

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

## A2RCC Midterm Review

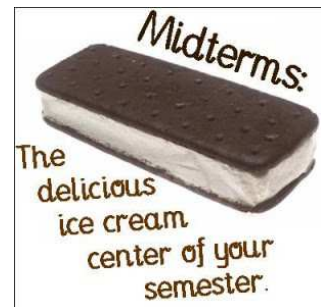
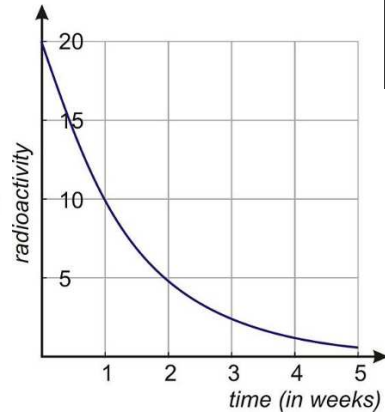
### Unit 1: Functions and Relations

#### Know your parent functions!

1. The accompanying graph shows the amount of radio-activity over time.

Which type of function does this graph best model?

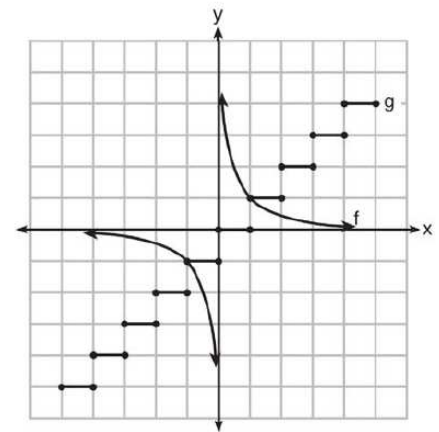
- 1) trigonometric
- 2) logarithmic
- 3) quadratic
- 4) exponential



#### Definition of function

2. Which statement is true about the graphs of  $f$  and  $g$  shown below?

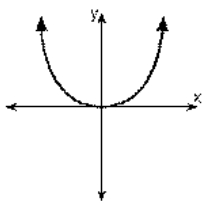
- 1)  $f$  is a relation and  $g$  is a function.
- 2)  $f$  is a function and  $g$  is a relation.
- 3) Both  $f$  and  $g$  are functions.
- 4) Neither  $f$  nor  $g$  is a function.



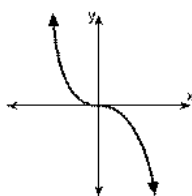
#### Definition of 1-1

3. Which diagram represents a one-to-one function?

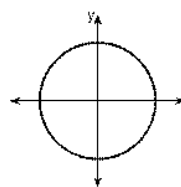
1)



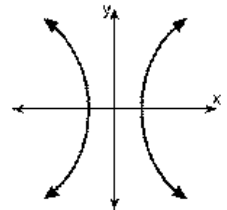
2)



3)



4)

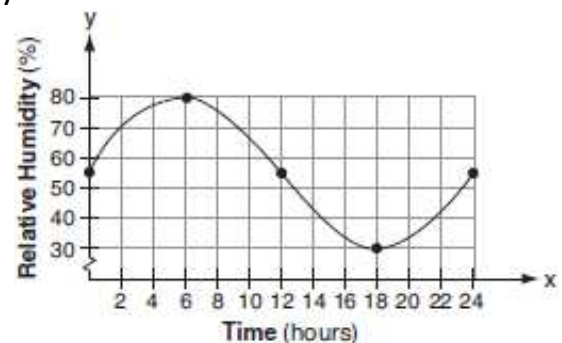


#### Domain and Range

4. A meteorologist drew the accompanying graph to show the changes in relative humidity during a 24-hour period in New York City.

State the domain in interval notation:

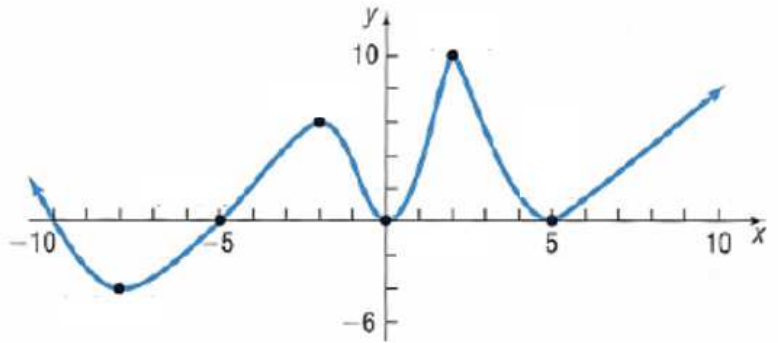
State the range in interval notation:



### Evaluating a function

5. The function  $y = f(x)$  is shown graphed.

Determine  $f(2)$ . \_\_\_\_\_



6. Find all the relative maximum and minimum values of the function. State the values of  $x$  where they occur as well.

Coordinates of relative maximums:

Coordinates of relative minimums:

Is there an absolute maximum? Absolute minimum? Why or Why not?

Find all the intervals where this function is increasing:

Find all the intervals where this function is decreasing:

Where is this function negative?

Is this function positive over  $(0, 5)$ ? \_\_\_\_\_

### Evaluating compositions of functions

7. If  $f(x) = \frac{1}{2}x - 3$  and  $g(x) = 2x + 5$ , what is the value of  $(g \circ f)(4)$ ?

- 1) -13
- 2) 3.5
- 3) 3
- 4) 6

### Inverse of a function

8.  $f(x) = 7x + 5$

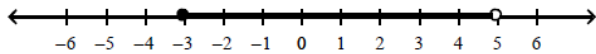
$f^{-1}(x) =$

Is the inverse a function? \_\_\_\_\_

## Set Notation

9. Write a set for each number line graph using BOTH set builder and Interval notation.

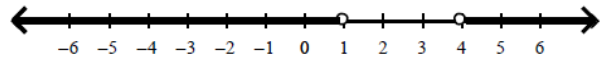
A)



Set builder: \_\_\_\_\_

Interval: \_\_\_\_\_

B)



Set builder: \_\_\_\_\_

Interval: \_\_\_\_\_

## Restricted Domains

10. Find the domain for each and write it in set builder notation.

A)  $f(x) = \frac{2x-5}{5x+1}$

B)  $g(x) = \sqrt{x^2 - 3x - 10}$

C)  $h(x) = \frac{5}{\sqrt{2x-3}}$

## Unit 2: Linear functions

### Average rate of change

11. The average rate of change of  $f(x) = x^2 + 5x + 14$  from  $x = -1$  to  $x = 2$  is

1. 6

2. 8

3. 10

4. 18

12. For the function  $g(x)$  given in the table below, calculate the average rate of change for each of the following intervals.

$x$	-3	-1	4	6	9
$g(x)$	8	-2	13	12	5

(a)  $-3 \leq x \leq -1$

(b)  $-1 \leq x \leq 6$

(c)  $-3 \leq x \leq 9$

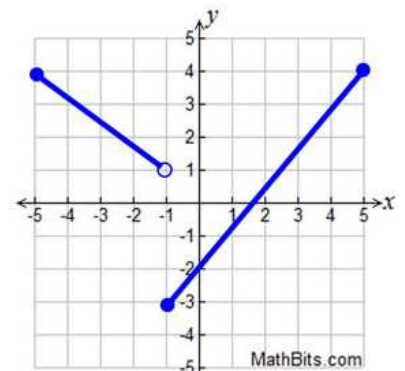
13. Regarding the graph at the right, what is the average rate of change over the interval  $-1 \leq x \leq 5$ ?

1

2. -1

3.  $\frac{7}{6}$

4.  $\frac{1}{2}$



### Direct Variation

14.  $y$  varies directly as  $x$ . If  $y = 4$ , when  $x = -2$ , find  $x$  when  $y = 6$ .

1. -3

2. 3

3. 8

4. -2

## Forms of Linear Equations

Write the slope-intercept form of a line : \_\_\_\_\_

Write the point-slope form of a line : \_\_\_\_\_

14. The point-slope form for the line with a slope of  $m = 2$  and point  $(-2, 5)$  is

1.  $y + 2 = 2(x - 5)$
2.  $y - 2 = 2(x + 5)$
3.  $y + 5 = 2(x - 2)$
4.  $y - 5 = 2(x + 2)$

## Writing a linear equation given 2 points

16. Write the point-slope AND the slope-intercept form of the line that passes through the points  $(2, 5)$  and  $(-4, 8)$ .

## Parallel and Perpendicular lines

17. Write a line in slope-intercept form **parallel** to the line  $2y = -3x - 5$  and passes through the point  $(4, 7)$ .

18. Write a line in slope-intercept form **perpendicular** to the line  $2y = -3x - 5$  and passes through the point  $(4, 7)$ .

## Piece-wise and Step functions

19. In the piecewise function  $f(x) = \begin{cases} -5x + 4 & \text{if } x < -3 \\ 2x + 3 & \text{if } x \geq -3 \end{cases}$ . The value of  $f(-7)$  equals

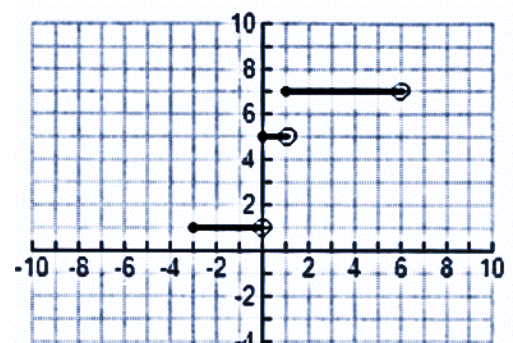
1. 39

2. 19

3. -10

4. -11

20. Write the Domain, Range and the equation(s) for the graph:



### **Absolute Value EQ. and INEQ.**

21. Solve the following inequality.  $|2x + 4| + 4 < 8$

1.  $x < -4$  or  $x > 0$
2.  $x < 0$
3.  $-4 < x < 0$
4.  $-\frac{5}{2} < x < 4$

22. Solve for x graphically.  $|2x + 12| - 7x = -3$

### **Systems of Linear Equations**

23. Solve for x, y and z algebraically.

$$x = -4z - 19$$

$$y = 5x + z - 4$$

$$-5y - z = 25$$

## Linear word problem

24. The admission fee at a small fair is \$1.50 for children and \$4.00 for adults. On a certain day, 2200 people enter the fair and \$5050 is collected. How many children and how many adults attended?

**Solve this algebraically using a system of equations. Check it graphically!**

## Unit 3: Exponents and Logs

### Exponent rules

25. Simplify  $(-3u^{-2}v^{-5})^{-4}$

1)  $81u^8v^{20}$

2)  $\frac{u^8v^{20}}{81}$

3)  $\frac{1}{81u^8v^{10}}$

4)  $\frac{u^8v^{20}}{-81}$

26. The expression  $(3x^2)(9x^{-6})$  is equivalent to

1)  $\frac{x^4}{3}$

2)  $\frac{3}{x^4}$

3)  $27x^4$

4)  $\frac{27}{x^4}$

27. Simplify:  $\frac{18x^{-5}y^4}{12x^{-3}y^{-3}}$

### Fractional exponents and Radical form

28. Write as fractional exponent:  $\sqrt[6]{2ab^5}$

29. Write as a simplified radical  $-11x^{\frac{2}{7}}$

Exponential  $\Leftrightarrow$  Log form  $B^E = N \Leftrightarrow \log_B N = E$

30. Rewrite the exponential equation in logarithmic form. a)  $4^3 = 64$

b)  $25^{\frac{1}{2}} = 5$

31. Rewrite the logarithmic equation in exponential form. a)  $2 = \log_7 49$

b)  $3 = \log_2 8$

## Log Properties

32. The expression  $(\log_a x - \log_a y) + 3\log_a z$  is equivalent to

1)  $\log_a \frac{xz^3}{y}$

3)  $\log_a \frac{3xz}{y}$

2)  $\log_a xz^3y$

4)  $\log_a \frac{x}{z^3y}$

33. The expression  $\log \frac{x+3}{x^4}$  is equivalent to

1)  $\log x + \log 3 - 4\log x$

3)  $3\log x - 4\log x$

2)  $\log(x+3) - 4\log x$

4)  $\log(x+3) + 4\log x$

## Solving exponential equations

34 Use common bases to solve for x.  $125^{x-1} = 25^x$

35. Use logs to solve for x.  $2e^{4-5x} = 7$

36. Use log properties to solve for x.  $\log_2(x^2 - 5x - 14) - \log_2(x + 2) = 4$

37. Use log properties to solve for x.  $\log_3(x+1) + \log_3(x-4) = \log_3 36$

## Exponential growth and decay

38. You drink a beverage with 120 mg of caffeine. Each hour, the caffeine in your system decreases by 12%.
- Write an equation to model the number of mg of caffeine in your system after drinking the beverage.
  - According to this model, **algebraically** determine how long it takes to the nearest hour, until you have 10 mg of caffeine left in your system.

## Continuous and compound interest

39. Cody and Eryl both invest \$10,000 at 3.2% interest. Eryl's bank compounds interest continuously, according to the formula  $A = Pe^{rt}$ . Cody's bank compounds interest monthly, using the formula

$$A = P \left( 1 + \frac{r}{n} \right)^{nt}$$

, where  $P$  is the initial principal,  $r$  is the rate of interest,  $n$  is number of times compounded per year, and  $t$  is time, in years. Determine, to the nearest dollar, the amount of money each will have after 10 years. **You must show algebraic work!**



## Unit 4: Arithmetic and Geometric Sequences

<b>Arithmetic</b>	<b>Equation Type</b>  Linear	<b>Formula</b> for the nth term: $a_n = a_1 + d(n-1)$ where $a_1$ is the initial term and $d$ is the common difference
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40. Find the two-hundredth term,  $a_{200}$ , of the sequence 2, 5, 8, 11, ...

1. 399                      2. 499                      3. 599                      4. 603

41. Write an equation for the nth term of the arithmetic sequence 8, 17, 26, 35, ...

<b>Geometric</b>	<b>Equation Type –</b>  Exponential	<b>Formula</b> for the nth term: $a_n = a_1(r)^{n-1}$ where $a_1$ is the initial term and $r$ is the common ratio
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42. Which formula represents the nth term in the sequence?

3, -6, 12, -24, ...

1.  $a_n = 3(-2)^{n-1}$                       2.  $a_n = 2(-3)^n$                       3.  $a_n = 2(3)^{n-1}$                       4.  $a_n = 3(-2)^n$

43. What is the common ratio of the geometric sequence whose first term is 12 and fifth term is 60.75?

1.  $\frac{2}{3}$                       2.  $\frac{3}{2}$                       3.  $-\frac{2}{3}$                       4.  $-\frac{3}{2}$

44. Write the explicit equation of the geometric sequence whose first term is 12 and fifth term is 60.75.

### Sigma notation

45. Simplify. (Show work)  $\sum_{n=1}^3 (2x - 3n)$

### Arithmetic and Geometric Series

46. Find the sum of the first 27 terms in the arithmetic series 23 + 32 + 41 + 50 ...

**Use your reference sheet**

47. Find the sum of the first 17 terms of the geometric series 6, -12, 24, -48, ...

**Recursive sequences**

48. What is the fifth term of this sequence?  $a_1 = -3$        $a_n = 3a_{n-1} + 1$

**Unit 5: Quadratic**

**Factoring**

49. GCF:  $3x^3 - 12x^2 + 9x$

50. DOPS:  $25 - 4x^2$

51. Trinomial:  $x^2 - 5x - 6$

52. Trinomial:  $3x^2 - x - 4$

53. Grouping:  $12x^3 + 2x^2 - 30x - 5$

**Solve each quadratic equation using the method specified.**

54. a) **Factoring**  $5x^2 - 2x - 16 = 0$

b) **Quadratic Formula**  $4x^2 + 6x - 7 = x^2$   
(Leave roots in simplest radical form)

**c) Square Root Property**

(Round to the nearest hundredth)

$$2(3x - 4)^2 - 8 = 0$$

**d) Completing the Square**

(Leave roots in simplest radical form)

$$3x^2 + 18x - 3 = 0$$

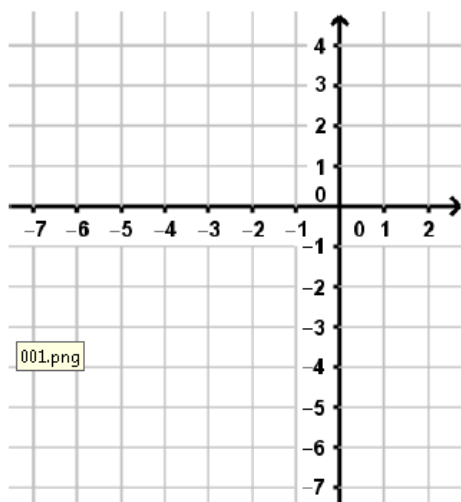
**Polynomial identity**     $(a + b)^2 = a^2 + 2ab + b^2$      $(a - b)^2 = a^2 - 2ab + b^2$ 

55.  $(2x + 4)^2 =$

56.  $(3x - 5)^2 =$

**Quadratic Inequalities**

57.

**a) Graph**     $x^2 + 4x - 3 > 0$ **b) Solve and graph on #line.**

$$5x^2 - 2x - 16 \leq 0$$

**Circles. Write the equation of the circle in center-radius form.**58. **a) Center: (3, -2) radius: 4****b) Center: (-5, 4) point on circle: (1, 3)***Use distance formula to find the radius!***c)**  $x^2 + 8x + y^2 - 6y = 16$  (*You must complete the square!*)

### **Vertex-form of a quadratic equation**

59. Put into vertex form to determine the turning point .  $3x^2 + 18x + 5 = 0$

Is the vertex a maximum or a minimum? \_\_\_\_\_

### **Locus definition**

60. Determine the equation of the parabola whose focus is the point (3, 5) and whose directrix is  $y = 1$ .

61. Determine the equation of the parabola whose focus is the point (-1, 4) and whose turning point is (-1, 1).

**Quadratic word problem Show work!!!!**

62. We are standing on the top of a 1680 ft tall building and throw a small object upwards. At every second, we measure the distance of the object from the ground. Exactly  $t$  seconds after we threw the object, its height, (measured in feet) is  $h(t) = -16t^2 + 254t + 1680$

a) Sketch the graph. Label axes and your window!

b) Find  $h(3)$  and explain the contextual meaning.

c) How much does the object travel during the two seconds between 5 seconds and 7 seconds?

d) How long does it take for the object to reach its maximum height? What is the maximum height?  
***Round to the nearest tenth.***

d) How long does it take for the object to hit the ground rounding to the nearest second?

Unit 6: Radicals and Complex numbers

**Simplifying radicals**

63.  $\sqrt{400x^4y^6}$

64.  $\sqrt{80x^5y^9}$

65.  $\sqrt[3]{27x^{12}y^3}$

66.  $\sqrt[4]{16xy^9}$

67.  $\sqrt[4]{6x^3} \cdot \sqrt[4]{8x^{10}}$

68.  $\sqrt[3]{16x^4y^3} - \sqrt[3]{54x^4y^3}$

**Rationalizing a denominator**

69.  $\frac{1}{2-\sqrt{11}}$  is equivalent to which expression?

(1)  $-\frac{2+\sqrt{11}}{7}$

(2)  $\frac{2+\sqrt{11}}{7}$

(3)  $-\frac{2+\sqrt{11}}{9}$

(4)  $\frac{2+\sqrt{11}}{9}$

**Solving square root equations**

70. Solve for x:  $5 + \sqrt{4x-3} = 10$

71. Solve for x:  $\sqrt{3x^2 + 7x - 15} = x$

**Powers of  $i$  and Complex numbers**

72. Simplify: a)  $i^{47}$       b)  $(2i^6)(-4i^7)$       c)  $(3i^4)^3$       d)  $\sqrt{-64}$

73. The expression  $\frac{i^{37}}{i^{10}}$  is equivalent to

A. 1

B.  $i$

C. -1

D.  $-i$

74. If  $(3 - 6i) + (2 + bi) = 5 - 8i$ , the value of b is

A) 6

B) -6

C) 2

D) -2

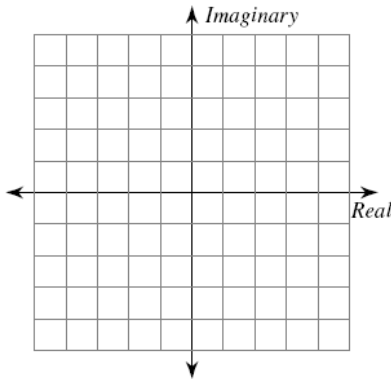
75. The product of a complex number and its conjugate is always

- A) 1
- B) 0
- C) a pure imaginary number
- D) a pure real number

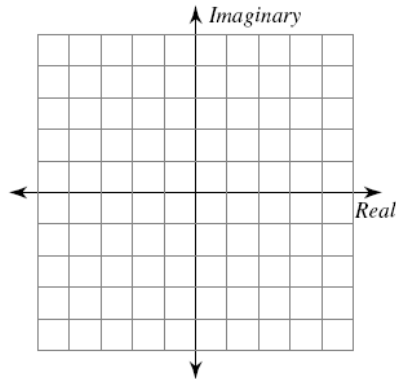
76. What is the sum of  $3 - 4i$  and the conjugate of  $5 - 9i$ ?

- A.  $8 + 5i$
- B.  $2 + 5i$
- C.  $8 - 5i$
- D.  $2 - 5i$

77. a) Graph  $4 - 3i$



b) the sum of  $-3+i$  and  $2+2i$



78. The complex number  $c + di$  is equal to  $(7 + 5i)^2$ . What is the value of  $c$ ?

79. Solve  $3x^2 + 4x = -x - 7$  over the set of complex numbers using the quadratic formula. Put solution in simplest **a + bi form**.

80. Solve  $x^2 + 6x = -10$  over the set of complex numbers by completing the square. Put solution in simplest **a + bi form**.

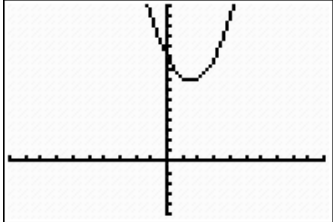
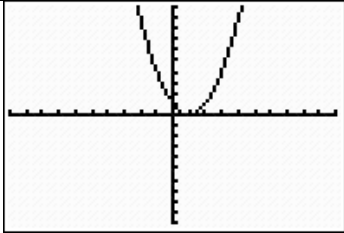
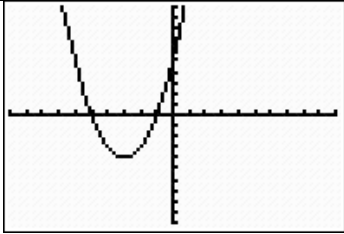
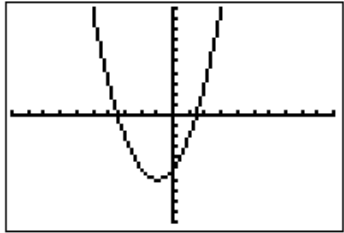
## Discriminant

The **discriminant** is the name given to the expression that appears under the square root (radical) sign in the quadratic formula.

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

Quadratic Formula

Discriminant  $b^2 - 4ac$

If the discriminant is	The roots will be	The graph will look like...
A negative number	Imaginary, unequal (2 roots)	 There are no x-intercepts.
zero	Real, rational, equal (1 root)	 There is one x-intercept.
Positive perfect square	Real, rational, unequal (2 roots)	 There are two x-intercepts.
Positive non-perfect square	Real, irrational, unequal (2 roots)	 There are two x-intercepts.

81. Describe the nature of the roots of each quadratic equation given their discriminants.

a) discriminant = 196      nature of roots = \_\_\_\_\_

b) discriminant = 27      nature of roots = \_\_\_\_\_

c) discriminant = 0      nature of roots = \_\_\_\_\_

d) discriminant = -8      nature of roots = \_\_\_\_\_



82. The roots of the equation  $x^2 - 6x + 5 = 0$  are

- A) real, irrational, and unequal
- B) imaginary

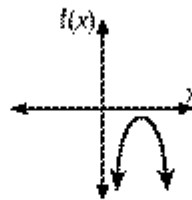
- C) real, rational, and unequal
- D) real, rational, and equal

83. The roots of the equation  $x^2 + 3x - 7 = 0$  are

- A) real, irrational, and unequal
- B) imaginary

- C) real, rational, and unequal
- D) real, rational, and equal

84. The accompanying diagram shows a sketch of a quadratic function,  $f(x)$ .



What is the nature of the roots of the quadratic equation  $f(x) = 0$ ?

- A) real, rational, and unequal
- B) real, rational, and equal

- C) real, irrational, and unequal
- D) imaginary

85. Which statement must be true if a parabola represented by the equation intersects the x-axis only once?

- A)  $b^2 - 4ac = 0$
- B)  $b^2 - 4ac > 0$ , and  $b^2 - 4ac$  is a perfect square.
- C)  $b^2 - 4ac < 0$
- D)  $b^2 - 4ac > 0$ , and  $b^2 - 4ac$  is not a perfect square.

Check your answers with the key on my website!!

