

Final Exam

Name (Print) _____

MTH 114, Section # _____

Signature _____

Tuesday, May 2, 2006

PID# _____

DO NOT BEGIN THIS TEST UNTIL YOU ARE TOLD TO DO SO.

This exam consists of 12 multiple choice questions and 11 open-ended questions on 11 pages, including this front page and formula sheet.

Turn in all 11 pages of this exam.

Circle the letter of the correct answer for multiple choice questions #1-12. Write your answers on the line provided for open-ended questions #13-23.

Show your work for open-ended questions #13-23!!! NO WORK = NO CREDIT! You must show work that supports your answer in order to get credit. Be neat and orderly.

For problems asking for EXACT answers, leave in terms of fractions, π and $\sqrt{\text{number}}$. For decimal answers, round to 1 decimal place unless otherwise specified.

Give measurement units (feet, degrees, etc.) when appropriate.

#	Score	Possible	#	Score	Possible
1-12		12x6=72	19		14
13		10	20		16
14		10	21		12
15		14	22		12
16		8	23		12
17		12			
18		8	TOTAL		200

Multiple Choice Questions – Circle the letter of the correct answer.
6 points each.

1. Find the exact value of $\csc\left(-\frac{4\pi}{3}\right)$

- a) -2 b) $-\frac{1}{2}$ c) $-\frac{2\sqrt{3}}{3}$ d) $\frac{2\sqrt{3}}{3}$ e) 2

2. Find the exact value of $\tan^{-1}\left(\tan\frac{7\pi}{4}\right)$.

- a) $\frac{5\pi}{4}$ b) $-\frac{\pi}{4}$ c) $\frac{\pi}{4}$ d) $\frac{3\pi}{4}$ e) $\frac{7\pi}{4}$

3. Two coterminal angles of $\frac{12\pi}{5}$ are:

- a) $\frac{2\pi}{5}, \frac{7\pi}{5}$ b) $\frac{2\pi}{5}, \frac{22\pi}{5}$ c) $\frac{11\pi}{5}, \frac{13\pi}{5}$ d) $\frac{14\pi}{5}, \frac{16\pi}{5}$

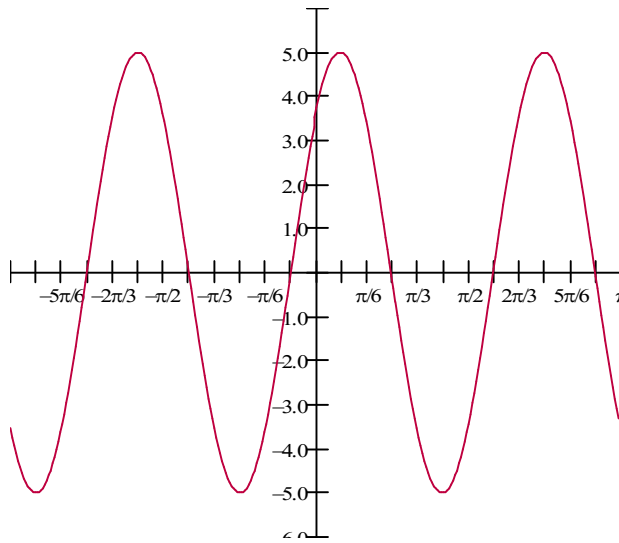
4. The reference angle for $\theta = -92^\circ$ is:

- a) -92° b) 2° c) 88° d) 178° e) 268°

5. The polar form of the rectangular equation $x^2 + y^2 - 7x = 0$ is:

- a) $r = 7\cos\theta$ b) $r = 7\sin\theta$ c) $r = 7r\cos\theta$
 d) $r^2 = 7x$ e) $x^2 + y^2 = 7r\cos\theta$ f) None of these.

6. Match the graph with the correct function:



- a) $5\cos\left(3x - \frac{3\pi}{4}\right)$ b) $-5\sin\left(\frac{2\pi}{3}x - \frac{\pi}{4}\right)$ c) $5\sin\left(\frac{2\pi}{3}x + \frac{\pi}{12}\right)$
 d) $5\cos\left(\frac{2\pi}{3}x - \frac{\pi}{12}\right)$ e) $-5\sin\left(3x - \frac{3\pi}{4}\right)$ f) None of these.

7. The minute hand of a clock is 6 inches long. How far does the minute hand move in 25 minutes ?

- a) $\frac{6}{25}$ inches b) $\frac{5}{12}$ inches c) $\frac{5\pi}{2}$ inches d) 5 inches e) 5π inches

8. The largest angle of a triangle with sides 4, 7 and 9 is approximately:

- a) 50° b) 73.4° c) 90°
d) 106.6° e) 163.4° f) Not enough information.

9. A triangular garden plot has sides 4 meters and 5 meters with the angle between the sides measuring 25° . What is the approximate area of the garden?

- a) 1.3 m^2 b) 4.2 m^2 c) 6 m^2 d) 8.5 m^2 e) 9.1 m^2

10. A polar representation of the rectangular coordinates $(-\sqrt{3}, -1)$ is:

- a) $(2, \frac{\pi}{6})$ b) $(-2, \frac{\pi}{6})$ c) $(-2, \frac{4\pi}{3})$ d) $(-2, \frac{\pi}{3})$ e) None of these.

11. When tuning a piano, a technician strikes a tuning fork for the “A” above “middle C” and sets up a wave motion approximated by $d = 0.001 \sin 880\pi t$, where t is in seconds. The frequency (in cycles per second) of this note is:

- a) .001 b) $\frac{1}{880\pi}$ c) $\frac{1}{440}$ d) 440 e) 880

12. If $\cos x = -\frac{1}{5}$, then $\cos(x - 2\pi)$ is:

- a) $-\frac{2\sqrt{6}}{5}$ b) $-\frac{6}{5}$ c) $-\frac{1}{5}$ d) $\frac{1}{5}$ e) $\frac{2\sqrt{6}}{5}$

Open-ended Questions – Points for each question are labeled.
Show your work, give EXACT answers when requested.

13. (10 points) Determine the period, phase shift, vertical shift, and range for the graph of $y = -2 - 3\sec(4x + \frac{\pi}{3})$.

Period = _____

Phase Shift = _____

Vertical Shift = _____

Range = _____

14. (10 points) Solve the triangle(s).

$$a = 11$$

$$B = 36^\circ$$

$$b = 12$$

14. _____

15. (14 points) Verify the identity. Work on ONE side only:

$$\frac{\sec\left(\frac{\pi}{2} - x\right)}{\csc x + \sin(-x)} - 1 = \tan^2 x$$

16. (8 points) Find the EXACT value of $\csc\left(\tan^{-1}\left(-\frac{5}{4}\right)\right)$.

16. _____

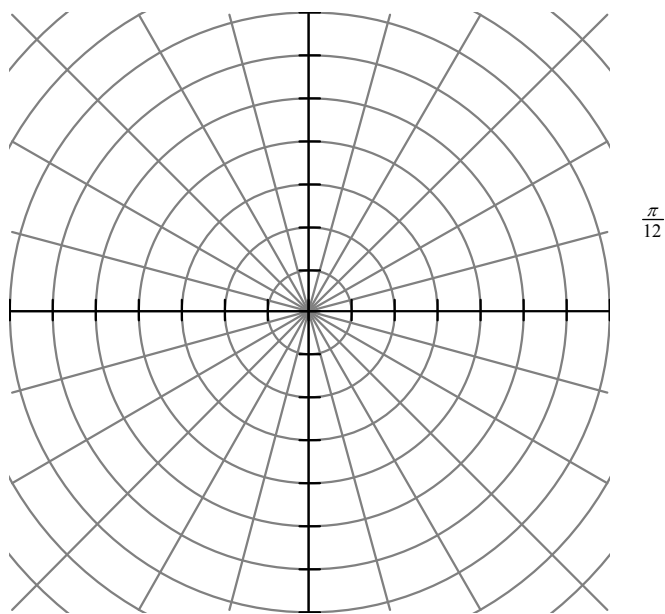
17. (12 points) Plot and label the following polar coordinates. Convert the points from polar to rectangular coordinates (Exact values).

a. $\left(2, \frac{5\pi}{6}\right)$ (,)

b. $\left(-4, \frac{\pi}{2}\right)$ (,)

c. $\left(3, -\frac{\pi}{3}\right)$ (,)

d. $\left(-5, -\frac{7\pi}{4}\right)$ (,)



18. (8 points) Find all EXACT solutions of x in $[0, 2\pi)$:

$$\cos 2x = \frac{1}{2}$$

18. _____

19. (14 points) Find all GENERAL solutions for x :

$\tan^2 x + \sec x = 5$ Give algebraic solutions only, EXACT if possible.
Round all other solutions to 4 decimal places.

19. _____

20. (16 points) Given $\csc u = -\frac{5}{2}$ and $\frac{3\pi}{2} < u < 2\pi$ and $\cot v = 3$ with $\sec v < 0$, find the EXACT value of:

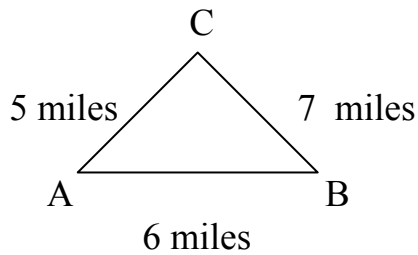
a. $\sin(u - v)$ _____

b. $\cos\left(\frac{u}{2}\right)$ _____

21. (12 points) An observer's eye is 6 feet above the floor. A painting is being viewed. The bottom of the painting is at floor level. The angle of depression from the observer's eye to the bottom of the painting is 12° and the angle of elevation from the observer's eye to the top of the painting is 18° . How tall is the painting? [Draw a fully labeled diagram of the given information as part of your answer.]

21. _____

22. (12 points) If you are on island C, what bearing should you navigate to go to island A?



22. _____

23. (12 points) MaCherie is driving north along a straight road in central Colorado. She looks out the left window of her car and sees Long's Peak at a bearing of $N15^\circ W$. After traveling at 45 miles per hour for 15 minutes, she looks out the window again and sees Long's Peak at a bearing of $N30^\circ W$. How far was MaCherie from Long's Peak at the first sighting? [Draw a fully labeled diagram, showing bearings, as part of your answer.]

23. _____

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FORMULA SHEET

(Sum, Difference, Double and Half Angle Formulas Only)

$$\sin(u \pm v) = \sin u \cos v \pm \cos u \sin v \quad \cos(u \pm v) = \cos u \cos v \mp \sin u \sin v$$

$$\tan(u \pm v) = \frac{\tan u \pm \tan v}{1 \mp \tan u \tan v} \quad \tan 2u = \frac{2 \tan u}{1 - \tan^2 u}$$

$$\sin 2u = 2 \sin u \cos u \quad \cos 2u = \cos^2 u - \sin^2 u = 2 \cos^2 u - 1 = 1 - 2 \sin^2 u$$

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