

Name: _____

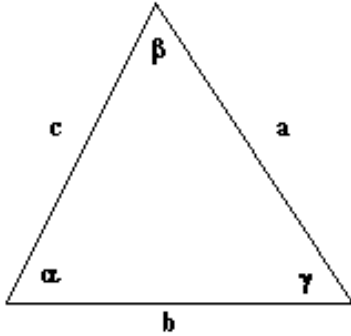
I pledge that I have neither given nor received any unauthorized assistance on this exam.

(signature)

DIRECTIONS

- 1) Print your name and sign the honor pledge above. If the pledge is not signed, your exam will **not** be graded.
- 2) Check now that your test contains all **5 pages** and **8 problems**.
- 3) You may use a calculator (except symbolic manipulators such as a TI-89, TI-92, or similar), but your answers must be given in their **exact** form. (i.e. $\sqrt{3}$ and not 1.73, π and not 3.14)
- 4) All work must be shown on this exam. If you are unsure whether or not you need to show something, ASK ME. **No credit will be given for a correct answer without supporting work that leads to the answer.** When it is indicated that calculators are not to be used, clear non-calculator work must be shown.
- 5) Place **all** of your final answers in the boxes provided. Include units when necessary. Always simplify!!
- 6) Notation and clarity count. Your job is to communicate mathematically; make what you are thinking clear.
- 7) Work quickly but thoroughly through the test. If you get stuck on a problem, move on to the next and return to it later after you've completed the problems you know how to do. **Good Luck.**

POTENTIALLY USEFUL FORMULAS



$$\frac{\sin \alpha}{a} = \frac{\sin \beta}{b} = \frac{\sin \gamma}{c}$$

$$a^2 = b^2 + c^2 - 2bc \cos \alpha$$

$$b^2 = a^2 + c^2 - 2ac \cos \beta$$

$$c^2 = a^2 + b^2 - 2ab \cos \gamma$$

$$\sin(\alpha \pm \beta) = \sin \alpha \cos \beta \pm \cos \alpha \sin \beta$$

$$\cos(\alpha \pm \beta) = \cos \alpha \cos \beta \mp \sin \alpha \sin \beta$$

$$\tan(\alpha \pm \beta) = \frac{\tan \alpha \pm \tan \beta}{1 \mp \tan \alpha \tan \beta}$$

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

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

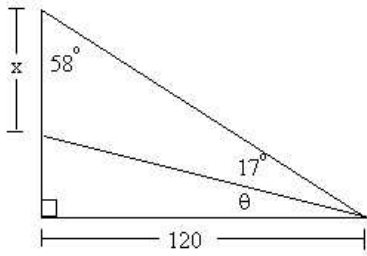
$$\tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$$

$$\sin \frac{\theta}{2} = \pm \sqrt{\frac{1 - \cos \theta}{2}}$$

$$\cos \frac{\theta}{2} = \pm \sqrt{\frac{1 + \cos \theta}{2}}$$

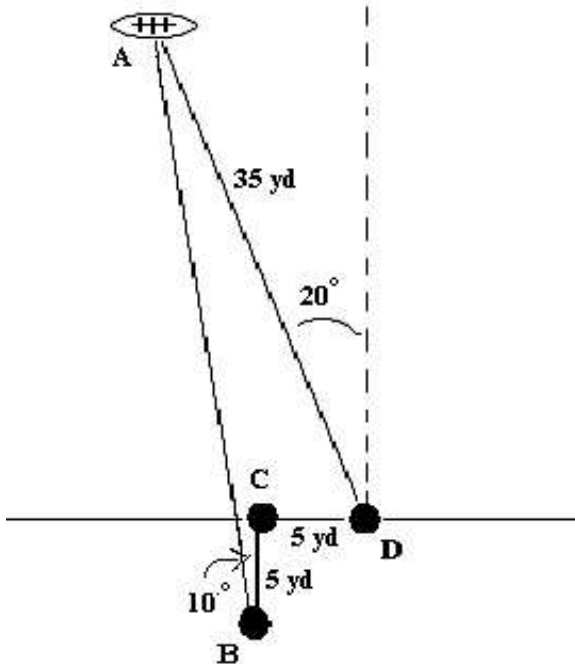
$$\tan \frac{\theta}{2} = \pm \sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}} = \frac{1 - \cos \theta}{\sin \theta} = \frac{\sin \theta}{1 + \cos \theta}$$

(12 points) 1. Find values for x and θ for the figure below, rounding answers to 2 decimal places.



$\theta =$
$x =$

(12 points) 2. As the football is snapped from point C, quarterback Tim Couch drops back 5 yards from the line of scrimmage to prepare to pass from point B. A wide receiver, who has originally lined up 5 yards to Couch's right (at point D) starts running at an angle of 20° to the left. After running for a distance of 35 yards at this angle, he connects with Couch's pass at point A. If the pass was released at an angle of 10° to the left, to the nearest hundredth, how long was the pass? (See Figure).



(12 points) 3. Two cyclists start at the same point and travel along straight paths across flat ground. The angle formed by their paths is 72° . One rides at a constant speed of 25 miles per hour while the other rides at a constant speed of 35 miles per hour. After an hour and a half, how far apart are the cyclists? Give your answer rounded to the nearest hundredth.



4. (4 points) (a) Convert $y^2 = 4x - 3$ to a polar equation.



(6 points) (b) Convert $r + \frac{1}{r} = 2 \sin \theta - 6 \cos \theta$ to a rectangular equation.



(6 points) (c) Graph $r + \frac{1}{r} = 2 \sin \theta - 6 \cos \theta$. [Hint: Complete the square in part (b)]

(3 points each) 5. For each point A and B given in polar coordinates,

(a) plot it

(b) give another pair of polar coordinates (r, θ) so that for A, $r < 0$, $0 \leq \theta < 2\pi$ and for B, $r > 0$, $-2\pi \leq \theta < 0$

(c) write it in rectangular coordinates.

$$A = \left(4, \frac{3\pi}{4}\right)$$

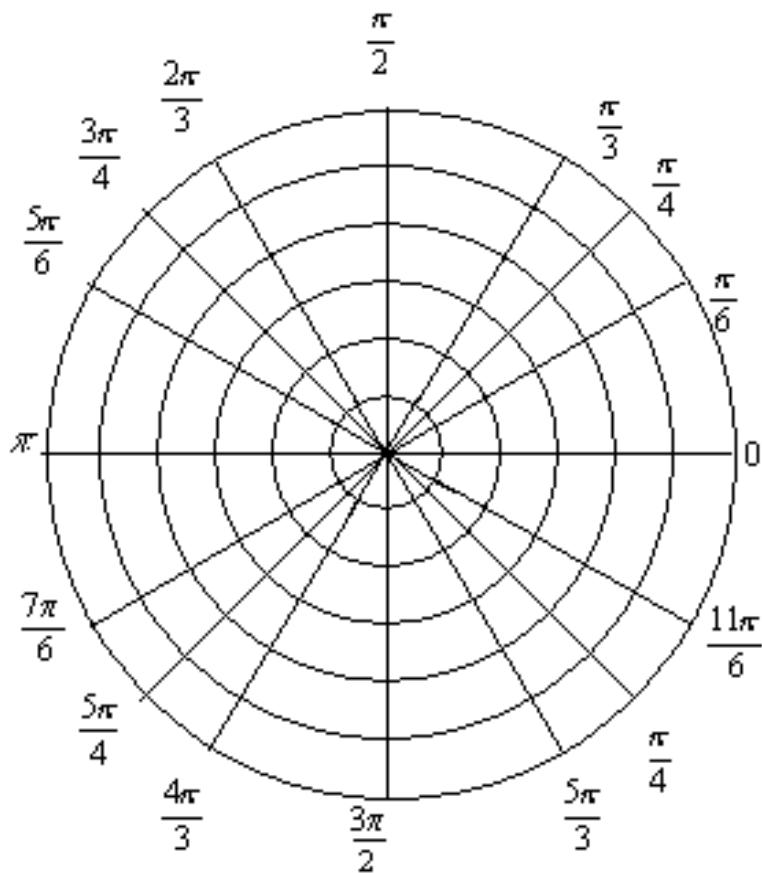
$$B = \left(-2, \frac{7\pi}{6}\right)$$

$A =$
$A =$
$B =$
$B =$

(6 points) 6. If $z = 3(\cos 170^\circ + i \sin 170^\circ)$ and $w = 9(\cos 210^\circ + i \sin 210^\circ)$, find $\frac{z}{w}$ in polar form.

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(12 points) 7. Graph $r = -2 - 2\sin\theta$; give a table of at least 6 values for θ and account for any symmetry you use.



(12 points) 8. Find the complex cube (3rd) roots of -1. Give your answers in polar form.

