NudgeLearn

Algebra 2 · Math

Quadratic Functions

Answer key | HSF.IF.C.8 | HSA.REI.B.4

15 problems

1. Find the axis of symmetry of $y = x^2 - 8x + 3$.

   Answer $x = 4$

   The axis is $x = -\dfrac{b}{2a} = -\dfrac{-8}{2(1)} = 4$.

2. Give the vertex of the parabola written in vertex form: $y = (x - 5)^2 + 2$.

   Answer $(5, 2)$

   In $y = (x - h)^2 + k$ the vertex is (h, k), so the vertex is $(5, 2)$.

3. Identify the vertex and state whether $y = -3(x + 1)^2 - 4$ opens up or down.

   Answer **Vertex** $(-1, -4)$**; opens down**

   Vertex form gives $(h, k) = (-1, -4)$. The leading coefficient $-3 < 0$, so it opens down.

4. Complete the square to write $y = x^2 + 4x + 1$ in vertex form.

   Answer $y = (x + 2)^2 - 3$

   Take half of 4 (which is 2) and square it: $y = (x^2 + 4x + 4) + 1 - 4 = (x + 2)^2 - 3$.

5. Complete the square to write $y = x^2 - 6x + 5$ in vertex form, then state the vertex.

   Answer $y = (x - 3)^2 - 4$**; vertex** $(3, -4)$

   Half of -6 is -3, squared is 9: $y = (x^2 - 6x + 9) + 5 - 9 = (x - 3)^2 - 4$. Vertex $(3, -4)$.

6. Write $y = x^2 + 10x + 21$ in vertex form by completing the square.

   Answer $y = (x + 5)^2 - 4$

   Half of 10 is 5, squared is 25: $y = (x^2 + 10x + 25) + 21 - 25 = (x + 5)^2 - 4$.

7. Complete the square to write $y = 2x^2 - 12x + 13$ in vertex form.

   Answer $y = 2(x - 3)^2 - 5$

   Factor 2 from the x-terms: $2(x^2 - 6x) + 13 = 2(x - 3)^2 - 18 + 13 = 2(x - 3)^2 - 5$.

8. Find the minimum value of $y = x^2 - 6x + 5$ and the x-value where it occurs.

   Answer **Minimum** -4 **at** $x = 3$

   From vertex form $y = (x - 3)^2 - 4$, the parabola opens up, so the minimum is -4 at $x = 3$.

9. Solve for the complex roots: $x^2 + 4 = 0$.

   Answer $x = \pm 2i$

   $x^2 = -4$, so $x = \pm\sqrt{-4} = \pm 2i$.

10. Use the quadratic formula to solve $x^2 - 2x + 5 = 0$.

    Answer $x = 1 \pm 2i$

    Discriminant $= (-2)^2 - 4(1)(5) = -16$. $x = \dfrac{2 \pm \sqrt{-16}}{2} = \dfrac{2 \pm 4i}{2} = 1 \pm 2i$.

11. Use the quadratic formula to solve $x^2 + 6x + 13 = 0$.

Answer $x = -3 \pm 2i$

Discriminant $= 6^2 - 4(1)(13) = -16$. $x = \dfrac{-6 \pm 4i}{2} = -3 \pm 2i$.

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12. Which best describes the roots of $x^2 - 4x + 7 = 0$?

Answer **C) Two complex (non-real) roots**

Discriminant $= (-4)^2 - 4(1)(7) = 16 - 28 = -12 < 0$, so there are two complex conjugate roots.

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13. Use the quadratic formula to solve $2x^2 - 4x + 5 = 0$.

Answer $x = 1 \pm \frac{\sqrt{6}}{2}i$

Discriminant $= (-4)^2 - 4(2)(5) = -24$. $x = \dfrac{4 \pm \sqrt{-24}}{4} = \dfrac{4 \pm 2i\sqrt{6}}{4} = 1 \pm \dfrac{\sqrt{6}}{2}i$.

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14. A profit function is $P(x) = -x^2 + 8x - 7$, where x is the price in dollars. Complete the square to find the price that maximizes profit and the maximum profit.

Answer **Vertex $(4, 9)$: price $\$4$ gives a maximum profit of $\$9$**

$P(x) = -(x^2 - 8x) - 7 = -(x - 4)^2 + 16 - 7 = -(x - 4)^2 + 9$. The vertex $(4, 9)$ is the maximum.

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15. A ball is thrown upward; its height in feet is $h(t) = -16t^2 + 32t + 48$ after t seconds. Find the time it reaches maximum height and the maximum height.

Answer **At $t = 1$ s, maximum height $= 64$ ft**

Vertex time $t = -\dfrac{32}{2(-16)} = 1$ s. Then $h(1) = -16 + 32 + 48 = 64$ ft.