MATH 117 EXAM 2
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, or ipads. Only a scientific calculator is allowed.

NO GRAPHING CALCULATORS!!

On the scan sheet

1. WRITE and CODE: Your name, last name first.
2. WRITE and CODE course and section number: Course no.: 117 See chart for appropriate section number.
3. Do not fill in the student ID number.
4. Put your instructor’s name at INSTRUCTOR.
5. Put the test form (located at lower right corner) at TEST FORM

After the exam begins:

1. Fill out the information at TOP of page 7.
2. Check to be sure you have 8 pages and 22 problems.

When finished submit the scan sheet and pages 7 and 8.

TEST FORM: 2-A3
1. Let \( f(x) = -2x^2 + 4x - 6 \). Which of the following statements is/are true?

   I. The vertex is at \((1, -4)\).

   II. \( f(x) \) has a minimum.

   III. The graph of \( f \) will intersect the x-axis.

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

2. Let \( g(x) = 3 - f(x + 2) \). Which of the following describes the sequence of transformations (in the correct order) applied to \( f(x) \) to generate the graph of \( g(x) \)?

   a. Reflect about the x-axis, up three units and to the right two units.

   b. Shift to the left two units, reflect about the y-axis and up three units.

   c. Reflect about the y-axis, shift to the left two units and up three units.

   d. Shift to the left two units, reflect about the x-axis and up three units.

   e. Shift to the left two units, reflect about the x-axis and down three units.

3. Determine the zeros of the polynomial: \( P(x) = x^3 - 6x^2 + 10x - 4 \). Which of the following is the exact value of the largest zero?

   a. 2  
   b. 4  
   c. \( 4 + \sqrt{3} \)  
   d. \( 2 + \sqrt{2} \)  
   e. None of the preceding
4. The graph of a polynomial function \( R(x) \) is given below. Which of the following statements is/are true?

\[
\begin{align*}
4. \quad & \text{The equation for } P(x) = R(-x) \text{ must have a positive leading coefficient.} \\
5. \quad & \text{The graph of } Q(x) = R(x + 1) \text{ has an } x\text{-intercept at } x = 3. \\
6. \quad & \text{The range of the graph of } K(x) = -R(x) \text{ is } (-\infty, -2].
\end{align*}
\]

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

5. Let \( f(x) = \frac{1}{x + 3} \). Which of the following is \( f^{-1}(x) \)?

\[\begin{align*}
\text{a. } f^{-1}(x) &= x + 3 \quad & \text{b. } f^{-1}(x) &= \frac{1}{x - 3} \\
\text{c. } f^{-1}(x) &= \frac{1 - 3x}{x} \quad & \text{d. } f^{-1}(x) &= \frac{3 + x}{x} \\
\text{e. } f^{-1}(x) &= \frac{3 - x}{x}
\end{align*}\]
6. Let \( f(x) = 1 + x^2 \) and \( g(x) = \sqrt{x - 4} \). Determine the domain of \((f \circ g)(x)\).

a. \((4, \infty)\)  

b. \((-\infty, 4) \cup (4, \infty)\)

c. \((-\infty, 4]\)  

d. \((-\infty, \infty)\)

e. \([0, \infty)\)

7. When a certain drug is taken orally, the concentration of the drug in the patient’s bloodstream after \(t\) minutes is given by \( C(t) = 0.06t - 0.0002t^2 \) where \(0 \leq t \leq 240\) and the concentration is measured in mg/L. When will the maximum concentration occur?

a. 300 minutes  

b. 150 minutes  

c. 0.17 minutes  

d. 120 minutes  

e. None of the preceding

8. A farmer wants to fence off a rectangular field and then divide it into two pens as indicated in the figure below. The interior fence will cost $3 per foot but the other fencing will cost $5 per foot. The entire pen is to have an area of 2800 square feet. Which of the following functions models the cost, \(C\), in terms of \(x\)?

a. \( C(x) = 3x + \frac{2800}{x} \)  

b. \( C(x) = 30x^2 + \frac{28,000}{x} \)

c. \( C(x) = 3x + 2800x \)  

d. \( C(x) = 13x + \frac{28,000}{x} \)

e. \( C(x) = 130x + \frac{2800}{x} \)
9. Let \( v(x) = 2x^2 - x \) and \( r(x) = x - 5 \). Which of the following is \( (r \circ v)(x) \) ?

a. \( 2x^2 - 11x \) 

b. \( 2x^2 - 21x + 55 \) 

c. \( 2x^3 - 11x^2 + 5x \) 

d. \( 2x^2 - 21x + 50 \) 

e. None of the preceding

10. Let \( f(x) = \sqrt{x + 10} \) and \( g(x) = \frac{x + 6}{x - 4} \). Determine the domain of \( \left( \frac{f}{g} \right)(x) \).

a. \( (-\infty, -10) \cup (-10, -6) \cup (-6, 4) \cup (4, \infty) \) 

b. \( [-10, -6) \cup (-6, \infty) \) 

c. \( [-10, -6) \cup (-6, 4) \cup (4, \infty) \) 

d. \( (-\infty, -6) \cup (-6, 4) \cup (4, \infty) \) 

e. \( (-10, -6) \cup (-6, 4) \cup (4, \infty) \) 

11. The complete graph of \( P(x) \) is given below. Determine the polynomial function of lowest degree that best describes the graph.

a. \( P(x) = x(x - 20)^2(x + 30) \) 

b. \( P(x) = x(x + 20)(x - 30) \) 

c. \( P(x) = x(x + 20)^2(x - 30) \) 

d. \( P(x) = -x(x + 20)^2(x - 30) \) 

e. \( P(x) = x^2(x + 20)(x - 30) \)
12. \( f(x) \) and \( g(x) \) are indicated on the graph below. Determine the value of \( (g \circ f)(2) \)

a. \(-10\)
b. \(1\)
c. \(3\)
d. \(4\)
e. none of the preceding

13. Let \( h(x) = (x^2 - 8)^4 \). If \( h(x) = (f \circ g)(x) \) and \( f(x) = (x - 8)^4 \), what is \( g(x) \)?

a. \(g(x) = x^2\)  
b. \(g(x) = x^2 - 8\)
c. \(g(x) = x\)  
d. \(g(x) = x - 8\)
e. \(g(x) = x^4\)

14. The graph of \( f(x) \) is given at the right.

Which of the following approximates \( f^{-1}(2) \)?

a. \(4\)  
b. \(-0.5\)  
c. \(-4\)  
d. \(1/4\)  
e. \(1\)
Questions 15 – 20. Match the polynomial function on the right with one of the graphs. Each graph is used only once. Each is worth 3 points.

15. \( U(x) = -x^3 + 2x^2 \)

16. \( S(x) = \frac{1}{2}x^6 - 2x^4 \)

17. \( T(x) = x^4 + 2x^3 \)

18. \( P(x) = x(x^2 - 4) \)

19. \( R(x) = -x^2(x^2 - 4) \)

20. \( Q(x) = -x^5 + 5x^3 - 4x \)
21. A baseball team plays in a stadium that holds 5,000 spectators. With the ticket price at $10, the average attendance at recent games has been 3300. A market survey indicates that for every dollar the ticket price is lowered, attendance increases by 660.

a. (8 pts.) Find a function that models the revenue, $R$. (This can be in terms of the ticket price or another clearly defined variable.)

b. (4 pts.) Find the price that maximizes revenue from ticket sales. Indicate your procedure.

22. (10 pts.) Factor each of the following polynomials completely. (Recall this means the factorization can contain irrational numbers and/or complex numbers!)

a. $P(x) = x^2 - 3$

b. $Q(x) = x^2 + 4x + 9$
ANSWERS:

1. A
2. D
3. D
4. A
5. C
6. A
7. B
8. D
9. E
10. C
11. C
12. B
13. A
14. E
15. IV
16. II
17. VI
18. III
19. I
20. V

21. a. \( R(x) = 9900x - 660x^2 \)  
   b. $7.50

22. a. \((x + \sqrt{3})(x - \sqrt{3})\)  
   b. \((x - (-2 + i\sqrt{5}))(x - (-2 - i\sqrt{5}))\)
   or \((x + 2 - i\sqrt{5})(x + 2 + i\sqrt{5})\)