

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. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e | 11. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e |
| 2. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e | 12. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e |
| 3. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e | 13. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e |
| 4. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e | 14. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e |
| 5. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e | 15. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e |
| 6. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e | 16. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e |
| 7. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e | 17. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e |
| 8. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e | 18. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e |
| 9. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e | 19. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e |
| 10. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e | 20. <input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d <input type="radio"/> e |

For grading use:

Number Correct	
	(out of 20 problems)

Total	
	(out of 100 points)

Multiple Choice Questions

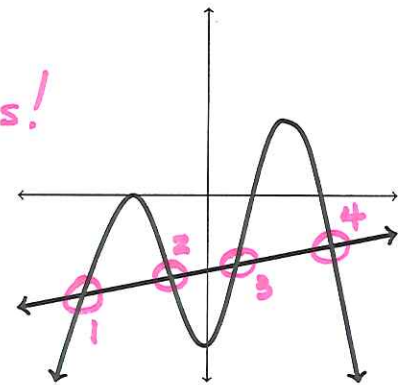
Show all your work on the page where the question appears.
Clearly mark your answer both on the cover page on this exam
and in the corresponding questions that follow.

1. The graph of two equations is shown below. Determine the number of solutions for the system of equations.

Possibilities:

- (a) 4
- (b) 3
- (c) 2
- (d) 0
- (e) 1

*points of intersection
are solutions to systems!



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

$$\begin{aligned} x + y^2 &= 17 \\ y - x &= -5 \Rightarrow y = x - 5 \end{aligned}$$

Possibilities:

- (a) $(x = 1, y = -4)$ and $(x = 8, y = 3)$
- (b) $(x = 1, y = 4)$ and $(x = 9, y = -4)$
- (c) $(x = 1, y = -4)$ only
- (d) $(x = 8, y = 3)$ only
- (e) No real solutions

$$\begin{aligned} x + (x-5)^2 &= 17 \\ x + x^2 - 10x + 25 - 17 &= 0 \\ x^2 - 9x + 8 &= 0 \\ (x-8)(x-1) &= 0 \\ \left. \begin{aligned} x-8 &= 0 \\ x &= 8 \end{aligned} \right\} \begin{aligned} x-1 &= 0 \\ x &= 1 \end{aligned} \\ \left. \begin{aligned} (8, 3) \\ y = 8 - 5 = 3 \end{aligned} \right\} \left. \begin{aligned} (1, -4) \\ y = 1 - 5 = -4 \end{aligned} \right. \end{aligned}$$

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

$$\begin{array}{r} 17x + 19y = 127 \\ (17x + 18y = 123) - 1 \Rightarrow \end{array} \Rightarrow \begin{array}{r} -17x - 18y = -123 \\ \underline{17x + 19y = 127} \\ y = 4 \end{array}$$

Possibilities:

- (a) Every solution has $y = 3$
- (b) Every solution has $y = 4$
- (c) Every solution has $y = \frac{4}{17}$
- (d) Every solution has $y = \frac{4}{19}$
- (e) Every solution has $y = -19$

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?

$$\begin{array}{r} 4x^5 + y = 7 \\ 6x + 9y^3 = 2 \end{array} \Rightarrow y = \boxed{7 - 4x^5}$$

Possibilities:

- (a) $6(7 - 4x^5) + 9y^3 = 2$
- (b) $6x + 9(\sqrt[5]{7 - y}) = 2$
- (c) $6x + 9(\sqrt[5]{7 - 4x^5}) = 2$
- (d) $6x + 9(7 - 4x^5)^3 = 2$
- (e) $6(\sqrt[5]{7 - 4x^5}) + 9y^3 = 2$

$$6x + 9(7 - 4x^5)^3 = 2$$

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

$$\begin{cases} \frac{47}{x} + \frac{6}{y} = 43 \\ \frac{17}{x} + \frac{3}{y} = 16 \end{cases} \xrightarrow{(-2)} \begin{cases} \frac{47}{x} + \frac{6}{y} = 43 \\ -\frac{34}{x} - \frac{6}{y} = -32 \end{cases}$$

$$\frac{13}{x} = 11$$

Possibilities:

(a) $(x = -47, y = 6)$ and $(x = -17, y = 3)$

(b) $\left(x = \frac{13}{11}, y = \frac{13}{7}\right)$ only

(c) $(x = 47, y = 6)$, $(x = -47, y = 6)$, $(x = 17, y = 3)$, and $(x = -17, y = -3)$

(d) $\left(x = \frac{13}{11}, y = \frac{13}{7}\right)$ and $\left(x = -\frac{13}{11}, y = -\frac{13}{7}\right)$

(e) $(x = 47, y = 6)$ and $(x = 17, y = 3)$

$$\frac{47}{13/11} + \frac{6}{y} = 43$$

$$47\left(\frac{11}{13}\right) + \frac{6}{y} = 43$$

$$\frac{6}{y} = \frac{43(13) - 47(11)}{13}$$

$$\frac{6y}{y} = \frac{42(13)}{13}$$

$$42y = (6)(13)$$

$$y = \frac{(6)(13)}{42} = \frac{13}{7}$$

6. Use substitution to solve the system.

$$\begin{cases} 3x + 2y = 19 \\ 9x + 8y = 23 \end{cases} \Rightarrow 2y = 19 - 3x$$

$$y = \frac{19}{2} - \frac{3}{2}x$$

$$9x + 8\left(\frac{19}{2} - \frac{3}{2}x\right) = 23$$

$$9x + (4)(19) - (4)(3)x = 23$$

$$9x - 12x = 23 - 76$$

$$-3x = -53$$

$$x = \frac{53}{3}$$

$$y = \frac{19}{2} - \frac{3}{2}\left(\frac{53}{3}\right)$$

$$y = \frac{19}{2} - \frac{53}{2}$$

$$y = \frac{-34}{2}$$

$$y = -17$$

Possibilities:

(a) $x = \frac{19}{3}$, $y = \frac{23}{9}$

(b) $x = 103$, $y = 355$

(c) $x = \frac{53}{3}$, $y = -17$

(d) $x = \frac{6}{103}$, $y = \frac{6}{355}$

(e) $x = -17$, $y = \frac{53}{3}$

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

Other methods are possible

$$\frac{12x}{x+72} = 5$$

$$12x = 5x + 360$$

$$-5x \quad -5x$$

$$7x = 360$$

$$x = \frac{360}{7} \approx 51.4286$$

exact approximate

Possibilities:

- (a) $x = 51.4235$
- (b) $x = 51.4252$
- (c) $x = 51.4269$
- (d) $x = 51.4286$**
- (e) $x = 51.4303$

8. Find an equation that helps solve for the worker's old salary, call it x , in the following problem:
A worker gets a 4.75% pay raise and now makes \$1350 per month. What was the worker's old salary?

$x = \text{old salary}$

Possibilities:

- (a) $x = (4.75)(1350)$
- (b) $x = 1350 - 4.75$
- (c) $x + 0.0475x = 1350$**
- (d) $4.75x = 1350$
- (e) $0.0475x = 1350$

old salary + raise = new salary

↓ ↓ ↓

$$x + 0.0475x = 1350$$

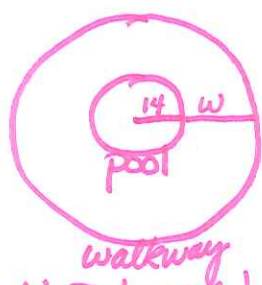
NOTE pay raise is a percentage of old salary

9. A concrete walk of uniform width is to be built around a giant circular pool. The radius of the pool is 14 meters, and enough concrete is available to cover 44.25π square meters (approximately). If all the concrete is to be used, how wide should the walk be (approximately)? Choose the closest answer.

$w = \text{width of walkway}$

Possibilities:

- (a) 3.16 meters wide
- (b) 7.35 meters wide
- (c) 30.2 meters wide
- (d) 14 meters wide
- (e) 1.5 meters wide**



***pic is NOT to scale!**

Area of outer circle - Area of inner circle = Area of walkway

$$\pi(14+w)^2 - \pi(14)^2 = 44.25\pi$$

$$14^2 + 28w + w^2 - 14^2 = 44.25$$

$$w^2 + 28w - 44.25 = 0$$

$$w = \frac{-28 \pm \sqrt{28^2 - 4(1)(-44.25)}}{2} \approx 1.5$$

A = πr²
area of a circle

5 eliminate the answer that will be negative

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).

$$\begin{aligned} \text{Supply: } p &= 9x - 7 \quad \Rightarrow \quad 5p = 45x - 35 \\ \text{Demand: } p &= -5x + 4 \quad \Rightarrow \quad 9p = -45x + 36 \end{aligned}$$

Possibilities:

- (a) $p = \$0.79$
- (b) $p = \$3$
- (c) $p = \$0.07$
- (d) $p = \$7$
- (e) $p = \$4$

$$\begin{aligned} 14p &= 1 \\ p &= \frac{1}{14} \\ p &= 0.0714285 \\ p &\approx 0.07 \end{aligned}$$

11. A radiator contains 4 quarts of fluid, 25% of which is antifreeze. How much fluid should be drained and replaced with pure (100%) antifreeze so that the new mixture is 55% antifreeze?

Possibilities:

- (a) 1 quarts drained and replaced
- (b) 4.8 quarts drained and replaced
- (c) 2.2 quarts drained and replaced
- (d) 1.6 quarts drained and replaced
- (e) 4 quarts drained and replaced

amount of antifreeze in old fluid + pure antifreeze = antifreeze in new mixture

$$(.25)(4 - q) + (1)(q) = .55(4)$$

$$1 - .25q + q = 2.2$$

$$.75q = 1.2$$

$$q = 1.6 \text{ quarts}$$

$q =$ amount to be drained & replaced

*Amount of something in a solution = (concentration)(quantity)

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

$$|x - 4| \leq 5$$

Possibilities:

- (a) $[0, 4]$
- (b) $[-1, 9]$
- (c) $[0, 5]$
- (d) $[4, 5]$
- (e) $[0, 9]$

$$+(x - 4) \leq 5$$

$$x - 4 \leq 5$$

$$x \leq 9$$

$$-(x - 4) \leq 5$$

$$x - 4 \geq -5$$

$$x \geq -1$$



13. Solve the inequality. Answer in interval notation.

$$6x + 9 \leq 4x + 14$$

Possibilities:

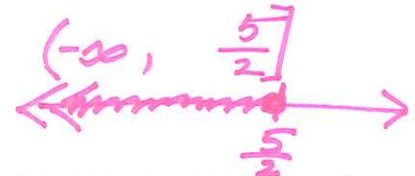
- (a) $(-\infty, \infty)$
- (b) $(-\infty, 6] \cup [9, \infty)$
- (c) $[\frac{5}{2}, \infty)$
- (d) $[\frac{3}{2}, \frac{7}{2}]$
- (e) $(-\infty, \frac{5}{2}]$

$$6x + 9 \leq 4x + 14$$

$$2x + 9 \leq 14$$

$$2x \leq 5$$

$$x \leq \frac{5}{2}$$



14. A rectangle must have a length of 25 inches and an area of at most 600 square inches. How wide can this rectangle be?

Possibilities:

- (a) at most 24 inches
- (b) at most 15000 inches
- (c) at least 24 inches
- (d) at most 15 inches
- (e) at least 15 inches

$l = \text{length}$

$w = \text{width}$

$A = l \cdot w$

$$l \cdot w \leq 600$$

$$25w \leq 600$$

$$w \leq 24 \text{ inches}$$

15. A business executive is considering two options for leasing a car. The first option is \$415 per month, but the first month costs \$90 extra. The second option is \$430 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?

Possibilities: *m = # of months to lease the car*

option #1 = 415m + 90

- (a) Both options cost the same regardless of the length of the lease.
- (b) The first option is cheaper if the lease is 14 months or shorter, the second option is cheaper if the lease is 16 months or longer, and the two options are the same price if the lease is exactly 15 months
- (c) 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
- (d) The first option is cheaper if the lease is 16 months or longer, the second option is cheaper if the lease is 14 months or shorter, and the two options are the same price if the lease is exactly 15 months
- (e)** 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

option #2 = 430m

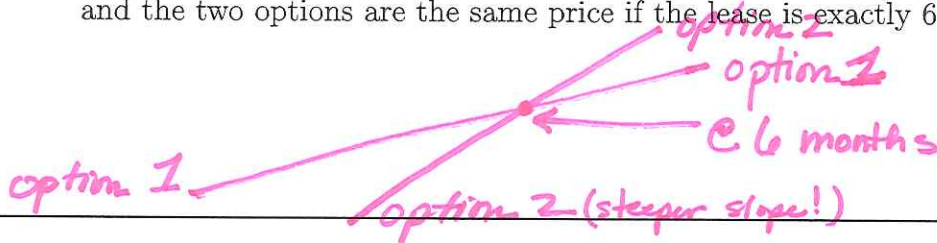
**when cost is same*

option #1 = option #2

415m + 90 = 430m

90 = 15m

6 = m



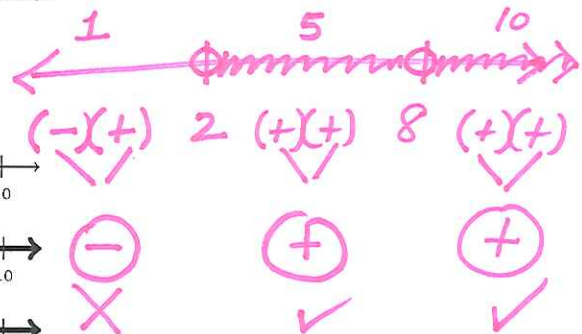
16. Solve the inequality. Answer by choosing the correct number line.

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

test values →

Possibilities:

- (a)
- (b)
- (c)
- (d)
- (e)**



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

$$0 \leq \frac{(x-4)(x-5)}{(x-6)(x-3)}$$

test values \Rightarrow 1 3.5 4.2 5.3 8
 3 4 5 6

Possibilities:

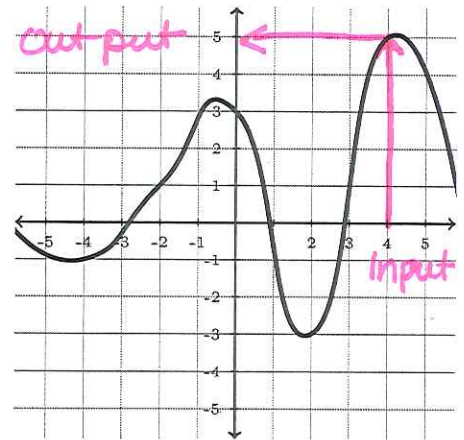
(a)		$\frac{(-)(-)}{(-)(-)}$	$\frac{(-)(-)}{(-)(+)}$	$\frac{(+)(-)}{(-)(+)}$	$\frac{(+)(+)}{(-)(+)}$	$\frac{(+)(+)}{(+)(+)}$
(b)		\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
(c)		\oplus	\ominus	\oplus	\ominus	\oplus
(d)		\checkmark	\times	\checkmark	\times	\checkmark
(e)						

18. Find $f(4)$ from the graph of $y = f(x)$.

input

Possibilities:

- (a) $f(4) = 3$
- (b) $f(4) = 0$
- (c) $f(4) = 5$
- (d) $f(4) = 4$
- (e) $f(4) = 7$



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

$$g(x) = \begin{cases} x^2 + 3 & \text{if } x \leq 2 \\ |x - 11| & \text{if } 2 < x \leq 4 \\ *10x + 2 & \text{if } 4 < x < 8 \\ \sqrt{x - 5} & \text{if } 8 \leq x \end{cases}$$

$4 < 5 < 8$
 \uparrow
 input

Evaluate $g(5)$

Possibilities:

- (a) $g(5) = 52$
- (b) $g(5) = 6$
- (c) $g(5) = 0$
- (d) $g(5) = \sqrt{47}$
- (e) $g(5) = 28$

$$g(5) = 10(5) + 2$$

$$g(5) = 50 + 2$$

$$g(5) = 52$$

20. Let $f(x) = 2x^2 + 4x$. Find $\frac{f(x+h) - f(x)}{h}$ if $h \neq 0$. Simplify your answer.

Possibilities:

- (a) $4x + 4h$
- (b) 8
- (c) $2h + 4$
- (d) $4x + 2h + 4$
- (e) $\frac{h + 8x}{h}$

$$f(x) = 2x^2 + 4x$$

$$f(x+h) = 2(x+h)^2 + 4(x+h)$$

$$= 2(x^2 + 2xh + h^2) + 4x + 4h$$

$$= 2x^2 + 4xh + 2h^2 + 4x + 4h$$

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