Name: Answers Date: _____

Homework: Solving Trigonometric Equations (Day 2) **Honors PreCalculus**

Textbook (Pages 465-467) – Problems 57, 59, 61, 63, 73, 75, 103a,b

Change window
xmin -2 ymin -20
xmax 14 ymax 50
xscl 2 yscl 10

1. A model for the average daily temperature T (in degrees Fahrenheit) in Kansas City, Missouri, is given by $T = 54 + 25.2sin\left(\frac{2\pi}{12}t + 4.3\right)$ where t is measured in months and $t = 0$ represents January 1.

   a) What months have average daily temperatures higher than 70°F?

   plug in 70 for T * use x instead of t *

   May, August Calc: graph... $0 = 54 + 25.2\sin\left(\frac{2\pi}{12}x + 4.3\right) - 70$

   calc. the zeros... $x = 5.1, 8.47$

   b) Do any months have average daily temperatures below 20°F?

   No Calc: graph... $0 = 54 + 25.2\sin\left(\frac{2\pi}{12}x + 4.3\right) - 20$

   calc. the zeros... it never crosses the x-axis, so none

A 2. **MULTIPLE CHOICE** Find the points of intersection of the graphs of $y = 2 + \sin x$ and $y = 3 - \sin x$ in the interval $0 \le x < 2\pi$.

(A) $\left(\frac{\pi}{6}, \frac{5}{2}\right), \left(\frac{5\pi}{6}, \frac{5}{2}\right)$ (B) $\left(\frac{\pi}{6}, \frac{1}{2}\right), \left(\frac{5\pi}{6}, \frac{1}{2}\right)$ (C) $\left(\frac{\pi}{3}, \frac{5}{2}\right), \left(\frac{4\pi}{3}, \frac{5}{2}\right)$

(D) $\left(\frac{\pi}{3}, \frac{1}{2}\right), \left(\frac{4\pi}{3}, \frac{1}{2}\right)$ (E) $\left(\frac{\pi}{6}, \frac{5}{2}\right), \left(\frac{11\pi}{6}, \frac{5}{2}\right)$

$2 + \sin x = 3 - \sin x$

$-3 \quad -3$

$-1 + \sin x = -\sin x$

$-\sin x \quad -\sin x$

$\frac{-1}{-2} = \frac{-2\sin x}{-2}$

$\frac{1}{2} = \sin x$ $\frac{\pi}{6}$ S|A $\frac{5\pi}{6}$ T|C

$x = \frac{\pi}{6}, \frac{5\pi}{6}$

$y = 2 + \sin\left(\frac{\pi}{6}\right)$

$y = 2 + \frac{1}{2}$

$y = 2.5$ or $\frac{5}{2}$

57) $2\cos^2\theta + \cos\theta = 0$

GCF! $\cos\theta(2\cos\theta + 1) = 0$

$\cos\theta = 0$ $2\cos\theta + 1 = 0$

(0,1) (1,0) (0,-1)

$\theta = \frac{\pi}{2} \pm 2\pi n$

$\frac{3\pi}{2} \pm 2\pi n$

OR

$\frac{\pi}{2} \pm \pi n$

$\cos\theta = -\frac{1}{2}$ $\frac{2\pi}{3}$ S|A $\frac{\pi}{3}$ T|C $\frac{4\pi}{3}$

$\theta = \frac{2\pi}{3} \pm 2\pi n$

$\frac{4\pi}{3} \pm 2\pi n$

59) $2\sin^2\theta - \sin\theta - 1 = 0$

Factor! $a = \sin\theta$

$2a^2 - a - 1 = 0$

$(2a+1)(a-1) = 0$

$(2\sin\theta + 1)(\sin\theta - 1) = 0$

$2\sin\theta + 1 = 0$ $\sin\theta - 1 = 0$

$\sin\theta = -\frac{1}{2}$ $\sin\theta = 1$

$-2 \times 1 = -2$

$-2 + 1 = -1$

$\frac{2a}{-2} = \frac{a}{-1}$ $\frac{2a}{1}$

(0,1) (1,0)

$\frac{7\pi}{6}$ S|A $\frac{\pi}{6}$ T|C $\frac{11\pi}{6}$

$\theta = \frac{7\pi}{6} \pm 2\pi n$ $\theta = \frac{\pi}{2} \pm 2\pi n$

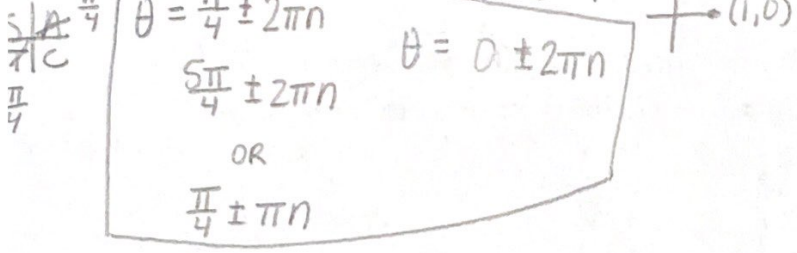
$\frac{11\pi}{6} \pm 2\pi n$

61) $(\tan\theta - 1)(\sec\theta - 1) = 0$

$\tan\theta - 1 = 0$ $\quad$ $\sec\theta - 1 = 0$

$\tan\theta = 1$ $\quad$ $\sec\theta = 1$

$\rightarrow \cos\theta = 1$



$\theta = \frac{\pi}{4} \pm 2\pi n$ $\quad$ $\theta = 0 \pm 2\pi n$

$\frac{5\pi}{4} \pm 2\pi n$

OR

$\frac{\pi}{4} \pm \pi n$

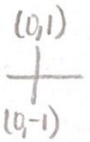
63) $\sin^2\theta - \cos^2\theta = 1 + \cos\theta$

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

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

$0 = 2\cos^2\theta + \cos\theta$

GCF $0 = \cos\theta(2\cos\theta + 1)$



$0 = \cos\theta$ $\quad$ $0 = 2\cos\theta + 1$

$\theta = \frac{\pi}{2} \pm 2\pi n$

$\frac{3\pi}{2} \pm 2\pi n$

OR

$\frac{\pi}{2} \pm \pi n$

$-\frac{1}{2} = \cos\theta$

$\theta = \frac{2\pi}{3} \pm 2\pi n$

$\frac{4\pi}{3} \pm 2\pi n$

73) $2\sin^2\theta - 5\sin\theta + 3 = 0$

let $a = \sin\theta$

$2a^2 - 5a + 3 = 0$ $\quad$ $-2 \times -3 = 6$ $\quad$ $-2 + -3 = -5$

$(2a - 3)(a - 1) = 0$ $\quad$ $\frac{2a}{-2}$ $\quad$ $\frac{2a}{-3}$

$(2\sin\theta - 3)(\sin\theta - 1) = 0$ $\quad$ $\frac{a}{-1}$

$2\sin\theta - 3 = 0$ $\quad$ $\sin\theta - 1 = 0$

$\sin\theta = \frac{3}{2}$ $\quad$ $\sin\theta = 1$

↑ No solution because $\frac{3}{2} > 1$

$\theta = \frac{\pi}{2} \pm 2\pi n$

75) $3(1 - \cos\theta) = \sin^2\theta$

$3 - 3\cos\theta = 1 - \cos^2\theta$

$\cos^2\theta - 3\cos\theta + 2 = 0$

let $a = \cos\theta$

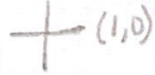
$a^2 - 3a + 2 = 0$ $\quad$ $-2 \times -1 = 2$ $\quad$ $-2 + -1 = -3$

$(a - 2)(a - 1) = 0$ $\quad$ $\frac{a}{-2}$ $\quad$ $\frac{a}{-1}$

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

$\cos\theta - 2 = 0$ $\quad$ $\cos\theta - 1 = 0$

$\cos\theta = 2$ $\quad$ $\cos\theta = 1$



No solution because $2 > 1$

$\theta = 0 \pm 2\pi n$

103) a) plug in 100 for P

$100 = 100 + 20\sin\left(\frac{7\pi}{3}t\right)$ $\quad$ * use x instead of t *

$-100 \quad -100$

$0 = 20\sin\left(\frac{7\pi}{3}t\right)$ $\quad$ ↓

Graph in Calc... $y = 20\sin\left(\frac{7\pi}{3}x\right)$

Change Window

$x_{min}: 0$	$y_{min}: -30$
$x_{max}: 1$	$y_{max}: 30$
$x_{scl}: 0.1$	$y_{scl}: 10$

Calc zeros...

$x = 0.5,\ 0.429s,\ 0.857s$

103b) plug in 120 for P

$120 = 100 + 20\sin\left(\frac{7\pi}{3}t\right)$ $\quad$ * use x instead of t *

$0 = -20 + 20\sin\left(\frac{7\pi}{3}t\right)$ $\quad$ ↓

Graph in calc... $y = -20 + 20\sin\left(\frac{7\pi}{3}x\right)$

leave Window same as part a but change y-min to -50 since the graph has been shifted down

* Calc zeros

$x = 0.214s$