

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

10.  a  b  c  d  e

2.  a  b  c  d  e

11.  a  b  c  d  e

3.  a  b  c  d  e

12.  a  b  c  d  e

4.  a  b  c  d  e

13.  a  b  c  d  e

5.  a  b  c  d  e

14.  a  b  c  d  e

6.  a  b  c  d  e

15.  a  b  c  d  e

7.  a  b  c  d  e

16.  a  b  c  d  e

8.  a  b  c  d  e

17.  a  b  c  d  e

9.  a  b  c  d  e

18.  a  b  c  d  e

**For grading use:**

<b>Total</b>	
	<b>(out of 90 pts)</b>

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. Which of the following is a polynomial function?

(I)  $h(x) = \frac{x + 1}{x^2 + 2x + 5}$

(II)  $k(x) = 3x^{1/3} + 2x - 5$

(III)  $g(x) = (x - 2)^2(3 - 5x)^4$

**Possibilities:**

- (a) (II) and (III) are polynomial functions.
  - (b) Only (I) is a polynomial function.
  - (c) Only (III) is a polynomial function.
  - (d) (I) and (III) are polynomial functions.
  - (e) Only (II) is a polynomial function.
- 

2. Find an equation for the line through the points  $(-2, 4)$  and  $(5, 14)$ .

**Possibilities:**

(a)  $y - 2 = -\frac{7}{10}(x - 4)$

(b)  $y - 4 = \frac{10}{7}(x + 2)$

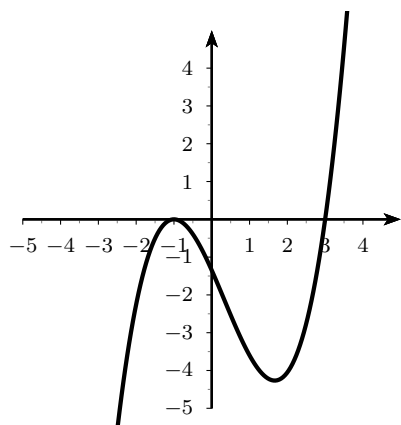
(c)  $y + 4 = \frac{10}{7}(x - 2)$

(d)  $y - 5 = \frac{10}{7}(x - 14)$

(e)  $y - 14 = -\frac{7}{10}(x - 5)$

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3. The graph of  $y = f(x)$  is shown, where  $f(x)$  is known to be a polynomial function. Which of the following must be true?



**Possibilities:**

- (a)  $f(x)$  has an even degree, the leading coefficient of  $f(x)$  is negative, and the multiplicity of the zero  $x = 3$  is even.
- (b)  $f(x)$  has an odd degree, the leading coefficient of  $f(x)$  is positive, and the multiplicity of the zero  $x = 3$  is odd.
- (c)  $f(x)$  has a negative degree, the leading coefficient of  $f(x)$  is negative, and the multiplicity of the zero  $x = 3$  is even.
- (d)  $f(x)$  has an even degree, the leading coefficient of  $f(x)$  is positive, and the multiplicity of the zero  $x = 3$  is odd.
- (e)  $f(x)$  has an odd degree, the leading coefficient of  $f(x)$  is negative, and the multiplicity of the zero  $x = 3$  is odd.

- 
4. Solve for  $r$ .

$$\frac{(5r - 1)^3}{25} = 5$$

**Possibilities:**

- (a)  $\frac{4}{5}$
- (b)  $\frac{26}{5}$
- (c)  $\frac{126}{5}$
- (d)  $\frac{6}{5}$
- (e) 30

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5. Use the graphing function on your calculator to find the number of solutions to the equation below.

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

**Possibilities:**

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

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6. Find the intercept(s) of the graph of  $y = x^2 - 13x + 40$ .

**Possibilities:**

- (a)  $x$ -intercepts: (5, 0) and (8, 0)  
 $y$ -intercept: (0, -40)
- (b)  $x$ -intercepts: (5, 0) and (8, 0)  
 $y$ -intercept: (0, 40)
- (c)  $x$ -intercepts: (-5, 0) and (-8, 0)  
 $y$ -intercept: (0, 40)
- (d)  $x$ -intercept: (-40, 0)  
 $y$ -intercepts: (0, -5) and (0, -8)
- (e)  $x$ -intercept: (40, 0)  
 $y$ -intercepts: (0, 5) and (0, 8)

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7. Let  $f(x) = \frac{x-4}{5}$ . Find  $f^{-1}(6)$ .

**Possibilities:**

- (a) 34
- (b)  $\frac{5}{2}$
- (c) -34
- (d) 26
- (e)  $\frac{2}{5}$

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8. Suppose  $f(x) = x^2 + 41$ . Find  $\frac{f(x+h) - f(x)}{h}$ .

**Possibilities:**

- (a)  $\frac{2x^2 + 2xh + h^2 + 82}{h}$
- (b)  $2x + h$
- (c)  $h$
- (d)  $\frac{2xh + h^2 + 82}{h}$
- (e) 1

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9. Let  $P(x) = 3x^{50} + 4x^{40} - 31x^{30} + 3x^{20} + 4$ . 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)  $\pm 1, \pm 4, \pm 4/3$
- (b)  $\pm 1, \pm 1/2, \pm 1/4, \pm 3, \pm 3/2, \pm 3/4$
- (c)  $\pm 1, \pm 4, \pm 3/4$
- (d)  $\pm 1, \pm 2, \pm 4, \pm 1/3, \pm 2/3, \pm 4/3$
- (e)  $\pm 1, \pm 2, \pm 4, \pm 3, \pm 3/2, \pm 3/4$

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10. A merchant wants to mix  $x$  pounds of peanuts that cost \$2.15 per pound and  $y$  pounds of cashews that cost \$2.90 per pound to obtain 40 pounds of a mixture that cost \$2.71 per pound. Which system of equations would you solve to find out how many pounds of peanuts are needed?

**Possibilities:**

- (a)  $\begin{cases} x + y = 108.40 \\ 2.15x + 2.90y = 40 \end{cases}$
- (b)  $\begin{cases} xy = 40 \\ 2.15x + 2.90y = 108.40 \end{cases}$
- (c)  $\begin{cases} x - y = 40 \\ x + y = 2.71 \end{cases}$
- (d)  $\begin{cases} x + y = 40 \\ 2.15x + 2.90y = 108.40 \end{cases}$
- (e)  $\begin{cases} x + y = 40 \\ 2.15x + 2.90y = 2.71 \end{cases}$

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

$$\frac{x^3 - 12x^2 + 48x - 63}{x - 4}$$

**Possibilities:**

- (a) Quotient:  $x^2 - 16x + 76$     Remainder: 305
- (b) Quotient:  $x^2 - 8x + 16$     Remainder: 1
- (c) Quotient:  $x^2$     Remainder:  $-3x^2$
- (d) Quotient:  $x^2 - 8x + 16$     Remainder:  $-127$
- (e) Quotient:  $x^2$     Remainder:  $-8x^2 + 48x - 64$

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12. A ball is thrown straight upward at an initial speed of 224ft/sec. From Physics it is known that, after  $t$  seconds, the ball reaches a height  $h$  feet given by the formula

$$h = -16t^2 + 224t.$$

What is the maximum height reached by the ball?

**Possibilities:**

- (a) 811 ft
- (b) 797 ft
- (c) 784 ft
- (d) 12 ft
- (e) 7 ft

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13. Explain how the graph of  $g(x) = (x - 6)^2 + 8$  is obtained from the graph of  $f(x) = x^2$ . What is the vertex of the graph of  $y = g(x)$ ?

**Possibilities:**

- (a) Shift left 6 units and shift up 8 units. The vertex of the graph of  $y = g(x)$  is  $(-6, 8)$ .
- (b) Shift left 8 units and shift down 6 units. The vertex of the graph of  $y = g(x)$  is  $(6, -8)$ .
- (c) Shift left 6 units and shift down 8 units. The vertex of the graph of  $y = g(x)$  is  $(6, 8)$ .
- (d) Shift right 6 units and shift up 8 units. The vertex of the graph of  $y = g(x)$  is  $(6, 8)$ .
- (e) Shift right 6 units and shift down 8 units. The vertex of the graph of  $y = g(x)$  is  $(6, -8)$ .

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14. Let  $f(x) = 8x$  and  $g(x) = x + 2$ . Find  $f(g(x))$ .

**Possibilities:**

(a)  $f(g(x)) = 8x + 2$

(b)  $f(g(x)) = 8x$

(c)  $f(g(x)) = 8x + 16$

(d)  $f(g(x)) = 8x^2 + 16$

(e)  $f(g(x)) = 8x^2 + 16x$

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15. Solve for  $x$ .

$$\ln(5x) = 3$$

**Possibilities:**

(a)  $\frac{e^3}{5}$

(b)  $\frac{3}{\ln(5)}$

(c)  $3 - \ln(5)$

(d)  $3 + \ln(5)$

(e)  $e^{3/5}$

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16. Let  $r(x) = \frac{(x+3)(x+4)}{x+7}$ . Find the vertical asymptote(s) of  $r(x)$ .

**Possibilities:**

(a)  $x = \frac{-12}{7}$

(b)  $x = -7$

(c)  $x = 1$

(d)  $x = -4$  and  $x = -3$

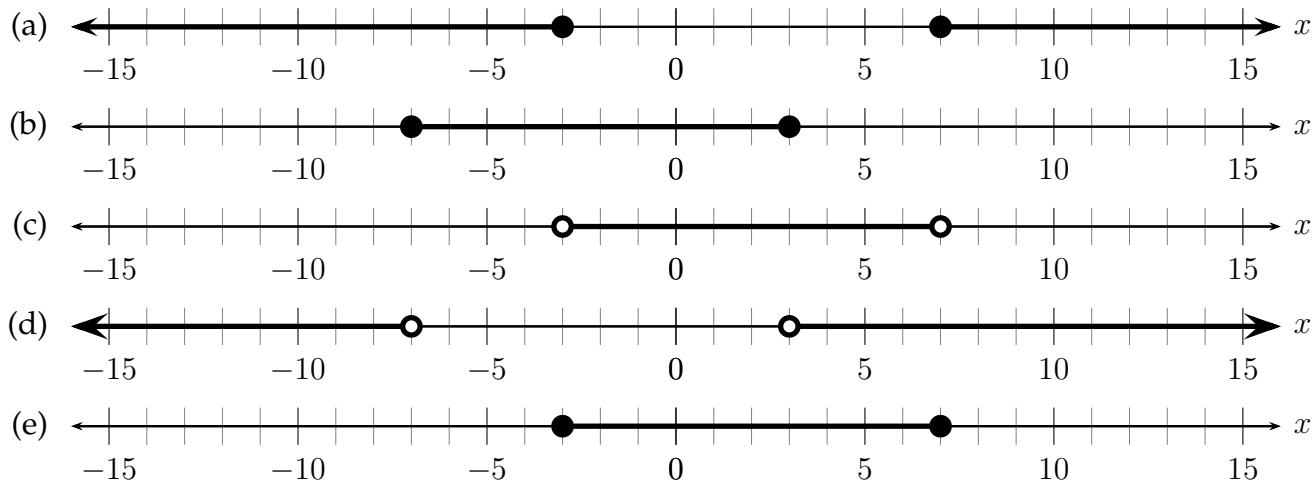
(e)  $x = 0$

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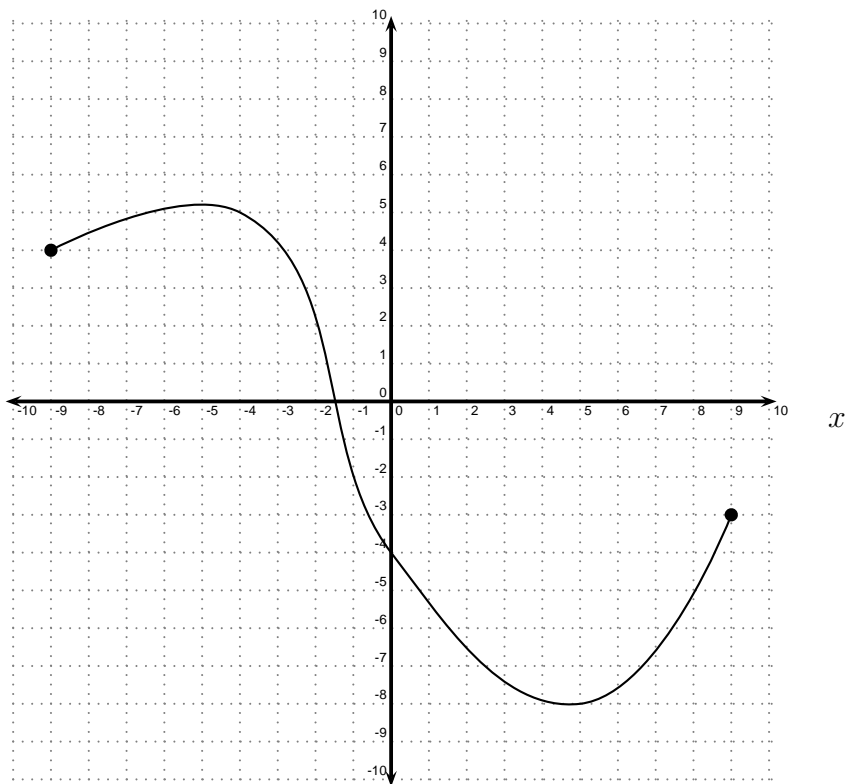
17. Solve the inequality and graph the solution set on the real number line.

$$x^2 - 4x - 21 \leq 0$$

**Possibilities:**



18. The graph of  $y = f(x)$  is shown below. Use the graph to find  $f(5)$ . (HINT: The answer is an integer.)



**Possibilities:**

- (a) -4
- (b) -8
- (c) -9
- (d) 5
- (e) 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:

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