

## CHAPTER 5-2

### MINIMUM AND MAXIMUM OF QUADRATICS

1. 080501b, P.I. A.A.41

What is the turning point, or vertex, of the parabola whose equation is  $y = 3x^2 + 6x - 1$ ?

- [A] (1,8)                      [B] (3,44)  
[C] (-1,-4)                  [D] (-3,8)

[1] \_\_\_\_\_

2. 080603b, P.I. A.A.41

What is the minimum point of the graph of the equation  $y = 2x^2 + 8x + 9$ ?

- [A] (-2,-15)                  [B] (-2,1)  
[C] (2,33)                    [D] (2,17)

[2] \_\_\_\_\_

3. 060101b, P.I. A.A.8

An archer shoots an arrow into the air such that its height at any time,  $t$ , is given by the function  $h(t) = -16t^2 + kt + 3$ . If the maximum height of the arrow occurs at time  $t = 4$ , what is the value of  $k$ ?

- [A] 128    [B] 64    [C] 8    [D] 4

[3] \_\_\_\_\_

4. 010322b, P.I. A.A.8

The height of an object,  $h(t)$ , is determined by the formula  $h(t) = -16t^2 + 256t$ , where  $t$  is time, in seconds. Will the object reach a maximum or a minimum? Explain or show your reasoning.

[4] \_\_\_\_\_

5. 060321b, P.I. A.A.41

Vanessa throws a tennis ball in the air. The function  $h(t) = -16t^2 + 45t + 7$  represents the distance, in feet, that the ball is from the ground at any time  $t$ . At what time, to the nearest tenth of a second, is the ball at its maximum height?

[5] \_\_\_\_\_

6. 080321b, P.I. A.A.41

The height,  $h$ , in feet, a ball will reach when thrown in the air is a function of time,  $t$ , in seconds, given by the equation  $h(t) = -16t^2 + 30t + 6$ . Find, to the nearest tenth, the maximum height, in feet, the ball will reach.

[6] \_\_\_\_\_

7. 010424b, P.I. A.A.41

When a current,  $I$ , flows through a given electrical circuit, the power,  $W$ , of the circuit can be determined by the formula  $W = 120I - 12I^2$ . What amount of current,  $I$ , supplies the maximum power,  $W$ ?

[7] \_\_\_\_\_

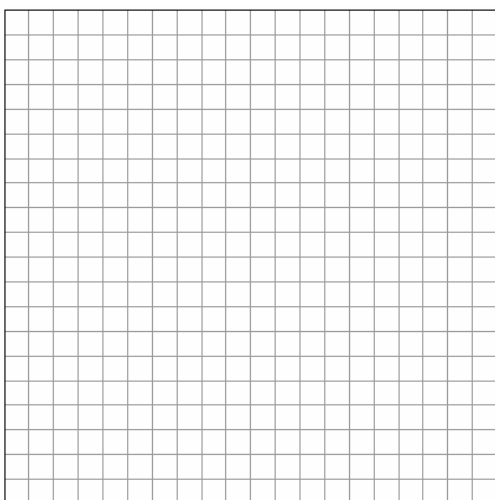
8. 060225b, P.I. A.A.41

The equation  $W = 120I - 12I^2$  represents the power ( $W$ ), in watts, of a 120-volt circuit having a resistance of 12 ohms when a current ( $I$ ) is flowing through the circuit. What is the maximum power, in watts, that can be delivered in this circuit?

[8] \_\_\_\_\_

9. 060430b, P.I. A.A.41

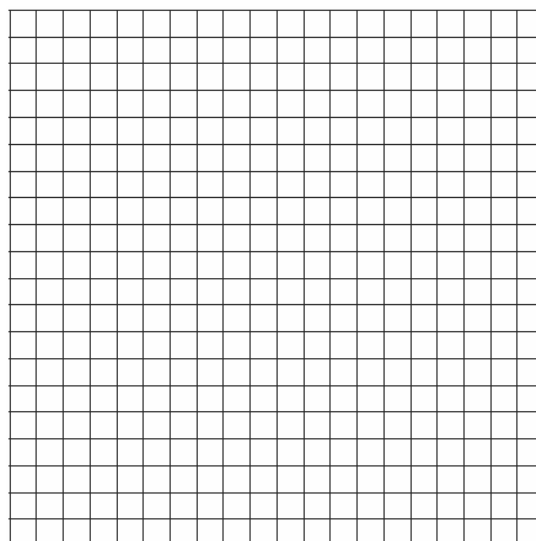
A baseball player throws a ball from the outfield toward home plate. The ball's height above the ground is modeled by the equation  $y = -16x^2 + 48x + 6$  where  $y$  represents height, in feet, and  $x$  represents time, in seconds. The ball is initially thrown from a height of 6 feet. How many seconds after the ball is thrown will it again be 6 feet above the ground? What is the maximum height, in feet, that the ball reaches? [The use of the accompanying grid is optional.]



[9] \_\_\_\_\_

10. 080229b, P.I. A.A.41

A rock is thrown vertically from the ground with a velocity of 24 meters per second, and it reaches a height of  $2 + 24t - 4.9t^2$  after  $t$  seconds. How many seconds after the rock is thrown will it reach maximum height, and what is the maximum height the rock will reach, in meters? How many seconds after the rock is thrown will it hit the ground? Round your answers to the *nearest hundredth*. [Only an algebraic or graphic solution will be accepted.]

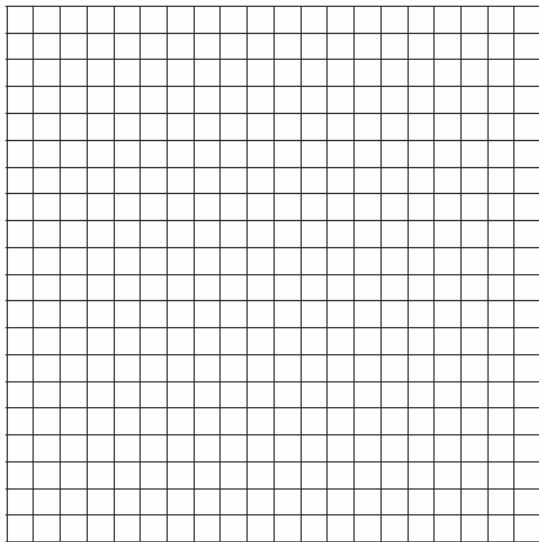


[10] \_\_\_\_\_

11. 060732b, P.I. A.A.41

The path of a rocket fired during a fireworks display is given by the equation

$s(t) = 64t - 16t^2$ , where  $t$  is the time, in seconds, and  $s$  is the height, in feet. What is the maximum height, in feet, the rocket will reach? In how many seconds will the rocket hit the ground? [The grid is optional.]

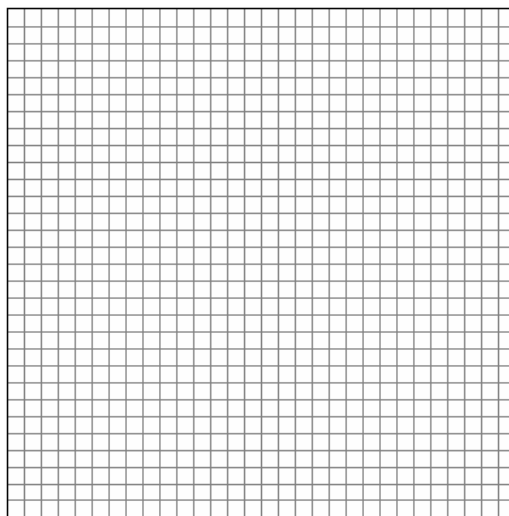


[11]

12. 010834b, P.I. A.A.41

The members of the Lincoln High School Prom Committee are trying to raise money for their senior prom. They plan to sell teddy bears. The senior advisor told them that the profit equation for their project is

$y = -0.1x^2 + 9x - 50$ , where  $x$  is the price at which the teddy bears will be sold and  $y$  is the profit, in dollars. On the grid below, graph this relationship so that  $0 \leq x \leq 90$  and  $-50 \leq y \leq 160$ . How much profit can the committee expect to make if they sell the teddy bears for \$20 each? What price should they charge for the teddy bears to make the maximum profit possible?



[12]

## CHAPTER 5-4

### INVERSE OF FUNCTIONS

13. 010209b, P.I. A2.A.44

If a function is defined by the equation  $y = 3x + 2$ , which equation defines the inverse of this function?

[A]  $x = \frac{1}{3}y + \frac{1}{2}$       [B]  $y = \frac{1}{3}x - \frac{2}{3}$

[C]  $y = -3x - 2$       [D]  $y = \frac{1}{3}x + \frac{1}{2}$

[13] \_\_\_\_\_

14. 080205b, P.I. A2.A.44

A function is defined by the equation  $y = 5x - 5$ . Which equation defines the inverse of this function?

[A]  $x = \frac{1}{5y-5}$       [B]  $y = \frac{1}{5x-5}$

[C]  $x = 5y - 5$       [D]  $y = 5x + 5$

[14] \_\_\_\_\_

15. 080319b, P.I. A2.A.44

A function is defined by the equation  $y = \frac{1}{2}x - \frac{3}{2}$ . Which equation defines the inverse of this function?

[A]  $y = 2x + 3$       [B]  $y = 2x - 3$

[C]  $y = 2x + \frac{3}{2}$       [D]  $y = 2x - \frac{3}{2}$

[15] \_\_\_\_\_

16. 010332b, P.I. A2.A.44

Given:  $f(x) = x^2$  and  $g(x) = 2^x$

a The inverse of  $g$  is a function, but the inverse of  $f$  is not a function. Explain why this statement is true.

b Find  $g^{-1}(f(3))$  to the *nearest tenth*.

[16] \_\_\_\_\_

17. 080216b

If the point  $(a, b)$  lies on the graph  $y = f(x)$ , the graph of  $y = f^{-1}(x)$  must contain point

[A]  $(a, 0)$       [B]  $(b, a)$

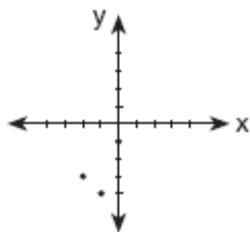
[C]  $(0, b)$       [D]  $(-a, -b)$

[17] \_\_\_\_\_

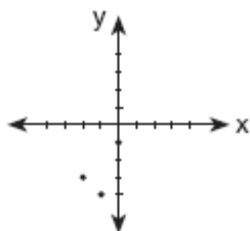
18. 060220b, P.I. A2.A.44

Which graph represents the inverse of  $f(x) = \{(0,1),(1,4),(2,3)\}$ ?

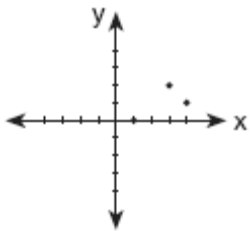
[A]



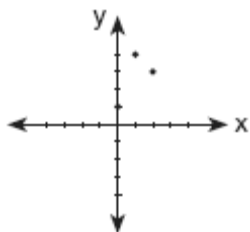
[B]



[C]



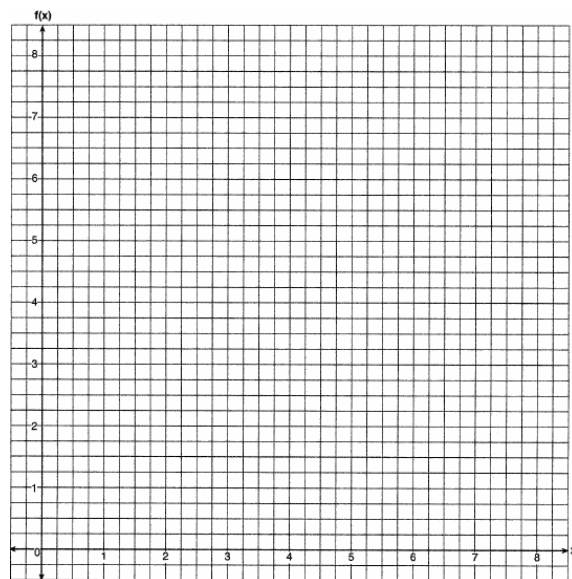
[D]



[18] \_\_\_\_\_

19. 060130b, P.I. A2.A.44

Draw  $f(x) = 2x^2$  and  $f^{-1}(x)$  in the interval  $0 \leq x \leq 2$  on the accompanying set of axes. State the coordinates of the points of intersection.

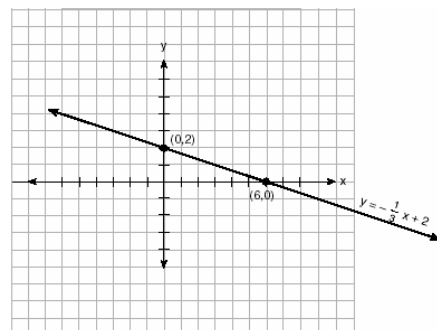


[19] \_\_\_\_\_

20. 010521b, P.I. A2.A.44

The accompanying diagram shows the graph of the line whose equation is  $y = -\frac{1}{3}x + 2$ .

On the same set of axes, sketch the graph of the inverse of this function. State the coordinates of a point on the inverse function.

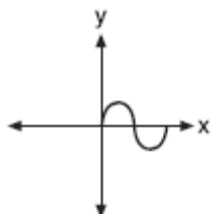


[20] \_\_\_\_\_

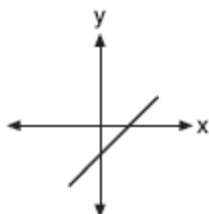
21. 080712b, P.I. A2.A.44

Which graph has an inverse that is a function?

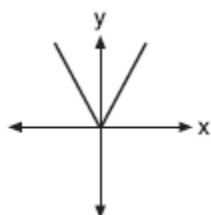
[A]



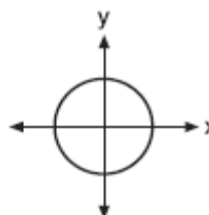
[B]



[C]



[D]



[21] \_\_\_\_\_

22. 080416b, P.I. A2.A.44

What is the inverse of the function  
 $y = \log_4 x$ ?

[A]  $4^y = x$

[B]  $4^x = y$

[C]  $x^4 = y$

[D]  $y^4 = x$

[22] \_\_\_\_\_

23. 060115b, P.I. A2.A.44

The inverse of a function is a logarithmic function in the form  $y = \log_b x$ . Which equation represents the original function?

[A]  $by = x$

[B]  $x = b^y$

[C]  $y = b^x$

[D]  $y = bx$

[23] \_\_\_\_\_

## CHAPTER 5-6

### IMAGINARY NUMBERS

24. 010705b, P.I. A2.N.7

The expression  $i^{25}$  is equivalent to

[A]  $i$

[B]  $-1$

[C]  $1$

[D]  $-i$

[24] \_\_\_\_\_

25. 060615b, P.I. A2.N.7

Mrs. Donahue made up a game to help her class learn about imaginary numbers. The winner will be the student whose expression is equivalent to  $-i$ . Which expression will win the game?

[A]  $i^{49}$

[B]  $i^{48}$

[C]  $i^{46}$

[D]  $i^{47}$

[25] \_\_\_\_\_

26. 080215b, P.I. A2.N.9

Expressed in simplest form,  $i^{16} + i^6 - 2i^5 + i^{13}$

[A]  $1$

[B]  $-1$

[C]  $-i$

[D]  $i$

[26] \_\_\_\_\_

27. 080407b, P.I. A2.N.9

When simplified,  $i^{27} + i^{34}$  is equal to

[A]  $-i-1$

[B]  $i-1$

[C]  $i$

[D]  $i^{61}$

[27] \_\_\_\_\_

28. 060315b, P.I. A2.N.9

What is the value of  $i^{99} - i^3$ ?

[A]  $i^{96}$

[B]  $-i$

[C]  $0$

[D]  $1$

[28] \_\_\_\_\_

29. 060215b, P.I. A2.N.9

What is the sum of  $\sqrt{-2}$  and  $\sqrt{-18}$ ?

[A]  $2i\sqrt{5}$

[B]  $6i$

[C]  $4i\sqrt{2}$

[D]  $5i\sqrt{2}$

[29] \_\_\_\_\_

30. 060410b, P.I. A2.N.9

The expression  $i^0 \cdot i^1 \cdot i^2 \cdot i^3 \cdot i^4$  is equal to

[A]  $i$

[B]  $-i$

[C]  $1$

[D]  $-1$

[30] \_\_\_\_\_

31. 010518b, P.I. A2.N.9

The expression  $\frac{i^{16}}{i^3}$  is equivalent to

- [A] 1      [B]  $i$       [C]  $-1$       [D]  $-i$

[31] \_\_\_\_\_

32. 060614b

What is the multiplicative inverse of  $3i$ ?

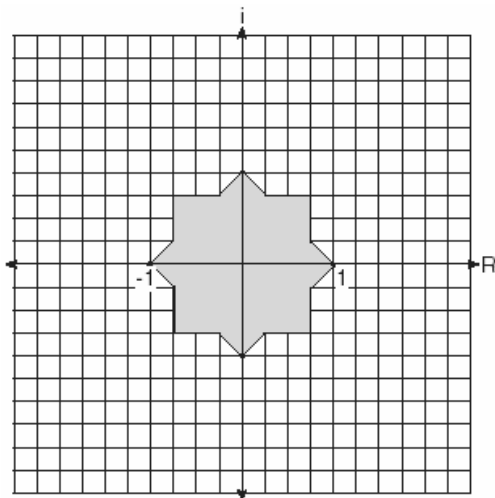
- [A]  $\frac{1}{3}$       [B]  $-3$       [C]  $-3i$       [D]  $-\frac{i}{3}$

[32] \_\_\_\_\_

### COMPLEX NUMBERS

33. 060108b

Fractal geometry uses the complex number plane to draw diagrams, such as the one shown in the accompanying graph.



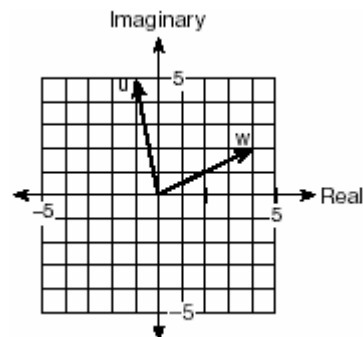
Which number is *not* included in the shaded area?

- [A]  $-0.9 - 0.9i$       [B]  $-0.5 - 0.5i$   
[C]  $-0.5i$       [D]  $-0.9$

[33] \_\_\_\_\_

34. 080512b

Two complex numbers are graphed below.



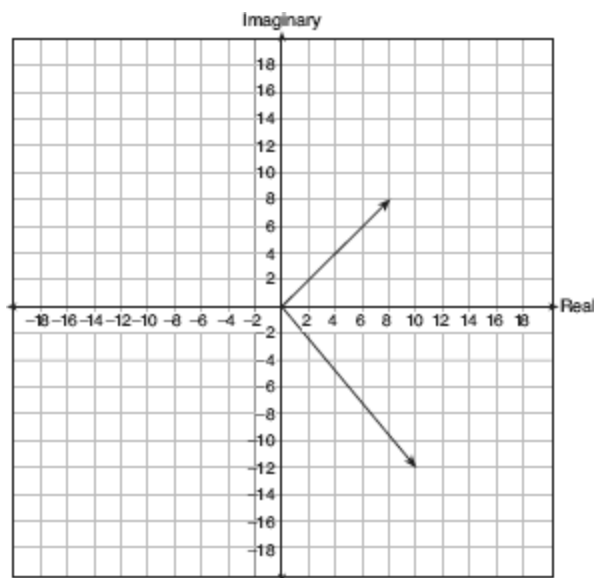
What is the sum of  $w$  and  $u$ , expressed in standard complex number form?

- [A]  $7 + 3i$       [B]  $5 + 7i$   
[C]  $-5 + 3i$       [D]  $3 + 7i$

[34] \_\_\_\_\_

35. 060726b

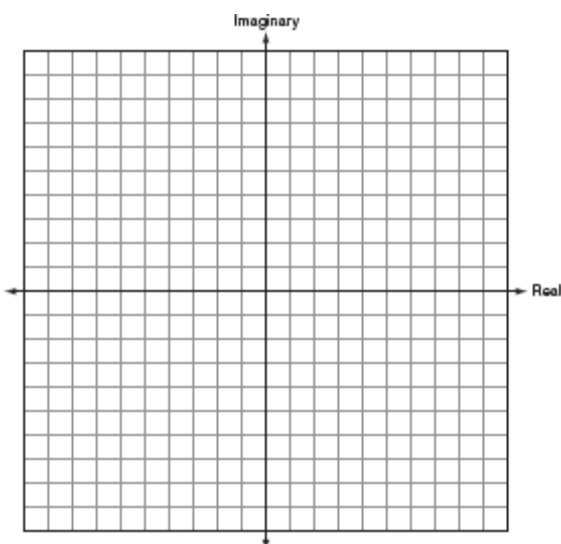
On a stamp honoring the German mathematician Carl Gauss, several complex numbers appear. The accompanying graph shows two of these numbers. Express the sum of these numbers in  $a + bi$  form.



[35] \_\_\_\_\_

36. 060621b

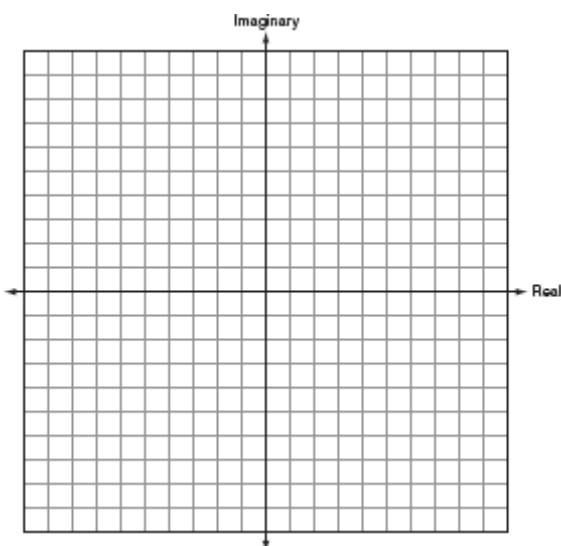
Find the sum of  $-2 + 3i$  and  $-1 - 2i$ . Graph the resultant on the accompanying set of axes.



[36] \_\_\_\_\_

37. 010724b, P.I. A2.A.4

On the accompanying set of axes, graphically represent the sum of  $3 + 4i$  and  $-1 + 2i$ .



[37] \_\_\_\_\_

38. 060111b, P.I. A2.N.9

Melissa and Joe are playing a game with complex numbers. If Melissa has a score of  $5 - 4i$  and Joe has a score of  $3 + 2i$ , what is their total score?

[A]  $8 + 6i$  [B]  $8 + 2i$

[C]  $8 - 2i$  [D]  $8 - 6i$

[38] \_\_\_\_\_

39. 080422b, P.I. A2.N.9

Express  $\sqrt{-48} + 3.5 + \sqrt{25} + \sqrt{-27}$  in simplest  $a + bi$  form.

[39] \_\_\_\_\_

40. 060401b, P.I. A2.N.9

What is the sum of  $2 - \sqrt{-4}$  and  $-3 + \sqrt{-16}$  expressed in simplest  $a + bi$  form?

[A]  $-1 + i\sqrt{20}$  [B]  $-14 + i$

[C]  $-1 + 2i$  [D]  $-1 + 12i$

[40] \_\_\_\_\_

41. 080507b, P.I. A2.N.9

When expressed as a monomial in terms of  $i$ ,  $2\sqrt{-32} - 5\sqrt{-8}$  is equivalent to

[A]  $18i\sqrt{2}$  [B]  $2\sqrt{2}i$

[C]  $-2i\sqrt{2}$  [D]  $2i\sqrt{2}$

[41] \_\_\_\_\_

42. 080314b, P.I. A2.N.9

What is the product of  $5 + \sqrt{-36}$  and  $1 - \sqrt{-49}$ , expressed in simplest  $a + bi$  form?

[A]  $-37 + 41i$  [B]  $47 - 29i$

[C]  $5 - 71i$  [D]  $47 + 41i$

[42] \_\_\_\_\_



43. 080122b, P.I. A2.N.9

Show that the product of  $a + bi$  and its conjugate is a real number.

[43] \_\_\_\_\_

44. 010325b, P.I. A2.N.9

In an electrical circuit, the voltage,  $E$ , in volts, the current,  $I$ , in amps, and the opposition to the flow of current, called impedance,  $Z$ , in ohms, are related by the equation  $E = IZ$ . A circuit has a current of  $(3 + i)$  amps and an impedance of  $(-2 + i)$  ohms. Determine the voltage in  $a + bi$  form.

[44] \_\_\_\_\_

45. 060304b, P.I. A2.N.9

The relationship between voltage,  $E$ , current,  $I$ , and resistance,  $Z$ , is given by the equation  $E = IZ$ . If a circuit has a current  $I = 3 + 2i$  and a resistance  $Z = 2 - i$ , what is the voltage of this circuit?

[A]  $8 + 7i$  [B]  $4 - i$  [C]  $8 + i$  [D]  $4 + i$

[45] \_\_\_\_\_

46. 080702b, P.I. A2.N.9

The expression  $3i(2i^2 - 5i)$  is equivalent to

[A]  $-1 + 0i$  [B]  $15 - 6i$   
[C]  $15 - 5i$  [D]  $-15 - 5i$

[46] \_\_\_\_\_

47. 080621b, P.I. A2.N.9

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

[47] \_\_\_\_\_

48. 010219b, P.I. A2.N.9

The expression  $(-1 + i)^3$  is equivalent to

[A]  $2 + 2i$  [B]  $-2 - 2i$   
[C]  $-3i$  [D]  $-1 - i$

[48] \_\_\_\_\_

49. 010415b, P.I. A2.N.9

If  $f(x) = x^3 - 2x^2$ , then  $f(i)$  is equivalent to

[A]  $-2 + i$  [B]  $2 - i$  [C]  $-2 - i$  [D]  $2 + i$

[49] \_\_\_\_\_

50. 080302b, P.I. A2.A.22

What is the value of  $x$  in the equation

$$\sqrt{5 - 2x} = 3i?$$

[A] 1 [B] 7 [C] 4 [D] -2

[50] \_\_\_\_\_

51. 010811b, P.I. A2.N.9

The expression  $\frac{10}{3+i}$  is equivalent to

[A]  $3 + i$  [B]  $\frac{5}{4}$   
[C]  $\frac{15 + 5i}{4}$  [D]  $3 - i$

[51] \_\_\_\_\_

52. 060513b, P.I. A2.N.9

The expression  $\frac{2+i}{3+i}$  is equivalent to

[A]  $\frac{7-5i}{10}$  [B]  $\frac{6+i}{8}$   
[C]  $\frac{7+i}{10}$  [D]  $\frac{6+5i}{8}$

[52] \_\_\_\_\_

53. 060509b, P.I. A2.N.9

Impedance measures the opposition of an electrical circuit to the flow of electricity. The total impedance in a particular circuit is given by the formula  $Z_T = \frac{Z_1 Z_2}{Z_1 + Z_2}$ . What is the total impedance of a circuit,  $Z_T$ , if  $Z_1 = 1 + 2i$  and  $Z_2 = 1 - 2i$ ?

- [A]  $-\frac{3}{2}$  [B]  $\frac{5}{2}$  [C] 1 [D] 0

[53] \_\_\_\_\_

## CHAPTER 5-8

### QUADRATICS WITH NONINTEGER SOLUTIONS

54. 060104a, P.I. A2.A.7

One root of the equation  $2x^2 - x - 15 = 0$  is

- [A] -3 [B] 3 [C]  $\frac{5}{2}$  [D]  $\frac{3}{2}$

[54] \_\_\_\_\_

55. 010419a, P.I. A2.A.7

What is the solution set of the equation  $3x^2 - 34x - 24 = 0$ ?

- [A]  $\{-12, \frac{2}{3}\}$  [B]  $\{-6, 2\}$   
[C]  $\{-\frac{2}{3}, 12\}$  [D]  $\{-2, 6\}$

[55] \_\_\_\_\_

56. 080112b, P.I. A.A.8

A ball is thrown straight up at an initial velocity of 54 feet per second. The height of the ball  $t$  seconds after it is thrown is given by the formula  $h(t) = 54t - 12t^2$ . How many seconds after the ball is thrown will it return to the ground?

- [A] 9.2 [B] 4 [C] 6 [D] 4.5

[56] \_\_\_\_\_

57. 080217b

If the sum of the roots of  $x^2 + 3x - 5$  is added to the product of its roots, the result is

- [A] -15 [B] 15 [C] -8 [D] -2

[57] \_\_\_\_\_

58. 080634b, P.I. A2.A.25

Barb pulled the plug in her bathtub and it started to drain. The amount of water in the bathtub as it drains is represented by the equation  $L = -5t^2 - 8t + 120$ , where  $L$  represents the number of liters of water in the bathtub and  $t$  represents the amount of time, in minutes, since the plug was pulled. How many liters of water were in the bathtub when Barb pulled the plug? Show your reasoning. Determine, to the *nearest tenth of a minute*, the amount of time it takes for all the water in the bathtub to drain.

[58] \_\_\_\_\_

59. 010729b, P.I. A2.A.25

Matt's rectangular patio measures 9 feet by 12 feet. He wants to increase the patio's dimensions so its area will be twice the area it is now. He plans to increase both the length and the width by the same amount,  $x$ . Find  $x$ , to the *nearest hundredth of a foot*.

[59] \_\_\_\_\_

60. 060128b, P.I. A2.A.25

A homeowner wants to increase the size of a rectangular deck that now measures 15 feet by 20 feet, but building code laws state that a homeowner cannot have a deck larger than 900 square feet. If the length and the width are to be increased by the same amount, find, to the *nearest tenth*, the maximum number of feet that the length of the deck may be increased in size legally.

[60] \_\_\_\_\_

61. 080727b, P.I. A2.A.25

A rectangular patio measuring 6 meters by 8 meters is to be increased in size to an area measuring 150 square meters. If both the width and the length are to be increased by the same amount, what is the number of meters, to the *nearest tenth*, that the dimensions will be increased?

[61] \_\_\_\_\_

62. 010522b

If  $2 + 3i$  is one root of a quadratic equation with real coefficients, what is the sum of the roots of the equation?

[62] \_\_\_\_\_

63. 080328b, P.I. A2.A.25

Express, in simplest  $a + bi$  form, the roots of the equation  $x^2 + 5 = 4x$ .

[63] \_\_\_\_\_

64. 010222b, P.I. A2.A.25

Solve for  $x$  in simplest  $a + bi$  form:  
 $x^2 + 8x + 25 = 0$

[64] \_\_\_\_\_

65. 010627b, P.I. A2.A.25

In physics class, Taras discovers that the behavior of electrical power,  $x$ , in a particular circuit can be represented by the function  $f(x) = x^2 + 2x + 7$ . If  $f(x) = 0$ , solve the equation and express your answer in simplest  $a + bi$  form.

[65] \_\_\_\_\_

66. 080612b, P.I. A.A.8

For which equation is the sum of the roots equal to the product of the roots?

- [A]  $x^2 + 3x - 6 = 0$     [B]  $x^2 + x + 1 = 0$   
[C]  $x^2 - 8x - 4 = 0$     [D]  $x^2 - 4x + 4 = 0$

[66] \_\_\_\_\_

67. 080718b

Which equation has the complex number  $4 - 3i$  as a root?

- [A]  $x^2 - 8x + 25 = 0$     [B]  $x^2 - 6x + 25 = 0$   
[C]  $x^2 + 8x - 25 = 0$     [D]  $x^2 + 6x - 25 = 0$

[67] \_\_\_\_\_

68. 010714b

Which quadratic equation has the roots  $3 + i$  and  $3 - i$ ?

- [A]  $x^2 + 6x - 10 = 0$     [B]  $x^2 + 6x + 8 = 0$   
[C]  $x^2 - 6x - 8 = 0$     [D]  $x^2 - 6x + 10 = 0$

[68] \_\_\_\_\_

69. 060719b

If  $2 + i$  and  $2 - i$  are the roots of the equation  $x^2 - 4x + c = 0$ , what is the value of  $c$ ?

- [A] 5    [B] -4    [C] -5    [D] 4

[69] \_\_\_\_\_

**USING THE DISCRIMINANT**

70. 010201b, P.I. A2.A.2

The roots of a quadratic equation are real, rational, and equal when the discriminant is

- [A] 2      [B] 4      [C] 0      [D] -2

[70] \_\_\_\_\_

71. 060717b, P.I. A2.A.2

Which number is the discriminant of a quadratic equation whose roots are real, unequal, and irrational?

- [A] 0      [B] 4      [C] -5      [D] 7

[71] \_\_\_\_\_

72. 060103b, P.I. A2.A.2

Jacob is solving a quadratic equation. He executes a program on his graphing calculator and sees that the roots are real, rational, and unequal. This information indicates to Jacob that the discriminant is

- [A] zero                      [B] negative  
[C] not a perfect square  
[D] a perfect square

[72] \_\_\_\_\_

73. 080106b, P.I. A2.A.2

The roots of the equation  $x^2 - 3x - 2 = 0$  are

- [A] real, rational, and unequal  
[B] real, irrational, and unequal  
[C] imaginary  
[D] real, rational, and equal

[73] \_\_\_\_\_

74. 010513b, P.I. A2.A.2

The roots of the equation  $2x^2 - 8x - 4 = 0$  are

- [A] real, irrational, and unequal  
[B] real, rational, and equal  
[C] imaginary  
[D] real, rational, and unequal

[74] \_\_\_\_\_

75. 060219b, P.I. A2.A.2

The roots of the equation  $2x^2 - x = 4$  are

- [A] real, rational, and equal  
[B] real and irrational  
[C] real, rational, and unequal  
[D] imaginary

[75] \_\_\_\_\_

76. 010614b, P.I. A2.A.2

The roots of the equation  $2x^2 - 5 = 0$  are

- [A] imaginary  
[B] real, rational, and unequal  
[C] real, rational, and equal  
[D] real and irrational

[76] \_\_\_\_\_

77. 010817b, P.I. A2.A.2

Which equation has roots that are real, rational, and unequal?

- [A]  $x^2 - 4 = 0$                       [B]  $x^2 - 4x + 4 = 0$   
[C]  $x^2 - 2 = 0$                       [D]  $x^2 + x + 1 = 0$

[77] \_\_\_\_\_

78. 080211b, P.I. A2.A.2

Which equation has imaginary roots?

- [A]  $x^2 - 1 = 0$                       [B]  $x^2 - x - 1 = 0$   
[C]  $x^2 + x + 1 = 0$                       [D]  $x^2 - 2 = 0$

[78] \_\_\_\_\_

79. 060518b, P.I. A2.A.2

Which equation has imaginary roots?

[A]  $(2x + 1)(x - 3) = 7$  [B]  $x(5 + x) = 8$

[C]  $x(5 - x) = -3$  [D]  $x(x + 6) = -10$

[79] \_\_\_\_\_

80. 080516b, P.I. A2.A.2

For which positive value of  $m$  will the equation  $4x^2 + mx + 9 = 0$  have roots that are real, equal, and rational?

[A] 4 [B] 9 [C] 12 [D] 3

[80] \_\_\_\_\_

81. 060307b, P.I. A2.A.2

The roots of the equation  $ax^2 + 4x = -2$  are real, rational, and equal when  $a$  has a value of

[A] 2 [B] 3 [C] 1 [D] 4

[81] \_\_\_\_\_

82. 080320b, P.I. A2.A.2

In the equation  $ax^2 + 6x - 9 = 0$ , imaginary roots will be generated if

[A]  $a < -1$  [B]  $a < 1$ , only

[C]  $a > -1$ , only [D]  $-1 < a < 1$

[82] \_\_\_\_\_

83. 080411b, P.I. A2.A.2

The equation  $2x^2 + 8x + n = 0$  has imaginary roots when  $n$  is equal to

[A] 10 [B] 6 [C] 4 [D] 8

[83] \_\_\_\_\_

84. 060423b, P.I. A2.A.2

Find all values of  $k$  such that the equation  $3x^2 - 2x + k = 0$  has imaginary roots.

[84] \_\_\_\_\_

85. 080525b

Given the function  $y = f(x)$ , such that the entire graph of the function lies above the  $x$ -axis. Explain why the equation  $f(x) = 0$  has no real solutions.

[85] \_\_\_\_\_

86. 010416b, P.I. A2.A.2

Which statement must be true if a parabola represented by the equation  $y = ax^2 + bx + c$  does not intersect the  $x$ -axis?

[A]  $b^2 - 4ac > 0$ , and  $b^2 - 4ac$  is not a perfect square.

[B]  $b^2 - 4ac > 0$ , and  $b^2 - 4ac$  is a perfect square.

[C]  $b^2 - 4ac < 0$  [D]  $b^2 - 4ac = 0$

[86] \_\_\_\_\_

87. 010313b, P.I. A2.A.2

If the roots of  $ax^2 + bx + c = 0$  are real, rational, and equal, what is true about the graph of the function  $y = ax^2 + bx + c$ ?

[A] It lies entirely below the  $x$ -axis.

[B] It is tangent to the  $x$ -axis.

[C] It intersects the  $x$ -axis in two distinct points.

[D] It lies entirely above the  $x$ -axis.

[87] \_\_\_\_\_

88. 010713b, P.I. A2.A.2

Which is a true statement about the graph of the equation  $y = x^2 - 7x - 60$ ?

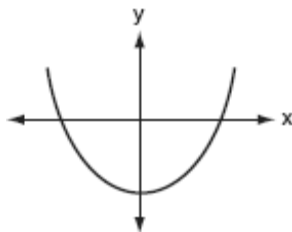
- [A] It intersects the  $x$ -axis in two distinct points that have irrational coordinates.
- [B] It does not intersect the  $x$ -axis.
- [C] It intersects the  $x$ -axis in two distinct points that have rational coordinates.
- [D] It is tangent to the  $x$ -axis.

[88] \_\_\_\_\_

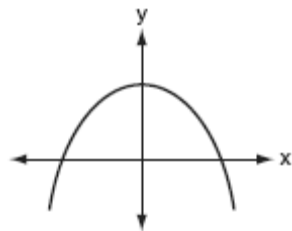
89. 080620b

Which graph represents a quadratic function with a negative discriminant?

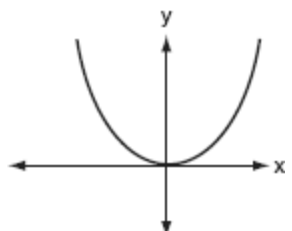
[A]



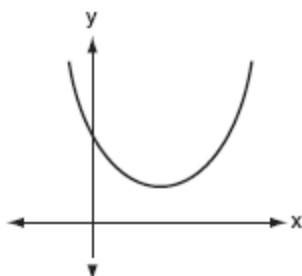
[B]



[C]



[D]



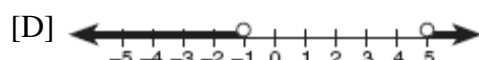
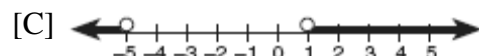
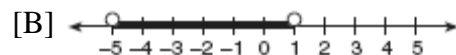
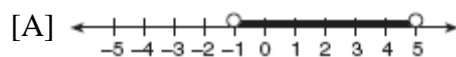
[89] \_\_\_\_\_

## NY LESSON 2

### QUADRATIC INEQUALITIES

90. 010509b, P.I. A2.A.4

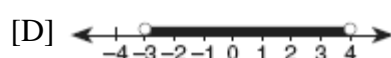
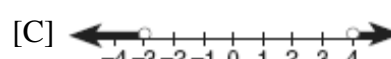
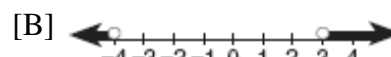
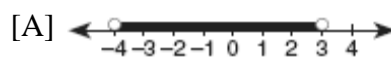
Which graph represents the solution set of the inequality  $x^2 - 4x - 5 < 0$ ?



[90] \_\_\_\_\_

91. 010318b, P.I. A2.A.4

Which graph represents the solution set of  $x^2 - x - 12 < 0$ ?



[91] \_\_\_\_\_

92. 080713b, P.I. A2.A.4

What is the solution set of the inequality  $x^2 + 4x - 5 < 0$ ?

[A]  $\{x|x < -5 \text{ or } x > 1\}$

[B]  $\{x|-5 < x < 1\}$  [C]  $\{x|-1 < x < 5\}$

[D]  $\{x|x < -1 \text{ or } x > 5\}$

[92] \_\_\_\_\_

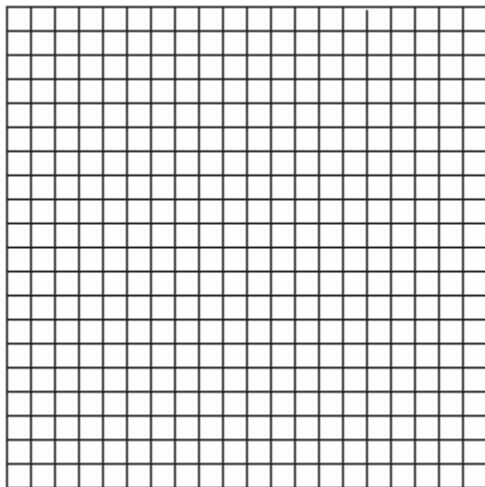
93. 010231b, P.I. A2.A.4

When a baseball is hit by a batter, the height of the ball,  $h(t)$ , at time  $t$ ,  $t \geq 0$ , is determined by the equation  $h(t) = -16t^2 + 64t + 4$ . For which interval of time is the height of the ball greater than or equal to 52 feet?

[93] \_\_\_\_\_

94. 060632b, P.I. A.G.4

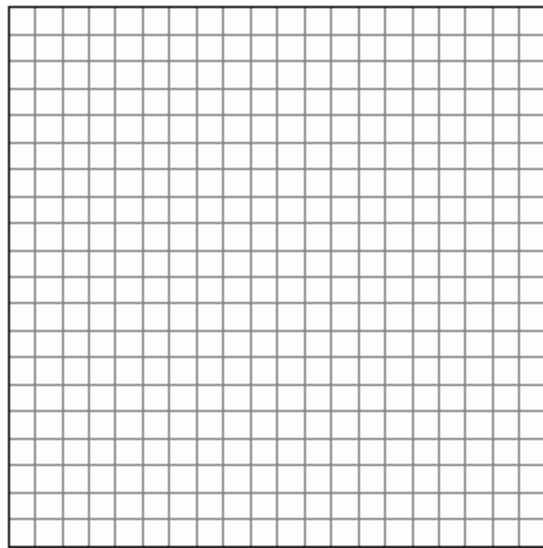
A small rocket is launched from a height of 72 feet. The height of the rocket in feet,  $h$ , is represented by the equation  $h(t) = -16t^2 + 64t + 72$ , where  $t$  = time, in seconds. Graph this equation on the accompanying grid. Use your graph to determine the number of seconds that the rocket will remain at or above 100 feet from the ground. [Only a graphic solution can receive full credit.]



[94] \_\_\_\_\_

95. 060532b, P.I. A2.A.4

The height of a projectile is modeled by the equation  $y = -2x^2 + 38x + 10$ , where  $x$  is time, in seconds, and  $y$  is height, in feet. During what interval of time, to the *nearest tenth of a second*, is the projectile *at least* 125 feet above ground? [The use of the accompanying grid is optional.]



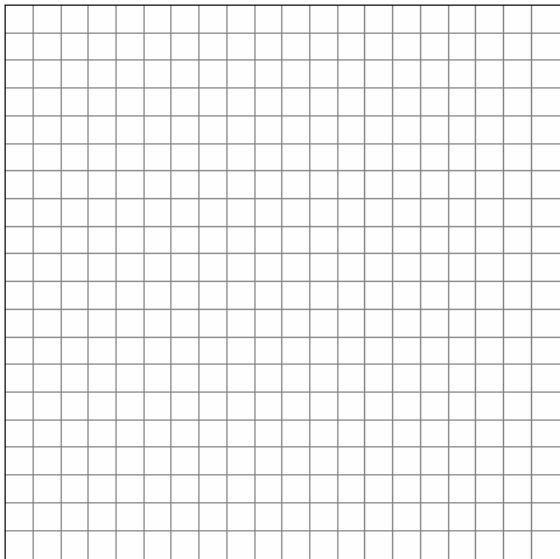
[95] \_\_\_\_\_

96. 080424b, P.I. A2.A.4

The profit a coat manufacturer makes each day is modeled by the equation

$P(x) = -x^2 + 120x - 2000$ , where  $P$  is the profit and  $x$  is the price for each coat sold.

For what values of  $x$  does the company make a profit? [The use of the accompanying grid is optional.]

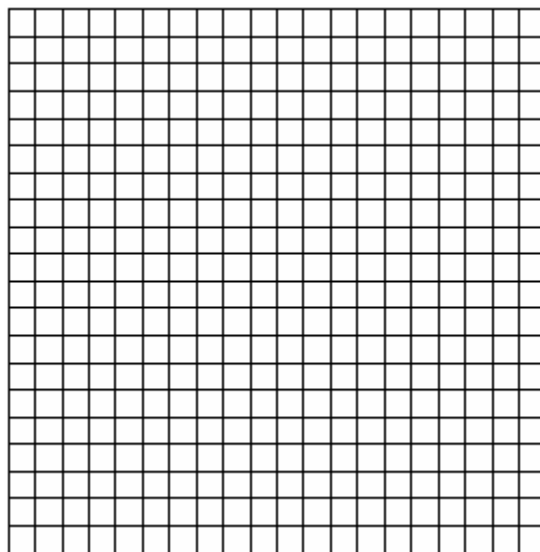


[96]

97. 080531b, P.I. A2.A.4

The profit,  $P$ , for manufacturing a wireless device is given by the equation

$P = -10x^2 + 750x - 9,000$ , where  $x$  is the selling price, in dollars, for each wireless device. What range of selling prices allows the manufacturer to make a profit on this wireless device? [The use of the grid is optional.]



[97]

## NY LESSON 7

### REGRESSION

98. 060209b, P.I. A2.S.7

What is the equation of a parabola that goes through points (0,1), (-1,6), and (2,3)?

[A]  $y = x^2 - 3x + 1$       [B]  $y = 2x^2 + 1$

[C]  $y = 2x^2 - 3x + 1$       [D]  $y = x^2 + 1$

[98] \_\_\_\_\_



[1] C

[2] B

[3] A

[2] Maximum, and an appropriate reason is given, such as the value of  $a$  is negative (less than 0) or the graph opens downward.

[1] Minimum, but an appropriate reason is given, based on an incorrect equation, such as an error in finding the axis of symmetry.

[0] Maximum or minimum, but no reason or an inappropriate reason is given.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[4] obviously incorrect procedure.

[2] 1.4, and appropriate work is shown, such as finding the axis of symmetry.

[1] Appropriate work is shown, but one computational or rounding error is made.

or [1] 1.4, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[5] incorrect procedure.

[2] 20.1, and appropriate work is shown.

[1] Appropriate work is shown, but one computational or rounding error is made.

or [1] Appropriate work is shown, but one conceptual error is made.

or [1] The time when the ball reaches its maximum height is found correctly, but no further correct work is shown.

or [1] 20.1, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[6] incorrect procedure.

[2] 5, and appropriate work is shown.

[1] Appropriate work is shown, but one computational error is made.

or [1] Appropriate work is shown, but one conceptual error is made.

or [1] 5, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[7] incorrect procedure.

[2] 300, and appropriate work is shown.

[1] Appropriate work is shown, but one computational error is made.

or [1] 300, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[8] incorrect procedure.

[4] 3 and 42, and appropriate work is shown, such as a graph, substitution, or a table of values.

[3] Appropriate work is shown, but one computational or graphing error is made.

[2] Appropriate work is shown, but two or more computational or graphing errors are made.

or [2] Appropriate work is shown, but one conceptual error is made.

or [2] The number of seconds is found correctly, and appropriate work is shown, but the height is not found or is found incorrectly.

or [2] The height is found correctly, and appropriate work is shown, but the number of seconds is not found or is found incorrectly.

[1] 3 and 42, but no work is shown.

[0] 3 or 42, but no work is shown.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[9] obviously incorrect procedure.

- [4] Time of maximum height = 2.45, maximum height = 31.39, time when it hit the ground = 4.98, and appropriate algebraic or graphic work is shown. [Answers for time, in seconds, may vary based on method of solution.]
- [3] Appropriate algebraic or graphic work is shown, but one computational or graphing error is made.
- or [3] The times are found correctly, but the maximum height is incorrect.
- [2] The rock's maximum height and the time it takes to reach that height are found correctly, but the time it takes to hit the ground is incorrect.
- or [2] The time it takes the rock to hit the ground is found correctly, but the maximum height and the time it takes to reach that height are incorrect.
- [1] Time of maximum height = 2.45, maximum height = 31.39, time when it hit the ground = 4.98, but no work is shown.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 

- [4] Maximum height = 64 and time = 4, and appropriate work is shown.
- [3] Appropriate work is shown, but one computational or graphing error is made.
- or [3] The correct time is found, and appropriate work is shown, but the maximum height is not found.
- [2] Appropriate work is shown, but two or more computational or graphing errors are made.
- or [2] Appropriate work is shown, but one conceptual error is made.
- or [2] The maximum height is found correctly, and appropriate work is shown, but an incorrect value is found for  $t$ .
- or [2] Appropriate work is shown, but only the time that the maximum height occurs is found, and the quadratic equation  $64t - 16t^2 = 0$  is factored, but no further correct work is shown.
- [1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.
- or [1] Appropriate work is shown, but only the time that the maximum height occurs is found, or the quadratic equation  $64t - 16t^2 = 0$  is factored.
- or [1] Maximum height = 64 and time = 4, but no work is shown.
- [0] Maximum height = 64 or time = 4, but no work is shown.
- or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
-

- [6] A correct graph is drawn, 90 and 45, and appropriate work is shown.  
[5] Appropriate work is shown to answer all three parts of the question, but one computational or graphing error is made.  
[4] Appropriate work is shown, but two or more computational or graphing errors are made.  
or [4] A correct graph is drawn, and 90 or 45, and appropriate work is shown.  
[3] Appropriate work is shown, but one conceptual error is made.  
or [3] 90 and 45, and appropriate work is shown, but no graph is drawn.  
or [3] A correct graph is drawn, but no further correct work is shown.  
[2] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.  
[1] 90 or 45, and appropriate work is shown.  
or [1] 90 and 45, but no work is shown and no graph is drawn.  
[0] 90 or 45, but no work is shown.  
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [12] \_\_\_\_\_
- [13] B \_\_\_\_\_
- [14] C \_\_\_\_\_
- [15] A \_\_\_\_\_

- a [2] Appropriate sketches of the functions are shown, and the horizontal line tests are used to explain why the statement is true.  
or [2] An explanation is given that the inverse of  $g$  is a function and the inverse of  $f$  is not a function, which includes a definition of the relationship between a function and its inverse or the vertical line test.  
or [2] Appropriate sketches of the inverses are shown that use the vertical line test to explain why the statement is true.  
or [2] The correct inverses are found algebraically, and appropriate explanations are given.  
[1] An explanation is given that indicates only that  $g$  is a 1:1 function or that  $g$  passes the horizontal line test.  
or [1] An explanation is given that indicates only that  $f$  is not a 1:1 function or that  $f$  does not pass the horizontal line test.  
b [2] 3.2, and appropriate work is shown.  
[1] Appropriate work is shown, but one computational or rounding error is made.  
or [1] 3.2, but no work is shown.  
a and b [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [16] \_\_\_\_\_
- [17] B \_\_\_\_\_
- [18] C \_\_\_\_\_

[4]  $(0,0)$  and  $(\frac{1}{2}, \frac{1}{2})$ , and both graphs are drawn correctly.

[3] Both graphs are drawn correctly, but one or both points of intersection are stated incorrectly.

or [3] The graph of  $y = 2x^2$  is incorrect, but the inverse is appropriate or correct, and the appropriate points of intersection are stated correctly.

[2] Both points of intersection are found correctly, using an algebraic solution.

or [2] The graph of  $y = 2x^2$  is incorrect, but the inverse is appropriate or correct, but no further work is shown.

or [2] The graph of  $y = 2x^2$  is correct, but the inverse is incorrect, but the appropriate points of intersection are stated.

or [2] The graph of  $y = 2x^2$  is incorrect, but the inverse is correct, but the points of intersection are not stated or are incorrect.

[1] Both graphs are incorrect, but the points of intersection are appropriate, based on the incorrect graphs.

or [1] The graph of  $y = 2x^2$  is correct, but the inverse is incorrect, and the points of intersection are labeled or stated incorrectly.

or [1]  $(0,0)$  and  $(\frac{1}{2}, \frac{1}{2})$ , but no work is shown.

[0] Straight lines are used as graphs of the functions.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[19] obviously incorrect procedure.

[2] An appropriate reflection of  $f(x)$  in the line  $y = x$  is sketched, and the coordinates of one point are stated correctly.

[1] An appropriate graph is sketched, but no coordinates or incorrect coordinates are stated.

or [1] A reflection in some other line is sketched, but appropriate coordinates are stated.

or [1] An incorrect graph is sketched, based on an error in plotting one of the points, but appropriate coordinates are stated.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[20] incorrect procedure.

[21] B

[22] B

[23] C

[24] A

[25] D

[26] C

[27] A

[28] C

[29] C

[30] D

[31] B

[32] D

[33] A

[34] D

- [2]  $18 - 4i$ , and appropriate work is shown, such as  $(8 + 8i) + (10 - 12i)$ .  
 [1] Appropriate work is shown, but one computational or graphing error is made.  
 or [1] Appropriate work is shown, but one conceptual error is made.  
 or [1] A graphic solution is drawn, but the sum is not expressed in  $a + bi$  form.  
 or [1]  $18 - 4i$ , but no work is shown.  
 [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [35] \_\_\_\_\_
- [2]  $-3 + i$ , and an appropriate graph is drawn.  
 [1] The sum is found incorrectly, but an appropriate graph is drawn.  
 or [1]  $-3 + i$ , but no graph or an incorrect graph is drawn.  
 [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [36] \_\_\_\_\_
- [2] A correct graph is drawn to represent  $2 + 6i$ .  
 [1] Appropriate work is shown, but one computational or graphing error is made.  
 or [1] Appropriate work is shown, but one conceptual error is made.  
 or [1] The sum  $2 + 6i$  is written, but no graph is drawn.  
 [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [37] \_\_\_\_\_
- [38] C

- [2]  $8.5 + 7i\sqrt{3}$ , and appropriate work is shown.  
 [1] Appropriate work is shown, but one computational error is made.  
 or [1] Appropriate work is shown, but one conceptual error is made.  
 or [1]  $8.5 + 7i\sqrt{3}$ , but no work is shown.  
 [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [39] \_\_\_\_\_
- [40] C
- [41] C
- [42] B
- [2] Appropriate work is shown, such as  $(a + bi)(a - bi) = a^2 + b^2$ .  
 [1] The conjugate is incorrect, but multiplication and substitution for  $i^2$  are appropriate.  
 or [1] The conjugate is correct, but one or more errors in multiplication and/or substitution for  $i^2$  are made.  
 [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [43] \_\_\_\_\_
- [2]  $-7 + i$ , and appropriate work is shown, such as  $(-2 + i)(3 + i)$ .  
 [1] Appropriate work is shown, but one computational error is made.  
 or [1]  $-7 + i$ , but no work is shown.  
 [0]  $(-2 + i)(3 + i)$  is shown but not multiplied, or the values are added instead of multiplied.  
 or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [44] \_\_\_\_\_
- [45] C
- [46] B

[2] 3, and appropriate work is shown.

[1] Appropriate work is shown, but one computational error is made.

or [1] Appropriate work is shown, but one conceptual error is made.

or [1] The expression  $3 + 4i$  is found, but  $c$  is not identified.

or [1] 3, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[47] incorrect procedure.

[48] A

[49] B

[50] B

[51] D

[52] C

[53] B

[54] B

[55] C

[56] D

[57] C

[6] 120 and 4.2, and appropriate work is shown, such as substituting  $t = 0$  into the equation and solving the equation

$$-5t^2 - 8t + 120 = 0.$$

[5] Appropriate work is shown, but one computational or rounding error is made.

or [5] 120 and 4.2, but no work is shown to find the amount of water, but appropriate work is shown to find the amount of time.

[4] Appropriate work is shown, but two or more computational or rounding errors are made.

or [4] Appropriate work is shown, and the amount of water is found correctly, but one conceptual error is made in finding the amount of time.

or [4] The amount of time is found correctly, and appropriate work is shown, but the amount of water is not found.

or [4] The amount of water is found correctly, and appropriate work is shown, and a correct substitution into the quadratic formula is made, but the amount of time is not found.

[3] Appropriate work is shown, but one conceptual error is made in finding the amount of time, and one computational error is made in finding the amount of water.

[2] The amount of water is found correctly, and appropriate work is shown, but no further correct work is shown.

or [2] 120 and 4.2, but no work is shown.

[1] 120 *or* 4.2, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[58] incorrect procedure.

- [4] 4.27, and appropriate work is shown, such as solving the equation  $(9 + x)(12 + x) = 216$ .  
 [3] Appropriate work is shown, but one computational or rounding error is made.  
 or [3] Appropriate work is shown, but the negative root is not rejected.  
 [2] Appropriate work is shown, but two or more computational or rounding errors are made.  
 or [2] Appropriate work is shown, but one conceptual error is made.  
 or [2] A correct equation is written in standard form, but no further correct work is shown.  
 or [2] An incorrect quadratic equation of equal difficulty is solved appropriately.  
 [1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.  
 or [1] An incorrect quadratic equation of a lesser degree of difficulty is solved appropriately.  
 or [1] 4.27, but no work is shown.  
 [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 
- [59]

- [4] 12.6, and appropriate work is shown.  
 [3] Appropriate work is shown, but one computational or rounding error is made.  
 or [3] Appropriate work is shown, but the quadratic formula is incorrect.  
 [2] An appropriate equation is shown and put in standard form, but the quadratic formula is not used correctly.  
 or [2] An appropriate equation is shown and put in standard form, but no further work is shown.  
 or [2] Appropriate work is shown, but more than one computational error or one computational and one rounding error are made.  
 [1] An appropriate equation is shown, but all other work is missing or is incorrect.  
 or [1] 12.6, but no work is shown.  
 [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 
- [60]
- [4] 5.3, and appropriate work is shown, such as solving the equation  $(x + 6)(x + 8) = 150$  by using a table or the quadratic formula.  
 [3] Appropriate work is shown, but one computational or rounding error is made.  
 or [3] Appropriate solutions are found, but the negative root is not rejected.  
 [2] Appropriate work is shown, but two or more computational or rounding errors are made.  
 or [2] Appropriate work is shown, but one conceptual error is made.  
 [1] The correct quadratic equation in standard form,  $x^2 + 14x - 102 = 0$ , is written, but no further correct work is shown.  
 or [1] An incorrect quadratic equation is solved appropriately.  
 or [1] 5.3, but no work is shown.  
 [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 
- [61]

- [2] 4, and appropriate work is shown.  
 [1] Appropriate work is shown, but one computational error is made.  
 or [1] Appropriate work is shown, but one conceptual error is made.  
 or [1] The second root of the equation is found, but the sum of the roots is not calculated or is calculated incorrectly.  
 or [1] 4, but no work is shown.  
 [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [62] \_\_\_\_\_
- [4]  $2 \pm i$ , and appropriate work is shown.  
 [3] Appropriate work is shown, but one computational error is made, but the result is expressed as a complex number in simplest  $a + bi$  form.  
 or [3] Appropriate work is shown, but the roots are not expressed in simplest  $a + bi$  form.  
 or [3] Appropriate work is shown, but only one complex root, in simplest  $a + bi$  form, is found.  
 [2] Appropriate work is shown, but one computational error is made, resulting in a solution that is not a complex number.  
 or [2] Appropriate work is shown, but two or more computational errors are made, but the result is expressed as a complex number in simplest  $a + bi$  form.  
 or [2] Appropriate work is shown, but one conceptual error is made.  
 or [2] An incorrect quadratic formula is used, but the result is expressed as a complex number in simplest  $a + bi$  form.  
 [1] Incorrect substitution is made into the quadratic formula, such as  $a = 1$ ,  $b = 5$ , and  $c = -4$ , but the resulting equation is solved appropriately.  
 or [1]  $2 \pm i$ , but no work is shown.  
 [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [63] \_\_\_\_\_

- [2]  $-4 \pm 3i$ , and appropriate work is shown.  
 [1] The quadratic formula is used correctly, but one computational error is made.  
 or [1]  $\frac{-8 \pm 6i}{2}$ , but appropriate work is shown.  
 or [1]  $-4 \pm 3i$ , but no work is shown.  
 [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [64] \_\_\_\_\_
- [4]  $-1 \pm i\sqrt{6}$ , and appropriate work is shown, such as appropriately substituting for  $a$ ,  $b$ , and  $c$  in the quadratic formula, solving the equation, and simplifying the answer correctly.  
 [3] Appropriate work is shown, but one computational or simplification error is made.  
 [2] Appropriate work is shown, but two or more computational or simplification errors are made.  
 or [2] Appropriate work is shown, but one conceptual error is made, such as writing the quadratic formula incorrectly.  
 [1] Appropriate work is shown, but one conceptual error and one computational or simplification error are made.  
 or [1]  $-1 \pm i\sqrt{6}$ , but no work is shown.  
 [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [65] \_\_\_\_\_
- [66]     D
- [67]     A
- [68]     D
- [69]     A
- [70]     C
- [71]     D
- [72]     D
- [73]     B



[74] A

[75] B

[76] D

[77] A

[78] C

[79] D

[80] C

[81] A

[82] A

[83] A

[2]  $k > \frac{1}{3}$ , and appropriate work is shown,

such as the solution of  $4 - 4(3)(k) < 0$ .

[1] Appropriate work is shown, but one conceptual error or one computational error is made.

or [1] Appropriate work is shown, but the answer is written as  $k < \frac{1}{3}$ .

or [1]  $k > \frac{1}{3}$ , but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[84] incorrect procedure.

[2] A complete and correct explanation is written, such as stating that since the graph lies entirely above the  $x$ -axis, there is no point on the graph where  $y = 0$ .

[1] An incomplete or partially correct explanation is written, such as stating that the equation has imaginary roots.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[85] incorrect procedure.

[86] C

[87] B

[88] C

[89] D

[90] A

[91] D

[92] B

[4]  $1 \leq t \leq 3$ , and appropriate work is shown, such as  $-16t^2 + 64t + 4 \geq 52$ .

[3] Appropriate work is shown, but one computational error is made.

or [3] An incorrect inequality is written, but the resulting quadratic inequality is solved appropriately.

[2] Appropriate work is shown, but more than one computational error is made.

or [2] The quadratic equation  $-16t^2 + 64t + 4 = 52$  is solved appropriately, and both solutions are found.

[1] An incorrect quadratic equation of equal difficulty is solved appropriately, but one computational error is made.

or [1]  $1 \leq t \leq 3$ , but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[93] incorrect procedure.

- [4] A correct graph is drawn, and 3.  
[3] 3, and appropriate work is shown, but one graphing error is made.  
or [3] A correct graph is drawn and the points 0.5 and 3.5 are identified, but the difference is not calculated.  
[2] Appropriate work is shown, but two or more graphing errors are made.  
or [2] Appropriate work is shown, but one conceptual error is made.  
or [2] 3, but a method other than a graphic solution is used.  
[1] Appropriate work is shown, but one conceptual error and one graphing error are made.  
or [1] A correct graph is sketched with  $t = 0$  to  $t = 4$ , but no further correct work is shown.  
or [1] 3, but no work is shown and no graph is drawn.  
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- 

- [4]  $3.8 \leq x \leq 15.2$ , and appropriate work is shown, such as using the quadratic formula or sketching the graph of the parabola and the line.  
[3] Appropriate work is shown, but one computational, rounding, or graphing error is made.  
or [3]  $3.8 < x < 15.2$ , and appropriate work is shown.  
[2] Appropriate work is shown, but two or more computational, rounding, or graphing errors are made.  
or [2] Appropriate work is shown, but one conceptual error is made.  
or [2] The graph of the parabola and the line are sketched correctly, but no further correct work is shown.  
[1] Appropriate work is shown, but one conceptual error and one computational, rounding, or graphing error are made.  
or [1] Correct substitution is made into the quadratic formula, but no further correct work is shown.  
or [1] The graph of the parabola is sketched correctly, but no further correct work is shown.  
or [1]  $3.8 \leq x \leq 15.2$ , but no work is shown.  
[0]  $3.8 < x < 15.2$ , but no work is shown.  
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
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- [2]  $20 < x < 100$ , and appropriate work is shown.  
[1] Appropriate work is shown, but one computational or graphing error is made.  
or [1] Appropriate work is shown, but one conceptual error is made.  
or [1] Appropriate work is shown to solve for 20 and 100, but the solution is not expressed as a correct inequality or interval.  
or [1]  $20 < x < 100$ , but no work is shown.  
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
-

[4]  $15 < x < 60$ , and appropriate work is shown, such as solving the algebraic inequality  $-10x^2 + 750x - 9000 > 0$  or a graphic solution.

[3] Appropriate work is shown, but one computational or graphing error is made.

[3]  $15 \leq x \leq 60$ , and appropriate work is shown.

[2] Appropriate work is shown, but two or more computational or graphing errors are made.

or [2] Appropriate work is shown, but one conceptual error is made, such as solving the equation  $-10x^2 + 750x - 9000 > 0$  for 15 and 60.

or [2] An incorrect inequality of equal difficulty is solved appropriately.

[1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.

or [1]  $15 < x < 60$ , but no work is shown.

[0]  $15 \leq x \leq 60$ , and no work is shown.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[97] obviously incorrect procedure.

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[98] C

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