Date Completed: _____
Mentor Initials: _____

Quadratics (Advanced)

1. You are given the following system of equations:

$$y = x^2$$
$$px + qy = -z$$

where p, q, and z are integers. For which of the following will there be more than one (x, y) solution, with real-number coordinates, for the system?

A. $p^2 + 4qz > 0$
B. $q^2 - 4pz < 0$
C. $p^2 - 4qz > 0$
D. $q^2 + 4qz > 0$
E. $q^2 + 4pz < 0$

2. Which of the following are linear factors of $ghx^2 + (gn + hm)x + mn$, a general quadratic expression in x?

A. $(gx - m)(hx - n)$
B. $(gx - m)(hx + n)$
C. $(gx + m)(hx - n)$
D. $(gx + m)(hx + n)$
E. $(gx - n)(hx - m)$

3. Given that $x = 4$ is a solution to $x^2 + bx - 8 = 0$, which of the following polynomials is a factor of $x^2 + bx - 15$?

A. $x - 3$
B. $x - 1$
C. $x + 3$
D. $x + 4$
E. $x + 5$

4. Given constants g, h, r, s such that $x^2 + rx + g$ has factors of $(x + 3)$ and $(x + 1)$, and $x^2 + sx + h$ has factors of $(x - 2)$ and $(x + 5)$, what is rs?

A. -30
B. -10
C. 3
D. 12
E. 24

5. Which of the following most accurately describes the roots of the equation $8x^2 + 5x - 3 = 0$?

A. One rational double root
B. One irrational double root
C. Two irrational roots
D. Two rational roots
E. Cannot be determined from the given information

6. Which of the following quadratic equations has the complex number $1 + \sqrt{-1}$ as a solution?

A. $x^2 + 1 = 0$
B. $x^2 + x + 1 = 0$
C. $x^2 - x + 1 = 0$
D. $x^2 - 2x + 1 = 0$
E. $x^2 - 2x + 2 = 0$

7. If $r + s = 8$ and $r - s = 4$, what is the value of $(r + s)(r^2 - s^2)$?

A. 4
B. 16
C. 32
D. 256
E. 512

8. If $9x^2 + bx + 16 = 0$, where b is a constant, has exactly one solution, what is a possible value of b?

A. 3
B. 16
C. 24
D. 25
E. 144

9. In the xy-plane, the graph of $y = x^2 + bx + c$, where b and c are constants, has roots at $x = -5$ and $x = 6$. What is the value of b?

A. -30
B. -1
C. 1
D. 11
E. 30

$$x - 3\sqrt{x} - 4 = 0$$

10. What value of x satisfies the equation above?

A. 4
B. 8
C. 16
D. 25
E. 36

$$y = -6t^2 + 24t + 30$$

11. The equation above gives the height of a football above the ground y, in feet, t seconds after it is released from a player's hand. How many seconds after it is thrown does the ball reach the ground?

A. 0
B. 3
C. 5
D. 6
E. 30

$$g(x) = x^3 + ax^2 + bx + c$$

12. The function g is defined above, where a, b, and c are integer constants. If the zeros of the function are -4, 5, and -7, what is the value of c?

A. -140
B. -1
C. 1
D. 140
E. Cannot be determined from the given information

13. In the standard (x, y) coordinate plane, the graph of $y = 24(x + 12)^2 - 21$ is a parabola. What are the coordinates of the vertex of the parabola?

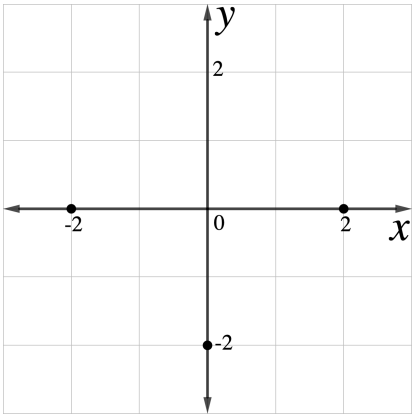
A. $(24, -21)$
B. $(24, 21)$
C. $(12, -21)$
D. $(-12, -21)$
E. $(-12, 21)$

$$4(x + a) + 6(x^2 - a) = 6x^2 + 4x + 10$$

14. In the equation above, a is a constant. If the equation is true for all values of x, then what is the value of a?

A. -5
B. -4
C. 4
D. 6
E. 10

15. Which of the following is an equation of a parabola that passes through the 3 points in the standard (x, y) coordinate plane below?



A. $y = 2(x + 2)^2$

B. $y = \frac{1}{2}(x + 2)^2$

C. $y = 2(x + 2)(x - 2)$

D. $y = \frac{1}{2}(x + 2)(x - 2)$

E. $y = 2x^2 - 2x + 2$

16. What are the solutions of the quadratic equation $(x - 3)^2 - 9 = 0$?

A. $x = -6$ and $x = 6$

B. $x = 6$ and $x = 0$

C. $x = 6$ and $x = 3$

D. $x = 0$ and $x = 3$

E. $x = -6$ and $x = 6$