A.REI.B.4: Using the Discriminant 1

1 Which graph represents a quadratic function with a negative discriminant?

2 If zero is the value of the discriminant of the equation $ax^2 + bx + c = 0$, which graph best represents $y = ax^2 + bx + c$?

3 If the roots of $ax^2 + bx + c = 0$ are real, rational, and equal, what is true about the graph of the function $y = ax^2 + bx + c$?
   1) It intersects the x-axis in two distinct points.
   2) It lies entirely below the x-axis.
   3) It lies entirely above the x-axis.
   4) It is tangent to the x-axis.
4 Which statement must be true if a parabola represented by the equation \( y = ax^2 + bx + c \) does not intersect the x-axis?
   1) \( b^2 - 4ac = 0 \)
   2) \( b^2 - 4ac < 0 \)
   3) \( b^2 - 4ac > 0 \), and \( b^2 - 4ac \) is a perfect square.
   4) \( b^2 - 4ac > 0 \), and \( b^2 - 4ac \) is not a perfect square.

5 Which is a true statement about the graph of the equation \( y = x^2 - 7x - 60 \)?
   1) It is tangent to the x-axis.
   2) It does not intersect the x-axis.
   3) It intersects the x-axis in two distinct points that have irrational coordinates.
   4) It intersects the x-axis in two distinct points that have rational coordinates.

6 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
   1) zero
   2) negative
   3) a perfect square
   4) not a perfect square

7 If the roots of a quadratic equation are real, irrational, and unequal, the discriminant could have a value of
   1) 1
   2) 0
   3) 8
   4) -6

8 The roots of a quadratic equation are real, rational, and equal when the discriminant is
   1) -2
   2) 2
   3) 0
   4) 4

9 Which number is the discriminant of a quadratic equation whose roots are real, unequal, and irrational?
   1) 0
   2) -5
   3) 7
   4) 4

10 Which equation has real, rational, and unequal roots?
   1) \( x^2 + 10x + 25 = 0 \)
   2) \( x^2 - 5x + 4 = 0 \)
   3) \( x^2 - 3x + 1 = 0 \)
   4) \( x^2 - 2x + 5 = 0 \)

11 Which equation has roots that are real, rational, and unequal?
   1) \( x^2 + x + 1 = 0 \)
   2) \( x^2 - 4x + 4 = 0 \)
   3) \( x^2 - 4 = 0 \)
   4) \( x^2 - 2 = 0 \)

12 Which equation has rational roots?
   1) \( x^2 + 8x - 8 = 0 \)
   2) \( x^2 + 8x + 9 = 0 \)
   3) \( 2x^2 + 4x + 5 = 0 \)
   4) \( 3x^2 + 8x + 4 = 0 \)

13 How many real-number solutions does \( 4x^2 + 2x + 5 = 0 \) have?
   1) one
   2) two
   3) zero
   4) infinitely many

14 How many real solutions does the equation \( x^2 - 2x + 5 = 0 \) have? Justify your answer.

15 Is the solution to the quadratic equation written below rational or irrational? Justify your answer.
   \[ 0 = 2x^2 + 3x - 10 \]

16 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.
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Answer Section

1. ANS: 4  REF: 080620b
2. ANS: 2  REF: 011020b
3. ANS: 4
   If the roots of the quadratic are equal, the graph of the function intersects the x-axis only once.
   REF: 010313b
4. ANS: 2
   If a parabola does not intersect the x-axis, the roots are imaginary, and the discriminant is less than 0.
   REF: 010416b
5. ANS: 4
   \( b^2 - 4ac = (-7)^2 - 4(1)(-60) = 289 \)
   REF: 010713b
6. ANS: 3  REF: 060103b
7. ANS: 3  REF: 061623a2
8. ANS: 3  REF: 010201b
9. ANS: 3  REF: 060717b
10. ANS: 2
    \((-5)^2 - 4(1)(4) = 9\)
    REF: 011506a2
11. ANS: 3
    \(0^2 - 4(1)(-4) = 16\)
    REF: 010817b
12. ANS: 4  REF: 089828siii
13. ANS: 3
    \(b^2 - 4ac = 2^2 - 4(4)(5) = 76\)
    REF: 061822ai
14. ANS:
    \(b^2 - 4ac = (-2)^2 - 4(1)(5) = 4 - 20 = -16\) None
    REF: 081529ai
15. ANS:
    Irrational, as 89 is not a perfect square. \(3^2 - 4(2)(-10) = 89\)
    REF: 081828ai
ANS:
Since the graph lies entirely above the $x$-axis, there is no point on the graph where $y = 0$.

REF: 080525b