MA109 — College Algebra Fall 2017
Exam2 2017-10-18

Name: Key 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 an ACT-approved calculator during the exam, but NO calculator with a Computer Algebra System (CAS), networking, or camera is permitted. Absolutely no cell phone use during the exam is allowed.

The exam consists of multiple choice questions. Record your answers on this page. For each multiple choice question, you will need to fill in the circle 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 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	11.	(a)	b	c	d	e
2.	(a)	b	c	d	e	12.	(a)	b	c	d	e
3.	(a)	b	c	d	e	13.	(a)	b	c	d	e
4.	(a)	b	c	d	e	14.	(a)	b	c	d	e
5.	(a)	b	c	d	e	15.	(a)	b	c	d	e
6.	(a)	b	c	d	e	16.	(a)	b	c	d	e
7.	(a)	b	c	d	e	17.	(a)	b	c	d	e
8.	(a)	b	c	d	e	18.	(a)	b	c	d	e
9.	(a)	b	c	d	e	19.	(a)	b	c	d	e
10.	(a)	b	c	d	e	20.	(a)	b	c	d	e

For grading use:

Number Correct	
	(out of 20 problems)

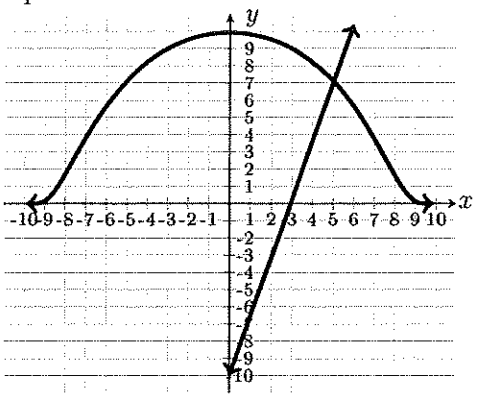
Total	
	(out of 100 points)

Name: _____

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. Determine the solutions to the system of equations in the following graph.



Possibilities:

(a) $(x = 0, y = -10)$ only

(b) $(x = -9, y = 0)$ and $(x = 9, y = 0)$

(c) $(x = 0, y = -10)$ and $(x = 0, y = 10)$

(d) $(x = 10, y = -10)$ only

(e) $(x = 5, y = 7)$ only

2. Use the substitution method to find all solutions of the system of equations.

$$\begin{aligned} &① \quad x + y^2 = 26 \\ &② \quad y - x = -6 \end{aligned}$$

Possibilities:

(a) $(x = 1, y = 5)$ and $(x = 11, y = -5)$

(b) $(x = 1, y = -5)$ only

(c) $(x = 10, y = 4)$ only

(d) $(x = 1, y = -5)$ and $(x = 10, y = 4)$

(e) No real solutions

Solve ② for y: $y = x - 6$ ③

Subst. into ①: $x + (x-6)^2 = 26$

$\Rightarrow x + x^2 - 12x + 36 = 26$

$\Rightarrow x^2 - 11x + 36 = 26$

$\Rightarrow x^2 - 11x + 10 = 0 \Rightarrow (x-1)(x-10) = 0$

$\Rightarrow x = 1, 10$

Put $x = 1$ into ②: $y = 1 - 6 = -5$

Put $x = 10$ into ③: $y = 10 - 6 = 4$

Solns: $(1, -5), (10, 4)$

3. Use the elimination method to solve the system. The multiple choice problem only asks you for y.

$$\begin{aligned} &\text{①}\quad 19x + 23y = 214 \\ &\text{②}\quad 19x + 22y = 208 \end{aligned}$$

mult ② by -1:

$$19x + 23y = 214$$
$$+\quad -19x - 22y = -208$$
$$y = 6$$

Possibilities:

(a) Every solution has $y = \dfrac{6}{19}$

(b) Every solution has $y = -23$

(c) Every solution has $y = 4$

(d) Every solution has $y = \dfrac{6}{23}$

(e) Every solution has $y = 6$

4. Suppose you are solving the system of equations below using the substitution method. You solve for y in the first equation and substitute it into the second equation. What equation must you solve then?

$$\begin{aligned} &\text{①}\quad 5x^6 + y = 2 \\ &\text{②}\quad 4x^8 + 9y = 3 \end{aligned}$$

Solve ① for y: $y = 2 - 5x^6$

Subst. into ②:

$$4x^8 + 9(2 - 5x^6) = 3$$

Possibilities:

(a) $4x^8 + 9(2 - 5x^6) = 3$

(b) $4\left(\sqrt[6]{2 - 5x^6}\right)^8 + 9y = 3$

(c) $4x^8 + 9\left(\sqrt[6]{2 - y}\right) = 3$

(d) $4x^8 + 9\left(\sqrt[6]{2 - 5x^6}\right) = 3$

(e) $4(2 - 5x^6)^8 + 9y = 3$

5. Use the elimination method to find all solutions of the system of equations.

$$\begin{cases} \frac{29}{x} + \frac{10}{y} = 201 \quad (1) \\ \frac{13}{x} + \frac{5}{y} = 92 \quad (2) \end{cases}$$

Let $u = \frac{1}{x}$ and $v = \frac{1}{y}$:

$$\begin{cases} 29u + 10v = 201 \quad (3) \\ 13u + 5v = 92 \quad (4) \end{cases}$$

Possibilities:

(a) $(x = 29, y = 10)$, $(x = -29, y = 10)$, $(x = 13, y = 5)$, and $(x = -13, y = -5)$

(b) $\left(x = \frac{3}{17}, y = \frac{3}{11}\right)$ and $\left(x = -\frac{3}{17}, y = -\frac{3}{11}\right)$

(c) $(x = -29, y = 10)$ and $(x = -13, y = 5)$

(d) $\left(x = \frac{3}{17}, y = \frac{3}{11}\right)$ only

(e) $(x = 29, y = 10)$ and $(x = 13, y = 5)$

Mult (4) by -2:

$$29u + 10v = 201$$
$$+ \quad -26u - 10v = -184$$
$$3u = 17 \Rightarrow u = 17/3$$
$$\Rightarrow x = 3/17$$

Put $u = 17/3$ into (1):

$$13(17/3) + 5v = 92 \Rightarrow \frac{221}{3} + 5v = 92$$
$$\Rightarrow 5v = 55/3 \Rightarrow v = 11/3 \Rightarrow y = 3/11$$

Ans: $(3/17, 3/11)$

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6. Find all distinct, real solutions (x, y) to:

$$\begin{cases} x + y = 9 \quad (1) \\ x^2 - y^2 = \sqrt{19} \quad (2) \end{cases}$$

Solve (1) for x: $x = 9 - y$

Subst into (2):

$$(9-y)^2 - y^2 = \sqrt{19} \Rightarrow 81 - 18y + y^2 - y^2 = \sqrt{19}$$
$$\Rightarrow -18y = \sqrt{19} - 81 \Rightarrow 18y = 81 - \sqrt{19}$$
$$\Rightarrow y = \frac{81 - \sqrt{19}}{18}$$

Put $y = \frac{81-\sqrt{19}}{18}$ into (1):

$$x + \frac{81-\sqrt{19}}{18} = 9 \Rightarrow x = 9 - \frac{81-\sqrt{19}}{18}$$
$$\Rightarrow x = \frac{162}{18} - \frac{81-\sqrt{19}}{18} = \frac{162 - 81 + \sqrt{19}}{18} = \frac{81+\sqrt{19}}{18}$$

Possibilities:

(a) $\left(x = \frac{9+\sqrt{19}}{2}, y = \frac{9-\sqrt{19}}{2}\right)$

(b) $\left(x = \frac{81+\sqrt{19}}{18}, y = \frac{81-\sqrt{19}}{18}\right)$

(c) $\left(x = \frac{9+\sqrt{19}}{38}, y = \frac{9-\sqrt{19}}{38}\right)$

(d) $\left(x = \frac{171+\sqrt{19}}{18}, y = \frac{171-\sqrt{19}}{18}\right)$

(e) $\left(x = \frac{-9\pm\sqrt{19}}{2}, y = \frac{-19\pm\sqrt{9}}{2}\right)$

Soln: $\left(\frac{81+\sqrt{19}}{18}, \frac{81-\sqrt{19}}{18}\right)$

7. Use algebraic, graphical, or numerical methods to find all real solutions of the equation, approximating when necessary to four decimal places.

$$\frac{7}{(x+2)^7+19x} = \frac{7}{32+(x+2)^7}$$

Cross multiply: $7[32+(x+2)^7] = 7[(x+2)^7+19x]$

$\Rightarrow 224 + 7(x+2)^7 = 7(x+2)^7 + 133x$

$\Rightarrow 224 = 133x \Rightarrow x = \frac{224}{133} \approx 1.6842$

Possibilities:

(a) $x = 1.6791$

(b) $x = 1.6808$

(c) $x = 1.6825$

(d) $x = 1.6842$

(e) $x = 1.6859$

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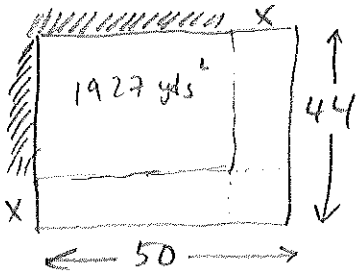
8. A corner lot has dimensions 50 by 44 yards. The city plans to take a strip of uniform width along the two sides bordering the streets to widen these roads. How wide should the strip be if the remainder of the lot is to have an area of 1927 square yards?

Which equation should you solve in order to find the answer? The variable x represents the width of the strip in yards.



$(50-x)(44-x) = 1927$

Possibilities:

(a) $(50-x)(44-x) = 1927$

(b) $(50)(44) - x^2 = 1927$

(c) $x^2 = 1927$

(d) $(50)(44) = x$

(e) $x = 2200 - 1927$

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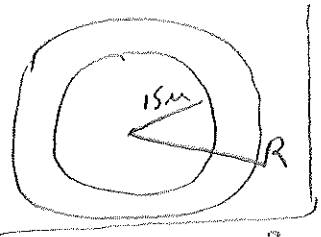
9. A concrete walk of uniform width is to be built around a giant circular pool. The radius of the pool is 15 meters, and enough concrete is available to cover 50.56π square meters (approximately). If all the concrete is to be used, how wide should the walk be (approximately)? Choose the closest answer.



$A_{pool} = \pi r^2 = \pi(15)^2 = 225\pi \text{ m}^2$

$A_{total} = A_{pool} + A_{concrete}$

$= 225\pi + 50.56\pi = 275.56\pi \text{ m}^2$

$A_{total} = \pi R^2 \Rightarrow 275.56\pi = \pi R^2 \Rightarrow R = \sqrt{275.56}$

$\Rightarrow R = 16.6 \text{ m} \Rightarrow$ width is $R - 15 = 16.6 - 15 = 1.6 \text{ m}$

Possibilities:

(a) 35.6 meters wide

(b) 1.6 meters wide

(c) 15 meters wide

(d) 7.89 meters wide

(e) 3.37 meters wide

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10. Find the equilibrium price. In the supply and demand equations, p is price (in dollars) and x is quantity (in thousands). Please round your answer to the nearest hundredth (the nearest cent).

$$\begin{array}{rrcrcr} & & & & & \\ \text{Supply:} & p & = & 5x & - & 6 \\ \text{Demand:} & p & = & -4x & + & 8 \end{array}$$

Possibilities:

(a) $p = \$1.78$

(b) $p = \$1.56$

(c) $p = \$4.50$

(d) $p = \$1$

(e) $p = \$2$

Set equal: $5x - 6 = -4x + 8$

$\Rightarrow 9x = 14 \Rightarrow x = \frac{14}{9}$

Put $x = 14/9$ into (1).

$p = 5(14/9) - 6 = \frac{70}{9} - 6 = \frac{70}{9} - \frac{54}{9} = \frac{16}{9} \approx 1.78$

11. The cost of a nut mix depends on how many pounds of each type of nut it contains: peanuts cost \$3.00 per pound and cashews cost \$4.50 per pound. How many pounds of peanuts and cashews should be added to 5 pounds of \$4.00 per pound mixed nuts to get 25 pounds of \$3.50 per pound mixed nuts?

Possibilities:

(a) 16.67 lbs of peanuts and 8.33 lbs of cashews

(b) 5.00 lbs of peanuts and 15.00 lbs of cashews

(c) 15.00 lbs of peanuts and 5.00 lbs of cashews

(d) 10.00 lbs of peanuts and 10.00 lbs of cashews

(e) 8.33 lbs of peanuts and 16.67 lbs of cashews

p: lbs peanuts, c: lbs cashews

old lbs + lbs peanuts + lbs cashews = new lbs mix

$\Rightarrow 5 + p + c = 25 \Rightarrow p + c = 20$ (1)

cost old mix + cost peanuts + cost cashews = new mix cost

$\Rightarrow 4(5) + 3p + 4.50c = 25(3.50) \Rightarrow 20 + 3p + 4.5c = 87.5$

$\Rightarrow 3p + 4.5c = 67.5$ (2)

System: $\begin{cases} p + c = 20 \\ 3p + 4.5c = 67.5 \end{cases}$

mult (1) by -3: $-3p - 3c = -60$

$+ \quad 3p + 4.5c = 67.5$

$1.5c = 7.5$

$\Rightarrow c = 5$

Put $c = 5$ into (1): $p = 15$

12. Solve the inequality. Express your answer in interval notation.

$$|x-5| \leq 6$$

$|x-5| \leq 6 \Rightarrow -6 \leq x-5 \leq 6 \Rightarrow -1 \leq x \leq 11$

Possibilities:

(a) $[0, 6]$

(b) $[-1, 11]$

(c) $[5, 6]$

(d) $[0, 5]$

(e) $[0, 11]$

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13. Solve the inequality. Answer in interval notation.

$10x + 15 > 4x + 12$

$10x + 15 > 4x + 12 \Rightarrow \frac{6x}{6} > \frac{-3}{6}$

$\Rightarrow x > -1/2$

Possibilities:

(a) $(-\infty, \infty)$

(b) $[-\frac{1}{2}, \infty)$

(c) $(-\frac{1}{2}, \infty)$

(d) $(-\infty, 10] \cup [15, \infty)$

(e) $[\frac{3}{2}, 3]$

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14. A rectangle must have a length of 22 inches and a width of at most 11 inches. How much area can this rectangle have?

$x \leq 11$

$\Rightarrow 22x \leq 242$

Possibilities:

(a) at least 11 square inches

(b) at most 2 square inches

(c) at least 2 square inches

(d) at least 242 square inches

(e) at most 242 square inches

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15. A business executive is considering two options for leasing a car. The first option is \$400 per month, but the first month costs \$60 extra. The second option is \$410 per month with no extra cost for the first month. The business executive wants to know which option is cheapest based on how many months they plan on leasing the car. Which choice below most accurately describes the situation?

x: # of months

Possibilities:

Cost opt 1: $400x + 60$
Cost opt 2: $410x$

(a) The first option is cheaper if the lease is 9 months or shorter, the second option is cheaper if the lease is 11 months or longer, and the two options are the same price if the lease is exactly 10 months

(b) The first option is cheaper if the lease is 11 months or longer, the second option is cheaper if the lease is 9 months or shorter, and the two options are the same price if the lease is exactly 10 months

opt 1 cheaper: $400x + 60 < 410x$
$\Rightarrow 60 < 10x$
$\Rightarrow 6 < x \Rightarrow x > 6$

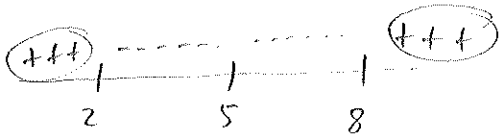
(c) The first option is cheaper if the lease is 7 months or longer, the second option is cheaper if the lease is 5 months or shorter, and the two options are the same price if the lease is exactly 6 months

(d) Both options cost the same regardless of the length of the lease.

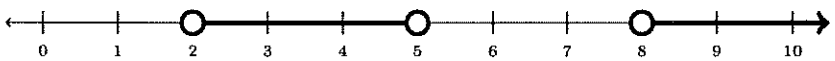
(e) The first option is cheaper if the lease is 5 months or shorter, the second option is cheaper if the lease is 7 months or longer, and the two options are the same price if the lease is exactly 6 months

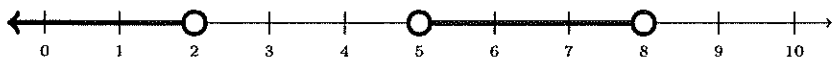
16. Solve the inequality. Answer by choosing the correct number line.

$0 < (x-2)(x-5)^2(x-8)$



Possibilities:

(a)


(b)


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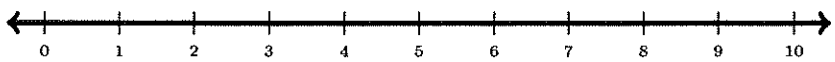

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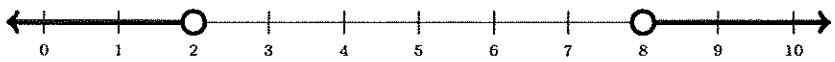
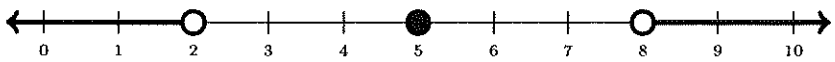


(e)


Put 0: $(-2)(-5)^2(-8) = 80$
Put 3: $(1)(-2)^2(-5) = -20$
Put 6: $(4)(1)^2(-2) = -8$
Put 9: $(7)(4)^2(1) = 112$

17. Solve the inequality. Answer in interval notation.

$$\frac{x-5}{x-6} \leq 0$$

Possibilities:

(a) $(-\infty, 6]$

(b) $[5, 6)$

(c) $[5, 6]$

(d) $(-\infty, 5] \cup [6, \infty)$

(e) $(-\infty, 5]$

put 0: $\frac{0-5}{0-6} = 5/6$

put 5.5: $\frac{5.5-5}{5.5-6} = \frac{+0.5}{-1.5} = -1/3$

put 7: $\frac{7-5}{7-6} = \frac{2}{1} = 2$

Can't input 6!

Input of 5 gives output 0

18. Find $f(-2)$ from the graph of $y = f(x)$.

Possibilities:

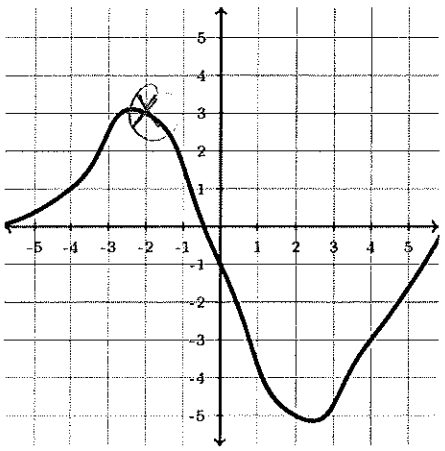
(a) $f(-2) = 0$

(b) $f(-2) = 7$

(c) $f(-2) = -2$

(d) $f(-2) = -1$

(e) $f(-2) = 3$



19. Let the piecewise function $g(x)$ be given by:

$$g(x) = \begin{cases} x^2 & \text{if } x \leq 3 \\ 5x + 7 & \text{if } x > 3 \end{cases}$$

Evaluate $g(4)$

$g(4) = 5 \cdot 4 + 7 = 20 + 7 = 27$

Possibilities:

(a) $g(4) = -\frac{7}{5}$

(b) $g(4) = 4$

(c) $g(4) = 27$

(d) $g(4) = 16$

(e) $g(4) = 0$

20. Let $f(x) = 2x^2 - 5$. Find $\dfrac{f(x+h) - f(x)}{h}$ if $h \neq 0$. Simplify your answer.

Possibilities:

(a) $4x + 2h$

(b) $2x - 5h$

(c) $\dfrac{2h^2 - 5}{h}$

(d) 1

(e) $\dfrac{h - 10}{h}$

$$\frac{f(x+h) - f(x)}{h} = \frac{2(x+h)^2 - 5 - (2x^2 - 5)}{h}$$

$$= \frac{2(x^2 + 2xh + h^2) - 5 - 2x^2 + 5}{h}$$

$$= \frac{2x^2 + 4xh + 2h^2 - 2x^2}{h} = \frac{h(4x + 2h)}{h} = 4x + 2h$$