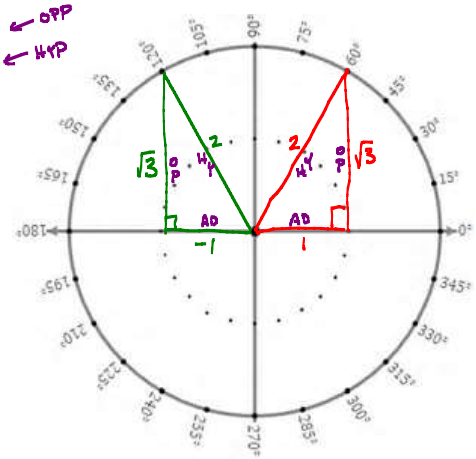
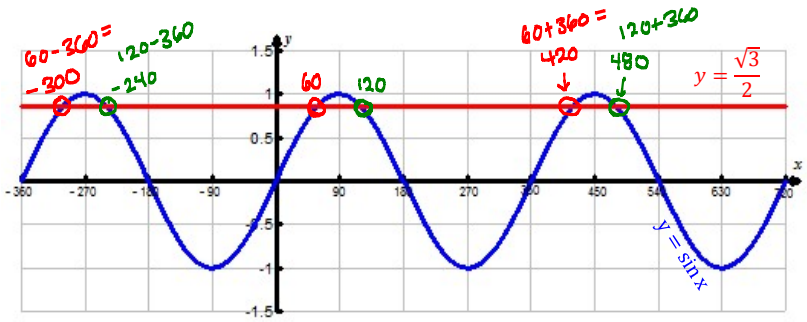
Sec 4.5 – Trigonometric Identities
Trigonometric Equations & Applications

Name:

Find the general solution to the following in <u>degrees</u> using a roster solution and an algebraic solution.

1. $sin(x) = \frac{\sqrt{3}}{2}$ ← OPP ← HYP





$Sin^{-1}(sin(x)) = Sin^{-1}(\frac{\sqrt{3}}{2})$

$x = 60°$ ← PRINCIPAL SOLUTION

GENERAL SOLUTION

Roster Solution: $x = \ldots -300°, 60°, 420°, 780°, \ldots$

OR $x = \ldots -240°, 120°, 480°, 840°, \ldots$

GENERAL SOLUTION

Algebraic Solution:

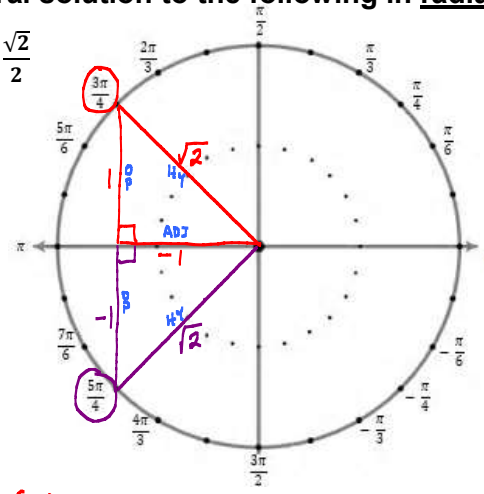
$x = 60 + 360n$

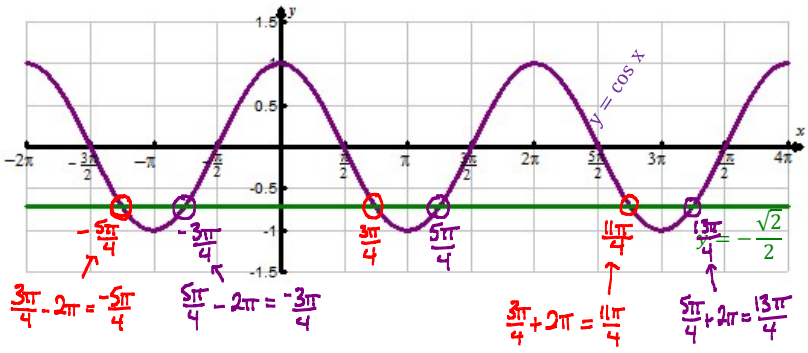
OR $x = 120 + 360n$; WHERE "n" IS ANY INTEGER

Find the general solution to the following in <u>radians</u> using a roster solution and an algebraic solution.

2. $cos(x) = -\frac{\sqrt{2}}{2}$

$Cos(x) = \frac{-1}{\sqrt{2}}$ ← ADJ ← HYP





$Cos^{-1}(Cos(x)) = Cos^{-1}(-\frac{\sqrt{2}}{2})$

$x = \frac{3\pi}{4}$ ← PRINCIPAL SOLUTION

GENERAL SOLUTION

Roster Solution: $x = \ldots -5\pi/4, 3\pi/4, 11\pi/4, 19\pi/4, \ldots$

OR $x = \ldots -3\pi/4, 5\pi/4, 13\pi/4, 21\pi/4, \ldots$

GENERAL SOLUTION

Algebraic Solution:

$x = 3\pi/4 + 2\pi n$

OR $x = 5\pi/4 + 2\pi n$; WHERE "n" IS ANY INTEGER

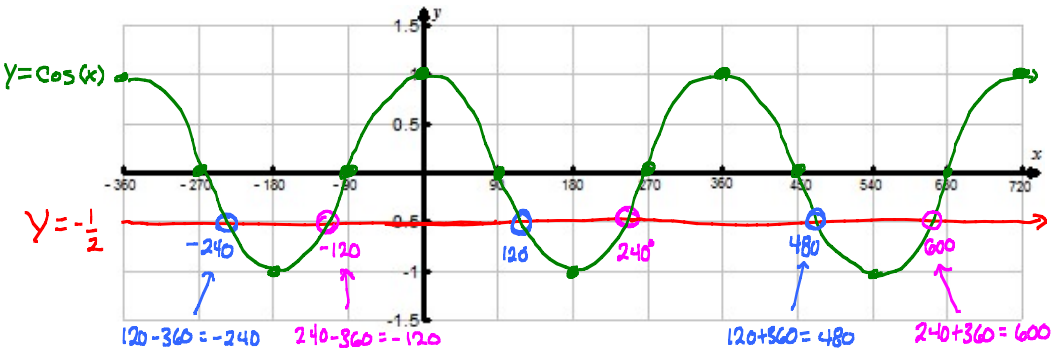
Find the general solution to the following in <u>degrees</u> using a roster solution and an algebraic solution.

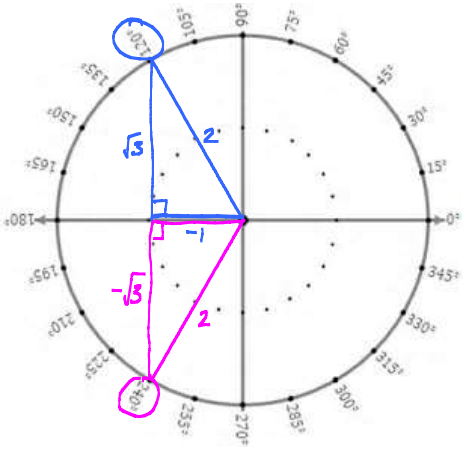
3. $2\cos(x) + 4 = 3$

$-4 \quad -4$

$\frac{2\cos(x)}{2} = \frac{-1}{2}$

$\cos(x) = \frac{-1}{2}$ ← ADJ, ← HYP





GENERAL SOLUTION

Roster Solution: $x = \ldots, -240, 120, 480, 840, \ldots$

OR $x = \ldots, -120, 240, 600, 960, \ldots$

GENERAL SOLUTION

Algebraic Solution:

$x = 120 + 360n$; WHERE "n" IS

OR $x = 240 + 360n$; ANY INTEGER.

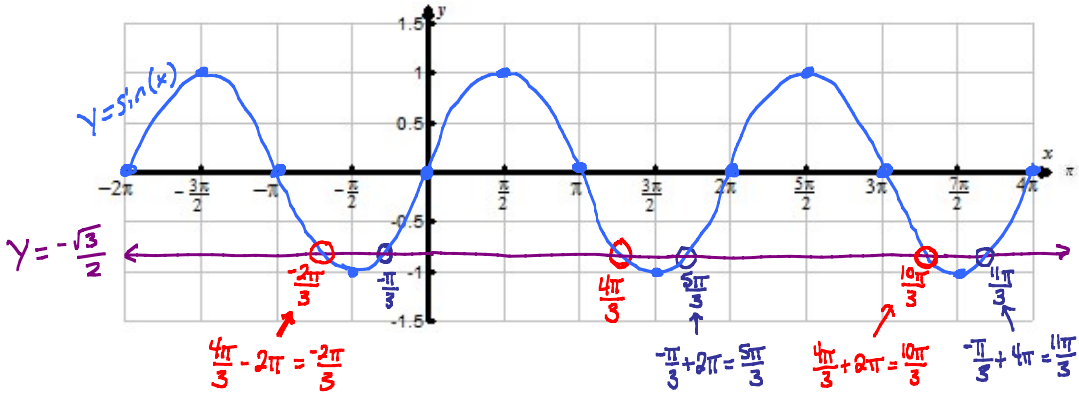
Find all solutions to the following problem in <u>radians</u> using a roster solution and an algebraic solution.

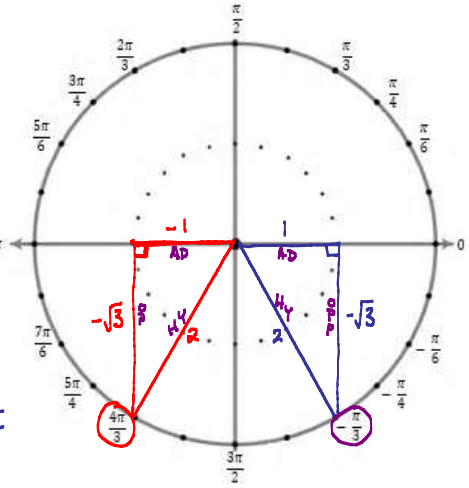
4. $\frac{2\sin(x)}{2} = \frac{-\sqrt{3}}{2}$

$\sin(x) = \frac{-\sqrt{3}}{2}$ ← OPP, ← HYP

$\sin^{-1}(\sin(x)) = \sin^{-1}\left(\frac{-\sqrt{3}}{2}\right)$

$x = \frac{-\pi}{3}$ ← PRINCIPAL SOLUTION





GENERAL SOLUTION

Roster Solution: $x = \ldots -2\pi/3, 4\pi/3, 10\pi/3, \ldots$

OR $x = \ldots -\pi/3, 5\pi/3, 11\pi/3, \ldots$

GENERAL SOLUTION

Algebraic Solution:

$x = 4\pi/3 + 2\pi n$; WHERE "n" IS

OR $x = -\pi/3 + 2\pi n$; ANY INTEGER.

Find all solutions to the following problems in <u>radians</u> using a roster solution and an algebraic solution.

5. $sin(2x) - sin(x) = 0$

$2\sin(x)\cos(x) - \sin(x) = 0$: REPLACE $\sin(2x)$ WITH $2\sin(x)\cos(x)$

: FACTOR OUT $\sin(x)$

$\sin(x)(2\cos(x) - 1) = 0$: SET FACTORS EQUAL TO ZERO

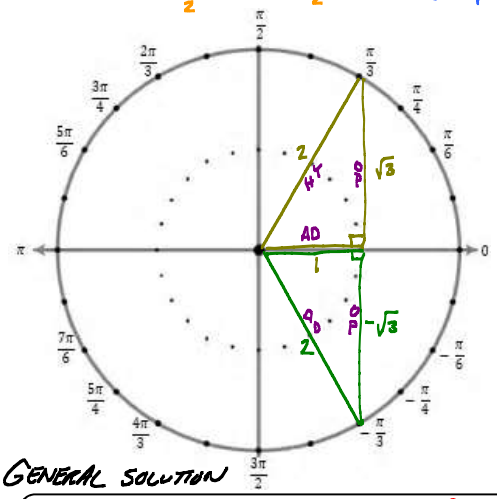
$\sin(x) = 0$

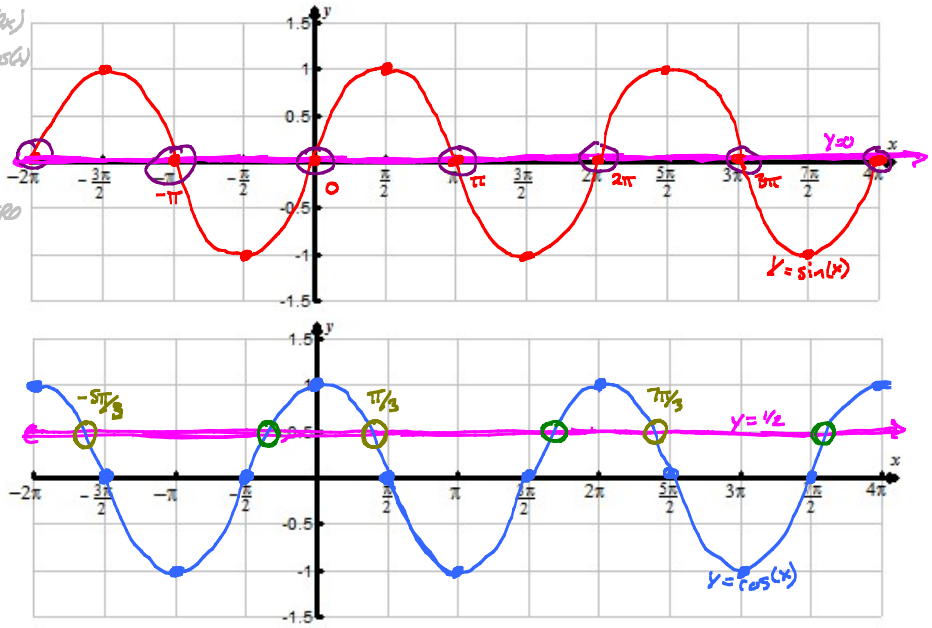
$2\cos(x) - 1 = 0$

$+1 \quad +1$

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

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





GENERAL SOLUTION

Roster Solution: $x = \ldots -\pi, 0, \pi, 2\pi, 3\pi, \ldots$
OR $x = \ldots -5\pi/3, \pi/3, 7\pi/3, 13\pi/3, \ldots$
OR $x = \ldots -\pi/3, 5\pi/3, 11\pi/3, 17\pi/3, \ldots$

GENERAL SOLUTION

Algebraic Solution: $x = 0 + \pi n$ OR $x = \frac{\pi}{3} + 2\pi n$ OR $x = \frac{-\pi}{3} + 2\pi n$; WHERE "n" IS AN INTEGER

6. $cos(2x) - cos(x) = 0$

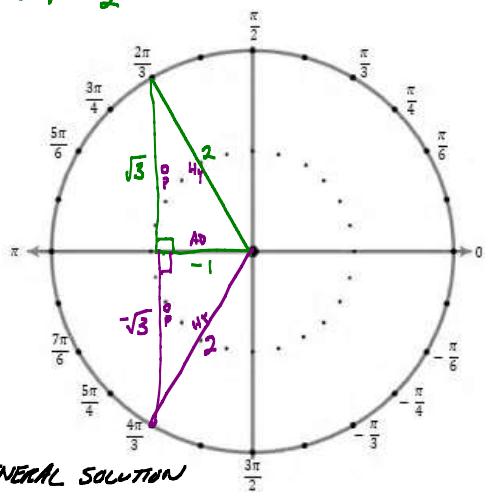
$2\cos^2(x) - 1 - \cos(x) = 0$: REPLACE $\cos(2x)$ WITH $2\cos^2(x) - 1$

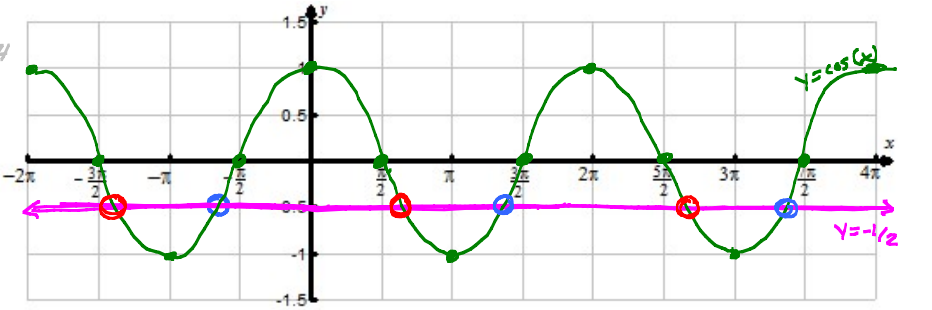
$2\cos^2(x) - \cos(x) - 1 = 0$: REARRANGE AND FACTOR QUADRATIC

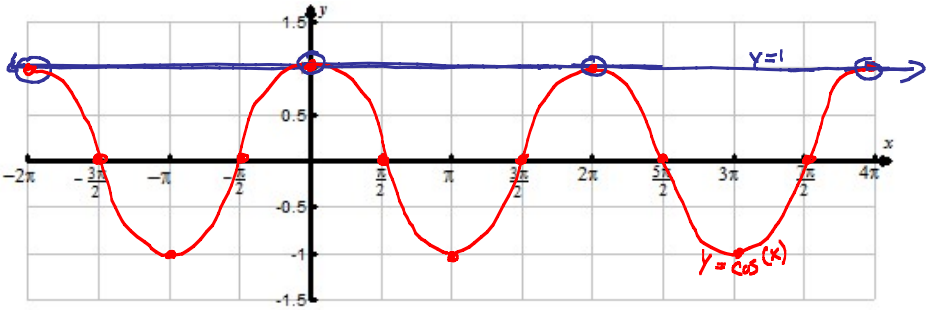
$(2\cos(x) + 1)(\cos(x) - 1) = 0$

$2\cos(x) + 1 = 0$ OR $\cos(x) - 1 = 0$

$\cos(x) = \frac{-1}{2}$ OR $\cos(x) = 1$: USE ZERO PRODUCT PROPERTY







GENERAL SOLUTION

Roster Solution: $x = \ldots, -4\pi/3, 2\pi/3, 8\pi/3, 14\pi/3, \ldots$
OR $x = \ldots, -2\pi/3, 4\pi/3, 10\pi/3, 16\pi/3, \ldots$
OR $x = \ldots -2\pi, 0, 2\pi, 4\pi, 6\pi, \ldots$

GENERAL SOLUTION

Algebraic Solution: $x = \frac{2\pi}{3} + 2\pi n$ OR $x = \frac{4\pi}{3} + 2\pi n$ OR $x = 2\pi n$; WHERE "n" IS ANY INTEGER.

Using your graphing calculator solve the following.

7. The average high temperature of a day in Atlanta can be modeled by the following equation:

$$T = 20sin\left(0.017(d - 106.82)\right) + 69$$

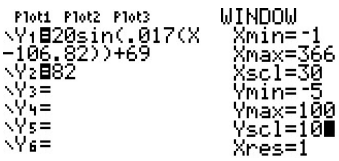
Where 'T' represents the temperature in Fahrenheit and 'd' is the day number of year (e.g. Feb. 2nd would be day 33)

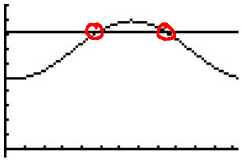
a. Using the model, what is the average high temperature in Atlanta on February 12th?

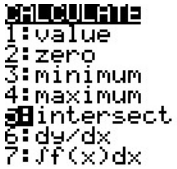
$x = 31 + 12 = 43$ (JAN, FEB)

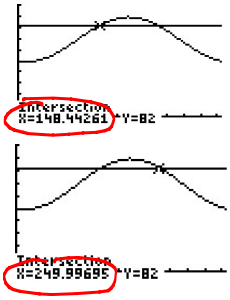
$T = 20\sin(0.017(43 - 106.82)) + 69 \approx 51.3°$

b. Using the model, what 2 dates should the average high temperature be 82° F?









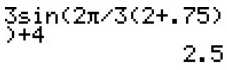
DAY 148 & DAY 250

WHICH WOULD BE MAY 28TH AND SEPT. 7TH.

8. The height (in feet) above aground of a child in a swing can be given by the function with respect to time in seconds. (starting from the swings highest point)

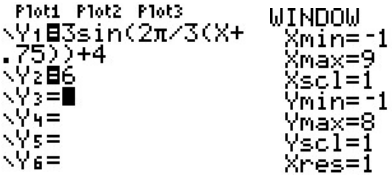
$$h = 3sin\left(\frac{2\pi}{3}(t + 0.75)\right) + 4$$

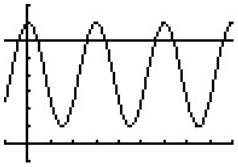
a. Using the model, what is the height of the child after 2 seconds?

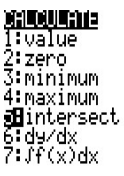


$h = 3\sin\left(\frac{2\pi}{3}(2 + 0.75)\right) + 4 = 2.5$ feet

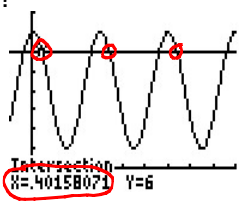
b. Using the model, at what times is the height of the child 6 feet high?



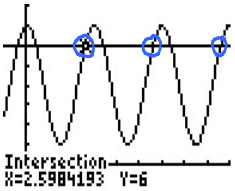




PERIOD $= \frac{2\pi}{b} = \frac{2\pi}{2\pi/3} = 3$



$t \approx 0.4, 3.4, 6.4, \ldots$



$t \approx 2.6, 5.6, 8.6, \ldots$