

Graphing Parabolas and Key Features

Grade 9 – Algebra 1 math · Test Answer Key · Standards: F-IF.C.7a, F-IF.C.8a, F-IF.B.4, A-SSE.B.3b

Use this answer key to score the test out of 20 points. Each solution lists where the points are earned. Give partial credit for a correct method with a small arithmetic slip, and accept equivalent forms of an equation.

Standards: F-IF.C.7a, F-IF.C.8a, F-IF.B.4, A-SSE.B.3b · **Level:** Grade 9 Algebra 1

Question 1 Vertex Form Features (2 points)

- a. Vertex $(-2, 7)$. Since $a = -3 < 0$, it **opens down**.
- b. Axis $x = -2$; the vertex is the highest point, so the **maximum is 7**.

Scoring: 1 point per part.

Question 2 Vertex from Standard Form (2 points)

Axis $x = 10 \div 2 = 5$. $y = 25 - 50 + 7 = -18$. The y-intercept is the constant term, 7.

Axis $x = 5$; vertex $(5, -18)$; y-intercept 7

Scoring: 1 point for axis and vertex, 1 point for the y-intercept.

Question 3 Complete the Square (2 points)

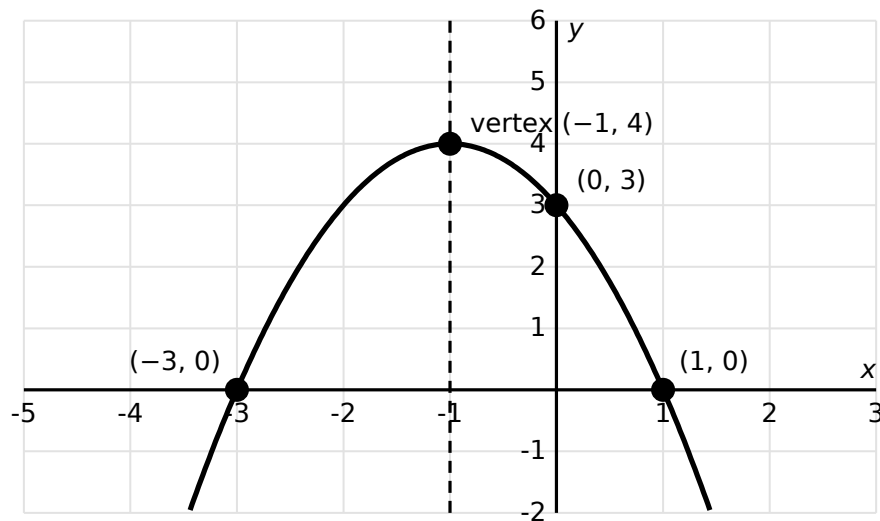
Half of 12 is 6: $y = (x^2 + 12x + 36) - 36 + 31 = (x + 6)^2 - 5$.

$y = (x + 6)^2 - 5$; vertex $(-6, -5)$

Scoring: 1 point for the vertex form, 1 point for the vertex.

Question 4 Features from a Graph (3 points)

- a. Vertex **$(-1, 4)$** ; axis **$x = -1$** .
- b. x-intercepts **$(-3, 0)$ and $(1, 0)$** ; y-intercept **$(0, 3)$** .
- c. Domain: **all real numbers**. The parabola opens down with maximum 4, so the range is **$y \leq 4$** .



Features of $y = -x^2 - 2x + 3$.

Scoring: 1 point per part.

Question 5 Factored Form (2 points)

Zeros: -3 and 7 . The axis is $(-3 + 7) \div 2 = 2$. At $x = 2$: $(5)(-5) = -25$.

Zeros -3 and 7 ; vertex $(2, -25)$

Scoring: 1 point for the zeros, 1 point for the vertex.

Question 6 Write an Equation (3 points)

a. $y = a(x - 3)^2 + 1$. At $(5, 9)$: $9 = 4a + 1$, so $a = 2$. **$y = 2(x - 3)^2 + 1$**

b. $2(x^2 - 6x + 9) + 1 = \mathbf{2x^2 - 12x + 19}$

Scoring: (a) 1 point for substituting, 1 point for a and the equation. (b) 1 point.

Question 7 Thrown Ball (3 points)

a. $h(0) = \mathbf{48 \text{ feet}}$.

b. $t = -32 \div (2 \cdot (-16)) = 1$. $h(1) = -16 + 32 + 48 = \mathbf{64 \text{ feet at } 1 \text{ second}}$.

c. $-16(t - 3)(t + 1) = 0$, so **$t = 3 \text{ seconds}$** (reject -1).

Scoring: 1 point per part.

Question 8 Fenced Pen (2 points)

a. **$A(w) = w(30 - w)$** .

- b. Zeros 0 and 30, so the vertex is at $w = 15$: $A(15) = 15 \cdot 15 = \mathbf{225 \text{ square feet}}$ (15 ft by 15 ft).

Scoring: 1 point per part.

Question 9 Does It Cross the Axis? (1 point)

The vertex is (1, 3) and $a = 2 > 0$, so the minimum value is 3, above the x-axis.

No x-intercepts

Scoring: 1 point for the answer with a correct justification.