

Name: \_\_\_\_\_

Section: \_\_\_\_\_

Last 4 digits of student ID #: \_\_\_\_\_

This exam has twelve multiple choice questions (five points each) and five free response questions (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 capabilities.

**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 reasoning used to arrive at that answer (*unsupported answers may not receive credit*),
2. Give exact answers, rather than decimal approximations to the answer (unless otherwise stated).

Each free response question is followed by space to write your answer. Please write your solutions neatly in the space below the question. You are not expected to write your solution 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
11	A	B	C	D	E
12	A	B	C	D	E

**Exam Scores**

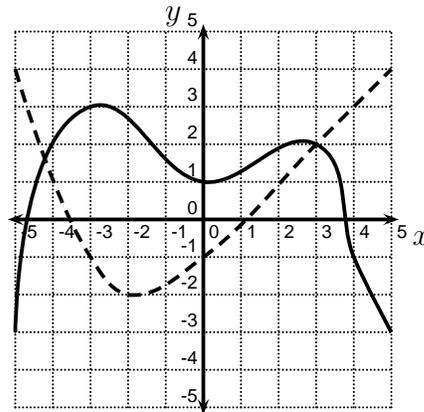
Question	Score	Total
MC		50
13		10
14		10
15		10
16		10
17		10
Total		100



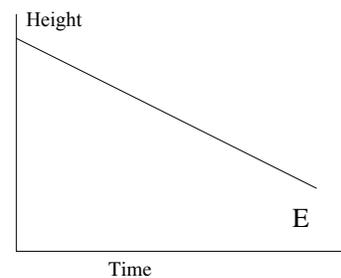
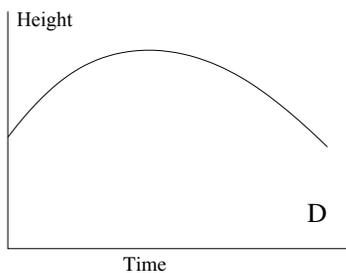
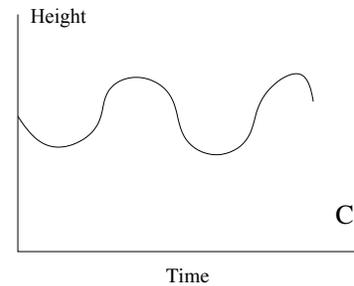
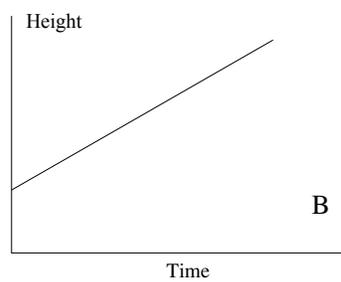
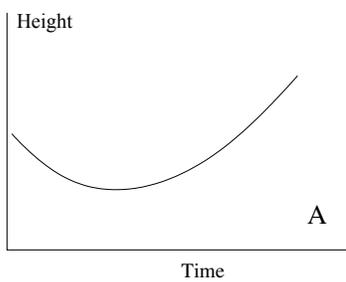
Record the correct answer to the following problems on the front page of this exam.

1. In the picture below, the graph of  $y = f(x)$  is the solid graph, and the graph of  $y = g(x)$  is the dashed graph. Use the graphs to evaluate  $g(f(0))$ .

- (A) 4  
 (B) -2  
 (C) 0  
 (D) 3  
 (E) -1



2. Consider the five graphs below. Which of these best describes the height of a ball thrown up from the top of a building as a function of time?



3. Given  $f(x) = |x|$ , find a rule for  $g(x)$  whose graph is obtained by transforming the graph of  $f$  in the following way:

shift the graph to the left by 3 units, stretch the graph vertically by a factor of 2, and shift the graph down 4 units

- (a)  $g(x) = 2|x - 3| + 4$   
 (b)  $g(x) = \frac{1}{2}|x + 3| - 4$   
 (c)  $g(x) = \frac{1}{2}|x - 3| + 4$   
 (d)  $g(x) = 2|x - 3| - 4$   
 (e)  $g(x) = 2|x + 3| - 4$

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

4. Given the following functions, find the value of  $g(f(2) + 3)$ .

$$g(t) = t^2 - t \quad \text{and} \quad f(x) = 1 + x$$

- (a) 30
- (b) 2
- (c) 40
- (d) 18
- (e) 8

5. Given the following function, find  $f^{-1}(x)$ .

$$f(x) = \frac{x - 5}{x + 8}$$

- (a)  $f^{-1}(x) = \frac{x - 5}{x + 8}$
- (b)  $f(x)$  is not a one-to-one function.
- (c)  $f^{-1}(x) = \frac{8x - 5}{x - 1}$
- (d)  $f^{-1}(x) = \frac{-8x - 5}{x}$
- (e)  $f^{-1}(x) = \frac{8x + 5}{1 - x}$

6. Given the following function, find  $g^{-1}(2)$

$$g(x) = \frac{1}{3}x^3 + 11.$$

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

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

7. Find the equation of the unique quadratic function with a vertex at the point  $(2, 4)$  and which passes through the point  $(0, -2)$

- (a)  $f(x) = -\frac{2}{3}(x + 2)^2 + 4$
- (b)  $f(x) = -2(x - 2)^2 + 4$
- (c)  $f(x) = \frac{3}{2}(x - 4)^2 - 2$
- (d)  $f(x) = -\frac{3}{2}(x - 2)^2 + 4$
- (e) There is not enough information given to answer the question.

8. Describe the end behavior of the graph of the following polynomial function.

$$Q(x) = -55x^{100} + 15x^{75} - 3$$

- (a)  $y \rightarrow \infty$  as  $x \rightarrow \infty$  and  $y \rightarrow \infty$  as  $x \rightarrow -\infty$
- (b)  $y \rightarrow \infty$  as  $x \rightarrow \infty$  and  $y \rightarrow -\infty$  as  $x \rightarrow -\infty$
- (c)  $y \rightarrow -\infty$  as  $x \rightarrow \infty$  and  $y \rightarrow \infty$  as  $x \rightarrow -\infty$
- (d)  $y \rightarrow -\infty$  as  $x \rightarrow \infty$  and  $y \rightarrow -\infty$  as  $x \rightarrow -\infty$
- (e)  $y \rightarrow -55$  as  $x \rightarrow \infty$  and  $y \rightarrow -55$  as  $x \rightarrow -\infty$

9. Given the following functions, find the remainder when  $f(x)$  is divided by  $g(x)$ .

$$f(x) = 3x^{90} - 3x^{70} + 3x^{50} - 5x^{35} - 2x^{16} + 3 \quad \text{and} \quad g(x) = x + 1$$

- (a)  $-1$
- (b)  $9$
- (c)  $4$
- (d)  $-2$
- (e)  $2$

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

10. Give the domain of the following function.

$$h(x) = \frac{x^7 + 2x^3 - 5x - \pi}{2x^4 + 16x}$$

- (a)  $(-\infty, \infty)$
- (b)  $(-\infty, -2) \cup (-2, 0) \cup (0, \infty)$
- (c)  $(-\infty, -2) \cup (0, \infty)$
- (d)  $(-\infty, -2) \cup (-2, \infty)$
- (e)  $(-\infty, 0) \cup (0, \infty)$

11. Solve the inequality

$$x^2 - 2x \geq 8$$

- (a)  $(-2, 4)$
- (b)  $[-2, 4]$
- (c)  $(-\infty, -4] \cup [2, \infty)$
- (d)  $[-4, 2]$
- (e)  $(-\infty, -2] \cup [4, \infty)$

12. Multiply and simplify.

$$\left(x^{\frac{3}{2}} - y^{\frac{3}{2}}\right) \left(x^{\frac{3}{2}} + y^{\frac{3}{2}}\right)$$

- (a)  $x - y$
- (b)  $x^{\frac{3}{2}} - y^{\frac{3}{2}}$
- (c)  $x^3 - y^3$
- (d)  $x^{\frac{9}{4}} - y^{\frac{9}{4}}$
- (e)  $x + y$

**Free Response Questions: Show your work!**

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13. Given the function  $g$  below, answer each of following questions.

$$g(x) = -3x^2 - 18x - 32$$

(a) Use “completing the square” to write  $g$  in standard (*vertex*) form. What are the coordinates of the vertex?

(b) What is the **absolute maximum** of  $g$ ?

(c) Describe the transformations that could be applied to the graph of  $f(x) = x^2$  in order to obtain the graph of  $g(x)$ .



**Free Response Questions: Show your work!**

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15. Given the following polynomial, determine whether each of the statements are either **TRUE** or **FALSE**. Write your answer on the line preceding each statement.

$$P(x) = (x + 5)(x - 2)^3(x + 6)^2(x - 7)$$

(a) \_\_\_\_\_ The graph will cross the  $x$ -axis at  $x = -6$ .

(b) \_\_\_\_\_ For  $y = P(x)$ ,  $y \rightarrow \infty$  as  $x \rightarrow \infty$ .

(c) \_\_\_\_\_ The graph will touch the  $x$ -axis, but not cross, at  $x = 2$ .

(d) \_\_\_\_\_ For  $y = P(x)$ ,  $y \rightarrow \infty$  as  $x \rightarrow -\infty$ .

(e) \_\_\_\_\_ The graph will have at most 3 local extrema.

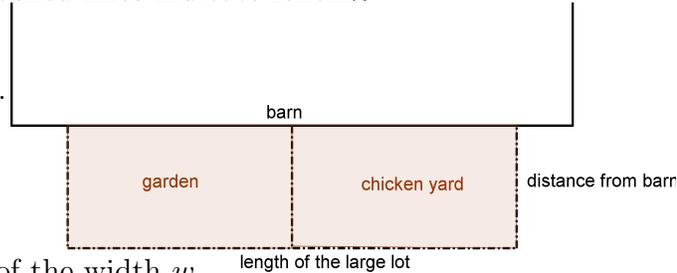
**Free Response Questions: Show your work!**

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16. Robert has a 195 foot roll of chicken wire fencing with which he would like to enclose a garden plot and a chicken yard alongside his barn. He wants to use all of his chicken wire while creating the maximum area possible for his garden and chickens. He plans to use the barn as one side of his lot with a common fence between the garden and the chicken yard, as shown in the figure, where the dashed lines indicate fencing.

Let  $w$  be the width of the lot, the distance from the barn.

Let  $l$  be the length of the lot, parallel to the barn.



- (a) Write an equation for the length  $l$  in terms of the width  $w$ .
- (b) Write an equation for the area of the lot in terms of the width  $w$ .
- (c) Use any method to determine how wide he should build the lot in order to maximize the total area.
- (d) What will the length of the maximum area lot be?
- (e) What is the maximum area?

**Free Response Questions: Show your work!**

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17. Solve the following inequality **algebraically**. **SHOW YOUR WORK!!!** Give your answer in **interval notation**.

$$\frac{(6x - 1)(x + 3)}{x^2 - 6x + 9} \geq 0$$