 2\pi$$

Amp:  $5/2 = 2.5$

Period:  $2\pi/3$

P.S. :  $\odot$

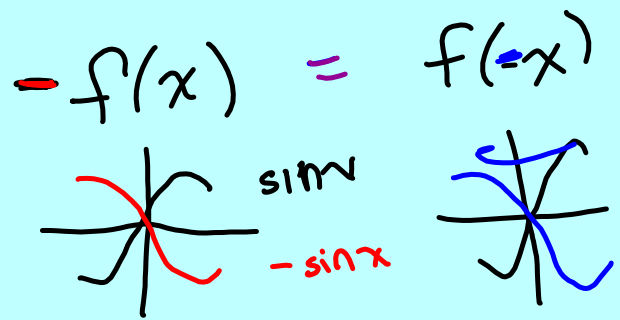
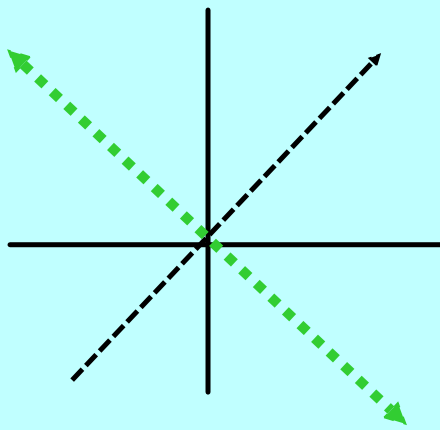
Raised:  $-1$



$3x$	$x$	$\sin x$	$\frac{5}{2} \sin x - 1$
0	0	0	-1
$\pi/2$	$\pi/6$	1	-1.5
$\pi$	$\pi/3$	0	-1
$3\pi/2$	$1/2$	-1	-3.5
$2\pi$	$2\pi/3$	0	-1

NORMAL FLOAT AU	
PRESS * FOR $\Delta$ Tbl	
X	Y1
0	-1
.5236	-1.5
1.0472	-1
1.5708	-3.5
2.0944	-1
2.618	-1.5
3.1416	-1
3.6652	-3.5
4.1888	-1
4.7124	-1.5
5.236	-1

# Lecture\_ Odd and Even Functions



ODD

$$y = 2x^3 + 4x^5 - 7x^9$$

$$= (-x)^3$$



## Odd and Even Functions

$$f(-x) = -f(x)$$

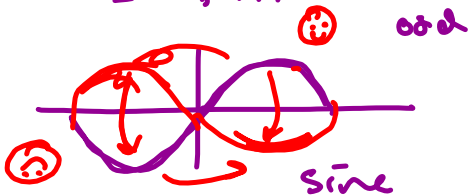
$$f(-x) = f(x)$$

Ex

$$f(x) = 2x^3 - 5x$$

$$f(-x) = 2(-x)^3 - 5(-x)$$
$$= -2x^3 + 5x$$

$$= (-1)(2x^3 - 5x)$$
$$= -f(x)$$



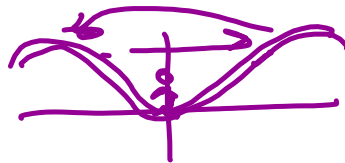
$$-\sin(x) = \sin(-x)$$

Ex

$$f(x) = 7x^{10} - 15x^8 + 7x^0$$

$$f(-x) = 7(-x)^{10} - 15(-x)^8 + 7$$
$$= 7x^{10} - 15x^8 + 7$$

$$f(-x) = f(x)$$



cosine

$$\cos(-x) = \cos(x)$$



$$x^2$$

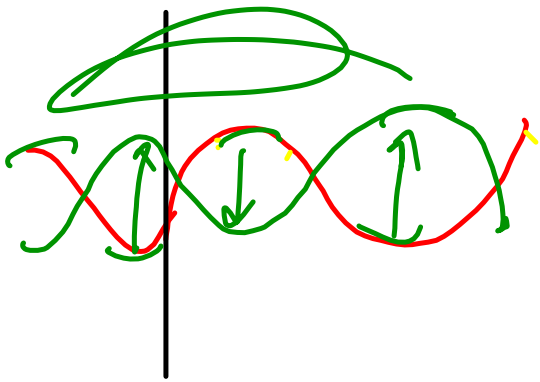
$$(-x)^2$$

Even.

$$\cos(-x)$$

$\equiv$

$$\cos(x)$$

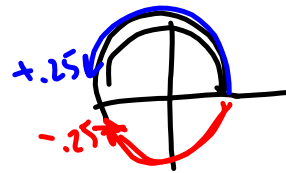


Even  $\cos(-2x) = \cos(2x)$

ODD  $\sin(-2x) = -\sin(2x)$

ODD  $\tan(-5x) = -\tan(5x)$

$$\sin(-2x) \\ = -\sin(2x)$$



$$\sin(\underline{-(3x+2)}) \Rightarrow \sin(\underline{-1}(3x-2))$$

Sine is odd

$$\underline{-}\sin(\underline{3x-2})$$

$$\cos(\underline{-(2x+6)}) \Rightarrow \cos(\underline{(2x-6)})$$

$$\cos(\underline{(2x-6)}) = \cos(2x-6)$$

### Graphing rational functions with holes

Graph the rational function  $g(x) = \frac{-3x^2 - 15x}{x^2 + 7x + 10}$ .

$$Z N: -5$$

$$Z D: -5$$

$$\frac{-3(x)(\cancel{x+5})}{(\cancel{x+5})(x+2)}$$

$$\text{Hole } x = -5$$

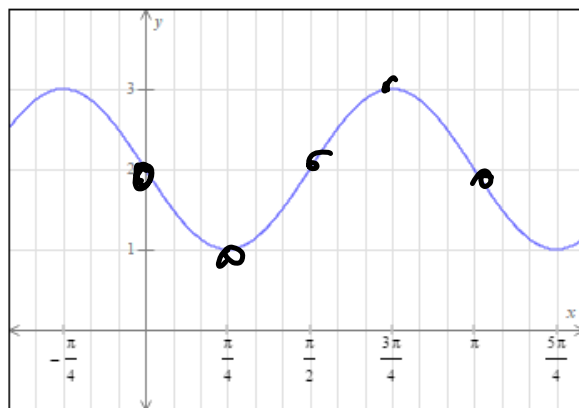




## Quiz 9 Review

**Writing the equation of a sine or cosine function given its graph: Problem type 2**

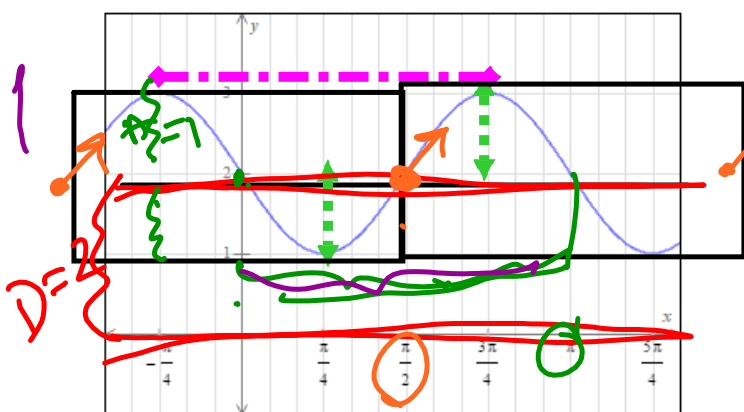
Write the equation of a sine or cosine function to describe the graph.



## Quiz 9 #5

Writing the equation of a sine or cosine function given its graph: Problem type 2

Write the equation of a sine or cosine function to describe the graph.



amplitude =  $1 = A$

period =  $\pi = 2\pi/B = \pi$

$B = 2$

$B = 2$

Phase shift =  $\pi/2 =$

$-C/2 = \pi/2 \quad C = -\pi \quad C = -1$

Raised by  $2 = D$

L1	L2	L3
0	2	-
.7854	1	-
1.5708	2	-
2.3562	3	-
3.1416	1	-

```

Y=Asin(Bx+C)+D
a=1
b=2
c=3.141592654 = pi
d=2
    
```

phase shift was  $-\pi/2$  (got a different C)

## 12 Practice Midterm

### The graph, domain, and range of a logarithmic function

Graph the function  $g(x) = \log_3(x-3)$  and give its domain and range using interval notation.

$$y = \log(x-3)/\log(3)$$

The graph of  $g(x) = \log_3(x-3)$  is a transformation of the graph of  $f(x) = \log_3 x$ .

So let's first consider the graph of  $f(x) = \log_3 x$ .

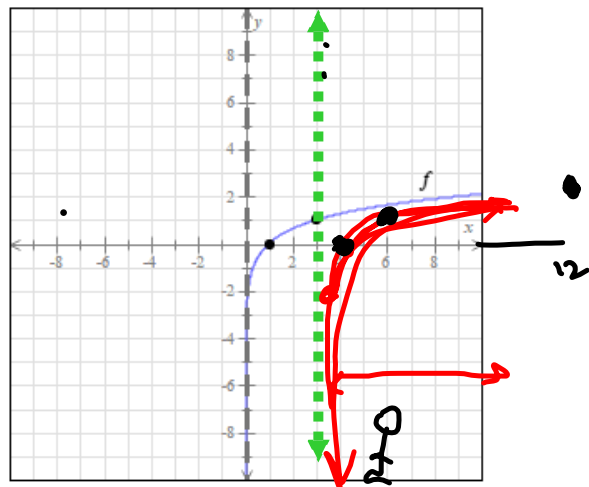
It passes through the points (1, 0) and (3, 1).

It has a vertical asymptote  $x = 0$ .

The domain is  $(0, \infty)$  and the range is  $(-\infty, \infty)$ .

More

$x$	$x-3$	
4	1	0
6	3	1
12	9	2



17

**Using a calculator to approximate cosecant, secant, and cotangent values**

Use the ALEKS calculator to evaluate each expression.

Round your answers to the nearest hundredth.

For each expression, make sure you are in the correct calculator mode.

$$\sec(-330^\circ) = \square \quad 1/\cos(-330^\circ) = 1.15$$

$$\csc \frac{10\pi}{9} = \square \quad 1/\sin(10\pi/9) = -2.92\dots$$

$$\cot \pi = \square$$

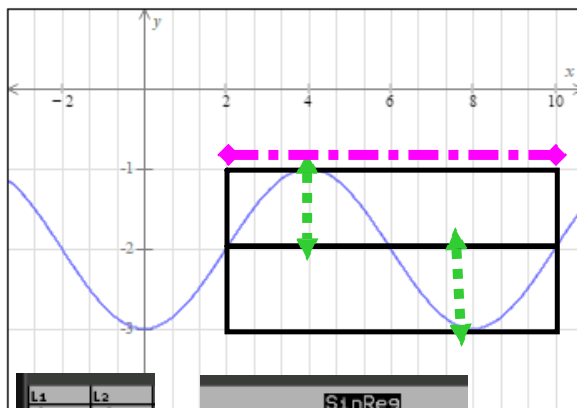
$\sec(-330^\circ) = 1.15$ $\csc \frac{10\pi}{9} = -2.92$ $\cot \pi = \text{Undefined}$
--

$$= \frac{\sqrt{4}}{\sqrt{3}} = \frac{2}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$$

19.

**Writing the equation of a sine or cosine function given its graph: Problem type 2**

Write the equation of a sine or cosine function to describe the graph.



L1	L2
2	-2
4	-1
6	-2
8	-3
10	-2

```
SinReg
y=a*sin(bx+c)+d
a=1
b=.7853981634
c=-1.570796327
d=-2
```

regression

amplitude:  $1=A$

Period  $=8=2\pi/B$

$B=\pi/4$

PS  $=2 = -C/B$

$c = -2B = -\pi/2$

Lowered:  $-2=D$

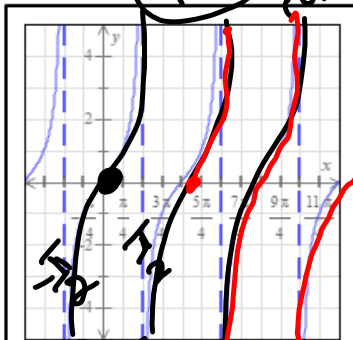
Matching graphs and equations for secant, cosecant, tangent, and cotangent functions

Three graphs are given below. For each, choose its equation from the following.

- $y = \csc x$
- $y = \tan x$
- $y = -\cot x$
- $y = 2 \sec x$
- $y = \tan(x - \frac{\pi}{4})$
- $y = 2 \sec 2x$

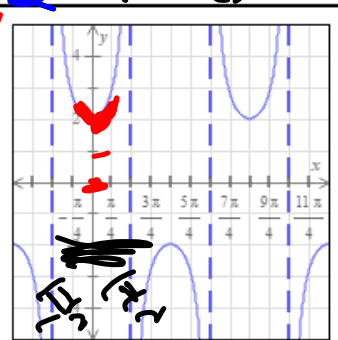
$\tan 0 = 0$

$\cot 0 = \text{undef}$



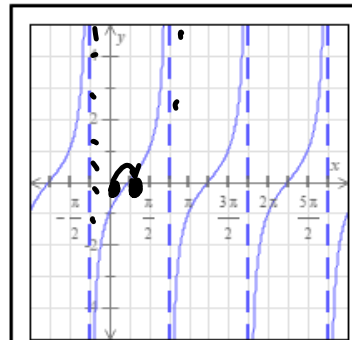
tan with period pi

Equation:  
  
 $y = \tan x$

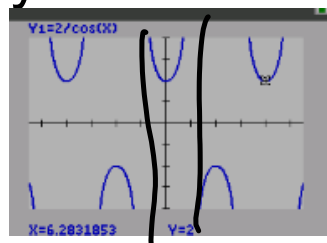
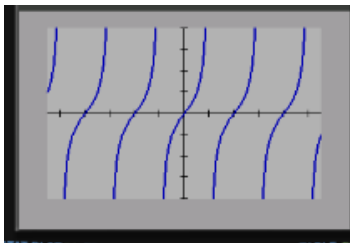


period = 2pi  
 regular sec

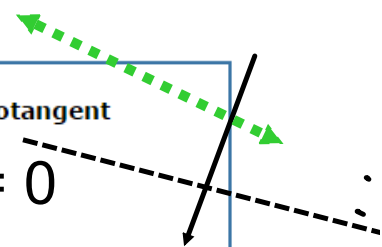
$y = 2 \sec x$



Equation:  
  
 $y = \tan(x - \pi/4)$

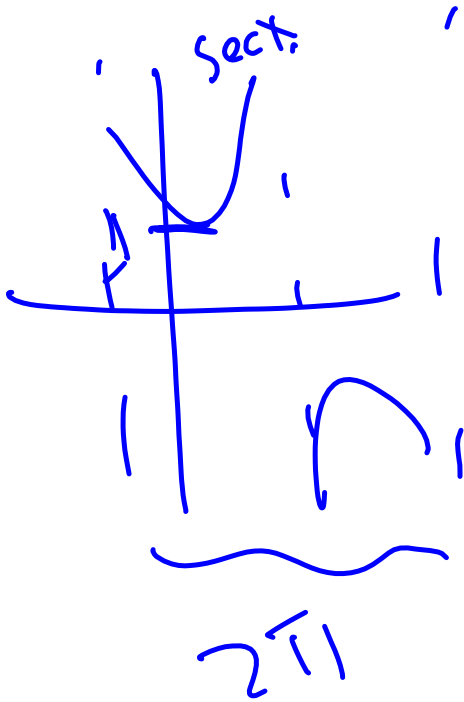


*Tangent Shift*

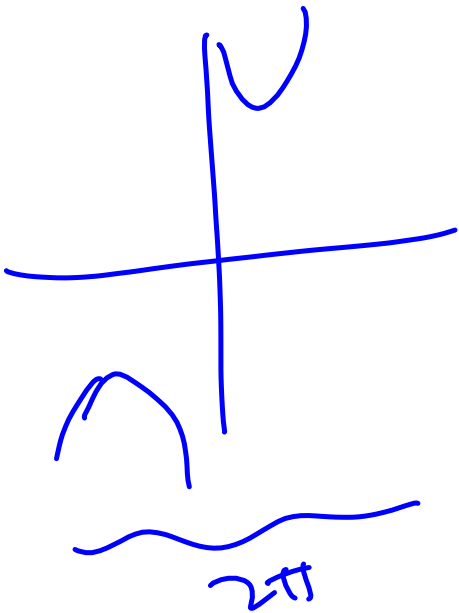








CSC



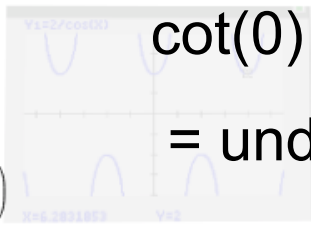
2 CCS V.



**Matching graphs and equations for secant, cosecant, tangent, and cotangent functions**

Three graphs are given below.  
For each, choose its equation from the following.

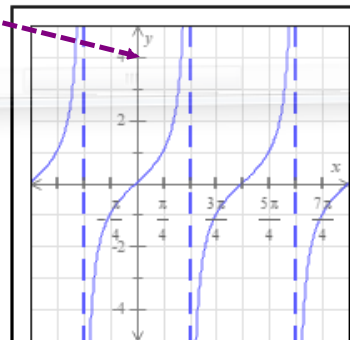
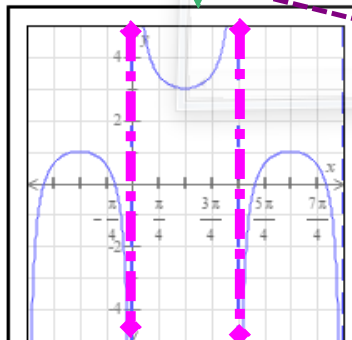
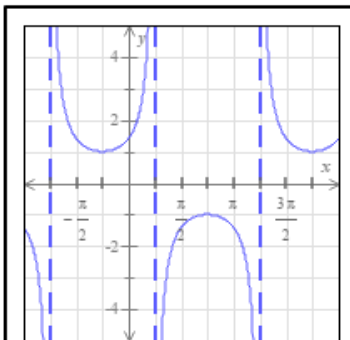
$y = -\cot x$      $y = \sec x$      $y = 2 + \csc x$   
 $y = \tan x$      $y = \cot\left(x - \frac{\pi}{4}\right)$      $y = \sec\left(x + \frac{\pi}{4}\right)$



$\cot(0) = 1/\tan(0)$   
 $= \text{undefined}$

sec or csc

cot or tan



Equation:

(Choose one) ▼

Equation:

(Choose one) ▼

Equation:

(Choose one) ▼

tan or cot

tan or cot

~~sec or csc~~



$$y = \tan\left(\pi x - \frac{\pi}{2}\right)$$

~~$$y = 2 \sec \frac{\pi x}{2}$$~~

tan or cot

$$y = \csc \frac{\pi x}{2}$$

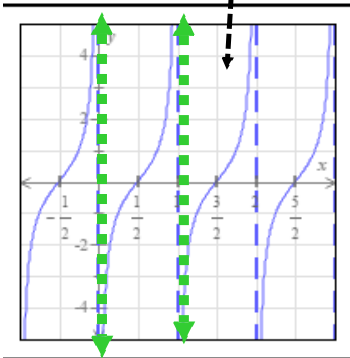
~~$$y = -\cot \frac{\pi x}{2}$$~~

$$y = \tan \frac{\pi x}{2}$$

~~$$y = 2 \csc \frac{\pi x}{2}$$~~

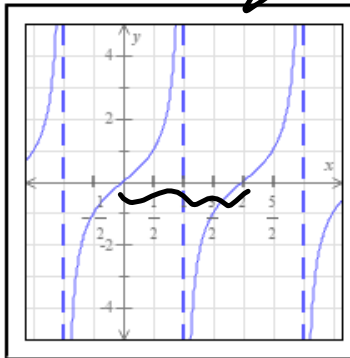
tan period =  $\frac{\pi}{B}$

$2 = \frac{\pi}{B}$   
 $B = \frac{\pi}{2}$



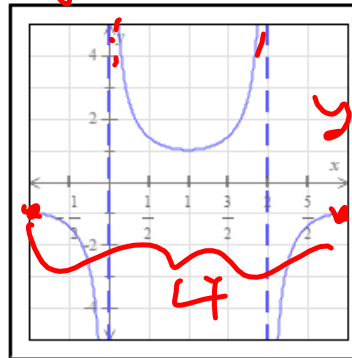
Equation:

(Choose one) ▼



Equation:

(Choose one) ▼



Equation:

(Choose one) ▼

$y = \csc \frac{\pi x}{2}$   
 Period:  $\frac{2\pi}{B}$   
 $\frac{2\pi}{\pi/2} = 4$

ps://www-awd.alek.com/alekscgi/x/1sl.exe/1dR5chS\_SpxKSi

*Handwritten signature*

eq1RdOckPAU.

Talking:

### Identifying linear, quadratic, and exponential

For each function, state whether it is linear, quadratic

Function 1

x	y
4	7
5	18
6	29
7	40
8	51

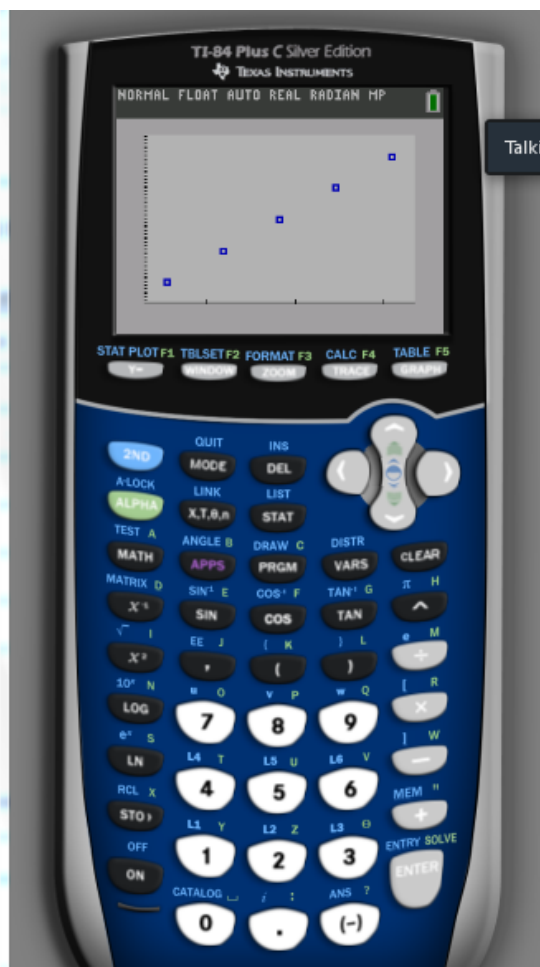
- Linear
- Quadratic
- Exponential
- None of the above

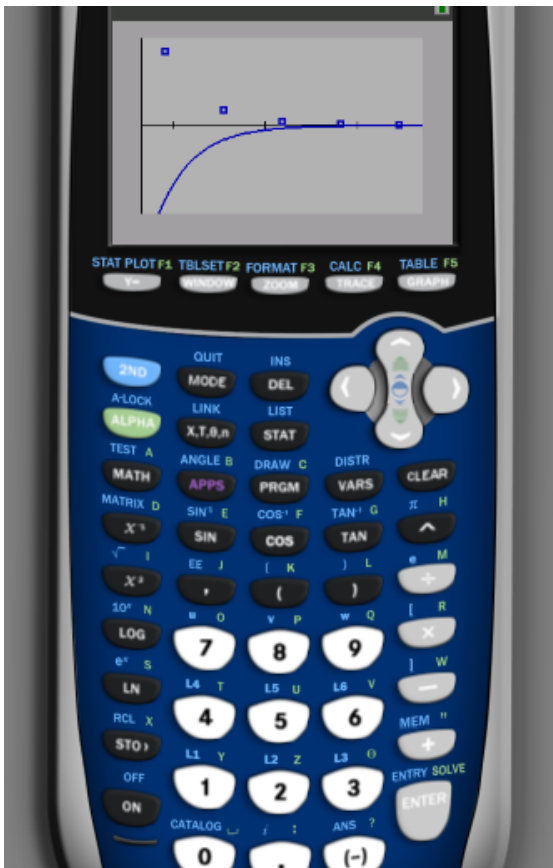
Function 2

x	y
3	
4	
5	
6	
7	

- Linear
- Quadratic
- Exponential
- None of the above

Background:





Linear, quadratic, and exponential functions given ordered pairs.

Determine whether it is linear, quadratic, or exponential.

Function 2

x	y
3	-1250
4	-250
5	-50
6	-10
7	-2

- Linear
- Quadratic
- Exponential
- None of the above

- Linear
- Quadratic
- Exponential
- None





## Lecture Trig Inverse



# Lecture:

**Trig Inverses** (2 topics, due on 11/09/2016)

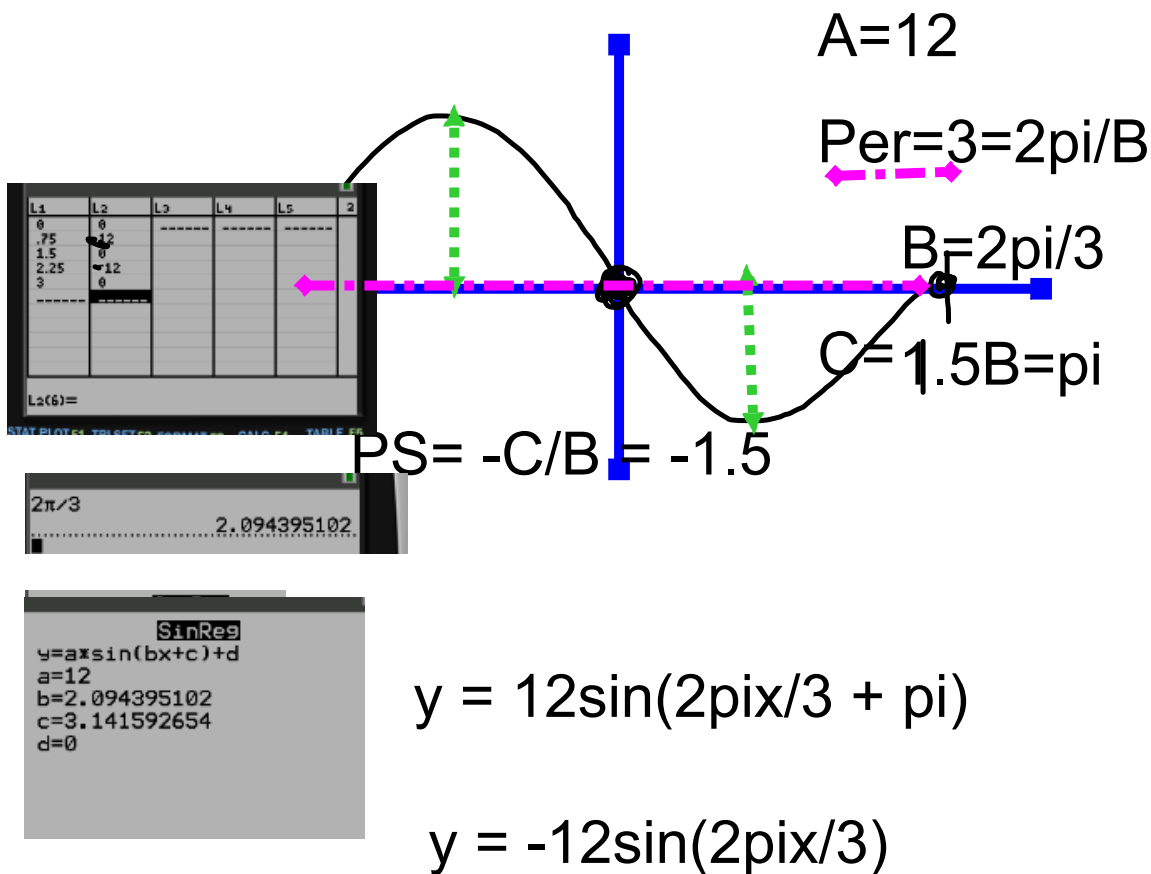
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- Sketching the graph of  $y = a \sin(x+c)$  or  $y = a \cos(x+c)$
- Sketching the graph of  $y = a \sin(bx)$  or  $y = a \cos(bx)$
- Sketching the graph of  $y = a \sin(bx+c)$  or  $y = a \cos(bx+c)$
- Sketching the graph of  $y = a \sin(bx) + d$  or  $y = a \cos(bx) + d$
- Word problem involving a sine or cosine function: Problem type 1
- Values of inverse trigonometric functions 
- Composition of a trigonometric function with its inverse trigonometric function: Problem type 2
- Composition of a trigonometric function with the inverse of another trigonometric function: Problem type 1
- Composition of a trigonometric function with the inverse of another trigonometric function: Problem type 2
- Composition of a trigonometric function with the inverse of another trigonometric function: Problem type 3 
- Composition of trigonometric functions with variable expressions as inputs: Problem type 1 
- Using a calculator to approximate inverse trigonometric values 

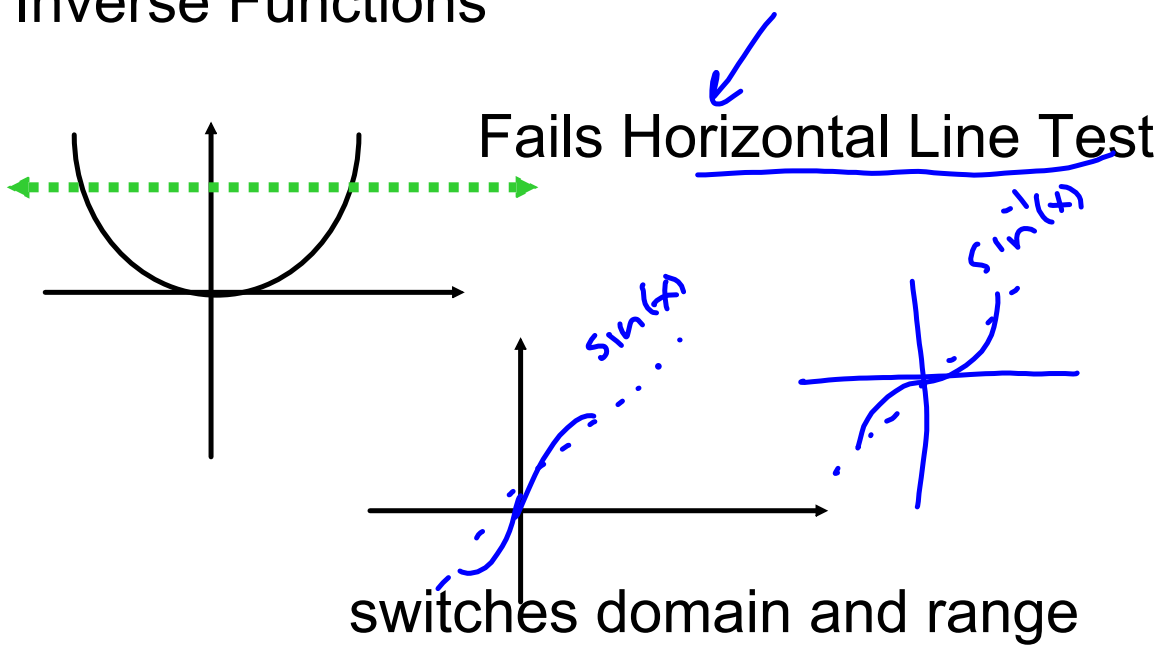
**Word problem involving a sine or cosine function: Problem type 1**

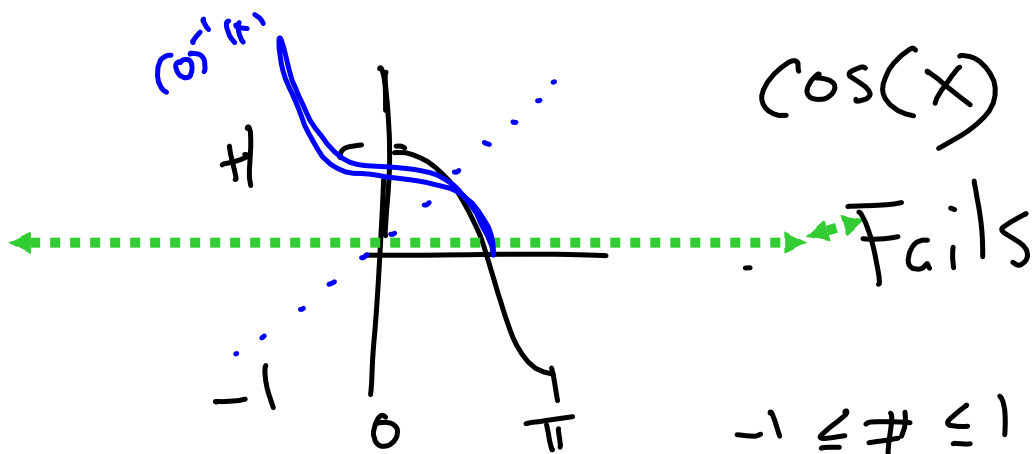
A buoy floating in the sea is bobbing in simple harmonic motion with period 3 seconds and amplitude 12 in. Its displacement  $d$  from sea level at time  $t = 0$  seconds is 0 in, and initially it moves downward. (Note that downward is the negative direction.)

Give the equation modeling the displacement  $d$  as a function of time  $t$ .



# Inverse Functions





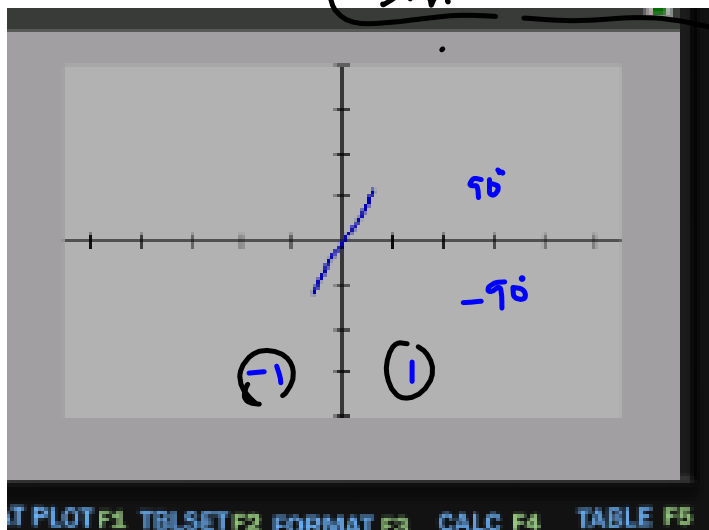
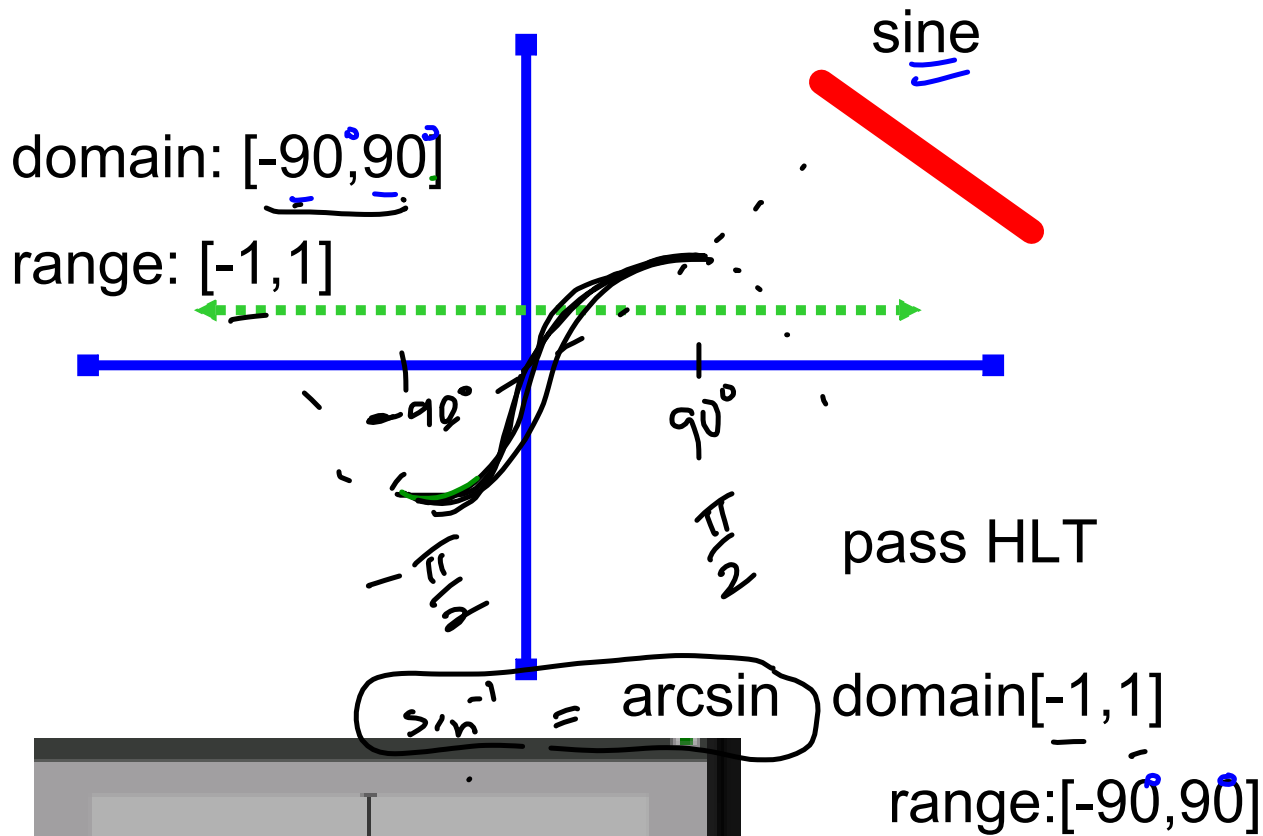
$\cos(x)$

Fails

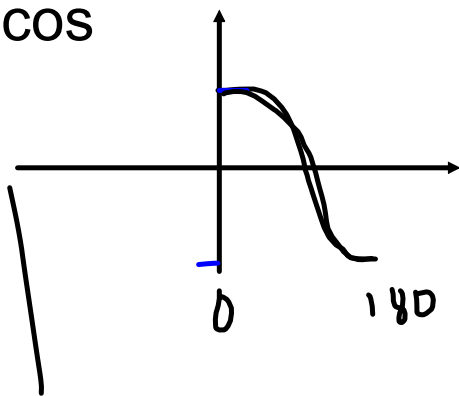
$$-1 \leq \# \leq 1$$

$$\cos^{-1}(\#) = \text{Answer}$$

$0 < \text{Rads} < \pi$       $\text{Angle}$   
 $0 < \text{Angle} < 180$

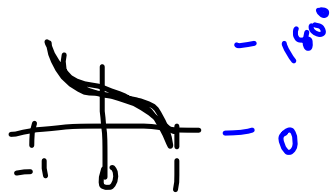


cos

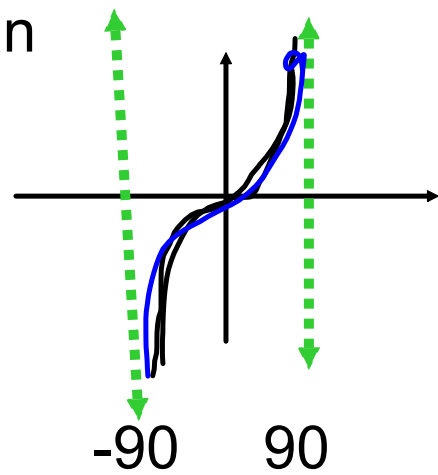


domain  $[0, 180^\circ]$

range  $[-1, 1]$

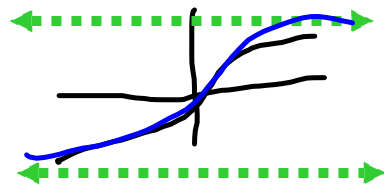


tan



domain  $[-90, 90]$

range:  $(-\infty, \infty)$



### Values of inverse trigonometric functions

Find the exact value of  $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$ .

Write your answer in radians in terms of  $\pi$ .

$\sin^{-1}(\sqrt{3}/2)$   
.....  
60

60°  
•  $\frac{\pi}{180} = \frac{\pi}{3 \text{ rad}}$   
0.175 rad

$$\sin(60^\circ) = \frac{\sqrt{3}}{2}$$

$$\frac{60}{180} \pi =$$

$$\frac{\pi}{3}$$

calculator

$\sin^{-1}(\sqrt{3}/2)$	1.047197551
$\pi/3$	1.047197551

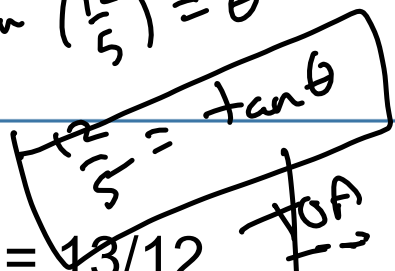


Composition of a trigonometric function with the inverse of another trigonometric function:  
 Problem type 1

Find the exact value of  $\csc\left(\tan^{-1}\left(\frac{12}{5}\right)\right)$ .

$\tan^{-1}\left(\frac{12}{5}\right) = \theta$

$\theta = \tan^{-1}\left(\frac{12}{5}\right)$   
 $\tan \theta = \frac{12}{5}$

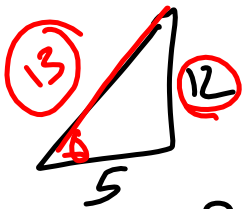


$1/\sin(\tan^{-1}(12/5)) = \text{hyp/opp} = 13/12$

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1/sin(tan^-1(12/5))
1.083333333
Ans>Frac
13
12
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angle =  $\tan^{-1}(12/5)$

$\tan(\text{angle}) = 12/5$

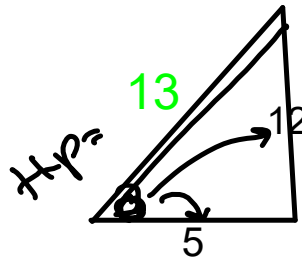


$\csc = \frac{1}{\sin}$

SOH

CAH

TOA



$\tan = \text{opp/adj}$

$5^2 + 12^2 = 13^2$   
 $25 + 144 = 169 = 13^2$



SOH	CAH	TOA
<u>Sine</u>	<u>Cosine</u>	<u>Tangent</u>
<u>Opposite</u>	<u>adjacent</u>	<u>Opposite</u>
Hypotenuse	Hypotenuse	Adjacent

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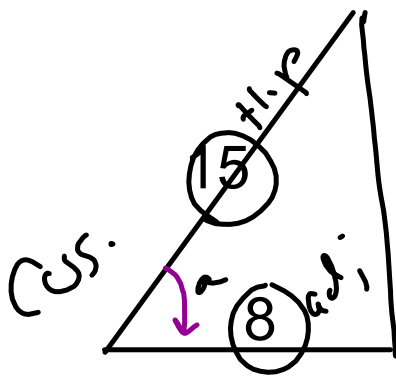




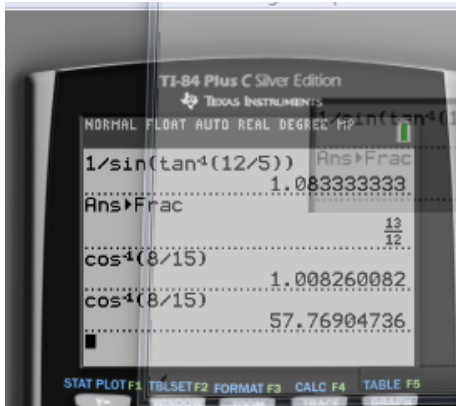
# Right Triangle Trig

CAH  
adj  
hyp

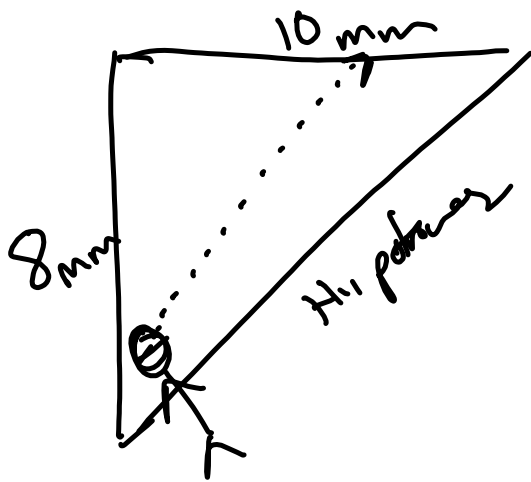
$$= \frac{8}{15} = \cos(a)$$



$$a = \cos^{-1}(8/15) =$$



	0	3	4	6	9	1	1	1	1	2	2	2	2	3
	0	0	5	0	0	2	3	5	8	1	2	4	7	0
						0	5	0	0	0	5	0	0	0
S	$\frac{\sqrt{0}}{2}$	$\frac{\sqrt{1}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{4}}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{1}}{2}$	$\frac{\sqrt{0}}{2}$	$\frac{-\sqrt{1}}{2}$	$\frac{-\sqrt{2}}{2}$	$\frac{-\sqrt{3}}{2}$	$\frac{-\sqrt{4}}{2}$	$\frac{-\sqrt{3}}{2}$
C	$\frac{\sqrt{4}}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{1}}{2}$	$\frac{\sqrt{0}}{2}$	$\frac{-\sqrt{1}}{2}$	$\frac{-\sqrt{2}}{2}$							



$$+ \\ \text{opp} = 10 \\ \text{adj} = 8$$

$$\theta =$$

$$\tan \theta = \frac{10}{8}$$

$$\theta = \tan^{-1} \left( \frac{10}{8} \right)$$