MA 109 — College Algebra Fall 2009
EXAM 3 11/18/2009

Name: _____ **Sec.:** _____

Do not remove this answer page — you will turn in the entire exam. You have two hours to do this exam. No books or notes may be used. You may use a graphing calculator during the exam, but NO calculator with a Computer Algebra System (CAS) or a QWERTY keyboard is permitted. Absolutely no cell phone use during the exam is allowed.

The exam consists of multiple choice and short answer questions. Record your answers on this page. For each multiple choice question, you will need to fill in the box corresponding to the correct answer. For example, if (a) is correct, you must write

[a] [b] [c] [d] [e]

Do not circle answers on this page, but please do circle the letter of each correct response in the body of the exam. It is your responsibility to make it CLEAR which response has been chosen. You will not get credit unless the correct answer has been marked on both this page and in the body of the exam.

GOOD LUCK!

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]

13. [a] [**b**] [c] [d] [e]

14. [**a**] [b] [c] [d] [e]

15. $(5, 4)$

16. $f^{-1}(x) = -7x + 4$

17. $2, \sqrt{5}, -\sqrt{5}$

18. $y = 4(x-3)^2 - 4$

19. $(-9, -1]$

20. 7

For grading use:

Total	
	(out of 100 pts)

Multiple Choice Questions

Show all your work on the page where the question appears.
Clearly mark your answer both on the cover page on this exam
and in the corresponding questions that follow.

1. Which of the following functions are even?

$$f(x) = |x| + 2 \qquad g(x) = x^4 - 1 \qquad h(x) = \sqrt{x}$$

Possibilities:

(a) Only $g(x)$ is even.
(b) Only $g(x)$ and $h(x)$ are even.
(c) None of the functions are even.
(d) Only $f(x)$ and $g(x)$ are even.
(e) All of the functions are even.

2. Find the vertex of the parabola given by $y = 3x^2 + 30x + 81$.

Possibilities:

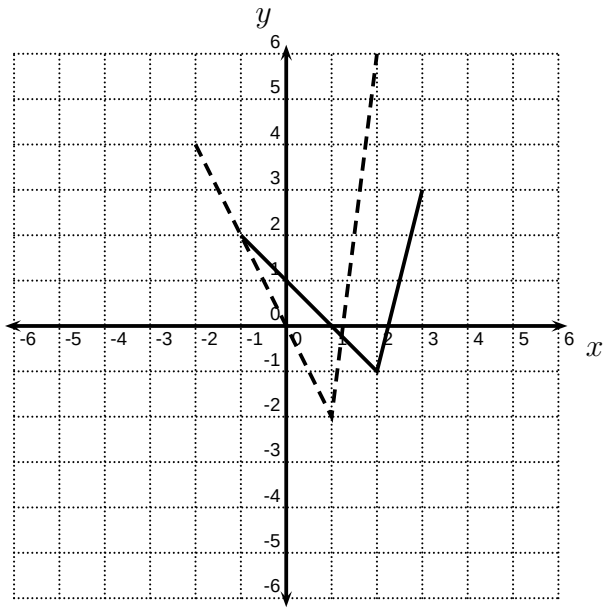
(a) $(6, -5)$
(b) $(3, 6)$
(c) $(3, 81)$
(d) $(-5, 6)$
(e) $(-5, 81)$

3. Let $f(x) = \dfrac{x-3}{5}$. Find $f^{-1}(6)$.

Possibilities:

(a) $\dfrac{3}{5}$
(b) 33
(c) -33
(d) $\dfrac{5}{3}$
(e) 27

4. 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. Find a formula for $g(x)$.



Possibilities:

(a) $g(x) = f(x+1) + 2$

(b) $g(x) = 2f(x-1)$

(c) $g(x) = \frac{1}{2}f(x-1)$

(d) $g(x) = \frac{1}{2}f(x+1)$

(e) $g(x) = 2f(x+1)$

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5. A ball is thrown across a playing field. Its path is given by the equation $y = -21/4x^2 + 21x + 9$, where x is the distance (in feet) the ball has travelled horizontally, and y is the height (in feet) of the ball above the ground. What is the maximum height attained by the ball?

Possibilities:

(a) 2 feet

(b) 21 feet

(c) 30 feet

(d) 9 feet

(e) 52 feet

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6. Let $f(x) = -4x$ and $g(x) = x - 9$. Find $f(g(x))$.

Possibilities:

(a) $f(g(x)) = -4x + 36$

(b) $f(g(x)) = -4x^2 + 36$

(c) $f(g(x)) = -4x - 9$

(d) $f(g(x)) = -4x$

(e) $f(g(x)) = -4x^2 + 36x$

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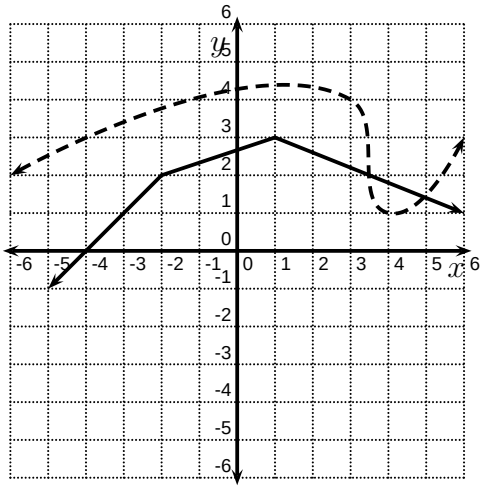
7. In the picture below, the graph of $y = f(x)$ is the solid graph, and the graph of $y = g(x)$ is the dashed graph. Use the graphs to evaluate $g(f(1))$.



Possibilities:

(a) 1
(b) 3
(c) -1
(d) 4
(e) 2

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8. Which of the following statements are true?

(I) If $P(x) = 5x^3 + 2x + 40x^2 + 16$, then $P(-8) = 0$.
(II) $(-8, 0)$ is an x-intercept on the graph of $y = 5x^3 + 2x + 40x^2 + 16$.
(III) The remainder of the division problem $\dfrac{5x^3 + 2x + 40x^2 + 16}{x + 8}$ is zero.
(IV) $(x + 8)$ is a factor of $5x^3 + 2x + 40x^2 + 16$.

Possibilities:

(a) Only (I) and (III) are true.
(b) (I), (II), (III), and (IV) are all true.
(c) None of (I), (II), (III), and (IV) are true.
(d) Only (I) and (II) are true.
(e) Only (III) and (VI) are true.

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9. Which of the following statements is (are) true about $P(x) = (x + 1)^{66} (-3x - 3)^{22}$?

(I) The leading coefficient of $P(x)$ is negative.
(II) The degree of $P(x)$ is even.
(III) $P(5) = 0$.

Possibilities:

(a) None of the statements are true.
(b) Only **(II)**.
(c) Only **(I)** and **(II)**.
(d) Only **(I)** and **(III)**.
(e) Only **(I)**.

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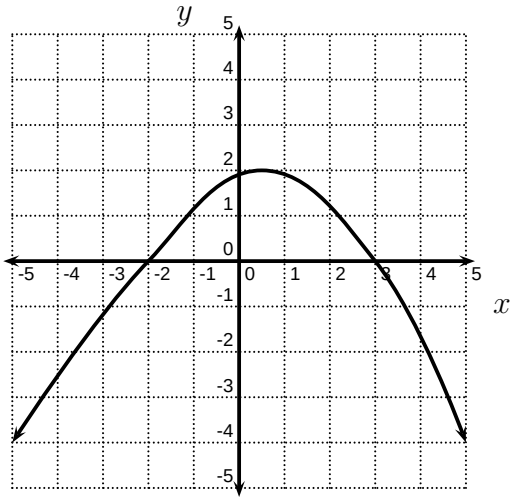
10. The graph shown below is **NOT** the graph of $y = -(x+2)^2(x-3)^2$. Which of the following are clues that the given graph is **NOT** the graph of this function?

(I) The graph displays the wrong end behavior.

(II) The graph crosses the x-axis at $(-2, 0)$, but it should not.

(III) The graph crosses the x-axis at $(3, 0)$, but it should not.

(IV) The graph of a polynomial of degree 4 cannot have exactly one local extreme point.



Possibilities:

(a) Only **(II)**, **(III)**, and **(IV)**.

(b) Only **(I)**.

(c) Only **(I)**, **(III)**, and **(IV)**.

(d) Only **(II)** and **(III)**.

(e) Only **(I)** and **(IV)**.

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11. Let $P(x) = 5x^5 + 2x^4 + 3x^3 - 2x + 27$. List all possible rational zeros of $P(x)$ given by the Rational Zeros Theorem (but do not check to see which are actually zeros).

Possibilities:

(a) $\pm 1, \pm 3, \pm 9, \pm 27, \pm 1/5, \pm 3/5, \pm 9/5, \pm 27/5$

(b) $\pm 1, \pm 27, \pm 27/5$

(c) $\pm 1, \pm 1/3, \pm 1/9, \pm 1/27, \pm 5, \pm 5/3, \pm 5/9, \pm 5/27$

(d) $\pm 1, \pm 3, \pm 9, \pm 27, \pm 5, \pm 5/3, \pm 5/9, \pm 5/27$

(e) $\pm 1, \pm 27, \pm 5/27$

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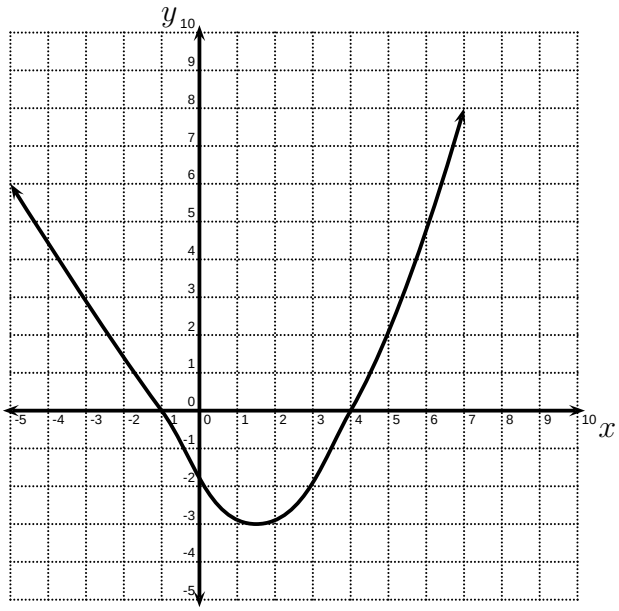
12. $P(x)$ is a polynomial. The graph of $y = P(x)$ is shown below. Use the graph to find the factors of $P(x)$.



Possibilities:

(a) Both $x + 4$ and $x - 1$
(b) Both $x - 4$ and $x + 1$
(c) Both $x + 4$ and $x + 1$
(d) $P(x)$ does not have any factors.
(e) Both $x - 4$ and $x - 1$

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13. Let $f(x) = \sqrt{x - 1}$ and $g(x) = x - 9$. Find the domain of $\left(\frac{g}{f}\right)(x)$.

Possibilities:

(a) $[1, 9]$
(b) $(1, \infty)$
(c) $[1, 9) \cup (9, \infty)$
(d) $(1, 9) \cup (9, \infty)$
(e) $[1, \infty)$

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14. The sales tax (in dollars) for an item costing x dollars can be modeled by the function $T(x) = 0.06x$. What does $T^{-1}(1.75)$ represent?

Possibilities:

(a) The original cost of an item if the sales tax is \$1.75.
(b) The original cost of an item divided by 1.75
(c) One divided by the original cost of an item.
(d) The sales tax for an item that costs \$1.75.
(e) The total tax for an item divided by 1.75

Short Answer Questions

Clearly write your answers in the spaces provided on the following pages.

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15. Suppose that the graph of $y = f(x)$ contains the point $(-2, 9)$. Find a point on the graph of $y = f(x - 7) - 5$.

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16. Find the inverse function of $f(x) = \dfrac{4 - x}{7}$.

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17. Let $P(x) = x^3 - 2x^2 - 5x + 10$. Find the real zeros of P(x).

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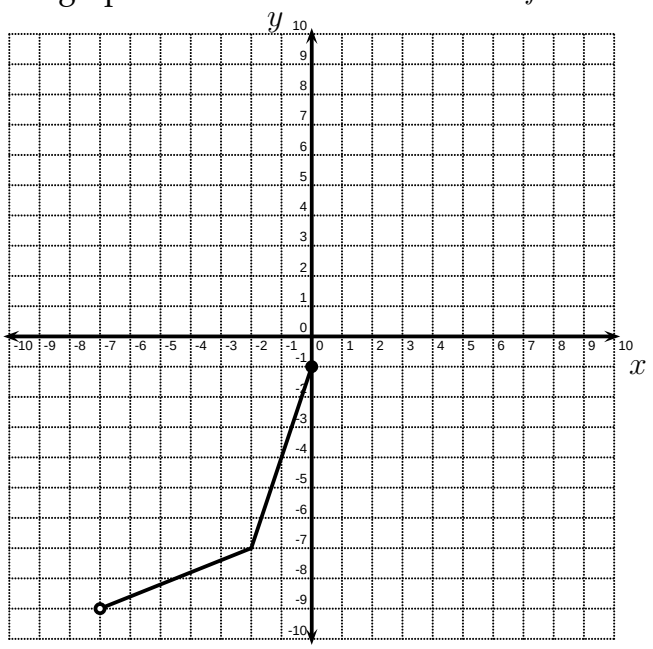
18. Find a formula for the parabola that has vertex $(3, -4)$ and passes through the point $(6, 32)$.

19. The graph of the one-to-one function f is shown below. Find the domain of f^{-1}.



20. Find the **remainder** of the division problem.

$$\frac{x^4 + x^2 + 5}{x - 1}$$