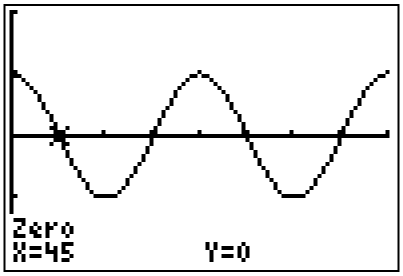
PreCalculus 12 Date ________________

Unit 5: Trigonometry & The Unit Circle

5.4 Equations & Graphs of Trigonometric Funtions

Ex. Use your graphing calculator to determine the solutions for the trigonometric equation $\underbrace{2\cos^2 x - 1}_{y_1 =} = 0$ in the interval [0°, 360°]. Verify algebraically.

Zero finder



$\boxed{x = 45°, 135°, 225°, 315°}$

$2\cos^2 x - 1 = 0$

$\cos^2 x = \frac{1}{2}$

$\cos x = \pm\frac{1}{\sqrt{2}}$

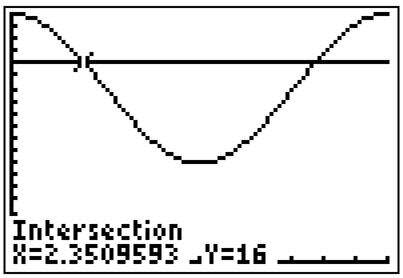
$\theta_R = 45°$

$180-45 \quad 180+45 \quad 360-45$

$\boxed{45°, 135°, 225°, 315°}$

Ex. Determine the general solutions for the trigonometric equation $\underbrace{16}_{y_1 =} = \underbrace{6\cos\frac{\pi}{6}x + 14}_{y_2 =}$. Express your answer to the nearest hundredth.

$\text{period} = \frac{2\pi}{\pi/6} = \cancel{2\pi} \times \frac{6}{\cancel{\pi}} = 12$



intersect finder

$\boxed{x = 2.35 + 12n \quad \& \quad x = 9.65 + 12n \; ; n \in I}$

$n \in Z$

Ex. The depth of water (d in meters) at dock by the Bay of Fundy at a certain time (t in hours after midnight) varies according to the function:

$d(t) = 3\cos\frac{2\pi}{12.4}(t - 4.5) + 5$

amp = 3 m change in depth from the mean

vert. disp. = 5 m the mean

∴ low 2 m high 8 m

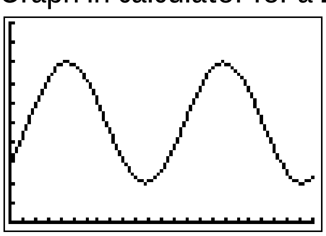
phase shift = 4.5 h 1st high tide (cosine) at 4:30 AM

period = $\frac{2\pi}{2\pi/12.4} = \cancel{2\pi} \times \frac{12.4}{\cancel{2\pi}} = 12.4$ h time between hightides

At what time is the first low tide?

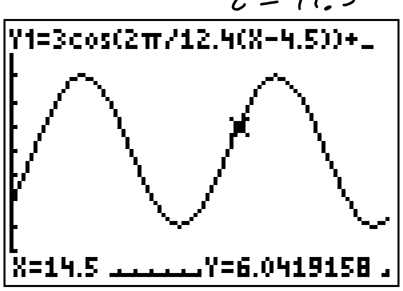
hightide time + $\frac{1}{2}$ period = 4.5 + 6.2 = $\boxed{10.7\text{h} \quad 10{:}42\text{ AM}}$

Graph in calculator for a 24 hour period.



Find the depth at 2:30 PM to the nearest tenth.

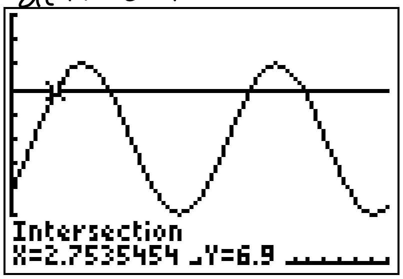
$t = 14.5$



$\boxed{6.0\text{ m}}$

A ship can dock safely if the depth of water is at least 6.9 m. For how many hours in a 24 hour cycle is it safe to dock?

$d(t) = 6.9$



$t = 2.75h$

$t = 6.25h$

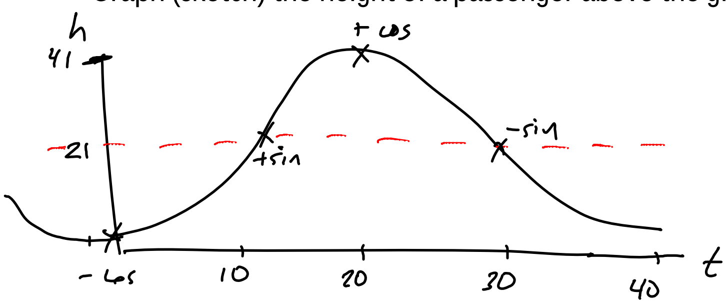
$2(6.25 - 2.75)$

$2(3.5)$

$= \boxed{7 \text{ hrs}}$

Ex. A Ferris wheel has a radius of 20 m. It rotates once every 40 seconds. Passengers get on at the lowest point 1 m above the ground. Determine a function that represents the height (h in meters) of a passenger at time (t in seconds) after it starts to rotate.

Graph (sketch) the height of a passenger above the ground for one rotation:



amp = 20

period = 40

$\therefore b = \frac{2\pi}{40}$

vert. disp. = 21

possible functions:

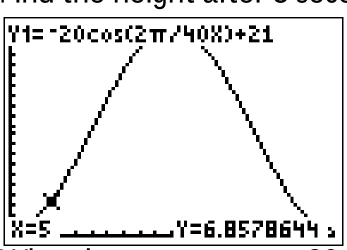
#1 + cosine $h(t) = 20\cos \frac{2\pi}{40}(t - 20) + 21$

#2 – cosine $\boxed{h(t) = -20\cos \frac{2\pi}{40} t + 21}$:) easiest to graph

#3 + sine $h(t) = 20\sin \frac{2\pi}{40}(t - 10) + 21$

#4 – sine $h(t) = -20\sin \frac{2\pi}{40}\underbrace{(t - 30)}_{t+10 ✓} + 21$

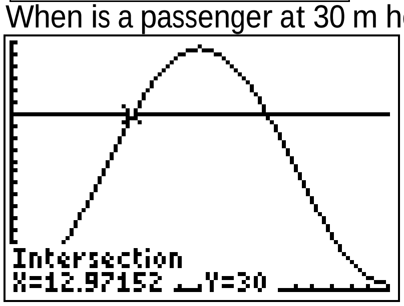
Find the height after 5 seconds? After 22 seconds? (nearest tenth)



$h(5) = 6.9m$

$h(22) = 40.0m$

When is a passenger at 30 m height during one rotation of the wheel?



$t = 13.0s$

& $27.0s$

Practice: pg. 275/# 1, 3 – 6, 8 – 11, 13, 15, 17 – 20