

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!**

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For grading use:

Total	
	(out of 100 pts)

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

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### Multiple Choice Questions

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

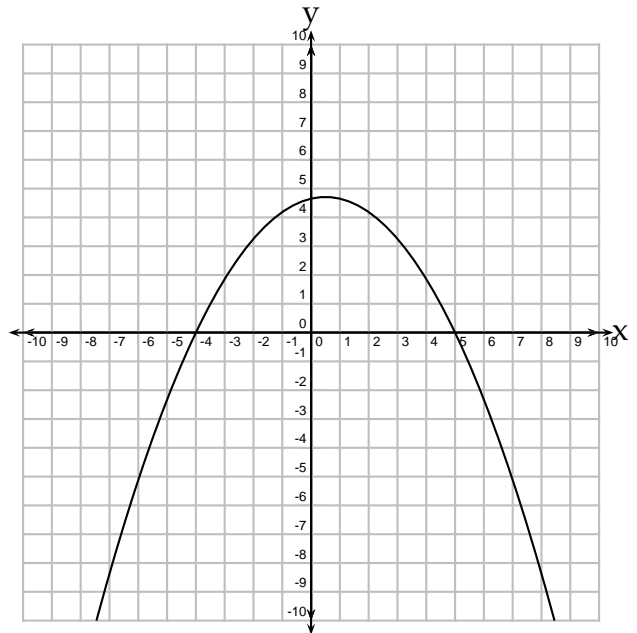
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1. Let  $P(x) = 2x^5 + 2x^4 + 3x^3 - 2x + 27$ . List all possible rational zeros of  $P(x)$  given by the Rational Zeros Theorem (but do not check to see which are actually zeros).

**Possibilities:**

- (a)  $\pm 1, \pm 27, \pm 27/2$
  - (b)  $\pm 1, \pm 3, \pm 9, \pm 27, \pm 1/2, \pm 3/2, \pm 9/2, \pm 27/2$
  - (c)  $\pm 1, \pm 3, \pm 9, \pm 27, \pm 2, \pm 2/3, \pm 2/9, \pm 2/27$
  - (d)  $\pm 1, \pm 27, \pm 2/27$
  - (e)  $\pm 1, \pm 1/3, \pm 1/9, \pm 1/27, \pm 2, \pm 2/3, \pm 2/9, \pm 2/27$
- 

2. The graph of the polynomial  $y = P(x)$  is shown below. What conclusions can you make from this graph?



- (I).  $(x + 4)$  is a factor of  $P(x)$
- (II). When  $P(x)$  is divided by  $(x + 5)$ , the remainder is 0.
- (III).  $x = 5$  is a root with an even multiplicity.

**Possibilities:**

- (a) Only (II) is true.
  - (b) Only (I) is true.
  - (c) Only (I) and (II) are true.
  - (d) (I), (II), and (III) are all true.
  - (e) Only (II) and (III) are true.
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3. Find a formula for the parabola that has vertex  $(1, 4)$  and passes through the point  $(5, -28)$ .

**Possibilities:**

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

(b)  $y = -x^2 + 2x + 3$

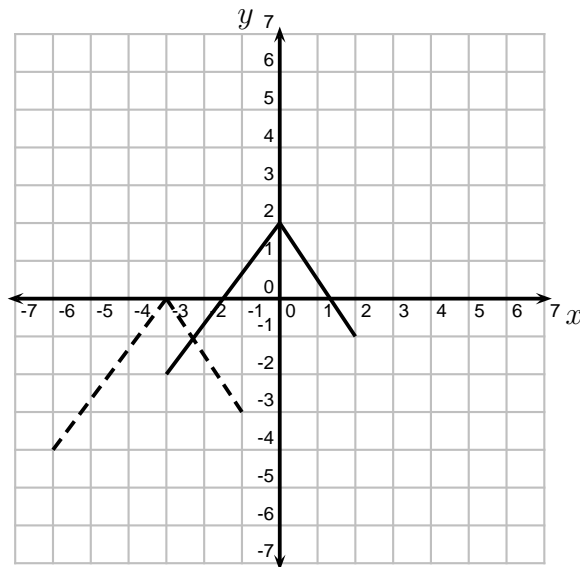
(c)  $y = 2x^2 - 4x - 2$

(d)  $y = -2x^2 - 4x - 6$

(e)  $y = -x^2 + x - 28$

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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)  $g(x) = f(x - 3) - 2$

(b)  $g(x) = f(x + 3) + 2$

(c)  $g(x) = f(x - 2) + 3$

(d)  $g(x) = f(x + 3) - 2$

(e)  $g(x) = f(x + 2) + 3$

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5. Let  $f(x) = -4x^{11} + x^4 - 3x^2 + 5x + 7$ . Determine the end behavior of  $y = f(x)$ .

**Possibilities:**

(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) None of the above.

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6. Let  $r(x) = \frac{(x+7)(x-5)}{x-2}$ . Find the vertical asymptote(s) of  $r(x)$ .

**Possibilities:**

- (a)  $x = 2$
- (b)  $x = \frac{-35}{2}$
- (c)  $x = 1$
- (d)  $x = 5$  and  $x = -7$
- (e)  $x = 0$

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7. A merchant wants to mix  $x$  pounds of peanuts that cost \$2.05 per pound and  $y$  pounds of cashews that cost \$3.00 per pound to obtain 40 pounds of a mixture that cost \$2.41 per pound. Which system of equations would you solve to find out how many pounds of peanuts are needed?

**Possibilities:**

- (a)  $\begin{cases} x + y = 40 \\ 2.05x + 3.00y = 96.40 \end{cases}$
- (b)  $\begin{cases} x - y = 40 \\ x + y = 2.41 \end{cases}$
- (c)  $\begin{cases} x + y = 40 \\ 2.05x + 3.00y = 2.41 \end{cases}$
- (d)  $\begin{cases} xy = 40 \\ 2.05x + 3.00y = 96.40 \end{cases}$
- (e)  $\begin{cases} x + y = 96.40 \\ 2.05x + 3.00y = 40 \end{cases}$

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8. Find the quotient and remainder of the division problem.

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

**Possibilities:**

- (a) Quotient:  $x^2$       Remainder:  $-4x^2$
- (b) Quotient:  $x^2$       Remainder:  $6x^2$
- (c) Quotient:  $x^2 - 4$       Remainder: 20
- (d) Quotient:  $x^2 + 6$       Remainder:  $-30$
- (e) Quotient:  $x^2 + 6$       Remainder: 30

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9. When a high school basketball team charges  $p$  dollars per ticket, the total revenue  $R$  from ticket sales is given by the formula

$$R(p) = 2000p - 100p^2.$$

What price should the team charge in order to maximize the revenue?

**Possibilities:**

- (a) \$8
- (b) \$9
- (c) \$11
- (d) \$7
- (e) \$10

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10. How many solutions does the following system of equations have?

$$\begin{cases} 8x + 16y = 24 \\ 12x + 24y = 37 \end{cases}$$

**Possibilities:**

- (a) No solutions
- (b) One solution
- (c) Two solutions
- (d) Three solutions
- (e) Infinitely many solutions

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11. Let  $f(x) = x^2 + 6x$ . Find the average rate of change of  $f(x)$  from  $x = a$  to  $x = a + h$ . Assume  $h \neq 0$ .

**Possibilities:**

- (a) 1
  - (b)  $h + 6$
  - (c)  $\frac{2ah + h^2 + 12a + 6h}{h}$
  - (d)  $-2a - h - 6$
  - (e)  $2a + h + 6$
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12. Solve the inequality.

$$x^2 - 4x \leq 21$$

**Possibilities:**

- (a)  $[-3, 7]$
- (b)  $(-3, 7)$
- (c)  $(-\infty, -3]$
- (d)  $[7, \infty)$
- (e)  $(-\infty, -3] \cup [7, \infty)$

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13. Let  $f(x) = \sqrt[3]{x - 15}$ . Find  $f^{-1}(x)$ .

**Possibilities:**

- (a)  $f^{-1}(x) = (x + 15)^3$
- (b)  $f^{-1}(x) = 15 + x^3$
- (c)  $f^{-1}(x) = 5$
- (d)  $f^{-1}(x) = 3x - 45$
- (e)  $f(x)$  is not one-to-one, therefore it does not have an inverse.

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14. Let

$$f(x) = \begin{cases} |x + 1| & \text{if } x \leq -2 \\ x + 5 & \text{if } x > -2 \end{cases}$$

Find  $f(-2)$ .

**Possibilities:**

- (a) 7
  - (b) 1
  - (c) 3
  - (d)  $-3$
  - (e)  $-1$
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15. How many solutions does the equation have?

$$\frac{5}{x+4} + \frac{6}{x^2+7x+12} = \frac{8}{x+3}.$$

**Possibilities:**

- (a) 4 solutions
  - (b) No solutions
  - (c) 2 solutions
  - (d) 1 solution
  - (e) 3 solutions
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16. Find an equation for the line through the points (2, 6) and (12, 7).

**Possibilities:**

- (a)  $y + 7 = \frac{1}{10}(x + 12)$
  - (b)  $y = -10(x - 12) - 7$
  - (c)  $y - 6 = 10x + 12$
  - (d)  $y - 2 = \frac{1}{10}(x - 6)$
  - (e)  $y - 6 = \frac{1}{10}(x - 2)$
- 

17. Let  $f(x) = \frac{2x - 10}{x + 6}$ . Find the domain of  $f(x)$ .

**Possibilities:**

- (a)  $(-6, \infty)$
  - (b)  $(-\infty, -6) \cup (-6, \infty)$
  - (c)  $(6, \infty)$
  - (d)  $(-\infty, -5] \cup (5, \infty)$
  - (e)  $(5, \infty)$
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18. Use the graphing function on your calculator to approximate all real solutions to the equation below.

$$25 - 3x = x^3 + 3x^2$$

**Possibilities:**

- (a)  $x \approx -3.0000$
- (b)  $x \approx 1.9625$
- (c)  $x \approx 8.3333$
- (d)  $x \approx -2.9850$
- (e)  $x \approx 1.9527$

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19. Which of the following is a true statement about the function  $f(x) = \frac{x - 1}{x^2 + 10x + 24}$ ?

**Possibilities:**

- (a) The graph of  $y = f(x)$  has a horizontal asymptote  $y = 0$  and a  $y$ -intercept of  $\left(0, \frac{-1}{24}\right)$ .
- (b) The graph of  $y = f(x)$  has a horizontal asymptote  $y = 0$  and a  $y$ -intercept of  $(0, 1)$ .
- (c) The graph of  $y = f(x)$  has a horizontal asymptote  $y = 1$  and a  $y$ -intercept of  $(0, -6)$ .
- (d) The graph of  $y = f(x)$  has a horizontal asymptote  $y = 0$  and a  $y$ -intercept of  $(0, -6)$ .
- (e) The graph of  $y = f(x)$  has a horizontal asymptote  $y = 1$  and a  $y$ -intercept of  $\left(0, \frac{-1}{24}\right)$ .

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20. The point  $(9, 1)$  is a point on the graph of which of the following equations?

**Possibilities:**

- (a)  $2x - 18 = xy$
  - (b)  $x = y$
  - (c)  $2x - 18 + xy = xy$
  - (d)  $xy = 0$
  - (e)  $2x - 18 + xy = 0$
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**Formula Sheet:**

**Compound Interest:** If a principal  $P_0$  is invested at an interest rate  $r$  for a period of  $t$  years, then the amount  $P(t)$  of the investment is given by:

$$P(t) = P_0 \left(1 + \frac{r}{n}\right)^{nt} \quad (\text{if compounded } n \text{ times per year})$$

$$P(t) = P_0 e^{rt} \quad (\text{if compounded continuously}).$$

**Change of Base Formula:** Let  $a$  and  $b$  be two positive numbers with  $a, b \neq 1$ . If  $x > 0$ , then:

$$\log_a x = \frac{\log_b x}{\log_b a}$$