Graph Quadratics in Standard Form: Vertex, Intercepts, and Points

Complete worked example / separate answer key

Graph y = x^2 - 4x + 3 by finding the axis of symmetry, vertex, intercepts, and one additional symmetric pair.

Answer: Axis of symmetry: x = -(-4)/(2*1) = 2. Vertex: y = 2^2 - 4*2 + 3 = -1, so vertex (2, -1). y-intercept: (0, 3). x-intercepts: solve x^2 - 4x + 3 = 0, which factors as (x - 1)(x - 3) = 0, so (1, 0) and (3, 0). Additional symmetric pair: x = 0 gives y = 3 and x = 4 gives y = 3, so (0, 3) and (4, 3) are symmetric about x = 2. Plot these points and draw a smooth upward-opening parabola.

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Original tasks 1, 2, 3 / complete keys

Task 1

Graph y = x^2 - 2x - 3. Find the axis of symmetry, vertex, y-intercept, and x-intercepts.

Answer: Axis: x = 1. Vertex: (1, -4). y-intercept: (0, -3). x-intercepts: (-1, 0) and (3, 0).

Reason: Here a = 1, b = -2, c = -3. Axis x = -(-2)/(2*1) = 1. Vertex y = 1^2 - 2*1 - 3 = -4. y-intercept is c = -3. Solve x^2 - 2x - 3 = 0: (x - 3)(x + 1) = 0, so x = 3 and x = -1.

Check: Substitute x = 1 into the equation to confirm the vertex y-value is -4. Substitute x = 3 and x = -1 to confirm each gives y = 0. Confirm the parabola opens upward because a = 1 > 0.

Task 2

Graph y = -x^2 + 4x - 1. Find the axis of symmetry, vertex, y-intercept, and two symmetric points.

Answer: Axis: x = 2. Vertex: (2, 3). y-intercept: (0, -1). Symmetric pair: (1, 2) and (3, 2).

Reason: a = -1, b = 4, c = -1. Axis x = -4/(2*(-1)) = 2. Vertex y = -(2)^2 + 4*2 - 1 = 3. y-intercept is (0, -1). Choose x = 1: y = -1 + 4 - 1 = 2. By symmetry about x = 2, x = 3 also gives y = 2.

Check: Verify the vertex by substituting x = 2. Check that (1, 2) and (3, 2) are equidistant from x = 2 and have the same y-value. Confirm the parabola opens downward because a = -1 < 0.

Task 3

Graph y = 2x^2 - 8x + 5. Find the axis of symmetry, vertex, y-intercept, and one additional symmetric pair.

Answer: Axis: x = 2. Vertex: (2, -3). y-intercept: (0, 5). Symmetric pair: (1, -1) and (3, -1).

Reason: a = 2, b = -8, c = 5. Axis x = -(-8)/(2*2) = 2. Vertex y = 2*4 - 8*2 + 5 = -3. y-intercept is (0, 5). At x = 1, y = 2 - 8 + 5 = -1; by symmetry, x = 3 gives y = -1.

Check: Substitute x = 2 to confirm the vertex. Check that (1, -1) and (3, -1) are symmetric about x = 2. Confirm the parabola opens upward because a = 2 > 0.

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Original tasks 4 / complete keys

Task 4

Graph y = -0.5x^2 + 2x + 1. Find the axis of symmetry, vertex, y-intercept, and two symmetric points. Use a consistent scale and label the axis of symmetry.

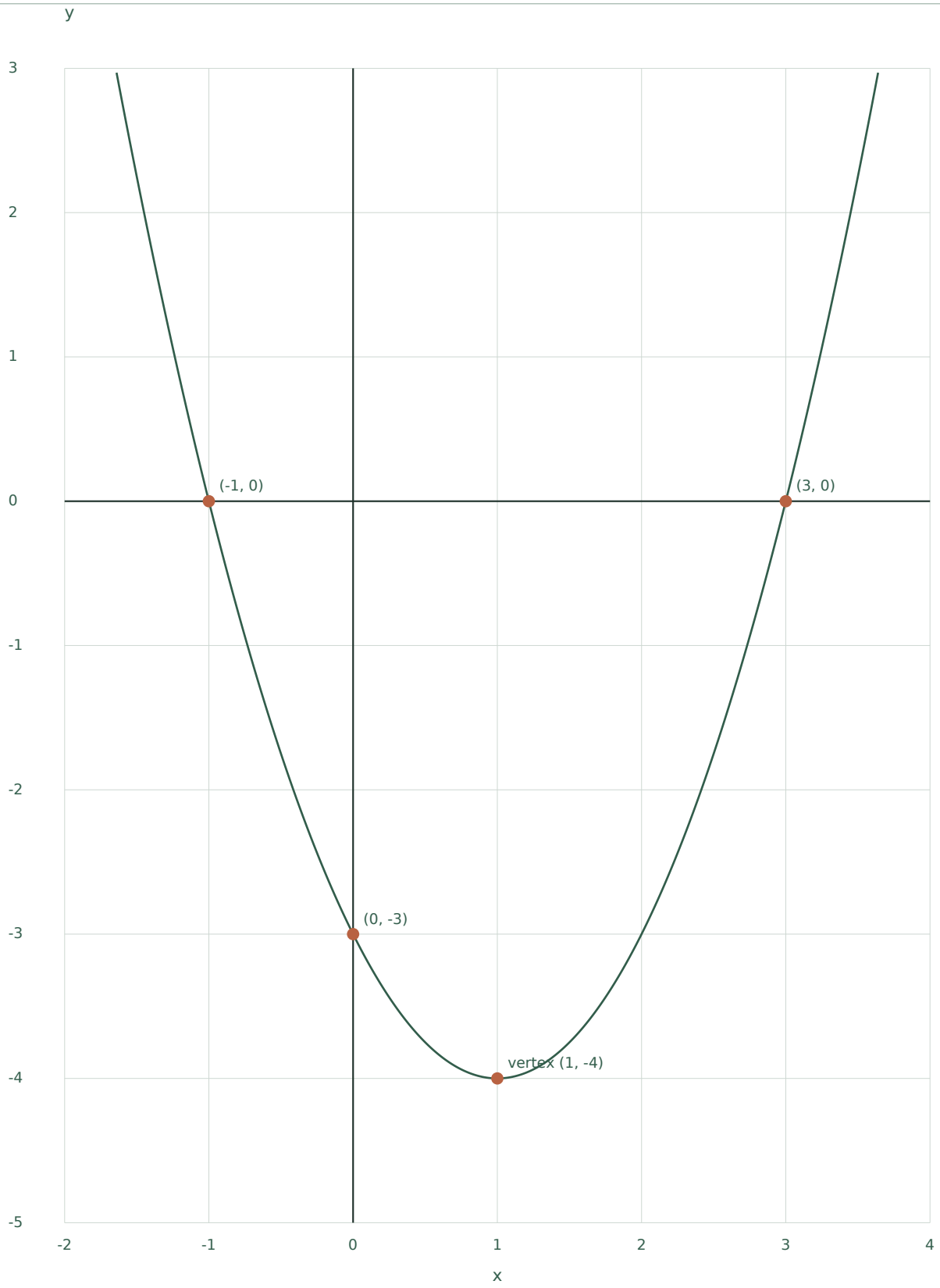
Answer: Axis: x = 2. Vertex: (2, 3). y-intercept: (0, 1). Symmetric pair: (0, 1) and (4, 1).

Reason: a = -0.5, b = 2, c = 1. Axis x = -2/(2*(-0.5)) = 2. Vertex y = -0.5*4 + 2*2 + 1 = 3. y-intercept is (0, 1). At x = 0, y = 1; by symmetry about x = 2, x = 4 also gives y = 1.

Check: Substitute x = 2 to confirm the vertex. Check that (0, 1) and (4, 1) are symmetric about x = 2. Confirm the parabola opens downward because a = -0.5 < 0. Verify the scale is consistent on both axes.

Graph Quadratics in Standard Form: Vertex, Intercepts, and Points

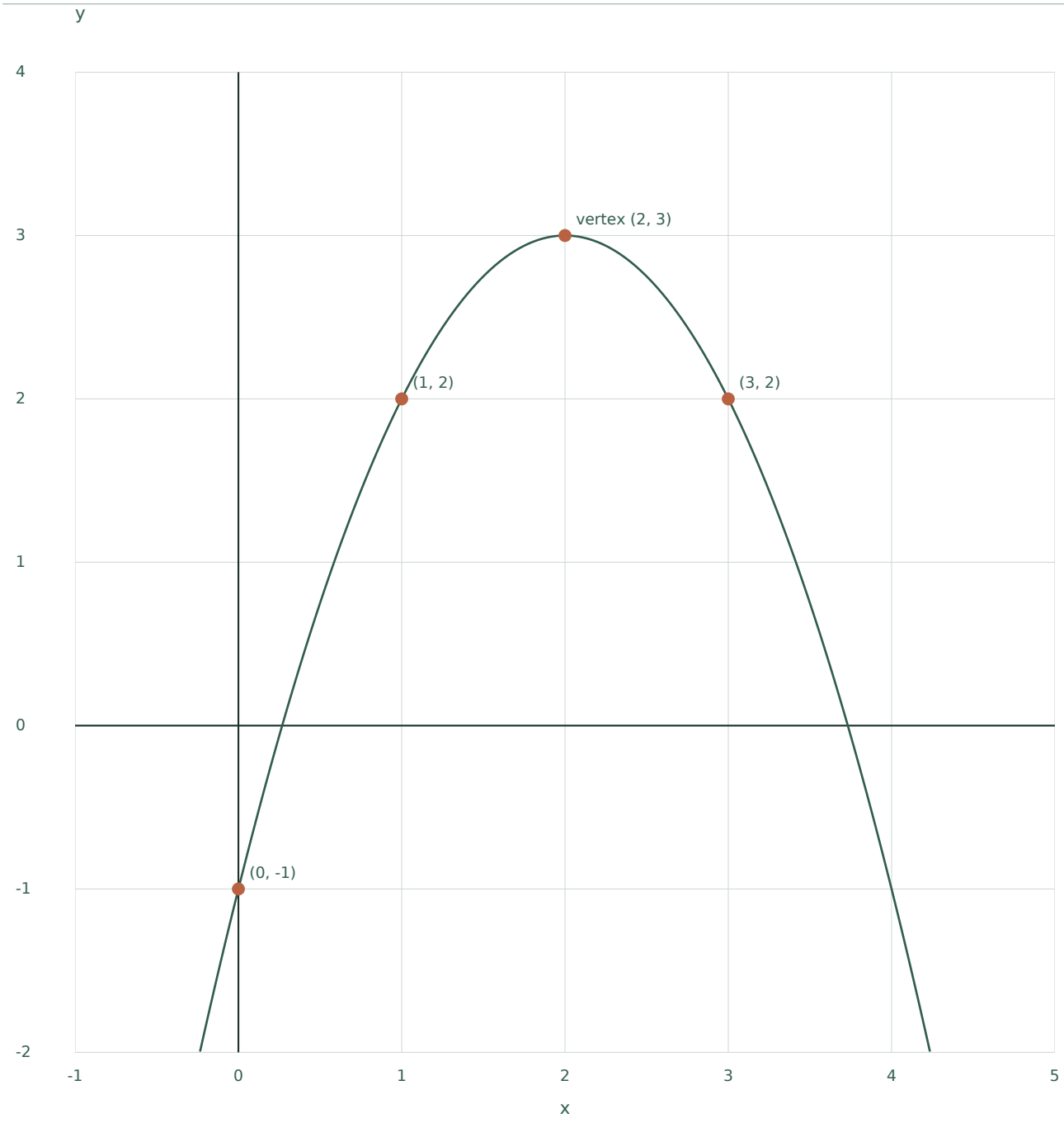
Task 1 / Answer graph: Task 1 y = x^2 - 2x - 3



Opens upward because a = 1 > 0.

Graph Quadratics in Standard Form: Vertex, Intercepts, and Points

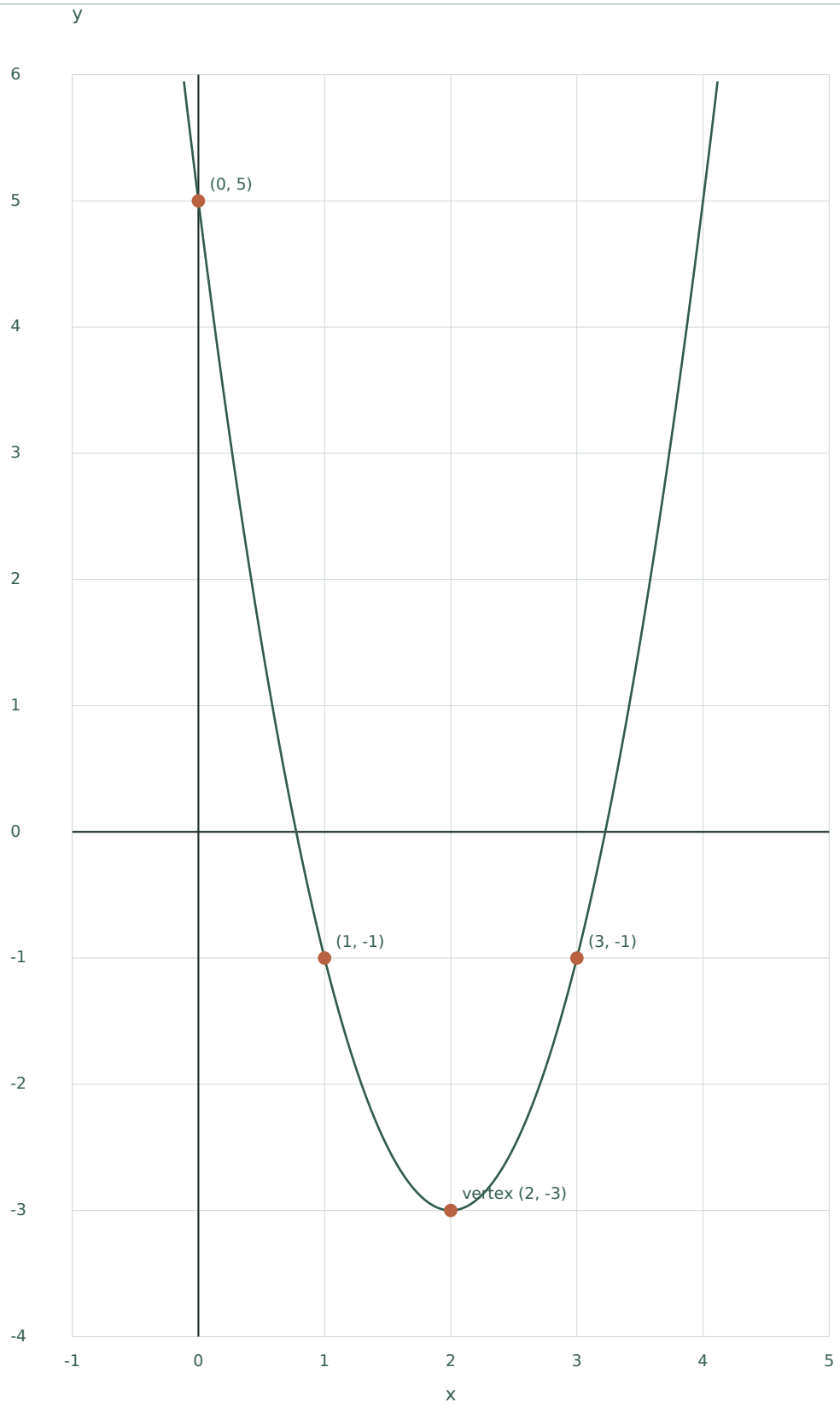
Task 2 / Answer graph: Task 2 y = -x^2 + 4x - 1



Opens downward because a = -1 < 0.

Graph Quadratics in Standard Form: Vertex, Intercepts, and Points

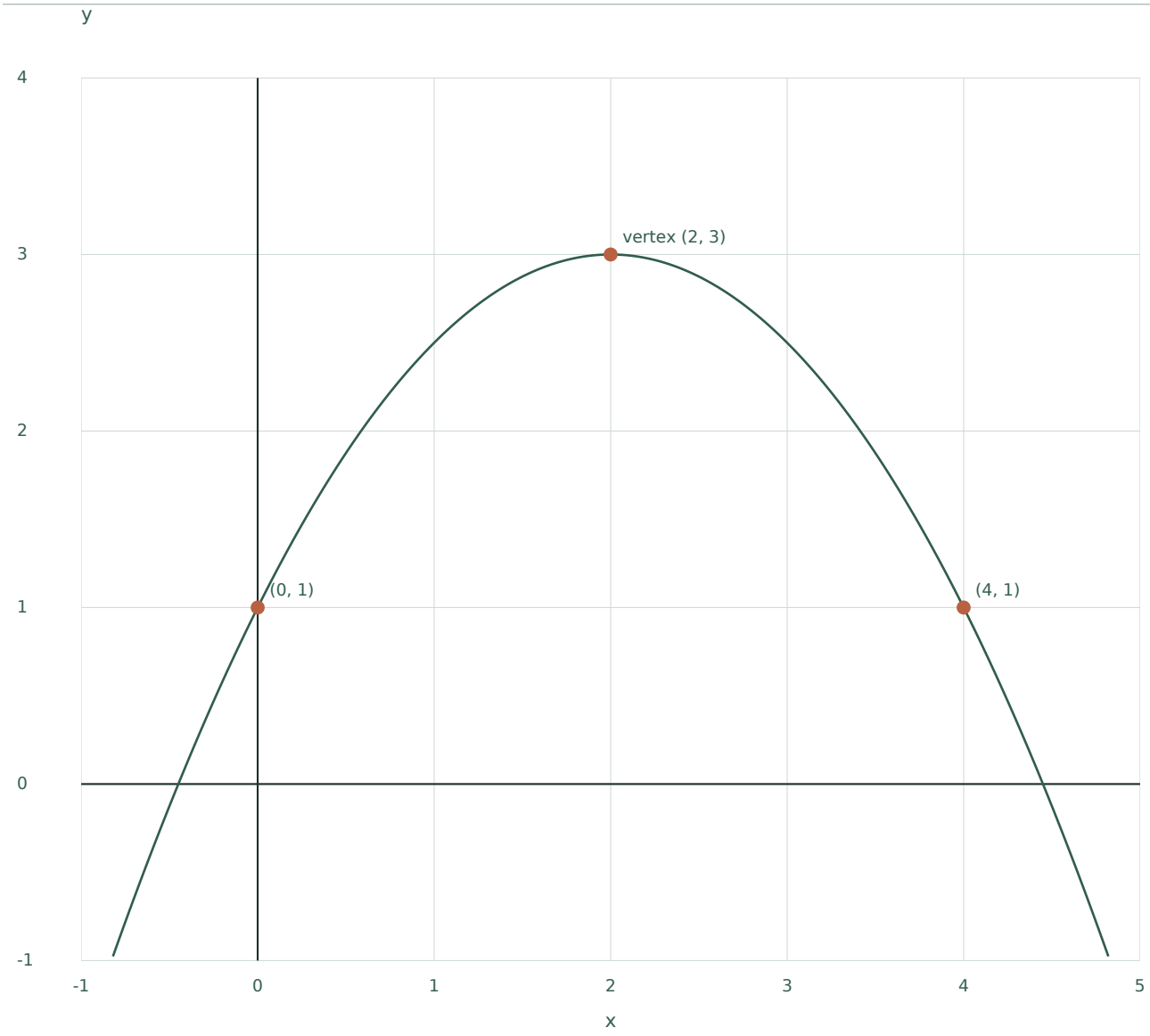
Task 3 / Answer graph: Task 3 y = 2x^2 - 8x + 5



Opens upward because a = 2 > 0.

Graph Quadratics in Standard Form: Vertex, Intercepts, and Points

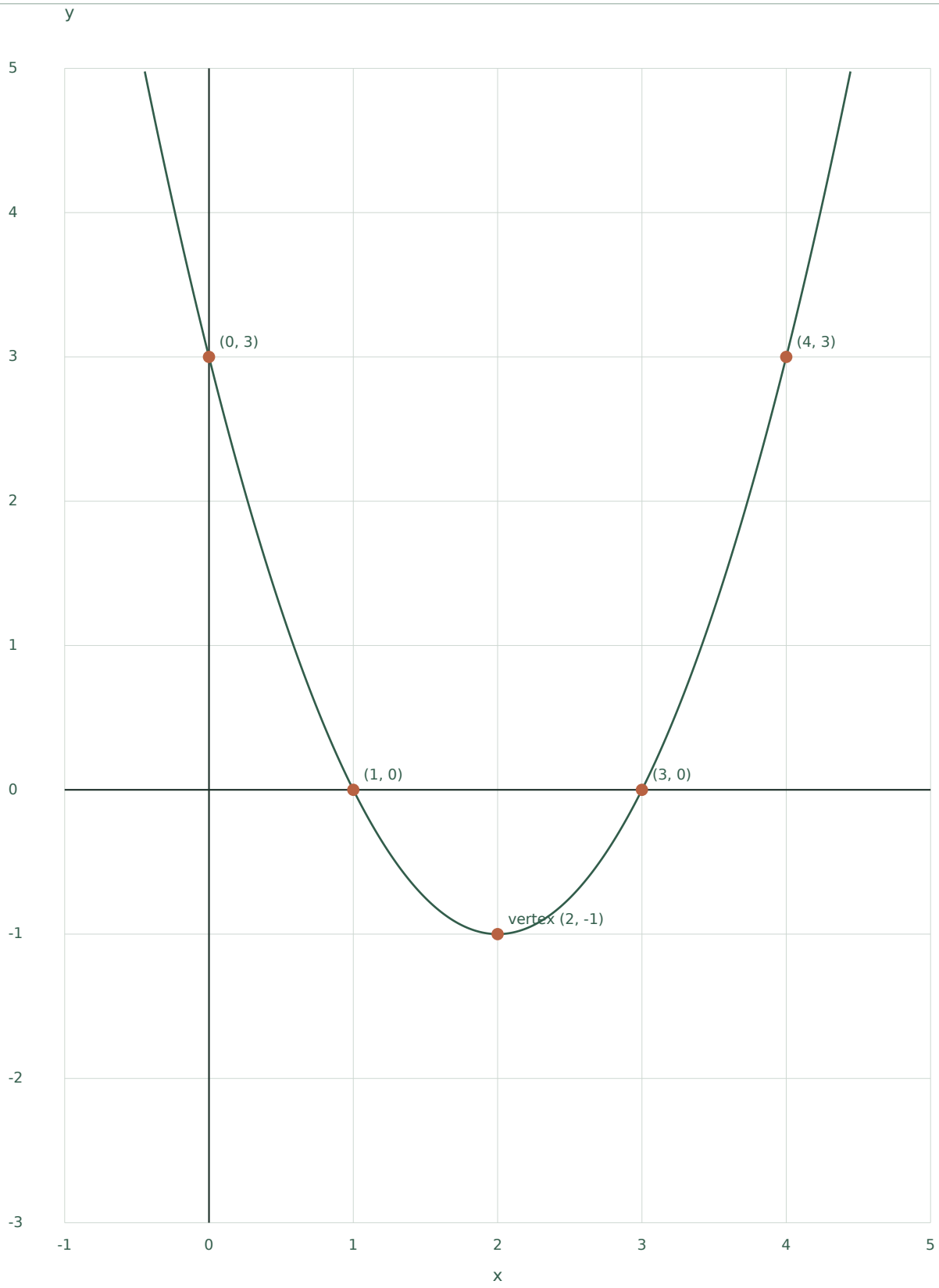
Task 4 / Answer graph: Task 4 y = -0.5x^2 + 2x + 1



Opens downward because a = -0.5 < 0. Scale is consistent on both axes.

Graph Quadratics in Standard Form: Vertex, Intercepts, and Points

Worked example / Worked example: y = x^2 - 4x + 3



Axis of symmetry x = 2 is the vertical line through the vertex; the symmetric pair (0, 3) and (4, 3) is equidistant from it.

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Source rubric / reflection

- [ ] Axis of symmetry correctly computed as x = -b/(2a).
- [ ] Vertex coordinates correctly found by substituting the axis value into the equation.
- [ ] y-intercept correctly identified as (0, c).
- [ ] x-intercepts correctly solved or explicitly noted as non-real.
- [ ] At least one symmetric pair of points plotted and used to check the curve.
- [ ] Curve is smooth and opens in the direction indicated by the sign of a.
- [ ] Labels for vertex, axis of symmetry, and intercepts are clear and consistent with the graph.

Reflection: What did you check, what did you change, and what will you try next?