### INSTRUCTIONS

1. Print your name and your instructor's name on this page using capital letters. Print your name on each page of the exam. Do not separate the pages of this exam.

2. This exam consists of this cover page and 7 additional pages containing 13 problems. Be sure your exam is complete before beginning work. Do not separate the pages of this exam.

3. Show your work. Work and/or explanation is required on all problems unless otherwise stated; if done well it may result in more credit. Answers accompanied by insufficient, unclear, or incorrect work may receive little or no credit.

4. The points assigned to a problem may not be distributed equally among the parts of the problem.

5. Do not use books, notes, papers or other references. You may use a TI-81 through TI-86 or equivalent calculator. You are not permitted to use calculators capable of symbolic differentiation or integration (such as the TI-89, TI-92, or HP-48), portable computers or any other device capable of storing or receiving information.

6. Do not submit scratch paper. Try to solve each problem in the space provided. If you need more space, use the back of this page or other blank space. Be sure to tell on the original page where your additional work can be found, and begin your additional work with the number of the problem being solved.

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<td><strong>TOTAL</strong></td>
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1. Find the values of the remaining five trigonometric functions of $\theta$ from the information given.

$$\cos \theta = -\frac{2}{7}, \quad \tan \theta < 0$$

2. Find $\sin \frac{x}{2}, \cos \frac{x}{2}, \sin 2x$, and $\cos 2x$ if $\cos x = \frac{2}{3}$ and $270^0 < x < 360^0$.

   a. $\sin \frac{x}{2}$
   b. $\cos \frac{x}{2}$
   c. $\sin 2x$
   d. $\cos 2x$
3. Find all solutions.

\[ 3 \tan^2 \theta = \tan \theta \]

4. Find all solutions.

\[ 2 \cos 3\theta = 1 \]

5. If \( x + y = \frac{\pi}{4} \), then what is \((1 + \tan x)(1 + \tan y)\)?
6. The following expressions are really constants, independent of $x$. Find the constant in each example.

a. $\cos(x) + \cos(\pi - x)$

b. $\frac{\tan x + \cot x}{\sec x \csc x}$

c. $(\sin(x^2 + 1))^2 + (\cos(x^2 + 1))^2$
7. Which of the following curves encloses the most area? Show support for your answer.

\[ 9x^2 + 4y^2 = 36 \]

\[ x^2 + \frac{16}{9}y^2 = 16 \]

8. Compute the exact value of each of the following without a calculator. No decimal answer will be accepted. Show all steps used in your computation.

\[ \sin(85^\circ)\cos(40^\circ) - \cos(85^\circ)\sin(40^\circ) \]
9. Complete parts (a) through (c) for the sinusoid \( f(x) = 2\sin\left(\frac{5}{6}(x - \frac{8\pi}{5})\right) \).

(a) Amplitude = _____  period = _______  phase shift = _______

x-min = _______  x-max = __________

(b) Graph exactly one periods of the sinusoid \( f(x) = 2\sin\left(\frac{5}{6}(x - \frac{8\pi}{5})\right) \). Use exact values to label the x-axis where each zero, each turning point, and the phase shift occur.

(c) Use the function \( f(x) = 2\sin\left(\frac{5}{6}(x - \frac{8\pi}{5})\right) \) to find the exact value of \( f\left(\frac{9\pi}{5}\right) \) by hand.
10. It was a dark and stormy night. A cruise boat began at point A, 120 miles distant from Kingston, Jamaica (point B). After traveling 130 miles and not reaching port, the captain discovers that the ship's course was off by $5^\circ$. How far is the ship from Kingston, Jamaica (meaning what is the distance from C to B)?

![Diagram of triangle ABC with sides labeled A=130, B=5, and C=120]

11. Find the horizontal and vertical components of the vector with the given length and direction, and write the vector in terms of the vectors $i$ and $j$.

$$|v| = 30, \quad \theta = 60^\circ$$
12. Are the following vectors perpendicular or not? Show support for your answer.

\[ \mathbf{v} = 13i + 7j \quad \text{and} \quad \mathbf{u} = -2i + 4j \]

13. Each of the following sets of data refers to the Law of Sines.

Solve the triangles if they exist.

(a) \( A = 47^\circ, a = 55, b = 61 \) \hspace{1cm} \text{Number of solution(s)} \]

(b) \( A = 47^\circ, a = 72, b = 61 \) \hspace{1cm} \text{Number of solution(s)}