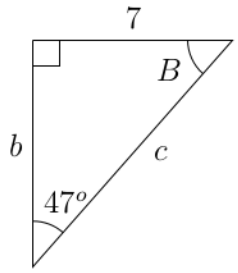
Name:_____ **Score:**____

- Please show all work in the space provided for each problem and **circle your final answer** when appropriate. **No credit may be awarded if no work is shown.**
- Make sure your calculator is in the appropriate **MODE** if you are using it for a problem.
- **No credit will be given for a decimal approximation in a problem which asks for an exact answer.**

	Max	Score
Page 1	10	
Page 2	20	
Page 3	18	
Page 4	32	
Page 5	20	
Total	100	

Problem 1. [2+4+4=10 points] Solve the triangle below by finding B, b and c. Round your answers to two decimal places.



$B =$ 43°

$b =$ 6.53

$c =$ 9.57

$\tan 47° = \frac{7}{b}$

$b = \frac{7}{\tan 47°}$

$\sin 47° = \frac{7}{c}$

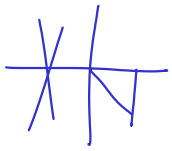
$c = \frac{7}{\sin 47°}$

ck: $6.53^2 + 7^2 = 91.64$

$9.57^2 = 91.58$

Problem 2. [3+3+7+7=20 points] Find the **exact** value (in radians) of the following expressions or indicate if the value does not exist.

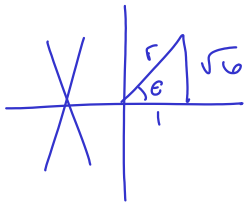
(a) $\tan^{-1}(-1)$



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

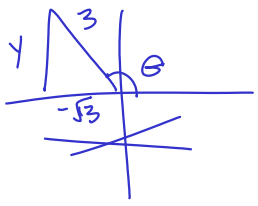
(b) $\sin^{-1}(2)$ DNE

(c) $\sec\left(\tan^{-1}\left(\sqrt{6}\right)\right) =$



$r = \sqrt{7}$ $\sec\theta = \frac{r}{x} = \boxed{\sqrt{7}}$

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

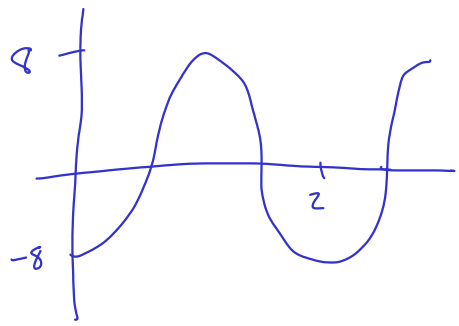


$y = \sqrt{9-3} = \sqrt{6}$

$\sin\theta = \frac{y}{r} = \boxed{\frac{\sqrt{6}}{3}}$

Problem 3. **[8+2=10 points]** An ocean buoy bobs up and down so that it's movement is modeled by simple harmonic motion. The distance from its lowest point to its highest point is 16 inches and it returns to its highest point every 2 seconds.

(a) Write an equation that describes the motion of the buoy so that it is at its **lowest** point at $t = 0$ where t is in seconds.



$per = 2 = \frac{2\pi}{b}$

$b = \pi$

$a = -8$

$y = -8\cos(\pi t)$

(b) What is the **frequency** of the buoy's motion? Include units in your answer.

$freq = \frac{1}{per} = \frac{1}{2}$ cycle per sec.

Problem 4. **[8 points]** Verify the following equation. Be sure that you make one side look **exactly like the other side** and show all work **neatly!**

$$\sec^2(x) - 1 = \cot^2\left(\frac{\pi}{2} - x\right)$$

$= \tan^2 x$

$= \sec^2 x - 1$ ✓

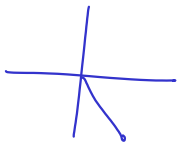
$\frac{\sin^2 x}{\cos^2 x} + \frac{\cos^2 x}{\cos^2 x} = \frac{1}{\cos^2 x}$

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

Problem 5. **[6+6=12 points]** Determine if the following statements are **true** or **false**. If a statement if false, **explain why** it is false and find the **correct solution** if possible.

(a) $\tan^{-1}\left(\tan\left(\frac{7\pi}{4}\right)\right) = \frac{7\pi}{4}$

False, it's $-\frac{\pi}{4}$



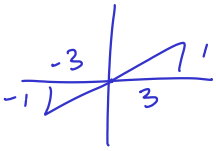
(b) $\sin\left(\sin^{-1}\left(\sqrt{2}\right)\right) = \sqrt{2}$ False, $\sqrt{2} > 1$ not in domain of $\sin^{-1} x$

Problem 6. **[10 points]** Find all solutions (in radians) for $\tan^2 x - 4\tan x = -3$ on the interval $[0, 2\pi)$. Round your answer(s) to 2 decimal places.

$\tan^2 x - 4\tan x + 3 = 0$

$(\tan x - 3)(\tan x - 1) = 0$

$\tan x = 3$ or $\tan x = 1$



$x = 1.25$

$x = \pi + 1.24 = 4.39$

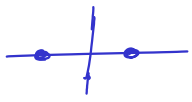
$x = 0.79, 1.25, 3.93, 4.39$

Problem 7. **[10 points]** Find the **general solution** (in radians) for $\sin\left(\frac{\pi}{2} - x\right) = \sec(x)$. **No decimal approximations.**

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

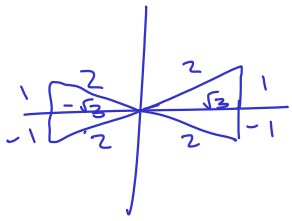
$\cos^2 x = 1$

$\cos x = \pm 1$



$x = \pi n$

Problem 8. [10 points] Find the **general solution** (in radians) for $3\sec^2(4x) - 4 = 0$. **No decimal approximations.**



$$\sec^2(4x) = \frac{4}{3}$$

$$\cos^2(4x) = \frac{3}{4}$$

$$\cos(4x) = \pm\frac{\sqrt{3}}{2}$$

$$4x = \frac{\pi}{6} + \pi n$$

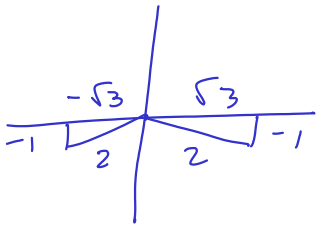
$$4x = \frac{5\pi}{6} + \pi n$$

$$x = \frac{\pi}{24} + \frac{\pi}{4} n$$

$$x = \frac{5\pi}{24} + \frac{\pi}{4} n$$

Problem 9. [10 points] Find all solutions (in radians) for $2\sin(2x) + 1 = 0$ on the interval $[0, 2\pi)$. **No decimal approximations.**

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



$$2x = \frac{7\pi}{6} + 2\pi n \quad , \quad 2x = \frac{11\pi}{6} + 2\pi n$$

$$x = \frac{7\pi}{12} + \pi n \quad , \quad x = \frac{11\pi}{12} + \pi n$$

$$x = \frac{7\pi}{12}, \frac{19\pi}{12}, \frac{11\pi}{12}, \frac{23\pi}{12}$$