Day 2 - Characteristics of Quadratics

One key component to fully understanding quadratic functions is to be able to describe characteristics of the graph and its equation.

Domain and Range

Domain

Define: All possible values of x

Think: How far left to right does the graph go?

Write: Smallest x ≤ x ≤ Biggest x
use < if the circles are open

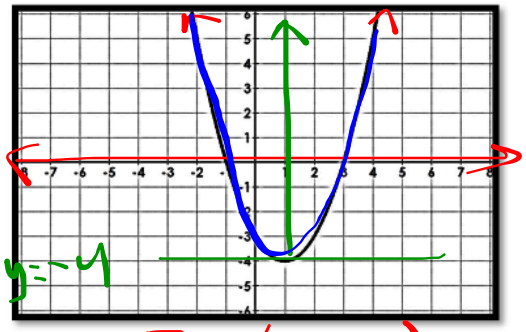
Range

Define: All possible values of y

Think: How far down to how far up does the graph go?

Write: y ≤ highest y value (opens down)
y ≥ lowest y value (opens up)

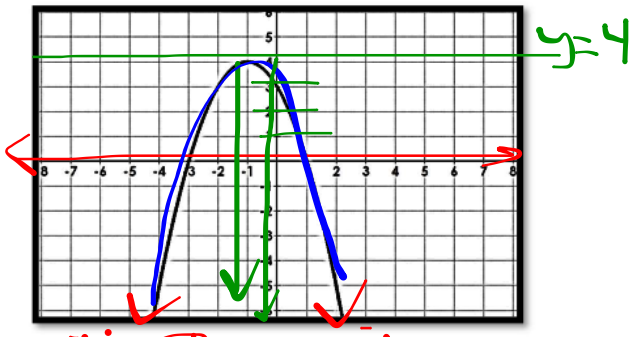
Graph 1



Domain: ℝ $(-\infty, \infty)$

Range: $y \geq -4$

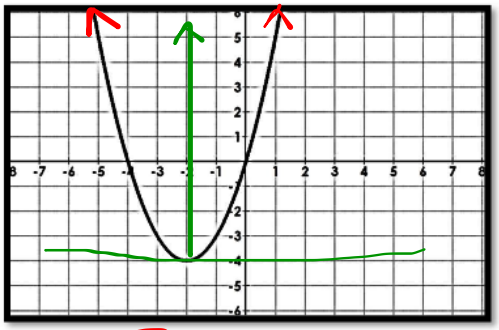
Graph 2



Domain: ℝ

Range: $y \leq 4$

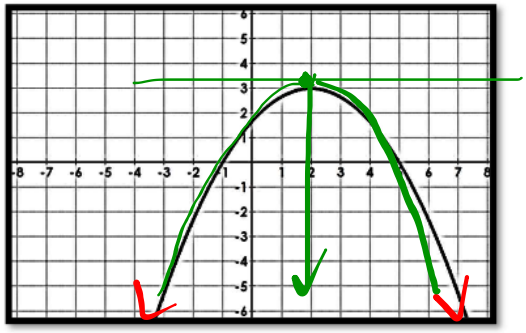
Graph 3



Domain: ℝ

Range: $y \geq -4$

Graph 4



Domain: ℝ

Range: $y \leq 3$

Algebra 1 | Unit 6: Quadratic Functions | Notes

Zeros and Intercepts

Y-Intercept

Define: Point where the graph crosses the y-axis

Think: At what coordinate point does the graph cross the y-axis?

Write: (0, b)

X-Intercept

Define: Point where the graph crosses the x-axis

Think: At what coordinate point does the graph cross the x-axis?

Write: (a, 0)

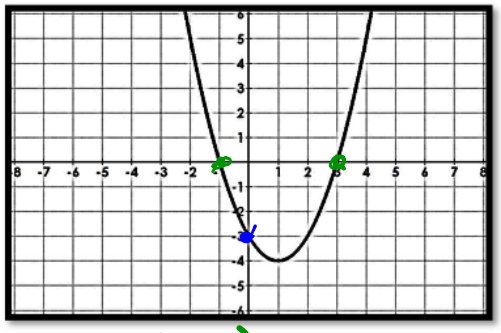
Zero

Define: Where the function (y-value) equals 0

Think: At what x-value does the graph cross the x-axis?

Write: x = ____

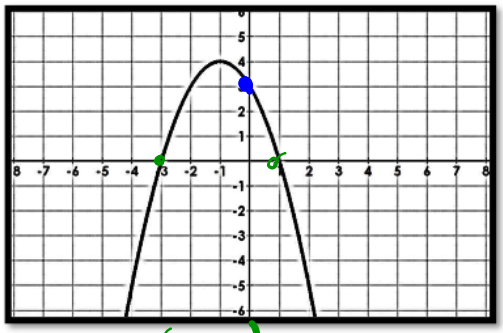
Graph 1



X-intercepts: (-1, 0) (3, 0) Y-intercept: (0, -3)

Zeros: x = -1, x = 3

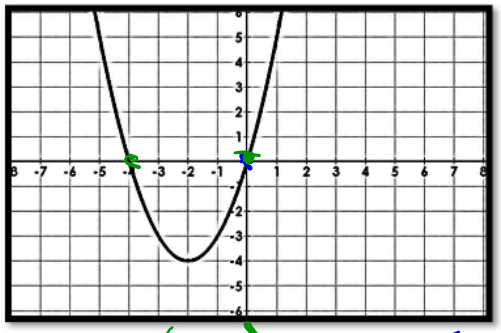
Graph 2



X-intercepts: (-3, 0) (1, 0) Y-intercept: (0, 3)

Zeros: x = -3, x = 1

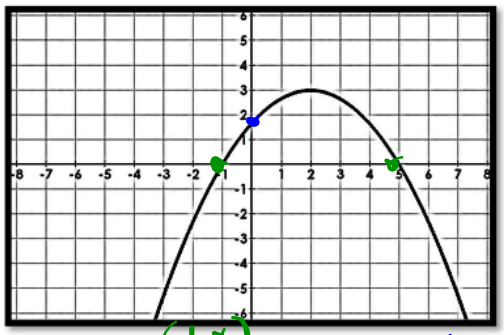
Graph 3



X-intercepts: (0, 0) (-4, 0) Y-intercept: (0, 0)

Zeros: x = 0, x = -4

Graph 4



X-intercepts: (-1, 0) (5, 0) Y-intercept: (0, 1.5)

Zeros: x = -1, x = 5

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Algebra 1 | Unit 6: Quadratic Functions | Notes

Vertex & Axis of Symmetry

Vertex

Define: Highest or lowest point or peak of a parabola

Think: What is my highest or lowest point on my graph?

Write: Name the point (h, k)

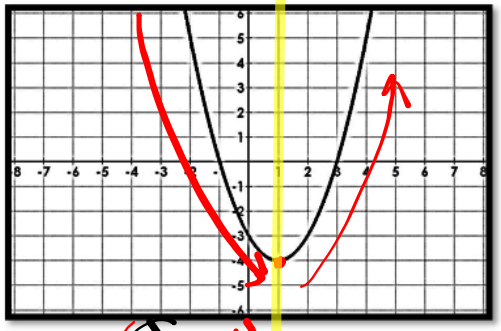
Axis of Symmetry

Define: The vertical line that divides the parabola into mirror images and runs through the vertex

Think: What imaginary, vertical line would make the parabola symmetrical?

Write: x = h (x value of the vertex)

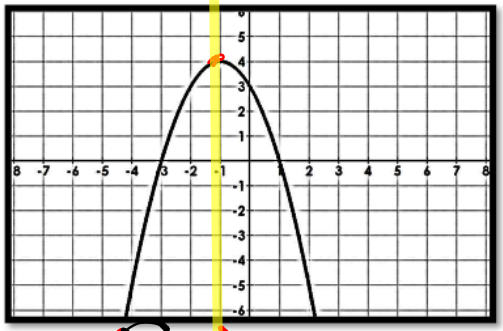
Graph 1



Vertex: (1, -4)

Axis of Symmetry: x = 1

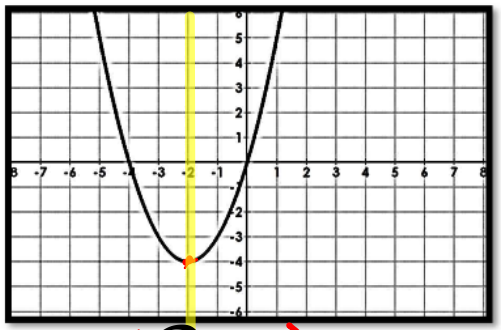
Graph 2



Vertex: (-1, 4)

Axis of Symmetry: x = -1

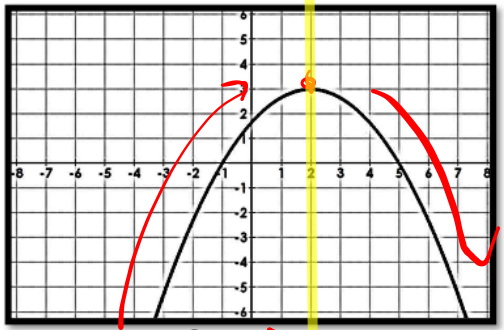
Graph 3



Vertex: (-2, -4)

Axis of Symmetry: x = -2

Graph 4



Vertex: (2, 3)

Axis of Symmetry: x = 2

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Algebra 1 Unit 6: Quadratic Functions Notes

Extrema

Maximum

Define: Highest point or peak of a function.

Think: What is my highest point on my graph?

Write: y = k (y-value of the vertex)

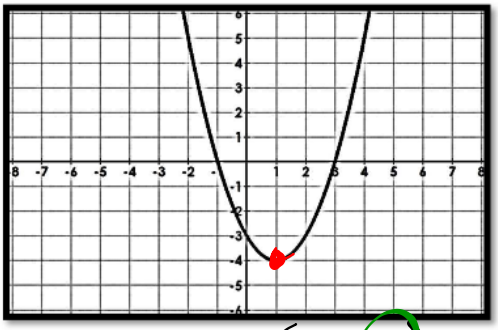
Minimum

Define: Lowest point or valley of a function.

Think: What is the lowest point on my graph?

Write: y = k (y-value of the vertex)

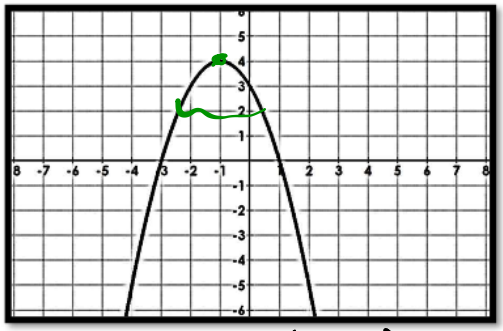
Graph 1



Extrema: min (1, -4)

Min/Max Value: y = -4

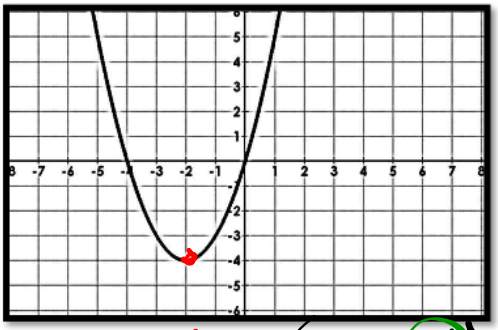
Graph 2



Extrema: max (-1, 4)

Min/Max Value: y = 4

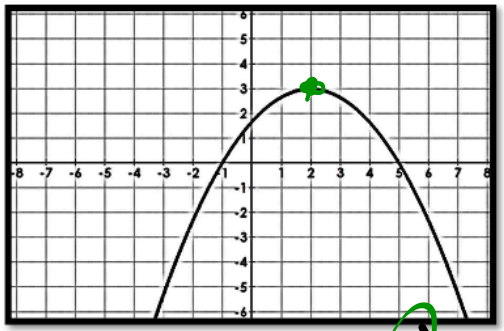
Graph 3



Extrema: min (-2, -4)

Min/Max Value: y = -4

Graph 4



Extrema: max (2, 3)

Min/Max Value: y = 3

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Algebra 1 Unit 6: Quadratic Functions Notes

End Behavior

End Behavior

Define:

Behavior of the ends of the function (what happens to the y-values or f(x)) as x approaches positive or negative infinity. The arrows indicate the function goes on forever so we want to know where those ends go.

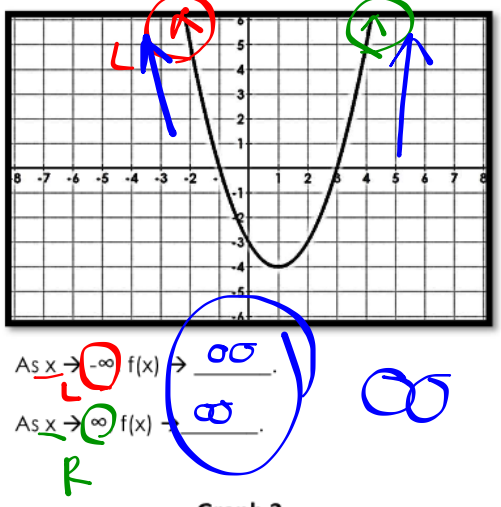
Think: As x goes to the left (negative infinity), what direction does the left arrow go?

Write: As x → -∞, f(x) → _____

Think: As x goes to the right (positive infinity), what direction does the right arrow go?

Write: As x → ∞, f(x) → _____

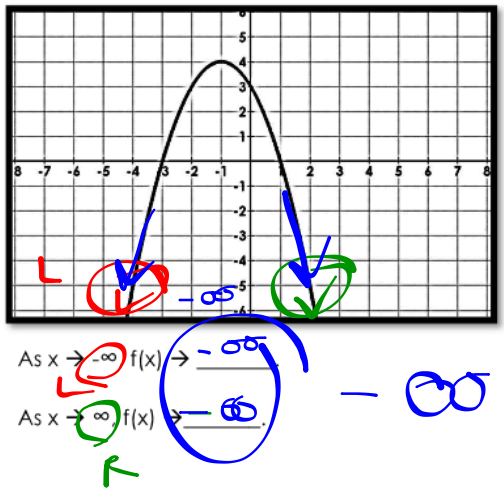
Graph 1



As x → -∞, f(x) → _____.

As x → ∞, f(x) → _____.

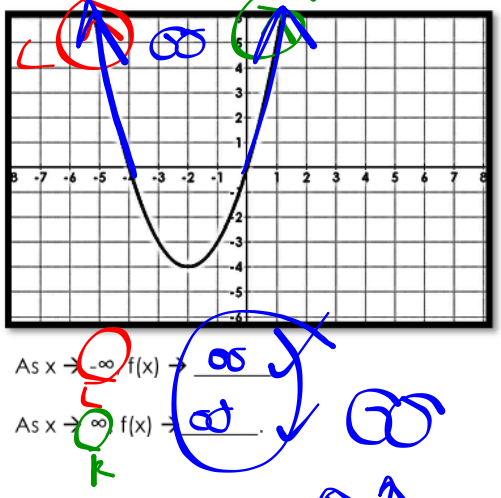
Graph 2



As x → -∞, f(x) → _____.

As x → ∞, f(x) → _____.

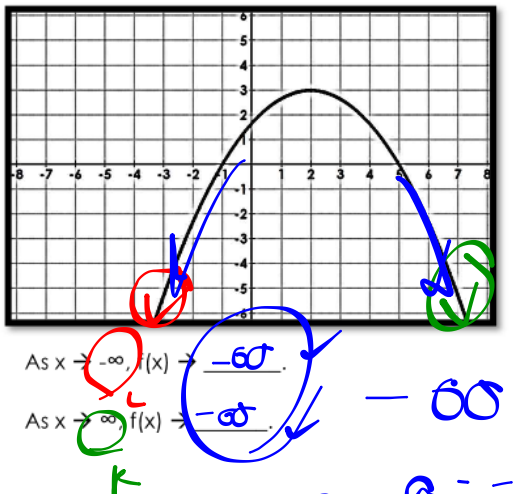
Graph 3



As x → -∞, f(x) → _____.

As x → ∞, f(x) → _____.

Graph 4



As x → -∞, f(x) → _____.

As x → ∞, f(x) → _____.

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Algebra 1 Unit 6: Quadratic Functions Notes

Intervals of Increase and Decrease

Interval of Increase

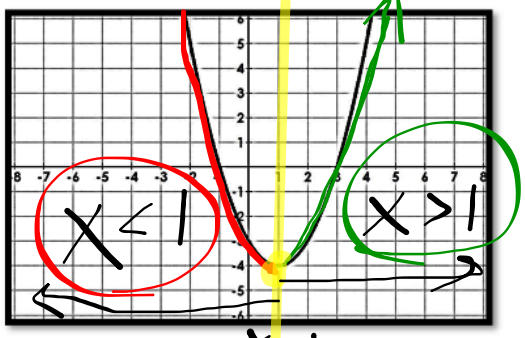
Define:	Think:	Write:
The part of the graph that is rising as you read left to right.	From left to right, is my graph going up?	An inequality using the x-value of the vertex

Interval of Decrease

Define:	Think:	Write:
The part of the graph that is falling as you read from left to right.	From left to right, is my graph going down?	An inequality using the x-value of the vertex

LEFT → RIGHT

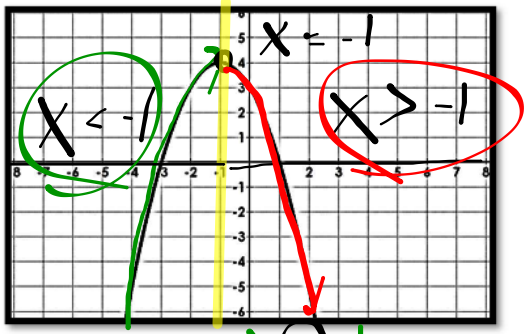
Graph 1



Interval of Increase: $x > 1$

Interval of Decrease: $x < 1$

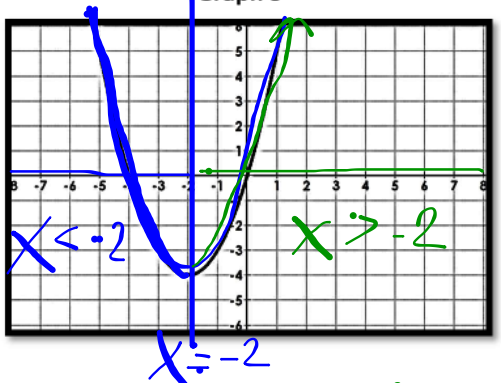
Graph 2



Interval of Increase: $x < -1$

Interval of Decrease: $x > -1$

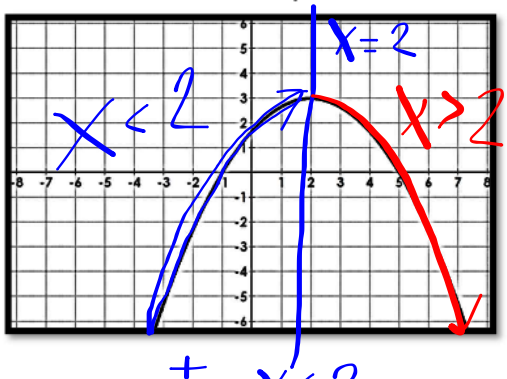
Graph 3



Interval of Increase: $x > -2$

Interval of Decrease: $x < -2$

Graph 4



Interval of Increase: $x < 2$

Interval of Decrease: $x > 2$

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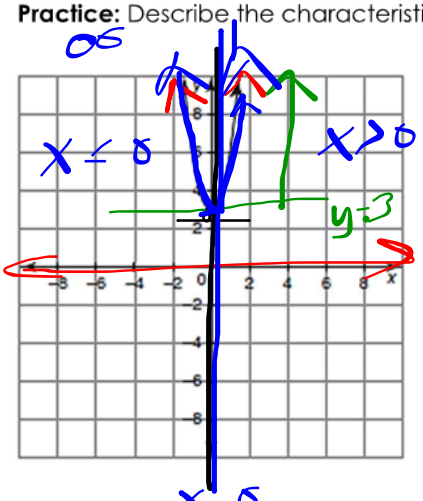
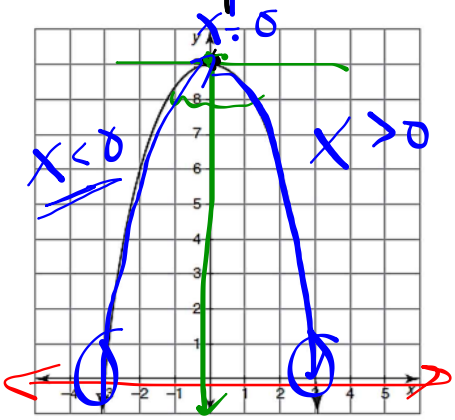
Algebra 1 Unit 6: Quadratic Functions Notes

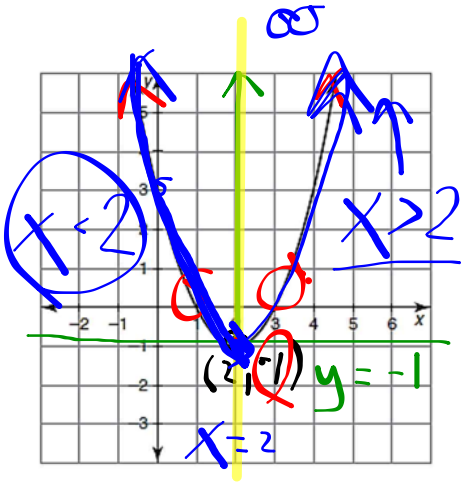
Practice: Describe the characteristics of the following graphs:



Domain: ℝ
Range: $y \geq 3$
Vertex: (0, 3)
Axis of Sym. $x = 0$
Y-Intercept: (0, 3)
Zeroes: none
Extrema: min
Max/Min Value: $y = 3$
Int of Inc: $x > 0$
Int of Dec: $x < 0$
Positive:
Negative:
End Behavior: As x → -∞, f(x) → ∞. As x → ∞, f(x) → ∞



Domain: ℝ
Range: $y \leq 9$
Vertex: (0, 9)
Axis of Sym. $x = 0$
Y-Intercept: (0, 9)
Zeroes: $x = -3, x = 3$
Extrema: max
Max/Min Value: (0, 9)
Int of Inc: $x < 0$
Int of Dec: $x > 0$
Positive:
Negative:
End Behavior: As x → -∞, f(x) → −∞. As x → ∞, f(x) → −∞



Domain: ℝ
Range: $y \geq -1$
Vertex: (2, -1)
Axis of Sym. $x = 2$
Y-Intercept: (0, 3)
Zeroes: $x = 1, x = 3$
Extrema: min
Max/Min Value: $y = -1$
Int of Inc: $x > 2$
Int of Dec: $x < 2$
Positive:
Negative:
End Behavior: As x → -∞, f(x) → ∞. As x → ∞, f(x) → ∞

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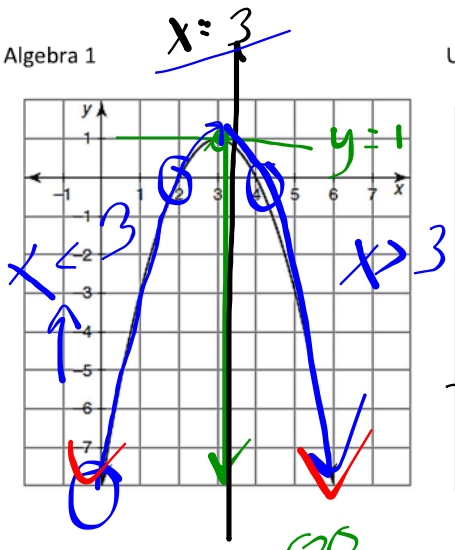
Algebra 1 Unit 6: Quadratic Functions Notes



Domain: $\mathbb{R}$ Range: $y \leq 1$

Vertex: $(3, 1)$ Axis of Sym. $x = 3$

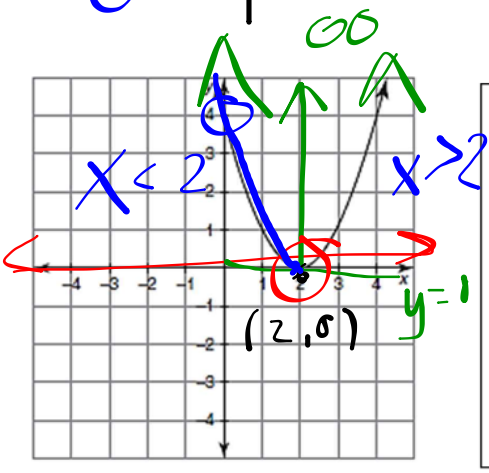
Y-Intercept: $(0, -8)$ Zeroes: $x = 2, x = 4$

Extrema: max Max/Min Value: $y = 1$

Int of Inc: $x < 3$ Int of Dec: $x > 3$

Positive: Negative:

End Behavior: As $x \to -\infty$, $f(x) \to -\infty$. As $x \to \infty$, $f(x) \to -\infty$



Domain: $\mathbb{R}$ Range: $y \geq 0$

Vertex: $(2, 0)$ Axis of Sym. $x = 2$

Y-Intercept: $(0, 4)$ Zeroes: $x = 2$

Extrema: min Max/Min Value: $y = 0$

Int of Inc: $x > 2$ Int of Dec: $x < 2$

Positive: Negative:

End Behavior: As $x \to -\infty$, $f(x) \to \infty$. As $x \to \infty$, $f(x) \to \infty$

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