

Characteristics of Quadratic Functions

TSIA2 Math • Section 9.2

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Quick Review and Helpful Hints

Quadratic functions can be read through their zeros, vertex, axis of symmetry, and opening direction. Choose factoring, square roots, completing the square, or the quadratic formula based on the form you see.

▷ **Example:** Solve $x^2 - 5x + 6 = 0$.

Work: Factor the quadratic: $x^2 - 5x + 6 = (x - 2)(x - 3)$. Set each factor equal to zero.

★ **Answer:** $x = 2$ or $x = 3$

◆ Practice Problems

Solve each problem. Show enough work that another student could follow your thinking.

1. Find the vertex of $y = x^2 - 6x + 11$. _____

6. Find the range of $y = -2(x - 1)^2 + 6$. _____

2. Find the minimum value of $y = (x - 5)^2 + 8$. _____

7. On which interval is $y = x^2$ increasing? _____

3. Find the maximum value of $y = -(x + 1)^2 + 12$. _____

8. On which interval is $y = -x^2$ decreasing? _____

4. Find the domain of $y = 2x^2 - 3x + 1$. _____

9. Find the zeros of $y = x^2 - 9$. _____

5. Find the range of $y = x^2 - 4$. _____

10. Find the axis of symmetry of $y = x^2 - 12x + 20$. _____

◆ Word Problems

11. A rocket's height is $h(t) = -5t^2 + 20t + 1$. Find the maximum height. _____

12. A profit model is $P(x) = -x^2 + 10x - 9$. On what interval is profit increasing? _____



Answer Keys

- | | |
|---------------------|----------------|
| 1. $(3, 2)$ | 7. $x \geq 0$ |
| 2. 8 | 8. $x \geq 0$ |
| 3. 12 | 9. $x = \pm 3$ |
| 4. All real numbers | 10. $x = 6$ |
| 5. $y \geq -4$ | 11. 21 |
| 6. $y \leq 6$ | 12. $x < 5$ |

Step-by-Step Explanations

- Use $x = -b/(2a) = 3$, then $y = 9 - 18 + 11 = 2$, so the vertex is $(3, 2)$.
- In vertex form, $k = 8$ is the lowest y can reach since the squared part can't go below zero.
- This opens downward, so the vertex y -value is the highest point: 12.
- Every quadratic accepts any real input — there are no restrictions on x .
- The minimum is -4 at $x = 0$, and the parabola climbs from there, so $y \geq -4$.
- Opening down, the maximum is 6, and outputs slide downward from there.
- To the right of the vertex at 0, the parabola climbs — so it increases for $x \geq 0$.
- This parabola opens downward, so once past the vertex at 0 it just keeps falling.
- Set $y = 0$: $x^2 = 9$, so $x = 3$ or $x = -3$ — the parabola crosses the x -axis at both.
- Apply $x = -b/(2a) = -(-12)/2 = 6$ to get the line of symmetry.
- Vertex $t = -20/(-10) = 2$; plug back in: $-5(4) + 40 + 1 = 21$.
- Vertex at $x = 5$; profit rises up to that point, then turns downward.



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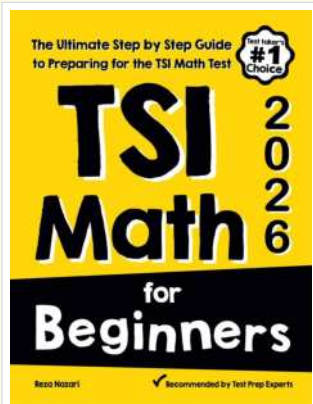
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