MA 110 Algebra and Trigonometry for
Calculus   Fall 2016
Exam 1   Tuesday, 20 September 2016

Name: _Answers_

Section: _____

Last 4 digits of student ID #: _____

This exam has ten multiple choice questions
(five points each) and five free response ques-
tions (ten points each). Additional blank sheets
are available if necessary for scratch work. No
books or notes may be used. Turn off your
cell phones and do not wear ear-plugs during
the exam. You may use a calculator, but not
one which has symbolic manipulation capa-
bilities.

On the multiple choice problems:

1. You must give your *final answers* in the
   multiple choice answer box on the front
   page of your exam. See the "EXAMPLE"
   row for a correct shading example.

2. Carefully check your answers. No credit
   will be given for answers other than those
   indicated on the *multiple choice answer
   box*.

On the free response problems:

1. Clearly indicate your answer and the rea-
   soning used to arrive at that answer *(un-
   supported answers may not receive credit)*.

2. Give exact answers, rather than decimal
   approximations to the answer (unless oth-
   erwise stated).

Each free response question is followed by
space to write your answer. Please write your
solutions neatly in the space below the ques-
tion. You are not expected to write your so-
lution next to the statement of the question.

Multiple Choice Answers

EXAMPLE	A	B	C	D	E
Question					
1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E
9	A	B	C	D	E
10	A	B	C	D	E

Exam Scores

Question	Score	Total
MC		50
11		10
12		10
13		10
14		10
15		10
Total		100

Record the correct answer to the following problems on the front page of this exam.

1. Write an inequality that is satisfied by those numbers x whose distance from -2 is greater than 7.

   (A) $|x + 2| < 7$

   (B) $|x + 2| > 7$

   (C) $|x - 2| < 7$

   (D) $|x - 2| > 7$

   (E) $|x + 2| \leq 7$

2. Solve the equation for c.
$$2A = \frac{b + 2c}{h}.$$

   (A) $c = \dfrac{A - b}{2h}$

   (B) $c = \dfrac{2A - b}{h}$

   (C) $c = \dfrac{Ah - b}{2}$

   (D) $c = \dfrac{2Ah - b}{2}$

   (E) $c = \dfrac{2Ah - bh}{2}$

3. Find the center and radius of the circle $x^2 + 6x + y^2 + 8y = 0$.

   (A) center: $(-3, -4)$, radius: 5

   (B) center: $(3, 4)$, radius: 5

   (C) center: $(3, 4)$, radius: 25

   (D) center: $(-3, -4)$, radius: 25

   (E) center: $(-3, 4)$, radius: 25

4. Find the slope and the y-intercept for the line given by the equation

$$2x + 3y = 9.$$

(A) slope of $-2/3$ and y-intercept of 3

(B) slope of $2/3$ and y-intercept of 3

(C) slope of $2/3$ and y-intercept of -3

(D) slope of $-3/2$ and y-intercept of 3

(E) slope of $3/2$ and y-intercept of -3

$3y = 9 - 2x$

$y = 3 - \frac{2}{3}x$

5. How many real solutions are there for the equation

$$x^3 + 200x^2 + 111 = 200x^2 - 2000?$$

(A) 0

(B) 1

(C) 2

(D) 3

(E) 4

$x^3 = -2000 + 111$

$= -1889.$

Looking at the graph there is only one solution.

6. The area of a rectangle whose sides are ℓ and w is $A = \ell \cdot w$. If we know that the sum of ℓ and w is 15, find a function that gives the area in terms of w.

   (A) $A(w) = 15w$

   (B) $A(w) = 15w + w^2$

   (C) $A(w) = 15 - w$

   (D) $A(w) = 15w - w^2$

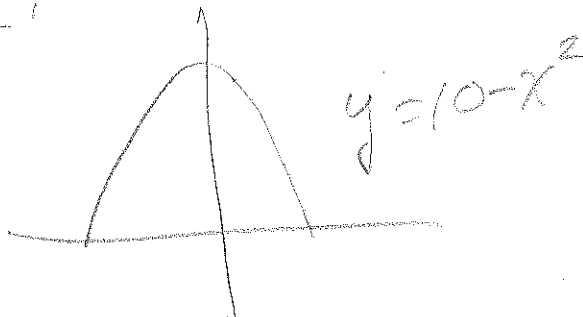   (E) $A(w) = w^2 - 15w$

   $\ell + w = 15$

   $\ell = 15 - w$

   $A(w) = w(15 - w).$

7. Consider the equation
   $$y + x^2 = 10.$$

   Which of the following is correct.

   (A) This equation defines x as a function of y, but does not define y as a function of x.

   (B) This equation defines x a function of y and defines y as a function of x.

   (C) This equation defines y as a function of x, but does not define x as a function of y.

   (D) This equation does not define y as a function of x and does not define x as a function of y.
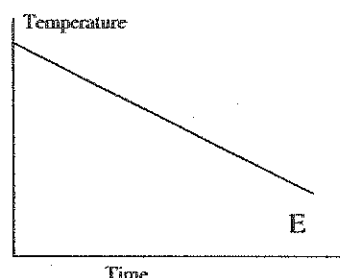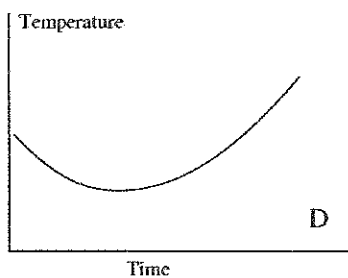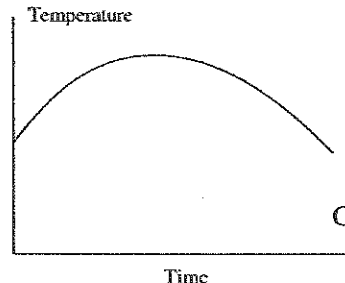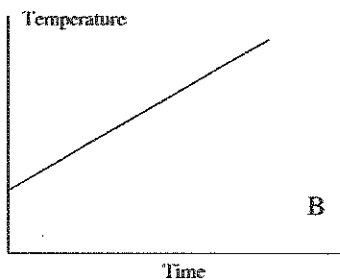
   (E) None of the above options is correct.

   $y = 10 - x^2$

4

8. Suppose that $f(x) = x^2 + 3$. Find $f(x+2)$ and simplify your answer.

   (A) $x^2 + 7$

   (B) $x^2 + 5$

   (C) $x^2 + 4x + 5$

   (D) $x^2 + 4x + 4$

   (E) $x^2 + 4x + 7$

   $f(x+2) = (x+2)^2 + 3$

   $= x^2 + 4x + 4 + 3$

   $= x^2 + 4x + 7$

9. Consider the five graphs below. Which of these best describes the temperature as a function of time over a period of two days?
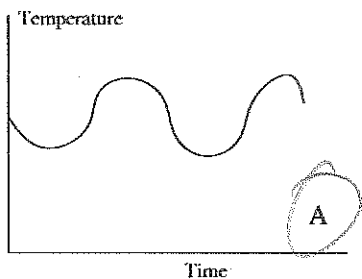
   Temp. rises during day & falls at night.

10. Consider the piecewise defined function given by

$$f(x) = \begin{cases} 1/|x|, & x \leq -1 \\ 1 + x, & -1 < x < 2 \\ 3 - x^2, & x \geq 2 \end{cases}$$

   Find $f(-1)$ and $f(1)$.

   (A) $f(-1) = 0$ and $f(1) = 2$

   (B) $f(-1) = 1$ and $f(1) = 1$

   (C) $f(-1) = 1$ and $f(1) = 2$

   (D) $f(-1) = 2$ and $f(1) = 2$

   (E) $f(-1) = 0$ and $f(1) = 1$

   $f(-1) = 1/|-1| = 1$

   $f(1) = 1 + 1 = 2$

11. Suppose that a point P lies on the y-axis and is 13 units distance from the point $(5, 7)$.

    (a) Let y denote the y-coordinate of the point P. Write an equation for y.

    (b) Solve the equation from part a) to find the point or points P that are on the y-axis and are 13 units from point $(5, 7)$.

The point $P = (0, y)$ satisfies

$$\sqrt{5^2 + (y-7)^2} = 13$$

or $25 + (y-7)^2 = 169.$

(b) $(y-7)^2 = 169 - 25 = 144$

$y - 7 = \pm 12$

$y = 7 \pm 12 = -5 \text{ or } 19.$

The two points are $(0, -5)$ or $(0, 19)$.

12. Verimobile cell phone company offers two text messaging plans. Plan T costs $22 and $0.02 for each message, while Plan V has a fixed charge of $9 and then adds $0.04 for each message.

   (a) Write two linear equations which give the total cost C for sending n text messages under each plan.

   (b) For which value of n do the two plans have the same cost?

   (c) For which values of n is Plan T less expensive?

(A) Plan T. $T(n) = \$22 + 0.02n$.

   $=$

   Plan V $V(n) = 9 + 0.04n$.

(b) $T(n) = V(n)$ if   or if $n = 650$.

   $22 + 0.02n = 9 + 0.04n$;   The two plans

   $13 = 0.02n$.   have the same
                                cost if $n = 650$.

   $\dfrac{13}{0.02} = n$.

                              $650 = \dfrac{13}{0.02} < n$.

(c) $T(n) < V(n)$ if

   $22 + 0.02n < 9 + 0.04n$ Plan T is less expensive

   $13 < 0.02n$.   if we send more than

                              650 messages.

13. Find all solutions of the equations below. You must use algebraic methods and show your work. ONLY **exact answers** will receive full credit!

(a)

$$|x| = 2 - 3x$$

$|x| = 2 - 3x$

$\begin{cases} x = 2 - 3x & \text{or} \quad -x = 2 - 3x \\ \end{cases}$

$2x = 2$

$4x = 2$

$x = 1$

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

Solution is $x = \frac{1}{2}$

Check

$|\frac{1}{2}| = 2 - 3\frac{1}{2} = \frac{1}{2}$

$\frac{1}{2}$ is a solution

$|1| = 2 - 3 = -1$

1 is a false root.

(b)

$$\frac{x}{x+2} = \frac{1}{x-5}$$

$x^2 - 5x = x + 2$.

$x^2 - 6x - 2 = 0$.

$x = \frac{6 \pm \sqrt{36 - 4(-2)}}{2}$

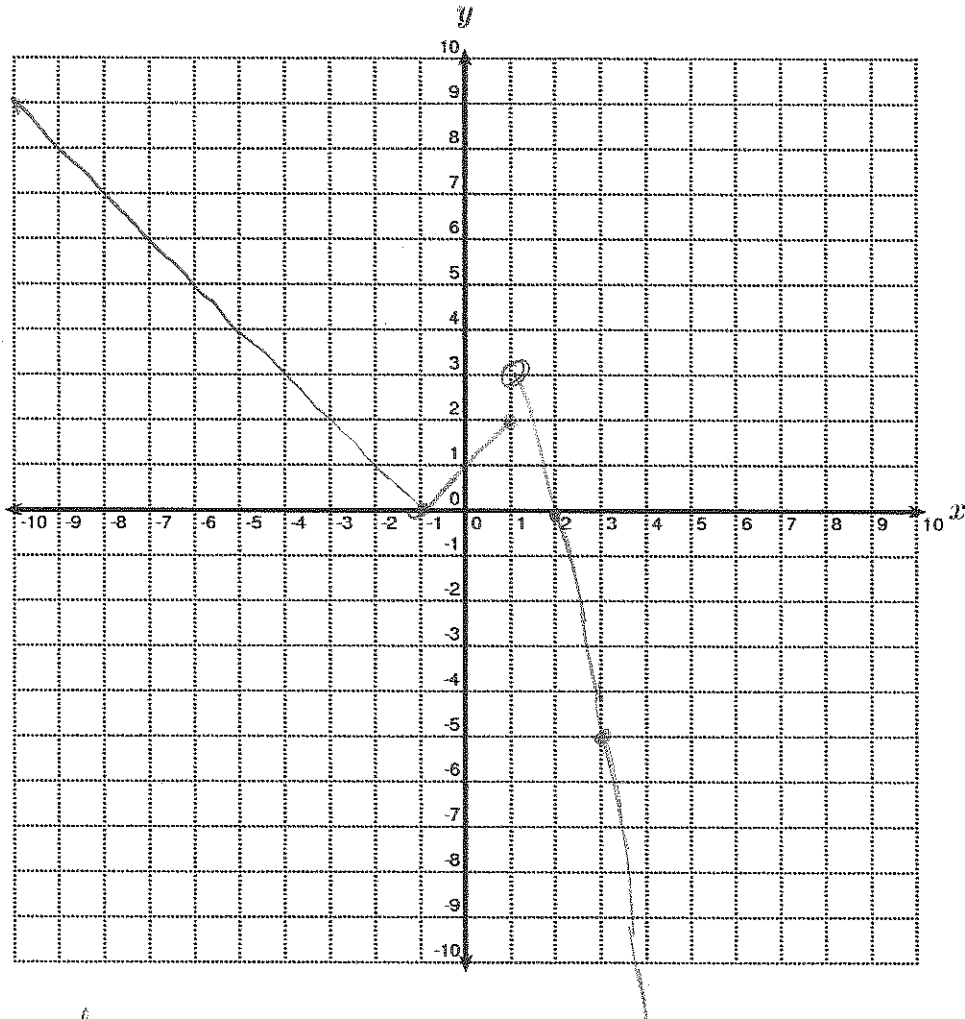$= 3 \pm \frac{1}{2}\sqrt{36 + 8}$

$= 3 \pm \frac{1}{2}\sqrt{44}$

$= 3 \pm \frac{1}{2}\sqrt{4 \cdot 11}$

$= 3 \pm \sqrt{11}$.

8

14. Graph the function

$$f(x) = \begin{cases} |x+1|, & x \le 1 \\ 4 - x^2, & x > 1 \end{cases}$$

x	$f(x)$
-4	$|-4+1| = 3$
-3	2
-2	1
-1	0
0	1
1	2
2	0
3	-5

15. Consider the function

$$f(x) = \frac{\sqrt{2x+4}}{x-1}$$

(a) Find $f(0)$ and $f(6)$.

$$f(0) = \frac{\sqrt{2\cdot0+4}}{0-1} = \frac{\sqrt{4}}{-1} = -2$$

$$f(6) = \frac{\sqrt{2\cdot6+4}}{6-1} = \frac{\sqrt{16}}{5} = 4/5.$$

(b) Find the domain of f and explain your reasoning. Give your answer using interval notation.

$f(x)$ is defined if   a) $2x+4 \geq 0$ and

b) $x-1 \neq 0$

We have $2x+4 \geq 0$ if $2x \geq -4$, or $x \geq -2$,

and $x-1 \neq 0$ if $x \neq 1$.

The set of x with $x \geq -2$ and $x \neq 1$

can be written as

$$[-2, 1) \cup (1, \infty).$$