

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!**

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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. Solve for  $b$  in  $2(9 - \sqrt{b}) = 16$ .

Possibilities:

- (a)  $b = 1$
- (b)  $b = 10$
- (c)  $b = -7$
- (d)  $b = \frac{13}{2}$
- (e) No solution

$$\begin{aligned} \frac{2(9 - \sqrt{b})}{2} &= \frac{16}{2} \\ 9 - \sqrt{b} &= 8 \\ -9 &\quad -9 \\ (-1)(9 - \sqrt{b}) &= (-1)(8) \\ \sqrt{b} &= 1 \end{aligned}$$

$(\sqrt{b})^2 = (1)^2$   
 $b = 1$

2. Find the  $y$ -intercept(s) of the graph of  $y - 17 = x^2 - 8x - 2$ .

Possibilities:

- (a) (3, 15) and (5, 15)
- (b) (3, 0) only
- (c) (0, 15) only
- (d) (3, 0) and (5, 0)
- (e) (5, 0) only

$$\begin{aligned} y - 17 &= 0^2 - 8(0) - 2 \\ y - 17 &= 0 - 0 - 2 \\ +17 &\quad +17 \\ y &= 15 \end{aligned}$$

$y = 15$

3. Solve for  $x$  in  $3 + |1 - x| = 5$ .

Possibilities:

- (a) 7 and -1
- (b) 7 only
- (c) -1 only
- (d) 3 only
- (e) -1 and 3

$$\begin{aligned} 3 + |1 - x| &= 5 \\ -3 &\quad -3 \\ |1 - x| &= 2 \end{aligned}$$

$1 - x = 2$   
 $-1 \quad -1$   
 $(-1)(1 - x) = (-1)(2)$   
 $x = -1$

$1 - x = -2$   
 $-1 \quad -1$   
 $(-1)(1 - x) = (-1)(-2)$   
 $x = 3$

4. Solve for  $t$  in  $\frac{(7t-6)^3}{3} = 9$ .

Possibilities:

(a)  $\frac{7}{9}$

(b) 61731

(c)  $\frac{9}{7}$

(d)  $6 \pm \sqrt{27}/7$

(e)  $\frac{15}{7}$

$$(3) \left[ \frac{(7t-6)^3}{3} \right] = 9(3)$$

$$\sqrt[3]{(7t-6)^3} = \sqrt[3]{27}$$

$$\begin{array}{r} 7t-6 = 3 \\ +6 \quad +6 \end{array}$$

$$\frac{7t}{7} = \frac{9}{7}$$

$$t = \frac{9}{7}$$

5. The point  $(7, 4)$  is on the graph of which of the following equations?

Possibilities:

(a)  $x = y - 3$

(b)  $xy + 28 = xy + 16$

(c)  $4x + 28 = 4y + 28$

(d)  $xy = 0$

(e)  $4x + 28 = xy + 28$

(a)  $7 \stackrel{?}{=} 4-3$   
 $7 \neq 1$

(b)  $7(4) + 28 \stackrel{?}{=} 7(4) + 16$   
 $28 + 28 \neq 28 + 16$

(c)  $4(7) + 28 \stackrel{?}{=} 4(4) + 28$   
 $28 + 28 \neq 16 + 28$

(d)  $7(4) \stackrel{?}{=} 0$   
 $28 \neq 0$

(e)  $4(7) + 28 \stackrel{?}{=} 7(4) + 28$   
 $28 + 28 \checkmark = 28 + 28$

6. The graph of  $x^2 + y^2 - 14x - 8y + 61 = 0$  is a circle. Find its center and its radius.

Possibilities:

(a) Radius: 4      Center:  $(14, 8)$

(b) Radius:  $\sqrt{61}$       Center:  $(7, 4)$

(c) Radius: 2      Center:  $(7, 4)$

(d) Radius:  $\sqrt{61}$       Center:  $(-7, -4)$

(e) Radius: 2      Center:  $(-7, -4)$

$$x^2 - 14x + 49 + y^2 - 8y + 16 = -61 + 49 + 16$$

$$(x-7)(x-7) + (y-4)(y-4) = 4$$

$$(x-7)^2 + (y-4)^2 = 2^2$$

center:  $(7, 4)$

radius 2

7. How many distinct, real solutions does each equation have?

(I)  $4x^2 + 9x + 5 = 0$

(II)  $7x^2 + 2x + 3 = 0$

Possibilities:

- (a) (I) has 2 distinct, real solutions; and (II) has 1 distinct, real solution
- (b) (I) has 1 distinct, real solution; and (II) has 2 distinct, real solutions
- (c) (I) has 0 distinct, real solutions; and (II) has 1 distinct, real solution
- (d) (I) has 0 distinct, real solutions; and (II) has 2 distinct, real solutions
- (e) (I) has 2 distinct, real solutions; and (II) has 0 distinct, real solutions

(I)  $a=4 \quad b=9 \quad c=5$

$$b^2 - 4ac$$

$$9^2 - 4(4)(5)$$

$$81 - 80$$

$$1 > 0 \Rightarrow \boxed{2 \text{ distinct real solutions}}$$

(II)  $a=7 \quad b=2 \quad c=3$

$$b^2 - 4ac$$

$$2^2 - 4(7)(3)$$

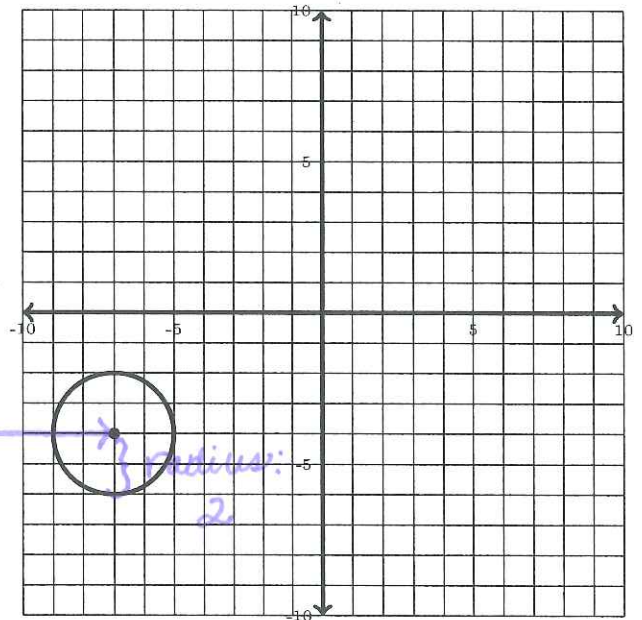
$$4 - 84$$

$$-80 < 0 \Rightarrow \boxed{0 \text{ distinct, real solutions}}$$

8. Find an equation for the circle shown below:

Possibilities:

- (a)  $(x + 14)^2 + (y - 8)^2 = -4$
- (b)  $(x - 7)^2 + (y + 4)^2 = 2$
- (c)  $(x - 7)^2 + (y - 4)^2 = 4$
- (d)  $(x + 7)^2 + (y + 4)^2 = 4$
- (e)  $(x + 7)^2 + (y - 4)^2 = 2$



center:  
 $(-7, -4)$

radius:  
2

$$(x-h)^2 + (y-k)^2 = r^2$$

$$[x - (-7)]^2 + [y - (-4)]^2 = 2^2$$

$$\boxed{(x+7)^2 + (y+4)^2 = 4}$$

9. Find all distinct, real solutions  $x$  to  $\sqrt{6-x} = x-4$

Possibilities:

- (a) 6 only
- (b) 5 only
- (c) 2 and 5
- (d) 2 only
- (e) 6 and -4

$$(\sqrt{6-x})^2 = (x-4)^2$$

$$6-x = (x-4)(x-4)$$

$$6-x = x^2 - 8x + 16$$

$$-6+x \quad \quad \quad +x-6$$

$$0 = x^2 - 7x + 10$$

$$0 = (x-5)(x-2)$$

$$x-5=0$$

$$\boxed{x=5}$$

CHECK:

$$\sqrt{6-5} \stackrel{?}{=} 5-4$$

$$\sqrt{1} \stackrel{?}{=} 1$$


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$$x-2=0$$

$$\cancel{x=2}$$

CHECK:

$$\sqrt{6-2} \stackrel{?}{=} 2-4$$

$$\sqrt{4} \stackrel{?}{=} -2$$

$$2 \neq -2$$

10. Find all distinct, real solutions  $x$  to  $3x = x^5$ .

Possibilities:

- (a)  $x = \sqrt[5]{3}$  only
- (b)  $x = 0$  and  $x = \sqrt[5]{3}$
- (c)  $x = 0$  and  $x = \pm\sqrt[4]{3}$
- (d)  $x = \pm\sqrt[4]{3}$  and  $x = \sqrt[5]{3}$
- (e)  $x = \pm\sqrt[4]{3}$  only

$$3x = x^5$$

$$-3x \quad -3x$$

$$0 = x^5 - 3x$$

$$0 = x(x^4 - 3)$$

$$\boxed{x=0}$$

$$x^4 - 3 = 0$$

$$x^4 = 3$$

$$\boxed{x = \pm\sqrt[4]{3}}$$

11. Find all distinct, real solutions  $x$  to  $x^2 + 7x + 5 = 0$ .

Possibilities:

- (a)  $\frac{-7 \pm \sqrt{29}}{2}$
- (b)  $\frac{-7 \pm \sqrt{69}}{2}$
- (c)  $\frac{\pm 7 - \sqrt{29}}{2}$
- (d)  $\frac{\pm 7 - \sqrt{69}}{2}$
- (e) No solution

$$a=1 \quad b=7 \quad c=5$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-7 \pm \sqrt{7^2 - 4(1)(5)}}{2(1)}$$

$$x = \frac{-7 \pm \sqrt{49 - 20}}{2}$$

$$\Rightarrow \boxed{x = \frac{-7 \pm \sqrt{29}}{2}}$$

12. How many distinct, real solutions  $x$  does  $\frac{3}{x-8} + \frac{1}{x-6} = \frac{5}{x^2 - 14x + 48}$  have?

Possibilities:

- (a) 4 solutions
- (b) No solutions
- (c) 3 solutions
- (d) 2 solutions
- (e) 1 solution

$$\left[ \frac{3}{x-8} + \frac{1}{x-6} = \frac{5}{(x-8)(x-6)} \right] (x-8)(x-6)$$

$$\left( \frac{3}{x-8} \right) \frac{(x-8)(x-6)}{1} + \left( \frac{1}{x-6} \right) \frac{(x-8)(x-6)}{1} = \left[ \frac{5}{(x-8)(x-6)} \right] \frac{(x-8)(x-6)}{1}$$

$$3(x-6) + 1(x-8) = 5$$

$$3x - 18 + x - 8 = 5$$

$$4x - 26 = 5$$

$$4x = 31$$

$$x = \frac{31}{4}$$

**1 distinct, real solution**

13. Find an equation for the line through the points (7, 4) and (2, 6).

Possibilities:

- (a)  $y + 4 = -\frac{5}{2}(x + 7)$
- (b)  $y - 4 = -\frac{2}{5}(x - 7)$
- (c)  $y + 4 = -\frac{2}{5}(x + 7)$
- (d)  $y - 4 = -\frac{5}{2}(x - 7)$
- (e)  $y = \frac{5}{2}(x - 7) - 4$

$$m = \frac{6-4}{2-7} = \frac{2}{-5}$$

$$y - 4 = -\frac{2}{5}(x - 7)$$

14. Rewrite the expression  $x^2 - 2x + 5$  by completing the square.

Possibilities:

- (a)  $(x - 1)^2 + 4$
- (b)  $(x + 2)^2 - 5$
- (c)  $(x + 1)^2 - 4$
- (d)  $(x - 2)^2 + 5$
- (e)  $(x + 1)^2 - 5$

$$x^2 - 2x + \left(\frac{-2}{2}\right)^2 - \underline{1} + 5$$

$$x^2 - 2x + 1 + 4$$

$$(x-1)(x-1) + 4$$

$$\boxed{(x-1)^2 + 4}$$

15. Find all distinct, real solutions  $x$  to  $(x^2 - 3)(x - 1)(x - 5) = 0$ .

Possibilities:

- (a)  $x = 3, x = 1,$  and  $x = 5$
- (b)  $x = \pm\sqrt{3}, x = -1,$  and  $x = -5$
- (c)  $x = -3, x = -1,$  and  $x = -5$
- (d)  $x = \pm\sqrt{3}, x = 1,$  and  $x = 5$
- (e) No solution

$$x^2 - 3 = 0$$

$$x^2 = 3$$

$$x = \pm\sqrt{3}$$

$$x - 1 = 0$$

$$x = 1$$

$$x - 5 = 0$$

$$x = 5$$

16. Find the slope of the line in the graph.

Possibilities:

- (a)  $-2$
- (b)  $-\frac{1}{2}$
- (c)  $2$
- (d)  $\frac{1}{2}$
- (e) The slope is not defined.

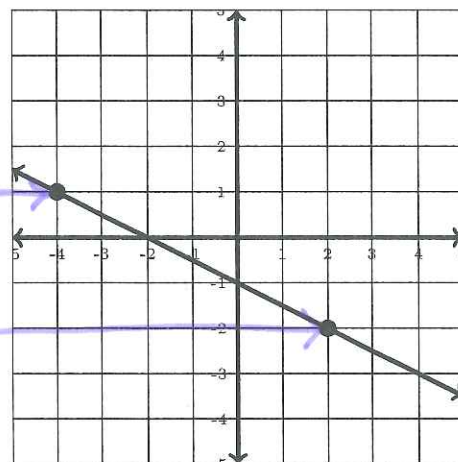
$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - (-2)}{-4 - 2} = \frac{1 + 2}{-6} = -\frac{3}{6} = -\frac{1}{2}$$

$$(x_1, y_1)$$

$$(-4, 1)$$

$$(x_2, y_2)$$

$$(2, -2)$$



17. Find an equation of the line parallel to  $y = \frac{4}{7}x + 2$  that passes through the point  $(6, 3)$

Possibilities:

- (a)  $y = \frac{4}{7}(x - 6) + 3$
- (b)  $y = -\frac{7}{4}(x - 6) + 2$
- (c)  $y = \frac{4}{7}(x - 6) + 2$
- (d)  $y = 3$
- (e)  $y = -\frac{7}{4}(x - 6) + 3$

$$m = \frac{4}{7} \text{ (since lines are parallel)}$$

$$y - y_1 = m(x - x_1)$$

$$y - 3 = \frac{4}{7}(x - 6) + 3$$

$$y = \frac{4}{7}(x - 6) + 3$$

18. Solve the equation  $6x^2 + 104xy = 3$  for  $y$  in terms of  $x$

Possibilities:

(a)  $y = \frac{104x}{6x^2 - 3}$

(b)  $y = 3 - 6x^2 - 104x$

(c)  $y = \frac{-104 \pm \sqrt{10888}}{12}$

(d)  $y = \frac{3 - 6x^2}{104x}$

(e)  $y = \frac{6x^2 - 3}{104x}$

$$6x^2 + 104xy = 3$$

$$-6x^2 \qquad \qquad -6x^2$$

$$\frac{104xy}{104x} = \frac{3 - 6x^2}{104x}$$

$$y = \frac{3 - 6x^2}{104x}$$

19. Find all distinct, real solutions  $x$  to  $x^{10} - 8x^5 + 12 = 0$

Possibilities:

(a)  $x = 6^5$  and  $x = 2^5$

(b)  $x = \sqrt[5]{6}$  and  $x = \sqrt[5]{2}$

(c)  $x = 2$  only

(d)  $x = 6$  only

(e)  $x = 6$  and  $x = 2$

$$u = x^5$$

$$u^2 = (x^5)^2 = x^{10}$$

$$u^2 - 8u + 12 = 0$$

$$(u - 6)(u - 2) = 0$$

$$u - 6 = 0 \quad u - 2 = 0$$

$$u = 6 \quad u = 2$$

$$x^5 = 6$$

$$x = \sqrt[5]{6}$$

$$x^5 = 2$$

$$x = \sqrt[5]{2}$$

20. What is the distance between  $(-3, 1)$  and  $(5, 8)$ ?

Possibilities:

(a) 7

(b) 5

(c) 8

(d)  $\sqrt{113}$

(e)  $\sqrt{15}$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$d = \sqrt{[5 - (-3)]^2 + (8 - 1)^2}$$

$$d = \sqrt{8^2 + 7^2}$$

$$d = \sqrt{64 + 49}$$

$$d = \sqrt{113}$$