Math 117
Final Exam - Fall 2011

THIS EXAM IS PROVIDED AS A SAMPLE OF A PREVIOUSLY ADMINISTERED EXAM.

IF YOU ARE USING THIS EXAM AS PART OF A COURSE REVIEW, PLEASE NOTE YOUR
EXAM MAY COVER DIFFERENT MATERIAL AND EMPHASIZE DIFFERENT PROBLEMS.
USE THIS EXAM ONLY AS PART OF YOUR STUDY/REVIEW ROUTINE – MAKE SURE TO
REVIEW YOUR CLASS ACTIVITIES (QUIZZES, TEXTBOOK ASSIGNMENTS, ETC.)!

Instructions: Make sure all electronic devices are turned off and stowed. This
includes cell phones, ipods and/or ipads. No Graphing Calculators! A scientific
calculator is required.

On the Scan Sheet:

1. Write and code: Your name, last name first.
2. Write and code the course (117) and your section number:
3. Put your instructor’s name at INSTRUCTOR.
4. Clearly print the test form (located at the lower right of this page) at TEST
   FORM.
5. Check to be sure you have 9 pages and 25 questions.

When finished, please submit your scan sheet only.

For each multiple choice question, choose the correct response and code it on the scan
sheet. To receive proper credit, make sure erasures are complete on the scan sheet.
Each question is worth 10 points.

TEST FORM: FE-A1
1. Determine the equation of a line through \((-3, 8)\) and perpendicular to the line \(2x - 3y = 4\). Which of the following is the y-intercept of this new line?

   a. \(\frac{7}{2}\)  
   b. \(\frac{25}{2}\)  
   c. \(-\frac{3}{2}\)  
   d. 10  
   e. none of the preceding

2. Determine all the solutions to the system: \(\begin{cases} x^2 + y = 12 \\ y = 2x^2 - 5x \end{cases}\). The largest y-coordinate of the solution is:

   a. \(y = \frac{92}{9}\)  
   b. \(\frac{124}{9}\)  
   c. \(y = \frac{5 - \sqrt{119}}{6}\)  
   d. 3  
   e. none of the preceding

3. Solve the equation: \(4x^2 - 2x = 3\).

   a. \(x = \frac{1 + 2\sqrt{13}}{4}\)  
   b. \(x = \frac{1 - 2\sqrt{13}}{4}\)  
   c. \(x = \frac{3}{2}, x = \frac{-1}{2}\)  
   d. \(x = \frac{1 + \sqrt{13}}{2} \)  
   e. none of the preceding
4. Solve: \[ \frac{x + 3}{x - 4} - \frac{x}{x + 2} = \frac{x - 3}{x^2 - 2x - 8} . \]

   a. \( x = 6 \)    b. \( x = \frac{-9}{8} \)
   c. \( x = 13 \)   d. \( x = 9 \)
   e. None of the preceding

5. Graph \( f(x) = 3^{x^2} - 27 \). Which of the following statements is/are true?

   I. There is a vertical asymptote at \( x = -27 \).
   II. The range is \((-27, \infty)\).
   III. The y-intercept is \((0, -27)\).

   a. I,II    b. II,III
   c. I    d. I,III
   e. II

6. Solve: \( \log_2(x + 3) + \log_2(x - 4) = 3 \). The solution lies in which of the following intervals?

   a. \([0,1]\)    b. \([1,3]\)
   c. \([-5,-2]\)   d. \([3,6]\)
   e. \([-2,0]\)
7. Determine the domain of \( f(x) = \sqrt{9 - x^2} \).
   
   a. \([-3, 3]\)  
   b. \([3, \infty)\)  
   c. \((\infty, 3]\)  
   d. \([-3, \infty)\)  
   e. None of the preceding

8. Solve: \( 3\sin^2(x) - 7\sin(x) + 2 = 0 \) on the interval \((0, 2\pi)\). The largest positive solution lies in which of the following intervals?
   
   a. \([0, 1]\)  
   b. \([1, 2]\)  
   c. \([2, 3]\)  
   d. \([3, 4]\)  
   e. \([5, 6]\)

9. A hot bowl of soup is served at a dinner party. It starts to cool according to Newton’s Law of Cooling, so its temperature at time \( t \) is given by \( T(t) = 65 + 145e^{-0.05t} \) where \( t \) is measured in minutes and \( T \) is measured in °F. Determine, to the nearest minute, when the temperature will be 110°F. The answer is in which of the following intervals?
   
   a. \([10, 15]\)  
   b. \([15, 20]\)  
   c. \([20, 25]\)  
   d. \([25, 30]\)  
   e. \([30, 35]\)
10. Solve: \( x^3 - 3x^2 + 3x - 2 = 0 \). Which of the following are the complex solutions?

\[
\begin{align*}
\text{a. } & \quad \frac{2 + i\sqrt{3}}{2} \\
\text{b. } & \quad 1 + i\sqrt{3} \\
\text{c. } & \quad \frac{1 + i\sqrt{3}}{2} \\
\text{d. } & \quad 3 \pm 2i \\
\text{e. } & \quad \text{None of the preceding}
\end{align*}
\]

11. Graph \( P(x) = 16 - x^4 \). Which of the following statements is true?

- I. It has two turning points.
- II. It has two x-intercepts.
- III. The range is \([16, \infty)\).
- IV. It is symmetric with respect to the y-axis.

\[
\begin{align*}
\text{a. } & \quad \text{I, II} \\
\text{b. } & \quad \text{II, IV} \\
\text{c. } & \quad \text{I, II, IV} \\
\text{d. } & \quad \text{II, III, IV} \\
\text{e. } & \quad \text{I, III, IV}
\end{align*}
\]

12. Factor the following expression completely: \( (x^2 + 3)^{-1/3} - 3x^2 (x^2 + 3)^{-4/3} \). Which of the following is a factor?

\[
\begin{align*}
\text{a. } & \quad -3x^4 - 9x^2 + 1 \\
\text{b. } & \quad -2x^2 + 3 \\
\text{c. } & \quad -3x^2 + 1 \\
\text{d. } & \quad 4x^2 + 3 \\
\text{e. } & \quad x^4 + 3x^2 + 9
\end{align*}
\]
13. A colony of bacteria grows exponentially where an initial population of 130 doubles in 48 hours. Approximately how long will it take the colony to grow to 1510 bacteria?

(Use either \( n(t) = n_0 2^{t/a} \) or \( n(t) = n_0 e^{rt} \))

\[ a. \ 170 \text{ hours} \quad b. \ 120 \text{ hours} \]
\[ c. \ 150 \text{ hours} \quad d. \ 290 \text{ hours} \]
\[ e. \ 190 \text{ hours} \]

14. Let \( f(x) = \frac{ax}{x + b} \) where \( a \) and \( b \) are positive real numbers. Which of the following statements is/are true?

I. The horizontal asymptote is \( y = 1 \)

II. The x-intercept is \((a,0)\).

III. The vertical asymptote is \( x = -b \).

\[ a. \ I,II \quad b. \ II,III \]
\[ c. \ I \quad d. \ III \]
\[ e. \ II \]

15. Let \((-3,2)\) be a point on the graph of \( y = f(x) \). Under the transformation \( y = \frac{1}{2} f(x - 4) + 3 \), the point \((-3,2)\) is transformed into which of the following points?

\[ a. \ (1,4) \quad b. \ (-7,4) \]
\[ c. \ \left(-7,\frac{5}{2}\right) \quad d. \ \left(1,\frac{5}{2}\right) \]
\[ e. \ \left(\frac{1}{2},5\right) \]
16. Determine the exact value of \( \sin(2 \theta) \) if \( \sin \theta = \frac{1}{4} \) and \( \tan \theta < 0 \).

a. \( \frac{\sqrt{15}}{8} \)  

b. \( \frac{\sqrt{15}}{16} \)  

c. \( \frac{7}{8} \)

d. \( -\frac{1}{2} \)

e. \( -\frac{\sqrt{15}}{8} \)

17. Carefully graph \( f(x) = \begin{cases} -2 & \text{if} & 0 \leq x \leq 4 \\ 2 - x & \text{if} & 4 < x \leq 8 \end{cases} \). What is the range of \( f(x) \) ?

a. \([0,8] \)

b. \([-6,-2] \)

c. \([-2,6) \)

d. \([-8,-6] \)

e. None of the preceding

18. A farmer wants to fence off a rectangular field and then divide it (with fencing) into two pens as indicated in the figure below. He will use 40 feet of fencing. Determine the area, \( A(x) \), of the pen in terms of \( x \).

a. \( A(x) = -x^2 + 40x \)  

b. \( A(x) = -x^2 + 20x \)

c. \( A(x) = -\frac{3}{2}x^2 + 20x \)

d. \( A(x) = 20 - \frac{3}{2}x \)

e. None of the preceding
19. A ball is tossed in the air with an initial velocity of 40 feet per second. The height of the ball in feet after \( t \) seconds is given by \( h(t) = 40t - 16t^2 \). Determine the average rate of change from \( t = 2.1 \) to \( t = 1 \) seconds.

a. 12.2  

b. 54.6  

c. -9.6  

d. -10.6  

e. None of the preceding

20. Let \( v(x) = 2x - 1 \) and \( k(x) = \frac{2}{x} - x \). Determine and simplify \( (k \circ v)(x) \).

a. \( \frac{-2x+3}{2x-1} \)  

b. \( \frac{-2x^2 - x + 4}{x} \)  

c. \( \frac{-4x^2 + 4x + 1}{2x-1} \)  

d. \( \frac{-4x^2 - 4x + 3}{2x-1} \)  

e. None of the preceding

21. Which of the following is equivalent to \( \frac{1}{1 + \sin x} + \frac{1}{1 - \sin x} \)?

a. \( \frac{1 - \sin x}{\cos x} \)  

b. \( 2 \sec^2 x \)  

c. \( \frac{2}{1 - \cos x} \)  

d. \( 2 \csc^2 x \)  

e. \( \frac{2}{\cos x} \)

22. Determine \( f^{-1}(2) \) where \( f(x) = \log(2 + 4x) \).

a. 24.5  

b. 1  

c. 2  

d. 0  

e. None of the preceding
23. Let \( f(x) = 14 \sin \left(2x + \frac{\pi}{4}\right)\). Which of the following statements is/are true?

I. The phase shift is \(-\frac{\pi}{4}\).

II. The maximum is 14.

III. The graph will go through the point \(\left(\frac{3\pi}{4}, -\sqrt{2}\right)\).

a. I, II  

b. II, III  

c. I, III  

d. II  

e. I

24. Which of the following statements is/are true? (Assume all logarithmic arguments are positive.)

I. \(\log_b(x + 3) - \log_b(x) = \frac{\log_b(x + 3)}{\log_b(x)}\)

II. \(\log_b(k) = m\) is equivalent to \(b^m = k\).

III. \(\log(3x^2) = 2\log(3x)\)

a. I, II  

b. II, III  

c. II  

d. I, III  

e. None of the statements are true.

25. Let \(\theta = \frac{14\pi}{3}\). Which of the following statements is/are true?

I. The reference angle is \(\frac{\pi}{3}\).

II. The terminal side of the angle is in Quadrant III.

III. A co-terminal angle is \(\frac{2\pi}{3}\)

a. I, II  

b. II, III  

c. I, III  

d. III  

e. All the statements are true.
ANSWERS:

1. A
2. A
3. D
4. B
5. E
6. D
7. A
8. C
9. C
10. C
11. B
12. B
13. A
14. D
15. A
16. E
17. B
18. C
19. C
20. C
21. B
22. A
23. B
24. E
25. C