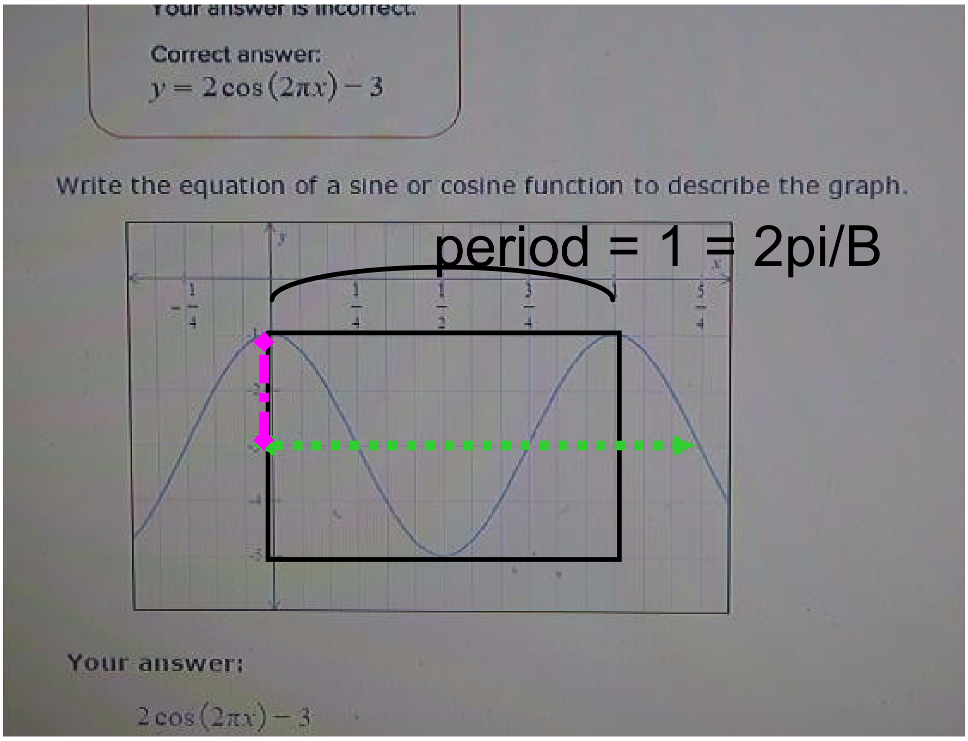
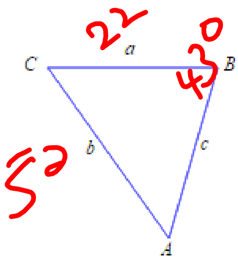


Solving a triangle with the law of sines: Problem type 2

Consider a triangle ABC like the one below. Suppose that $b = 52$, $a = 22$, and $B = 43°$. (The figure is not drawn to scale.) Solve the triangle.

Carry your intermediate computations to at least four decimal places, and round your answers to the nearest tenth.

If no such triangle exists, enter "No solution." If there is more than one solution, use the "or" button.



$$\frac{22}{\sin A} = \frac{52}{\sin 43°}$$

$\sin A = 22 \sin 43° / 52$

$A = 16.72..$

~~$A = 163.53$~~

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

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

$$y = 3\,\cancel{1}\cos\left(\cancel{1}\,x - \frac{\pi}{3}\right)$$

Give the exact values, not decimal approximations.

Amplitude: (Not 3) = 1

Period: $\frac{2\pi}{1} = 2\pi$

Phase Shift: $x - \frac{\pi}{3} = 0 \Rightarrow \frac{\pi}{3}$

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

Amplitude: 1

Period: 2pi/2pi = 1

Phase shift: 1/4

$2\pi x - \frac{\pi}{2} = 0$

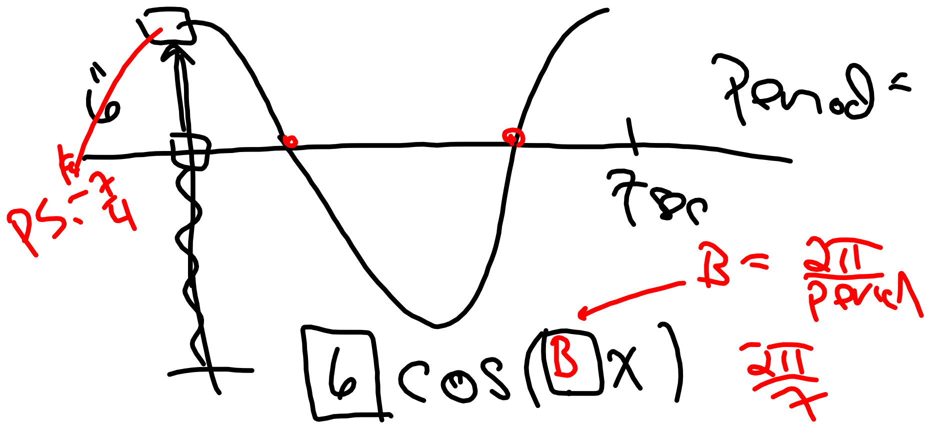
2pix = pi/2

x = 1/4

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

A weight on the end of a coiled spring is pushed 6 in above its resting position. The weight is released at time $t = 0$ seconds and moves downward, oscillating in simple harmonic motion. It completes one cycle in 7 seconds. (Note that downward is the negative direction.)

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



d = 6 cos (2πt/7)

Finding solutions in an interval for a basic equation involving sine or cosine

Find all solutions of the equation in the interval $[0, 2\pi)$.

$$2\cos\theta - \sqrt{2} = 0$$

Write your answer in radians in terms of π.
If there is more than one solution, separate them with commas.

y1= 2 cos(x) - √2

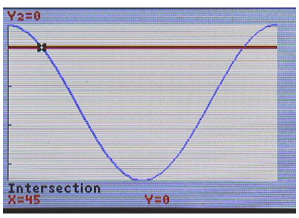
y2=0

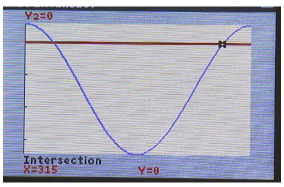
window xmin:0 Xmax:360

mode: degrees

zoom 0 : zoomfit

calc 5: intersect





45 * pi/180 = pi/4

315* pi/180 = 7pi/4

Find all solutions of the equation in the interval $[0, 2\pi)$.

$$2\cos\theta - \sqrt{2} = 0$$

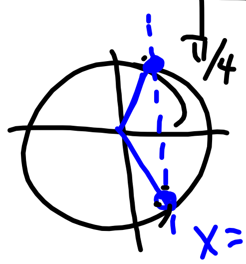
Write your answer in radians in terms of π.
If there is more than one solution, separate them with commas.

$2\cos\theta = \sqrt{2}$

$\cos\theta = \sqrt{2}/2$

$\cos\frac{\pi}{4} = \sqrt{2}/2$

	0	$\pi/6$	$\pi/4$	$\pi/3$	$\pi/2$
sin	0		$\sqrt{2}/2$		
			$\sqrt{2}/2$		



$x = \cos\theta = \sqrt{2}/2$

$x = \sqrt{2}/2$

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

$7\pi/4$

Proving trigonometric identities: Problem type 2

Prove the identity.

$$\frac{\cot^2 x}{\csc x} = \csc x - \sin x$$

Statement	Rule
$\frac{\cot^2 x}{\csc x}$	
$= \frac{\csc^2 x - 1}{\csc x}$	Pythagorean
$= \frac{\csc^2 x}{\csc x} - \frac{1}{\csc x}$	Algebra
$= \csc x - \frac{1}{\csc x}$	Algebra
$= \csc x - \sin x$	Reciprocal

$$(1+\sin x)(1-\sin x) = 1-\sin^2 x$$

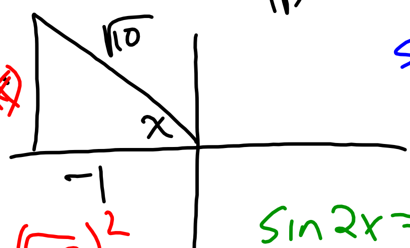
$$\sin(x+\pi/4) =$$

$$\sin x \cos\frac{\pi}{4} + \cos x \sin\frac{\pi}{4}$$

5. Double-angle identities: Problem type 1 CAH $= \frac{\text{adj}}{\text{hyp}}$

Find $\sin 2x$, $\cos 2x$, and $\tan 2x$ if $\cos x = -\frac{1}{\sqrt{10}}$ and x terminates in quadrant II.

$3 = \cancel{x}$



$\cancel{x}^2 + (-1)^2 = (\sqrt{10})^2$

Pythagorean Theorem

$\sin = \frac{\text{opp}}{\text{hyp}} = \frac{3}{\sqrt{10}}$

$\sin 2x = 2\sin x\cos x$

$2\left(\frac{3}{\sqrt{10}}\right)\left(-\frac{1}{\sqrt{10}}\right)$

$-6/10 = -3/5$

$\cos 2x = \cos^2 x - \sin^2 x$

$\left(\frac{1}{\sqrt{10}}\right)^2 - \left(\frac{3}{\sqrt{10}}\right)^2$

$\frac{1}{10} - \frac{9}{10} = -\frac{8}{10} = \frac{-4}{5}$

$\tan 2x = \sin(2x)/\cos(2x)$

$= -3/5 \,/\, -4/5 = 3/4$

$\tan 2x$ if $\cos x = -\dfrac{1}{\sqrt{10}}$

y1=cos(x)

y2= -1/SQR(10)

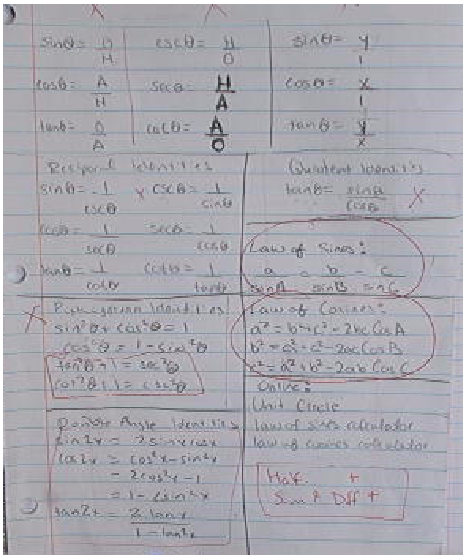
window xmin:90 xmax 180

zoomfit

calc 5: intersect

x = 108...

tan(2x)= .75



$\sin\theta = \frac{O}{H}$ $\csc\theta = \frac{H}{O}$ $\sin\theta = \frac{y}{1}$

$\cos\theta = \frac{A}{H}$ $\sec\theta = \frac{H}{A}$ $\cos\theta = \frac{x}{1}$

$\tan\theta = \frac{O}{A}$ $\cot\theta = \frac{A}{O}$ $\tan\theta = \frac{y}{x}$

Reciprocal Identities

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

$\cos\theta = \frac{1}{\sec\theta}$ $\sec\theta = \frac{1}{\cos\theta}$

$\tan\theta = \frac{1}{\cot\theta}$ $\cot\theta = \frac{1}{\tan\theta}$

Quotient Identities

$\tan\theta = \frac{\sin\theta}{\cos\theta}$

Law of Sines:

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Law of Cosines:

$a^2 = b^2 + c^2 - 2bc\cos A$

$b^2 = a^2 + c^2 - 2ac\cos B$

$c^2 = a^2 + b^2 - 2ab\cos C$

Pythagorean Identities

$\sin^2\theta + \cos^2\theta = 1$

$\cos^2\theta = 1 - \sin^2\theta$

$\tan^2\theta + 1 = \sec^2\theta$

$\cot^2\theta + 1 = \csc^2\theta$

Online:

Unit Circle

law of sines calculator

law of cosines calculator

Double Angle Identities

$\sin 2x = 2\sin x\cos x$

$\cos 2x = \cos^2 x - \sin^2 x$

$= 2\cos^2 x - 1$

$= 1 - 2\sin^2 x$

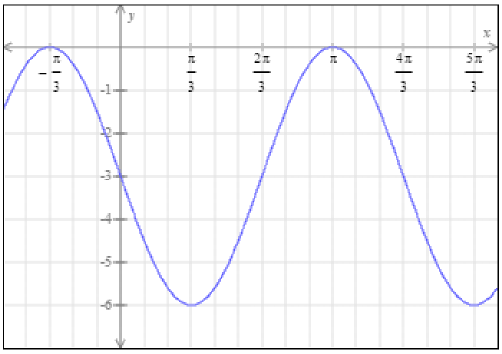
$\tan 2x = \frac{2\tan x}{1 - \tan^2 x}$

Half +

Sum & Diff +

15. 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.



You answered:

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

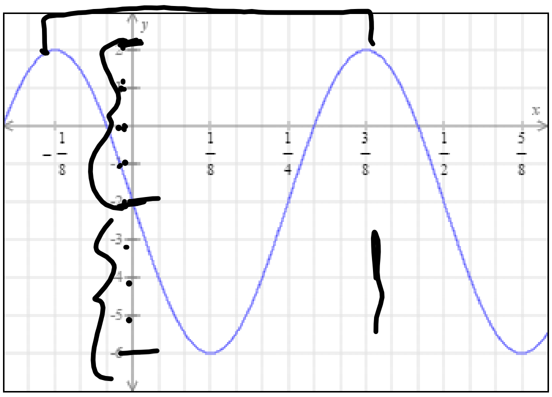
Your answer is incorrect.

The correct answer is:

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

15. 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.



$\text{Period} = \frac{1}{2} = \frac{2\pi}{B}$

$B = 4\pi$

You answered:

$$4\sin(\overset{4\pi}{4x})-2$$

$$-4\sin(4\pi x)-2$$

Your answer is incorrect.

The correct answer is:

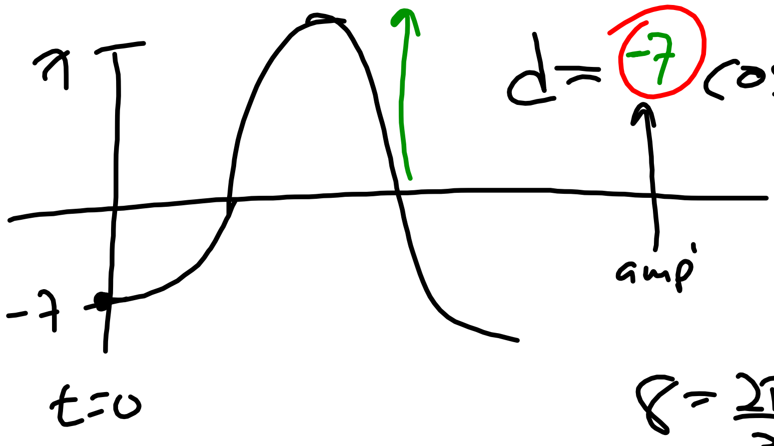
$$y=-4\sin(4\pi x)-2$$

Adjust the Points for This Answer:

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

A buoy floating in the ocean is bobbing in simple harmonic motion with amplitude 7 ft and period 8 seconds. Its displacement d from sea level at time $t = 0$ seconds is -7 ft, and initially it moves upward. (Note that upward is the positive direction.)

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



$d = -7\cos\left(\frac{\pi}{4}t\right)$

amp

B

$8 = \frac{2\pi}{B}$ $B = \frac{\pi}{4}$

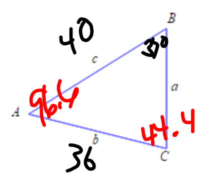
Solving a triangle with the law of sines: Problem type 2

Consider a triangle ABC like the one below. Suppose that $b = 36$, $c = 40$, and $B = 39°$. (The figure is not drawn to scale.) Solve the triangle.

Carry your intermediate computations to at least four decimal places, and round your answers to the nearest tenth.

If no such triangle exists, enter "No solution." If there is more than one solution, use the "or" button.

SSA



$\frac{36}{\sin 39°} = \frac{40}{\sin C}$

$180 - 39 - 44.4 = 96.6$

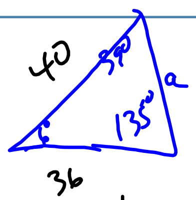
$\sin C = \frac{40 \sin 39°}{36}$

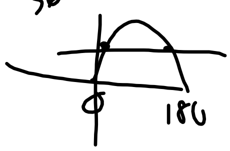
Solve for "C"

$C = \sin^{-1}\left(\frac{40 \sin 39°}{36}\right) = 44.4°$

other solution

$C = 180° - 44.4 = 135.6°$





$\frac{a}{\sin 6°} = \frac{36}{\sin 39°} = 5.94$

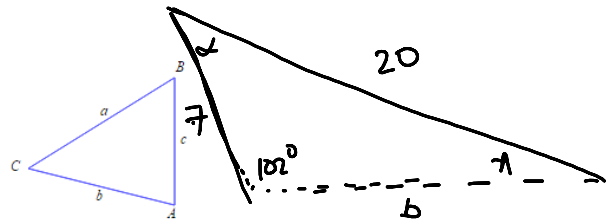
$\frac{a}{\sin 96.6} = \frac{36}{\sin 39°} = 56.8$

Solving a triangle with the law of sines: Problem type 2

Consider a triangle ABC like the one below. Suppose that $c = 20$, $a = 7$, and $C = 102°$. (The figure is not drawn to scale.) Solve the triangle.

Carry your intermediate computations to at least four decimal places, and round your answers to the nearest tenth.

If no such triangle exists, enter "No solution." If there is more than one solution, use the "or" button.



$$\frac{20}{\sin 102^\circ} = \frac{7}{\sin A}$$

$$\sin^{-1}\left(\frac{7 \sin 102^\circ}{20}\right) \approx 20^\circ$$

Complem: $180 - 20 = 160$

102 160°

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

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

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

Phase Shift

Give the exact values, not decimal approximations.

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

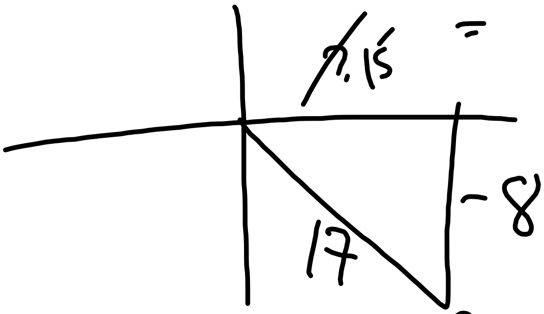
$$\frac{2\pi x}{2\pi} = \frac{\frac{3\pi}{2}}{2\pi}$$

$$x = 3/4$$

Finding values of trigonometric functions given information about an angle: Problem type 2

Let θ be an angle in quadrant IV such that $\sin\theta = -\frac{8}{17}$. $\frac{O}{H}$

Find the exact values of $\sec\theta$ and $\tan\theta$.



$= \sqrt{17^2 - 8^2}$

$\sqrt{289-64}$

$\sqrt{225}$

15

$\sec\theta = \frac{H}{a} = \frac{17}{15}$

$\tan\theta = \frac{O}{a} = \frac{-8}{15}$

After cutting squares of side length x from from the corners of the original rectangle, the distances between cut corners will be $3-2x$ and $8-2x$ (see Figure 3).

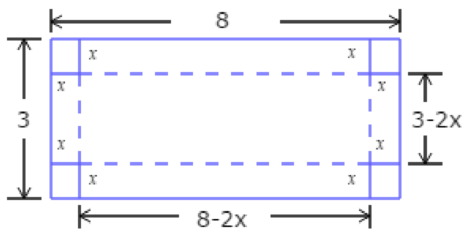


Figure 3

Therefore, the open-topped box formed by folding the sides upward will have dimensions $8-2x$ by $3-2x$ by x (see Figure 4). Note that because these dimensions represent distances, they must be positive. Thus, x must be greater than 0, and x must also be less than 1.5 to insure that both $8-2x$ and $3-2x$ are positive. Since the volume of a rectangular box is the product of its dimensions, we have that the volume, y, enclosed by this box is given by

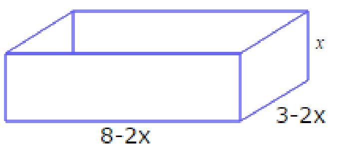
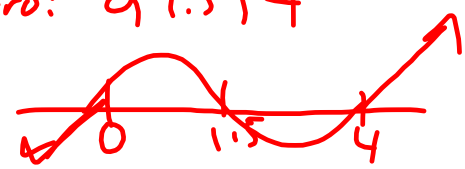


Figure 4

zero: 0, 1.5, 4

$$y = (8-2x)(3-2x)(x).$$

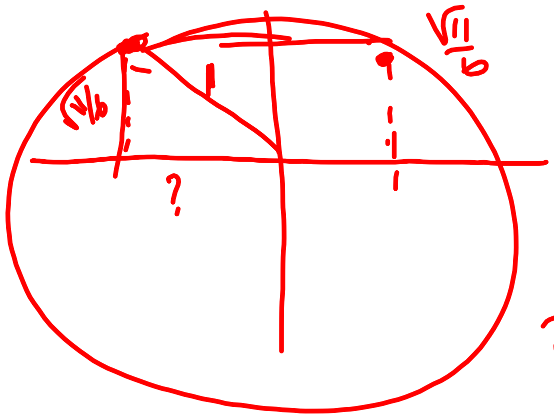


Finding a point on the unit circle given one coordinate

Suppose that $\left(x, \frac{\sqrt{11}}{6}\right)$ is a point in quadrant II lying on the unit circle.

Find x. Write the exact value, not a decimal approximation.

$-5/6$



$?^2 + (\sqrt{11}/6)^2 = 1$

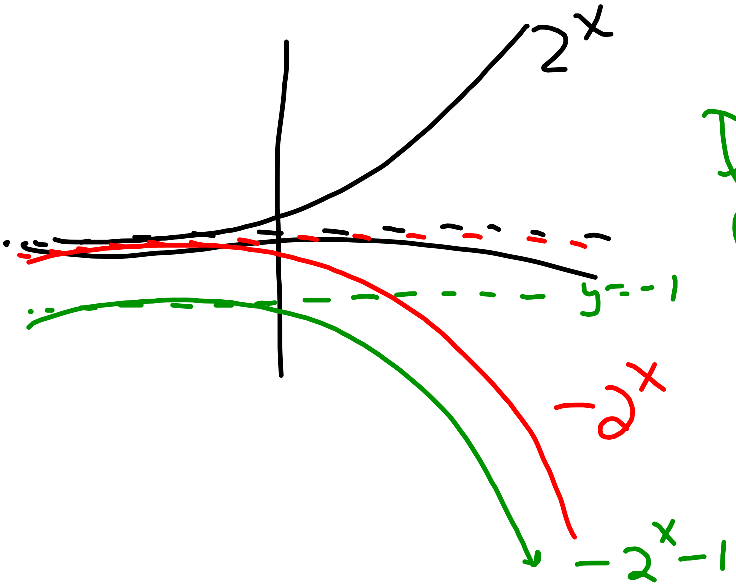
$?^2 + 11/36 = 36/36$

$?^2 = 25/36$

$? = \pm 5/6$

The graph, domain, and range of an exponential function

Graph the function $g(x) = -2^x - 1$ and give its domain and range using interval notation.



Domain: $\mathbb{R}$

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

Solving a rational inequality: Problem type 1

Solve the following inequality.

$$y = \frac{(x-6)^1}{x-2} \geq 0$$

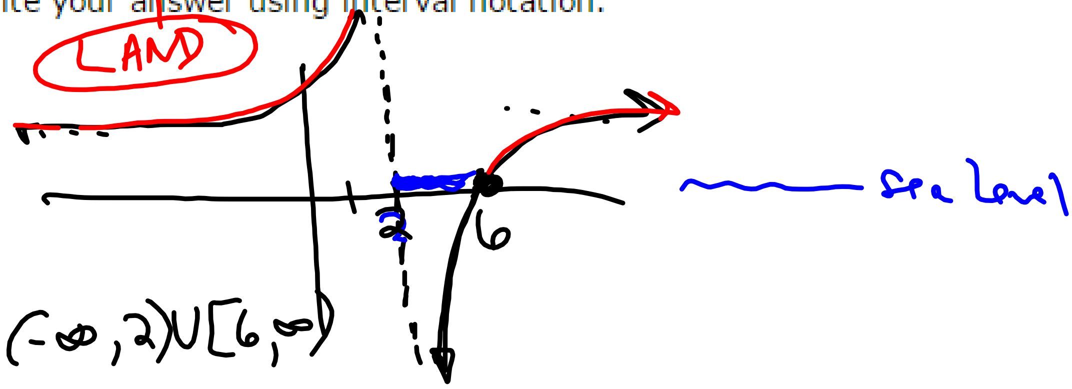
HA: $y = 1$

VA: $x = 2$

zeros: $x = 6$

Write your answer using interval notation.

LAND



$(-\infty, 2) \cup [6, \infty)$

Finding a polynomial of a given degree with given zeros: Complex zeros

Find a polynomial $f(x)$ of degree 3 with real coefficients and the following zeros.

$1, -3+i$, $-3-i$ zeros

$(x-1)(x+3-i)(x+3+i)$ Factors

$(x-1)((x+3)^2 - i^2)$

$(x-1)(x^2+6x+9+1)$

$(x^2+6x+10)$

$x - 1$

$-x^2 \quad -6x \quad -10$

$x^3 \quad 6x^2 \quad 10x$

$x^3+5x^2+4x-10$