5.4A Warmup

Solve the following equations algebraically. Where possible give exact values

1) $\sin x = -0.3$ $0 \le x < 2\pi$
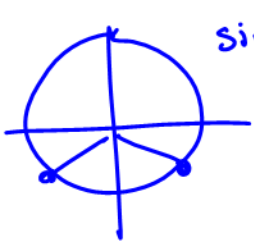
$\sin = y$-coord

$\sin x = -0.3$

$\sin x_r = 0.3$

$x_r = \sin^{-1}(0.3)$

$x_R = .305$

Q3: $x = \pi + .305$
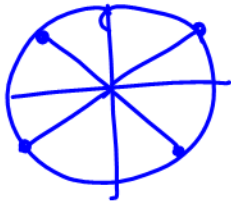$x = 3.44$

Q4: $x = 2\pi - .305$
$x = 5.98$

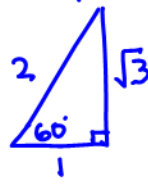$x = 3.44 , 5.98$

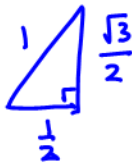2) $\tan^2 x - 3 = 0$ $0 \le x < 360^0$

$\tan^2 x - 3 = 0$

$\tan^2 x = 3$

$\tan x = \pm\sqrt{3}$

special triangle

$x_R = 60°$ or $\frac{\pi}{3}$

Q1: $x = 60°$ or $\frac{\pi}{3}$

Q2: $x = 120°$ or $\frac{2\pi}{3}$

✓ Q3: $x = 240°$ or $\frac{4\pi}{3}$

Q4: $x = 300° = \frac{5\pi}{3}$

3) $2\sin^2 x + 5\sin x = -3$

$2\sin^2 x + 5\sin x + 3 = 0$

$(2\sin x + 3)(\sin x + 1) = 0$

$\sin x = -\frac{3}{2}$

no solution

$\sin x = -1$
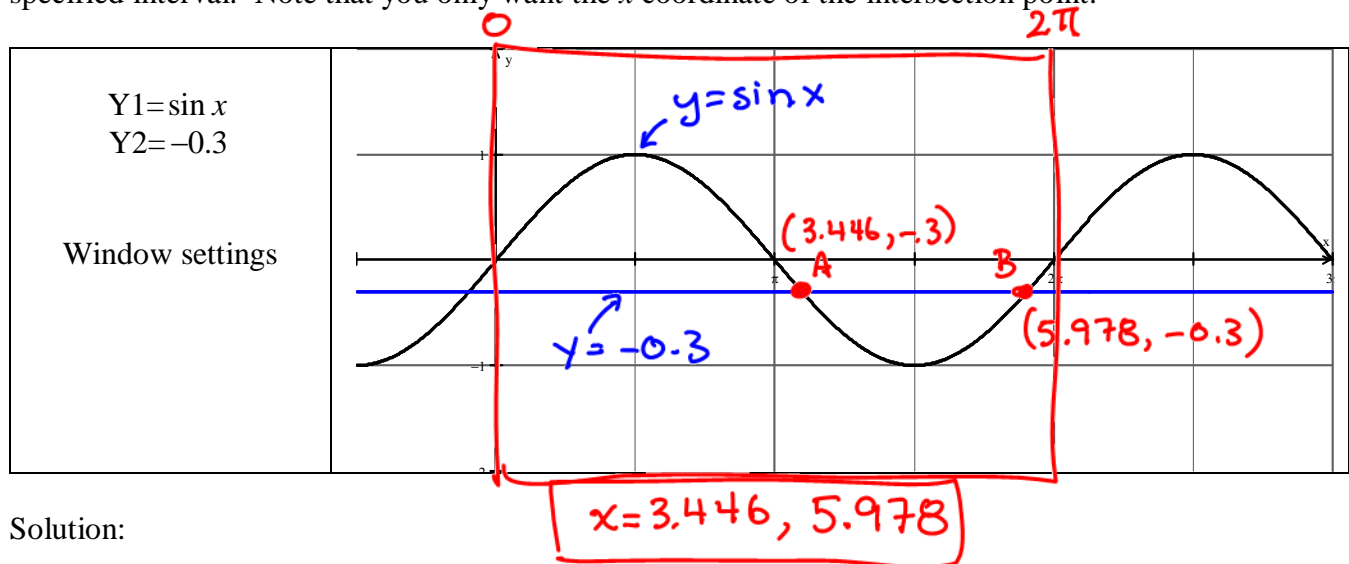
$x = 270° + n\,360°$

or

$x = \frac{3\pi}{2} + n\,2\pi$

5.4A Solving Trigonometric Equations Graphically

Solve the following equations graphically

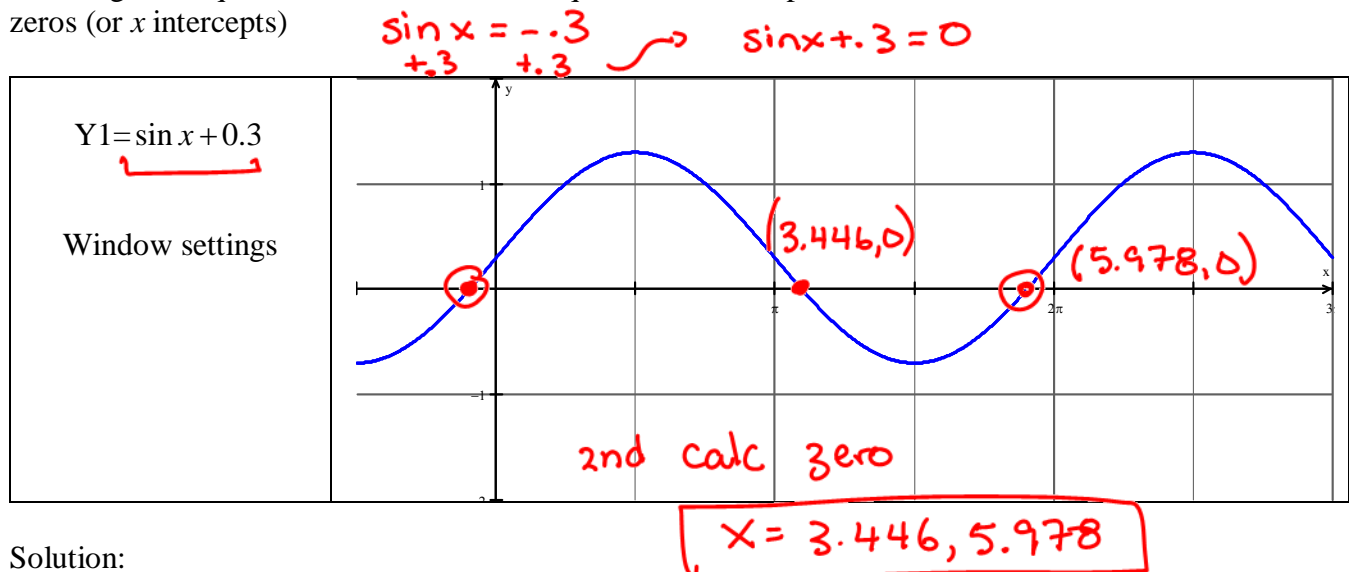1) $\sin x = -0.3$ $0 \le x < 2\pi$

Method 1: Intersection Method

Graph the functions represented by the two sides of the equation and find the intersection(s) in the specified interval. Note that you only want the x coordinate of the intersection point.

|	
Y1=$\sin x$ Y2=-0.3 Window settings	

[Graph annotations: O, 2π, $y=\sin x$, $(3.446,-.3)$ A, B, $y=-0.3$, $(5.978,-0.3)$, $x=3.446, 5.978$]

Solution:

Method 2: Zero Method

Rearrange the equation so that one side is equal to zero. Graph the one function and determine its zeros (or x intercepts)

$$\sin x = -.3 \quad\longrightarrow\quad \sin x + .3 = 0$$
$$+.3 \qquad +.3$$

Y1=$\sin x + 0.3$ Window settings	

[Graph annotations: $(3.446,0)$, $(5.978,0)$, 2nd calc zero, $x= 3.446, 5.978$]

Solution:

If you were asked to solve over the reals, how could you use the graph to help?

could find period using the graph

2) $\tan^2 x - 3 = 0$ $0 \le x < 360^0$

180°

Y1 = $\tan^2 x - 3$

Window settings

$x \left[-90°, 450° \right]$

$Y \left[-4, 4 \right]$
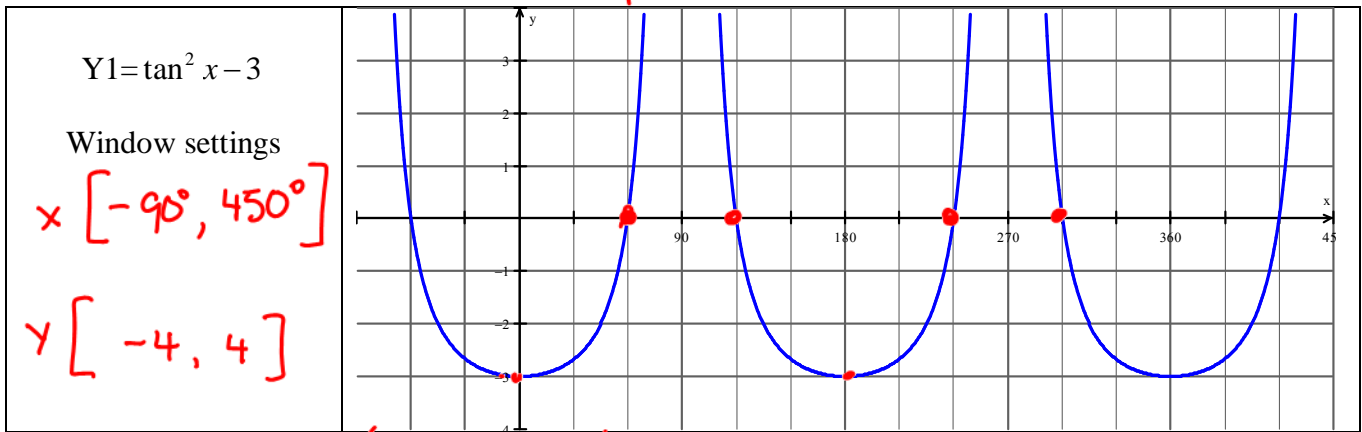
Solution: $x = 60°, 120°, 240°, 300°$

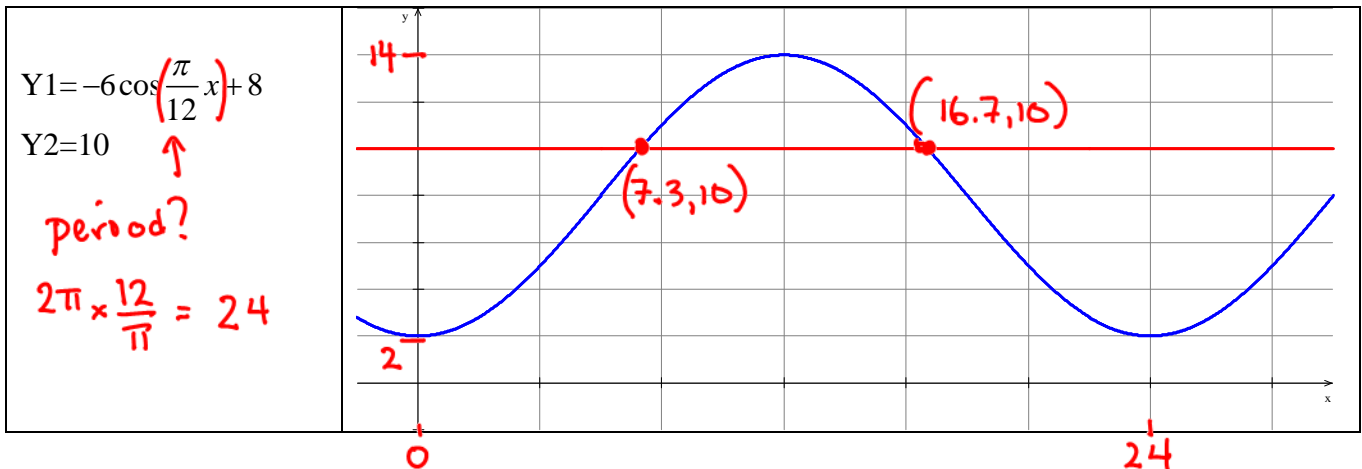What does the period appear to be?   **180°**

What would the general solution be?
$x = 60° + 180°n$
$x = 120° + 180°n$

Why does this not look like a tangent graph anymore?
it is $\tan^2(x)$

3) Determine the general solution for the trigonometric equation: $10 = -6\cos\dfrac{\pi}{12}x + 8$

a) Graphical solution

Y1 = $-6\cos\left(\dfrac{\pi}{12}x\right) + 8$

Y2 = 10

period?

$2\pi \times \dfrac{12}{\pi} = 24$

(16.7, 10)

(7.3, 10)

2

0

24

Use your knowledge of trigonometric functions to determine the amplitude, period, vertical displacement and phase shift for the function $y = -6\cos\dfrac{\pi}{12}x + 8$. Use this information to help to label the axes on the graph above.

$x = 7.3 + 24n$
$x = 16.7 + 24n$

What is the general solution?

b) Algebraic solution

To solve the equation $10 = -6\cos\dfrac{\pi}{12}x + 8$ algebraically, one technique is to use substitution. In this instance, what substitution might you make?
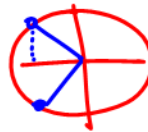
$$\frac{\pi}{12}x = a$$

$$10 = -6\cos a + 8$$
$$\underline{ -8 \qquad\qquad\qquad -8}$$
$$+2 = -6\cos a$$
$$\frac{+2}{-6} \qquad \frac{-6\cos a}{-6}$$
$$-\frac{1}{3} = \cos a$$

① quadrants

② ref angle

$$\cos a = \frac{-1}{3}$$
$$\cos a_r = \frac{1}{3}$$

Q2: $a = \pi - 1.23$
$a = 1.91$
Q3: $a = \pi + 1.23$
$ = 4.37$

$$a_r = \cos^{-1}\left(\frac{1}{3}\right)$$
$$a_r = 1.23$$

$$a = \frac{\pi}{12} \cdot x$$

$1.91 = \frac{\pi}{12} \cdot x$ and $4.37 = \frac{\pi}{12} \cdot x$

$\underline{7.3 = x}$ $\underline{16.7 = x}$

p275 #1-5,6,8,9

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