

MATH 150  
Fall 2007  
Aurispa  
Exam 3 - Form A

Name, Section Number, and Seat Number: \_\_\_\_\_

Please read and sign below:

**On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work.**

Signature: \_\_\_\_\_

Instructions:

- Part I is Multiple Choice and True/False. Clearly circle the letter of your answer.
- Part II is Work Out. Show ALL your work. Partial credit is possible. A correct answer without any work will NOT receive full credit. Please write clearly and legibly, and write your final answer in the blanks provided.
- Calculators are not allowed for this exam.
- There are problems on both the front and back of the pages. So make sure you answer them all.
- **Academic Dishonesty Will NOT Be Tolerated.**

GOOD LUCK. DO YOUR BEST.

Some formulas you may need:

Half-Angle Formulas

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

Sum-to-Product Formulas

$$\sin x + \sin y = 2 \sin \frac{x+y}{2} \cos \frac{x-y}{2}$$
$$\sin x - \sin y = 2 \cos \frac{x+y}{2} \sin \frac{x-y}{2}$$
$$\cos x + \cos y = 2 \cos \frac{x+y}{2} \cos \frac{x-y}{2}$$
$$\cos x - \cos y = -2 \sin \frac{x+y}{2} \sin \frac{x-y}{2}$$

**Part I: Multiple Choice.** Each problem is worth 5 points. Clearly indicate your answers.

1. Kristina is sitting on the edge of a circular carousel with radius 9 ft. The carousel is rotating at a rate of  $100^\circ$  every 2 seconds. Find Kristina's linear speed in ft/sec.

- (a)  $\frac{5\pi}{2}$
- (b)  $5\pi$
- (c)  $450\pi$
- (d)  $1800\pi$
- (e) None of the above

2. You are given the following parts of a triangle:  $a = 1$ ,  $b = \sqrt{7}$ , and  $c = 2$ . Find  $B$ .

- (a)  $\cos^{-1}(\frac{1}{4})$
- (b)  $120^\circ$
- (c)  $60^\circ$
- (d)  $\cos^{-1}(-\frac{1}{4})$
- (e) None of the above

3. Substitute  $x = 3 \csc \theta$  into the expression:  $x\sqrt{x^2 - 9}$ .  
Simplify by writing in terms of sine and cosine. (Assume  $\theta$  is in Quadrant I.)

- (a)  $\frac{27 \cos^2 \theta}{\sin^3 \theta}$
- (b)  $\frac{9}{\sin^2 \theta} - \frac{9}{\sin \theta}$
- (c)  $\frac{27 \cos \theta}{\sin^2 \theta}$
- (d)  $\frac{9 \cos \theta}{\sin^2 \theta}$
- (e)  $\frac{27}{\sin^2 \theta} - \frac{27}{\sin \theta}$

4. Find  $\cos \theta$  where  $\theta$  is the angle between the vectors  $\mathbf{u} = \langle 1, -1 \rangle$  and  $\mathbf{v} = \langle -1, 7 \rangle$ .

- (a)  $-\frac{4}{5}$
- (b)  $\frac{3}{5}$
- (c)  $-\frac{4}{25}$
- (d)  $\frac{3}{25}$
- (e) None of the above

5. Given that  $\tan \theta = \sqrt{15}$  and that  $180^\circ < \theta < 270^\circ$ , find the value of  $\sin \frac{\theta}{2}$ .

- (a)  $\sqrt{\frac{5}{8}}$
- (b)  $-\sqrt{\frac{5}{8}}$
- (c)  $\sqrt{\frac{3}{8}}$
- (d)  $-\sqrt{\frac{3}{8}}$
- (e) None of the above

6. Evaluate  $\cos(2 \sec^{-1} \frac{5}{2})$ .

- (a)  $\frac{4\sqrt{21}}{25}$
- (b)  $-\frac{17}{25}$
- (c)  $\frac{4}{5}$
- (d) 5
- (e) None of the above

7. You are given the following parts of a triangle:  $A = 100^\circ$ ,  $B = 50^\circ$ , and  $b = 2$ . Find  $c$ .

- (a)  $\frac{1}{\sin 100^\circ}$
- (b)  $\frac{\sqrt{3}}{\sin 50^\circ}$
- (c)  $\frac{1}{\sin 50^\circ}$
- (d)  $\frac{\sqrt{3}}{\sin 100^\circ}$
- (e) Not enough information

8. Consider the vectors  $\mathbf{u} = \langle 1, -2 \rangle$  and  $\mathbf{v} = -3\mathbf{i} + \mathbf{j}$ . Find  $\text{proj}_{\mathbf{v}} \mathbf{u}$ .

- (a)  $\left\langle \frac{3}{20}, -\frac{1}{20} \right\rangle$
- (b)  $\langle -1, 2 \rangle$
- (c)  $\left\langle -\frac{1}{5}, \frac{2}{5} \right\rangle$
- (d)  $\left\langle \frac{3}{2}, -\frac{1}{2} \right\rangle$
- (e) None of the above

9. True/False (2 points each) Circle True or False for each of the following statements.

(a) TRUE FALSE  $\cos^{-1}(\cos(-\frac{\pi}{3})) = -\frac{\pi}{3}$

(b) TRUE FALSE If  $\sin \theta > 0$  and  $\tan \theta < 0$ , then  $\cos \theta < 0$ .

(c) TRUE FALSE The vectors  $\langle 5, -6 \rangle$  and  $\langle -6, -5 \rangle$  are orthogonal.

(d) TRUE FALSE  $\cos(-x) = -\cos(x)$

(e) TRUE FALSE  $\sin^2 x = \frac{1 - \cos 2x}{2}$

(f) TRUE FALSE If  $\sin 22^\circ = \frac{3}{8}$ , then  $\sin 44^\circ = \frac{3}{4}$ .

**Part II: Work Out Problems.**

10. (7 points) Find the exact value of  $\sin 165^\circ$  by using an addition or subtraction formula.

11. (8 points) A force has magnitude 10 and is applied in a direction of  $210^\circ$ . This force moves an object from the point  $(-5, 8)$  to the point  $(-6, 2)$ . Find the work done. (Ignore units).

12. (7 points) A squirrel is sitting on the top of a 20 ft tree. There are two acorns on the ground, one on each side of the tree. The angle of depression from the squirrel to one acorn is  $40^\circ$ . The angle of depression to the acorn on the other side of the tree is  $70^\circ$ . How far apart are the two acorns? (You do not have to evaluate trig values. Ignore the width of the tree.)

Answer: \_\_\_\_\_

13. (a) (7 points) Solve the system of equations: 
$$\begin{cases} x + 3y = -1 \\ x - y^2 = -5 \end{cases}$$

Answer: \_\_\_\_\_

- (b) (2 points) For the system of inequalities 
$$\begin{cases} y \leq x^2 \\ y \leq 2 \end{cases}$$
, would the solution set be bounded or unbounded?

Circle One: BOUNDED UNBOUNDED

14. (a) (9 points) Find all solutions for the equation  $(3 \tan^2 x - 1)(2 \sin x - \sqrt{3}) = 0$ .

(b) (2 points) HOW MANY solutions would the equation  $\sin 7x = \frac{\sqrt{2}}{2}$  have on the interval  $[0, 2\pi)$ ?

Answer: \_\_\_\_\_

15. (6 points) A boat has velocity  $-10\mathbf{i} + 5\mathbf{j}$  relative to the water. The water is flowing due south at 4 mi/hr. What is the true speed of the boat?