A. Sign your scantron on the back at the bottom in ink.

B. In pencil, write and encode in the spaces indicated:
   1) Name (last name, first initial, middle initial)
   2) UF ID Number
   3) Section Number

C. Under “special codes”, code in the test ID number 1, 1.
   • 2 3 4 5 6 7 8 9 0
   • 2 3 4 5 6 7 8 9 0

D. At the top right of your answer sheet, for “Test Form Code”, encode A.
   • B C D E

E. 1) This test consists of 16 multiple choice questions, ranging from five points to one point in value, plus two sheets (four pages) of free response questions worth 30 points. The test is counted out of 80 points, and there are five bonus points available on the multiple choice.
   MAKE SURE YOUR EXAM IS COMPLETE WITH ALL QUESTIONS.
   2) The time allowed is 90 minutes.
   3) You may write on the test, since you will take it with you after the exam.
   4) Raise your hand if you need more scratch paper or if you have a problem with your test. DO NOT LEAVE YOUR SEAT UNLESS YOU ARE FINISHED WITH THE TEST.

F. KEEP YOUR SCANTRON COVERED AT ALL TIMES.

G. REMEMBER that you have agreed to the UF Honor Pledge: ”On my honor, I have neither given nor received unauthorized aid in doing this exam.”

H. When you are finished:
   1) Before turning in your test, check for transcribing errors. Any mistakes you leave in are there to stay.
   2) You must turn in your scantron and tearoff sheet to the proctor of the exam. Be prepared to show a picture ID with a legible signature.
   3) Answers will be posted on the MAC 2233 homepage after the exam. Your score will be posted in Sakai (E-Learning) within one week of the exam.
NOTE: Be sure to bubble the answers to questions 1–16 on your scantron.

Questions 1 - 8 are worth 5 points each.

1. Find the value of $k$ so that the line through the vertex of $y = 2x^2 - 4x + 3$ and the point $(3, -5)$ is parallel to the line $2y - kx + 2 = 0$.

   a. $k = -3$  
   b. $k = -6$  
   c. $k = 7$  
   d. $k = 4$  
   e. $k = \frac{2}{3}$

2. The supply and demand functions for a certain product are given by $p = S(q) = 120 + \frac{1}{2}q^2$ and $p = D(q) = 144 - q^2$, where $p$ is the price of the product and $q$ is the quantity measured in thousands. Find the equilibrium quantity and price.

   a. 4000 units; $128$  
   b. 2000 units; $122$  
   c. 8000 units; $152$
   d. 4000 units; $96$  
   e. 2000 units; $140$

3. A financial consulting firm has developed a seminar on best billing practices. Market research has indicated that 50 managers from a certain region can be expected to attend if the price of the seminar is $30. When the price is decreased by $2 per person, an average of 10 additional managers will attend. Find the linear demand function $p(x)$ which gives the price per seminar $p$ as a function of the number of managers who will attend, $x$:

   a. $p = \frac{1}{2}x + 55$  
   b. $p = -5x + 200$  
   c. $p = \frac{1}{5}x + 40$
   d. $p = -5x + 110$  
   e. $p = \frac{1}{5}x + 56$
4. Find the solution set of the inequality \( \frac{3x}{x-1} \leq 2 \). Use a number line to solve.

   a. \((-\infty,-2] \cup (1,\infty)\)  
   b. \((-1,2]\)  
   c. \((-\infty,-1) \cup [2,\infty)\)  
   d. \([-2,1)\) only  
   e. \((1,2]\) only

5. The demand and cost functions for a certain product are \( p(x) = 50 - 0.5x \) and \( C(x) = 500 + 10x - 2.5x^2 \). If the profit from the sale of the product was $100 on a given day, how many were sold that day? What price was charged for the product?

   a. 30 were sold at a price of $35 each  
   b. 15 were sold at a price of $42.50 each  
   c. 10 were sold at a price of $45 each  
   d. 30 were sold at a price of $20 each  
   e. 10 were sold at a price of $30 each

6. Find the inverse of one-to-one function \( f(x) = 2e^{x-3} + 1 \).

   a. \( f^{-1}(x) = 2 \ln(x + 3) - 1 \)  
   b. \( f^{-1}(x) = \frac{1}{2}e^{3-x} + 1 \)  
   c. \( f^{-1}(x) = \ln \left( \frac{x-3}{2} \right) + 1 \)  
   d. \( f^{-1}(x) = e^{x+3} - 2 \)  
   e. \( f^{-1}(x) = \ln \left( \frac{x-1}{2} \right) + 3 \)
7. If \( f(x) = \sqrt{x} \), then which of the following best represents the graph below?

\[
\begin{array}{c}
\text{3} \\
\text{2} \\
\text{1} \\
\text{0} \\
\text{-1} \\
\text{-2} \\
\text{-3} \\
\end{array}
\]

\[-4\quad-3\quad-2\quad-1\quad\text{1}\quad\text{2}\quad\text{3}\quad\text{4}\]

a. \( y = 2 - f(x - 4) \)  
   b. \( y = 4 - f(x + 2) \)  
   c. \( y = 2 + f(4 - x) \)  
   d. \( y = 2 - f(x + 4) \)  
   e. \( y = 4 - f(2 - x) \)

8. A sunscreen with an SPF rating of 25 loses its protection factor exponentially with exposure to sunlight. If after 2 hours the SPF rating has dropped to 15, when should the sunscreen be reapplied if dermatologists recommend maintaining an SPF rating of at least 10? Use the formula \( Q(t) = Q_0e^{kt} \) where \( Q(t) \) is the SPF rating \( t \) hours after application of the sunscreen.

The sunscreen should be reapplied after _______ hours.

a. \( 2 \ln 0.2 \)  
   b. \( \frac{2 \ln 0.4}{\ln 0.6} \)  
   c. \( \frac{1}{2} \ln \left( \frac{2}{3} \right) \)  
   d. \( \frac{\ln 0.6}{2 \ln 0.4} \)  
   e. \( \frac{\ln 0.4}{2 \ln 0.6} \)

Be sure to work the problems on the following pages.
Problems 9 and 10 are worth three points each.

9. An inventor plans to sell his latest gadget for $30. His fixed costs are $600, and he has determined that he will break even even if he can sell 40 items. Assuming the cost function \( C(x) \) is linear, where \( x \) is the number sold, find the marginal cost of his product.

   a. $12   b. $20   c. $15   d. $25   e. $16

10. Let \( f(x) = \frac{3}{\sqrt{x - 1}} \) and \( g(x) = x^2 \). Find \((g \circ f)(x)\) and its domain.

   a. \((g \circ f)(x) = \frac{9}{x - 1}\) domain: \((-\infty, 1) \cup (1, \infty)\)

   b. \((g \circ f)(x) = \frac{3}{\sqrt{x^2 - 1}}\) domain: \((-\infty, -1) \cup (1, \infty)\)

   c. \((g \circ f)(x) = \frac{3x^2}{\sqrt{x - 1}}\) domain: \((1, \infty)\)

   d. \((g \circ f)(x) = \frac{3}{\sqrt{x^2 - 1}}\) domain: \((-1, 1) \cup (1, \infty)\)

   e. \((g \circ f)(x) = \frac{9}{x - 1}\) domain: \((1, \infty)\)

Problems 11 and 12 are worth two points each.

11. The parents of a ten year old child invest an $8,000 inheritance in a college fund for which the annual interest rate is 2.8% compounded quarterly. If they add no more money to the fund, how much will be in the account (in dollars) when the child is ready to start college 8 years later?

   a. 8,000\((1.028)^{32}\)   b. 8,000\((1.007)^8\)   c. 8,000\((1.028)^8\)   d. 8,000\((1.007)^{32}\)
12. Find each vertical asymptote of the graph of \( f(x) = \frac{x^2 - 1}{x^2 - 3x + 2} \).

a. \( x = 2 \) only  
   b. \( x = 1 \) only  
   c. \( x = 1 \) and \( x = 2 \)  
   d. There are no vertical asymptotes.

**Bonus!**

13. (2 points) Evaluate \( \lim_{x \to -2} \frac{x^2 + 2x}{x + 2} \). Hint: graph the function.

a. 0  
   b. -2  
   c. -4  
   d. The limit does not exist.

14. (1 point) In one village, the number of people infected with the ebola virus is doubling every 20 days. This growth can best be modeled by which type of function?

a. linear  
   b. quadratic  
   c. exponential  
   d. none of these

15. (1 point) The function \( f(x) = \frac{x}{x^2 + 2} \) is __________.

a. even  
   b. odd  
   c. neither

16. (1 point) Find the domain of the inverse of \( f(x) = \sqrt{x + 3} \).

a. \([0, \infty)\)  
   b. \((-\infty, \infty)\)  
   c. \([-3, \infty)\)  
   d. The function has no inverse.
1. Let \( f(x) = x - \frac{4}{x} \) and let \( g(x) = \sqrt{x^2 + 3x} \).

(a) Find the domain of \( g(x) \). Set up a number line and write your answer in interval notation.

(b) Find \( (f \circ g)(x) \). Write as a single fraction. Do not rationalize the denominator.

(c) Find each \( x \)-intercept of the graph of \( (f \circ g)(x) \).
2. Let \( f(x) = |2x| - 3 + x \).

(a) Rewrite as a piecewise function without using absolute value.

\[
f(x) = \begin{cases} \\
\end{cases}
\]

(b) Sketch the graph of \( y = f(x) \). Label each intercept.

3. Solve each equation for \( x \):

(a) \( 6x(x - 1)^{2/3} - 4(x - 1)^{-1/3}x^2 = 0 \)

\[ x = \underline{\phantom{0000}} \]
(b) $\ln(x^2 - 3) + \ln 3 = \ln(6x)$

$x =$

4. (a) A farmer plans to enclose a rectangular field. One side of the field will be bordered by a straight river and requires no fencing. The opposite side faces a road and will require decorative fencing that costs $6 per linear foot, while the fencing for the two sides perpendicular to the river costs $2 per linear foot. If his budget for fencing is $480, write the area function $A(x)$ which expresses the area of the field in terms of $x$, the length of a side perpendicular to the river.

$A(x) =$

(b) Find the length $x$ (in feet) that will maximize the area the farmer can enclose. What is the maximum area?

$x =$; maximum area (include units):
5. Let \( f(x) = \begin{cases} 
  x + 2 & x < -1 \\
  x^2 - 1 & -1 \leq x < 1 \\
  \ln x & x > 1
\end{cases} \)

(a) Sketch the graph of \( y = f(x) \).

(b) Evaluate each limit if it exists. If not, write "DNE".

1) \( \lim_{x \to -1^-} f(x) = \)\_

2) \( \lim_{x \to -1^+} f(x) = \)\_

3) \( \lim_{x \to 1^-} f(x) = \)\_

4) \( \lim_{x \to 1} f(x) = \)\_

6. Find and simplify the expression \( \frac{f(a + h) - f(a)}{h} \) for \( f(x) = 2x^2 + x - 2 \).
Assume that \( h \neq 0 \).
MAC 2233  
Fall 2014  

Exam 1B

A.  Sign your scantron on the back at the bottom in ink.

B.  In pencil, write and encode in the spaces indicated:
   1) Name (last name, first initial, middle initial)
   2) UF ID Number
   3) Section Number

C.  Under “special codes”, code in the test ID number 1, 2.
   • 2 3 4 5 6 7 8 9 0
   1 • 3 4 5 6 7 8 9 0

D.  At the top right of your answer sheet, for “Test Form Code”, encode B.
   A • C D E

E.  1) This test consists of 16 multiple choice questions, ranging from five points to one
   point in value, plus two sheets (four pages) of free response questions worth 30
   points. The test is counted out of 80 points, and there are five bonus points available
   on the multiple choice.
   **MAKE SURE YOUR EXAM IS COMPLETE WITH ALL QUESTIONS.**
   2) The time allowed is 90 minutes.
   3) You may write on the test, since you will take it with you after the exam.
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   test. DO NOT LEAVE YOUR SEAT UNLESS YOU ARE FINISHED WITH THE
   TEST.

F.  KEEP YOUR SCANTRON COVERED AT ALL TIMES.

G.  **REMEMBER** that you have agreed to the UF Honor Pledge: ”On my honor, I have
    neither given nor received unauthorized aid in doing this exam.”

H.  When you are finished:
   1) Before turning in your test, **check for transcribing errors. Any mistakes you
      leave in are there to stay.**
   2) You must turn in your scantron and tearoff sheet to the proctor of the exam. Be
      prepared to show a picture ID with a legible signature.
   3) Answers will be posted on the MAC 2233 homepage after the exam. Your score will
      be posted in Sakai (E-Leārning) within one week of the exam.
NOTE: Be sure to bubble the answers to questions 1–16 on your scantron.

Questions 1 - 8 are worth 5 points each.

1. The supply and demand functions for a certain product are given by
   \[ p = S(q) = 132 + \frac{1}{2}q^2 \] and \[ p = D(q) = 156 - q^2, \]
   where \( p \) is the price of the product and \( q \) is the quantity measured in thousands. Find the equilibrium quantity and price.
   
   a. 2000 units; $152  
   b. 4000 units; $98  
   c. 2000 units; $134  
   d. 8000 units; $164  
   e. 4000 units; $140

2. Find the value of \( k \) so that the line through the vertex of \( y = 2x^2 - 4x + 5 \) and the point \((3, -5)\) is parallel to the line \( 2y - kx + 2 = 0 \).
   
   a. \( k = 4 \)  
   b. \( k = -16 \)  
   c. \( k = -8 \)  
   d. \( k = \frac{2}{5} \)  
   e. \( k = -4 \)

3. The demand and cost functions for a certain product are \( p(x) = 50 - 0.5x \) and \( C(x) = 500 + 10x - 2.5x^2 \). If the profit from the sale of the product was $100 on a given day, how many were sold that day? What price was charged for the product?
   
   a. 30 were sold at a price of $20 each
   b. 10 were sold at a price of $45 each
   c. 30 were sold at a price of $35 each
   d. 15 were sold at a price of $42.50 each
   e. 10 were sold at a price of $30 each

2B
4. A financial consulting firm has developed a seminar on best billing practices. Market research has indicated that 50 managers from a certain region can be expected to attend if the price of the seminar is $30. When the price is decreased by $2 per person, an average of 10 additional managers will attend. Find the linear demand function $p(x)$ which gives the price per seminar $p$ as a function of the number of managers who will attend, $x$.

a. $p = \frac{1}{5}x + 40$  
 b. $p = -5x + 110$  
 c. $p = -\frac{1}{5}x + 56$

d. $p = -\frac{1}{2}x + 55$  
 e. $p = -5x + 200$

5. Find the solution set of the inequality $\frac{4x}{x - 2} \leq 3$. Use a number line to solve.

a. $(2, 6]$ only  
 b. $(-\infty, -6) \cup (2, \infty)$  
 c. $(-2, 6]$

d. $[-6, 2)$ only  
 e. $(-\infty, 2) \cup [6, \infty)$

6. A sunscreen with an SPF rating of 25 loses its protection factor exponentially with exposure to sunlight. If after 2 hours the SPF rating has dropped to 15, when should the sunscreen be reapplied if dermatologists recommend maintaining an SPF rating of at least 10? Use the formula $Q(t) = Q_0 e^{kt}$ where $Q(t)$ is the SPF rating $t$ hours after application of the sunscreen.

The sunscreen should be reapplied after ________ hours.

a. $\frac{2 \ln 0.4}{\ln 0.6}$  
 b. $\frac{1}{2} \ln \left(\frac{2}{3}\right)$  
 c. $\frac{\ln 0.4}{2 \ln 0.6}$  
 d. $2 \ln 0.2$  
 e. $\frac{\ln 0.6}{2 \ln 0.4}$
7. Find the inverse of one-to-one function \( f(x) = 4e^{x-3} + 1 \).

a. \( f^{-1}(x) = \ln \left( \frac{x - 3}{4} \right) + 1 \)

b. \( f^{-1}(x) = 4 \ln(x + 3) - 1 \)

c. \( f^{-1}(x) = \ln \left( \frac{x - 1}{4} \right) + 3 \)

d. \( f^{-1}(x) = \frac{1}{4} e^{3-x} + 1 \)

e. \( f^{-1}(x) = e^{x+3} - 4 \)

8. If \( f(x) = \sqrt{x} \), then which of the following best represents the graph below?

![Graph](image)

a. \( y = 3 - f(x - 2) \)  b. \( y = 3 + f(2 - x) \)  c. \( y = 2 - f(x + 3) \)

d. \( y = 2 - f(3 - x) \)  e. \( y = 3 - f(x + 2) \)

Be sure to work the problems on the following pages.
Problems 9 and 10 are worth three points each.

9. Let \( f(x) = \frac{5}{\sqrt{x^2 - 4}} \) and \( g(x) = x^2 \). Find \( (g \circ f)(x) \) and its domain.

   a. \( (g \circ f)(x) = \frac{5}{\sqrt{x^2 - 4}} \) domain: \((-2, 2) \cup (2, \infty)\)
   
   b. \( (g \circ f)(x) = \frac{25}{x - 4} \) domain: \((-\infty, 4) \cup (4, \infty)\)
   
   c. \( (g \circ f)(x) = \frac{5x^2}{\sqrt{x - 4}} \) domain: \((4, \infty)\)
   
   d. \( (g \circ f)(x) = \frac{25}{x - 4} \) domain: \((4, \infty)\)
   
   e. \( (g \circ f)(x) = \frac{5}{\sqrt{x^2 - 4}} \) domain: \((-\infty, -2) \cup (2, \infty)\)

10. An inventor plans to sell his latest gadget for $20. His fixed costs are $400, and he has determined that he will break even if he can sell 50 items. Assuming the cost function \( C(x) \) is linear, where \( x \) is the number sold, find the marginal cost of his product.

   a. $10  
   b. $16  
   c. $12  
   d. $9  
   e. $15

Problems 11 and 12 are worth two points each.

11. Find each vertical asymptote of the graph of \( f(x) = \frac{x^2 - 1}{x^2 - 4x + 3} \).

   a. \( x = 1 \) and \( x = 3 \)  
   b. \( x = 3 \) only  
   c. \( x = 1 \) only  
   d. There are no vertical asymptotes.
12. The parents of an eight year old child invest an $8,000 inheritance in a college fund for which the annual interest rate is 3.6% compounded quarterly. If they add no more money to the fund, how much will be in the account (in dollars) when the child is ready to start college 10 years later?

a. \(8,000(1.009)^{10}\)   b. \(8,000(1.036)^{40}\)   c. \(8,000(1.036)^{10}\)   d. \(8,000(1.009)^{40}\)

**Bonus!**

13. (2 points) Evaluate \(\lim_{x \to -3} \frac{x^2 + 3x}{x + 3}\). Hint: graph the function.

a. \(-3\)   b. \(-6\)   c. 0   d. The limit does not exist.

14. (1 point) Find the domain of the inverse of \(f(x) = \sqrt{1 - x}\).

a. The function has no inverse.

b. \((-\infty, 1]\)   c. \((-\infty, \infty)\)   d. \([0, \infty)\)

15. (1 point) The function \(f(x) = \frac{x}{x^2 - 1}\) is _______.

a. odd   b. even   c. neither

16. (1 point) In one village, the number of people infected with the ebola virus is doubling every 20 days. This growth can best be modeled by which type of function?

a. quadratic   b. exponential   c. linear   d. none of these
1. Let \( f(x) = x - \frac{8}{x} \) and let \( g(x) = \sqrt{x^2 - 2x} \).

(a) Find the domain of \( g(x) \). Set up a number line and write your answer in interval notation.

(b) Find \( (f \circ g)(x) \). Write as a single fraction. Do not rationalize the denominator.

(c) Find each \( x \)-intercept of the graph of \( (f \circ g)(x) \).

\[ x = \underline{\hspace{2cm}} \]
2. Let \( f(x) = |3x| - x - 4 \).

(a) Rewrite as a piecewise function without using absolute value.

\[
\begin{align*}
f(x) = \begin{cases} 
& 
\end{cases}
\end{align*}
\]

(b) Sketch the graph of \( y = f(x) \). Label each intercept.

3. Solve each equation for \( x \):

(a) \( \ln(x^2 - 12) + \ln 2 = \ln(8x) \)

\[
x = 
\]
(b) \(4x(x + 2)^{2/3} - 6(x + 2)^{-1/3}x^2 = 0\)

\[ x = \text{_______________} \]

4. (a) A farmer plans to enclose a rectangular field. One side of the field will be bordered by a straight river and requires no fencing. The opposite side faces a road and will require decorative fencing that costs $6 per linear foot, while the fencing for the two sides perpendicular to the river costs $4 per linear foot. If his budget for fencing is $480, write the area function \(A(x)\) which expresses the area of the field in terms of \(x\), the length of a side perpendicular to the river.

\[ A(x) = \text{_______________} \]

(b) Find the length \(x\) (in feet) that will maximize the area the farmer can enclose. What is the maximum area?

\[ x = \text{_______________}; \text{ maximum area (include units): } \text{_______________} \]
5. Find and simplify the expression \( \frac{f(a + h) - f(a)}{h} \) for \( f(x) = 3x^2 + 2x - 1 \). Assume that \( h \neq 0 \).

6. Let \( f(x) = \begin{cases} 
2x + 8 & x < -2 \\
x^2 & -2 < x \leq 1 \\
\ln x & x > 1 
\end{cases} \)

(a) Sketch the graph of \( y = f(x) \).

(b) Evaluate each limit if it exists. If not, write "DNE".

1) \( \lim_{x \to -2} f(x) = \) ________ 2) \( \lim_{x \to 1^+} f(x) = \) ________

3) \( \lim_{x \to 1^-} f(x) = \) ________ 4) \( \lim_{x \to 1} f(x) = \) ________