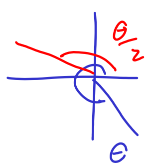
Name:____ **Score:**_____

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

	Max	Score
Page 1	20	
Page 2	24	
Page 3	32	
Page 4	24	
Total	100	

Problem 1. [4+4+4+4+4=20 points] Circle either **True** or **False** for each of the following statements.

(a) If θ is in Quadrant 4, then $\sin\left(\frac{\theta}{2}\right) = \sqrt{\frac{1-\cos\theta}{2}}$ True False



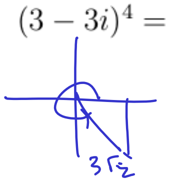
(b) Since $\tan(\pi) = 0$ and $\tan(2x) = \frac{2\tan x}{1-\tan^2 x}$, we know $\frac{2\tan\left(\frac{\pi}{2}\right)}{1-\tan^2\left(\frac{\pi}{2}\right)} = 0$ True False

$\tan\left(\frac{\pi}{2}\right)$ DNE

(c) $3(\cos 190^o + i\sin 190^o)\cdot 4(\cos 200^o + i\sin 200^o) = 12(\cos 30^o + i\sin 30^o)$ True False

$190° + 200° = 390°$ co-terminal w/ $30°$

(d) $(3-3i)^4 = 81 + 81i$ True False

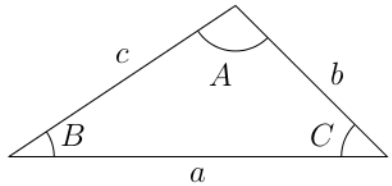


$\left[3\sqrt{2}\left(\cos\frac{7\pi}{4} + i\sin\frac{7\pi}{4}\right)\right]^4$

$= 18^2(-1)$

(e) $z = 115 + \sqrt{3}i$ has 4 fourth roots. True False

Problems 2 and 3 refer to the labels in the triangle below. Answers should be rounded to **two decimal places** and angle measures should be given in degrees. Please note that this triangle is not drawn to scale.



Problem 2. [8+4=12 points]

(a) Given $a = 10$, $b = 5$ and $c = 7$, find A, B and C for **all possible triangles**.

$$\cos A = \frac{25+49-100}{70}$$

$$\boxed{A = 111.80^\circ}$$

$$\frac{\sin B}{5} = \frac{\sin 111.80^\circ}{10}$$

$$\boxed{\begin{array}{l} B = 27.66^\circ \\ C = 40.54^\circ \end{array}}$$

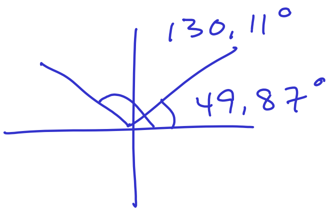
(b) Find the area of the triangle(s) in part (a).

$$\text{Area} = \sqrt{11(6)(4)} = 16.25$$

Problem 3. [12 points] Given $a = 8$, $b = 6$ and $B = 35°$, find A, C and c for **all possible triangles**.

$$\frac{\sin A}{8} = \frac{\sin 35^\circ}{6}$$

$$\sin A = 0.7648$$



$$\boxed{\begin{array}{l|l} A = 49.87^\circ & A = 130.11^\circ \\ C = 95.13^\circ & C = 14.89^\circ \\ c = 10.42 & c = 2.69 \end{array}}$$

$$\frac{c}{\sin 95.13^\circ} = \frac{6}{\sin 35^\circ}$$

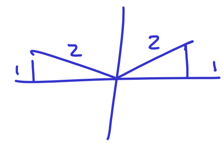
$$\frac{c}{\sin 14.89^\circ} = \frac{6}{\sin 35^\circ}$$

Problem 4. [12 points] Find all solutions (in radians) for $\sin(2\theta) - \cos(\theta) = 0$ on the interval $[0, 2\pi)$. Be sure to give the **exact** solution(s).

$2\sin\theta\cos\theta - \cos\theta = 0$

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

$\cos\theta = 0 \qquad \sin\theta = \frac{1}{2}$



$\boxed{\theta = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{\pi}{6}, \frac{5\pi}{6}}$

Problem 5. [4 points] Find the **exact** value of $\cos(105^o)$.

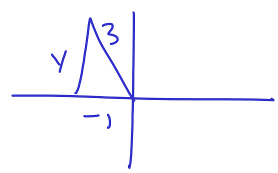
$\cos(45^\circ + 60^\circ)$

$= \cos 45^\circ \cos 60^\circ - \sin 45^\circ \sin 60^\circ$

$= \frac{1}{\sqrt{2}}\frac{1}{2} - \frac{1}{\sqrt{2}}\frac{\sqrt{3}}{2} = \boxed{\frac{1-\sqrt{3}}{2\sqrt{2}}}$

Problem 6. [8+8=16 points] Given $\sec\theta = -3$ and θ is in Quadrant 2, find the **exact** value for the following.

$\cos\theta = -\frac{1}{3}$



$1 + y^2 = 9$

$y = \sqrt{8}$

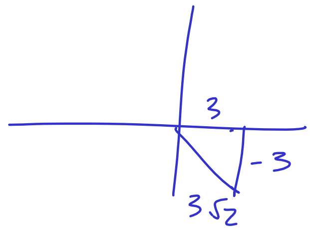
(a) $\cos(2\theta)$

$\cos^2\theta - \sin^2\theta = \frac{1}{9} - \frac{8}{9} = \boxed{-\frac{7}{9}}$

(b) $\cos\left(\frac{\theta}{2}\right)$ $\pm\sqrt{\frac{1}{2}(1+\cos\theta)}$

$\sqrt{\frac{1}{2}(1-\frac{1}{3})} = \boxed{\frac{1}{\sqrt{3}}}$

Problem 7. [4 points] Write $z = 3 - 3i$ in trigonometric form.



$$\boxed{z = 3\sqrt{2}\left(\cos\frac{7\pi}{4} + i\sin\frac{7\pi}{4}\right)}$$

Problem 8. [4+4+4+4+4=20 points] Answer the following for the vectors $\mathbf{v} = \langle 2, -4 \rangle$ and $\mathbf{u} = \langle 1, 5 \rangle$.

(a) $||\mathbf{v}||$ $\sqrt{20}$

(b) $2\mathbf{v} - 3\mathbf{u}$ $\langle 4, -8 \rangle + \langle -3, -15 \rangle = \boxed{\langle 1, -23 \rangle}$

(c) $\mathbf{u} \cdot \mathbf{v}$ $2 - 20 = \boxed{-18}$

(d) The angle between $\mathbf{v}$ and $\mathbf{u}$ $\cos\theta = \dfrac{-18}{\sqrt{20 \cdot 26}}$

$$\boxed{\theta = 142.13^\circ}$$

(e) $\mathrm{proj}_{\mathbf{v}}\mathbf{u}$

$$\frac{-18}{20}\langle 2, -4 \rangle = -\frac{9}{10}\langle 2, -4 \rangle = \boxed{\left\langle -\frac{9}{5}, \frac{18}{5} \right\rangle}$$