Write Quadratic Equations from Parabola Graphs: Vertex Form to Standard Form

Original tasks 1, 2, 3 / complete keys

Task 1

A parabola opens upward with vertex (1, -4) and passes through (3, 0). Write the equation in vertex form and standard form.

Answer: Vertex form: y = (x - 1)^2 - 4. Standard form: y = x^2 - 2x - 3.

Reason: Substitute vertex: y = a(x - 1)^2 - 4. Use (3, 0): 0 = a(2)^2 - 4, so 4a = 4 and a = 1. Expand: (x - 1)^2 - 4 = x^2 - 2x + 1 - 4 = x^2 - 2x - 3.

Check: Substitute x = 1 to get y = -4 and x = 3 to get y = 0 in the standard form.

Task 2

A parabola opens downward with vertex (2, 5) and passes through (4, 1). Write the equation in vertex form and standard form.

Answer: Vertex form: y = -(x - 2)^2 + 5. Standard form: y = -x^2 + 4x + 1.

Reason: Vertex form: y = a(x - 2)^2 + 5. Use (4, 1): 1 = a(2)^2 + 5, so 4a = -4 and a = -1. Expand: -(x - 2)^2 + 5 = -(x^2 - 4x + 4) + 5 = -x^2 + 4x + 1.

Check: Check vertex (2, 5) and point (4, 1) in y = -x^2 + 4x + 1.

Task 3

A parabola opens upward with vertex (-1, -2) and passes through (1, 6). Write the equation in vertex form and standard form.

Answer: Vertex form: y = 2(x + 1)^2 - 2. Standard form: y = 2x^2 + 4x.

Reason: Vertex form: y = a(x + 1)^2 - 2. Use (1, 6): 6 = a(2)^2 - 2, so 4a = 8 and a = 2. Expand: 2(x + 1)^2 - 2 = 2(x^2 + 2x + 1) - 2 = 2x^2 + 4x + 2 - 2 = 2x^2 + 4x.

Check: Substitute x = -1 to get -2 and x = 1 to get 6 in the standard form.

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Original tasks 4 / complete keys

Task 4

A parabola opens downward with vertex (0, 4) and passes through (2, 0). Write the equation in vertex form and standard form.

Answer: Vertex form: y = -(x)^2 + 4. Standard form: y = -x^2 + 4.

Reason: Vertex form: y = a(x - 0)^2 + 4 = ax^2 + 4. Use (2, 0): 0 = a(4) + 4, so 4a = -4 and a = -1. Standard form is y = -x^2 + 4.

Check: Check vertex (0, 4) and point (2, 0) in y = -x^2 + 4.

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Source rubric / reflection

- [ ] Vertex coordinates correctly identified and substituted with the correct sign.
- [ ] Extra point substituted correctly into vertex form.
- [ ] Value of a solved accurately, with sign matching the opening direction.
- [ ] Vertex form written clearly with parentheses and correct operations.
- [ ] Expansion to standard form is algebraically correct.
- [ ] Verification shows both the vertex and extra point satisfy the final equation.

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