

DOMAIN & RANGE

- *Domain = all of the x-values that can go INTO the function. [How wide does the graph spread?]
- *Range = all of the y-values you can get OUT of the function. Use the y-coordinate from the absolute minimum/maximum value to help you determine the range.
- *If the graph goes above the absolute minimum/maximum value, then the range will be $y \geq$ y-coordinate.
- *If the graph goes below the minimum/maximum value, then the range will be $y \leq$ y-coordinate.

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INTERCEPTS

- *x-intercept = the point (x, 0). You can find the value of x by plugging in zero for y and solving. The x-coordinate from the x-intercept is the REAL ZERO of the polynomial.
- *y-intercept - the point (0, y). You can find the value of y by plugging in zero for x and solving.

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INTERVALS OF INCREASE/DECREASE

- *Intervals of Increase - the x-values of the graph where it goes UP from left to right.
- *Intervals of Decrease - the x-values of the graph where it goes DOWN from left to right. Remember to join multiple intervals with a "u."

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MAXIMUMS AND MINIMUMS

- Relative Maximum/Minimum
 - *Relative Maximum - the highest point on a turn.
 - *Relative Minimum - the lowest point on a turn.
- Absolute Maximum/Minimum
 - *Absolute Maximum - the highest point of all the points on the graph.
 - *Absolute Minimum - the lowest point of all the points on the graph.

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EVEN/ODD FUNCTIONS

- Even Functions
 - *have symmetry about the y-axis.
 - [If you folded the graph along the y-axis, the left side and right side would overlap.]
- Odd Function
 - *have symmetry about the origin.
 - [If you folded the graph along the x & y-axis, the graph would overlap itself.]

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END BEHAVIOR:

Describes what $f(x)$ does if you could follow the graph FOREVER!

$$\begin{aligned} \text{as } x \rightarrow \infty, f(x) &\rightarrow \underline{\hspace{2cm}} \\ \text{as } x \rightarrow -\infty, f(x) &\rightarrow \underline{\hspace{2cm}} \end{aligned}$$

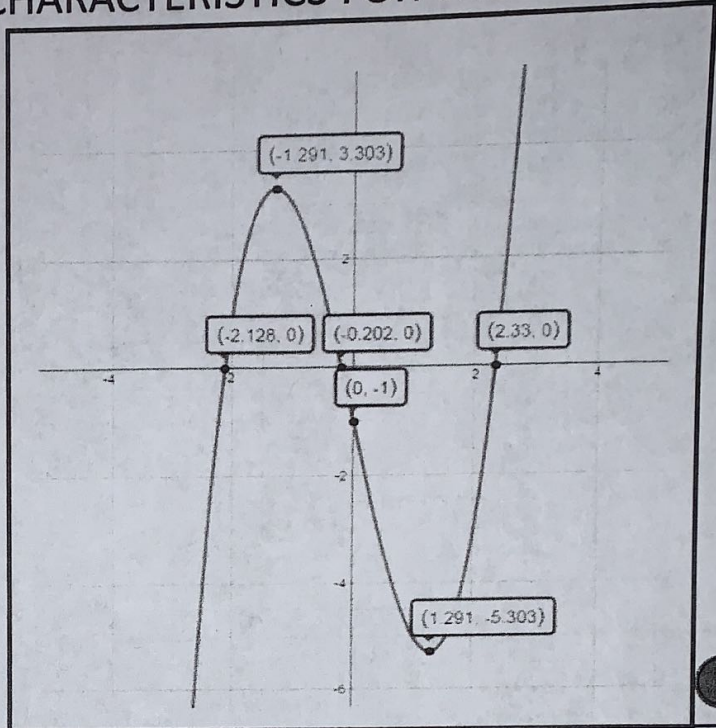
- *If the arrow points up, use ∞ .
- *If the arrow points down, use $-\infty$.

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Give intervals of x-values⁷
Positive: where y-values are positive (above x-axis)
Negative: where y-value are negative (below x-axis)

EXAMPLE # 1: DESCRIBE THE CHARACTERISTICS FOR THE FUNCTION GIVEN BY THE GRAPH.

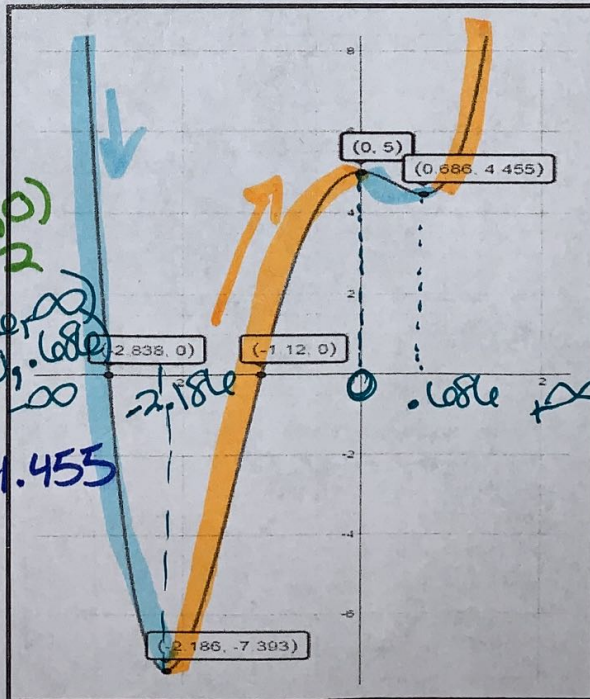
- Domain
- Range
- X-intercept
- Zeros
- Y-intercept
- Intervals of Increase
- Intervals of Decrease
- Relative Maximum
- Relative Minimum
- Absolute Maximum
- Absolute Minimum
- Even/Odd
- End Behavior



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EXAMPLE # 2: DESCRIBE THE CHARACTERISTICS FOR THE FUNCTION GIVEN BY THE GRAPH.

- Domain $(-\infty, \infty)$
- Range $[-7.393, \infty)$
- X-intercept $(-2.838, 0) + (-1.12, 0)$
- Zeros $x = -2.838 + x = -1.12$
- Y-intercept $(0, 5)$
- Intervals of Increase $(-2.186, 0) \cup (0.686, \infty)$
- Intervals of Decrease $(-\infty, -2.186) \cup (0, 0.686)$
- Relative Maximum $y = 5$
- Relative Minimum $y = -7.393 + y = 4.455$
- Absolute Maximum none
- Absolute Minimum $y = -7.393$
- Even/Odd none
- End Behavior $x \rightarrow \infty, f(x) \rightarrow \infty$

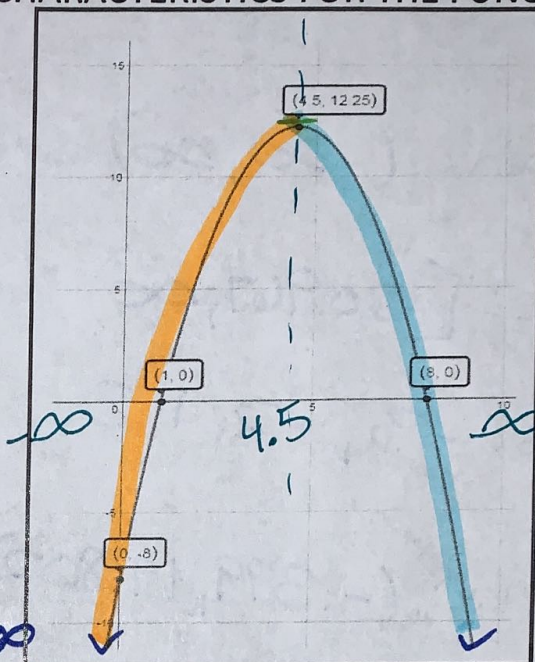


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$x \rightarrow -\infty, f(x) \rightarrow \infty$

EXAMPLE # 3: DESCRIBE THE CHARACTERISTICS FOR THE FUNCTION GIVEN BY THE GRAPH.

| | |
|-----------------------|-------------------------------------------------------------------------------------------------------|
| Domain | $(-\infty, \infty)$ |
| Range | $(-\infty, 12.25]$ |
| X-intercept | $(1, 0) + (8, 0)$ |
| Zeros | $x=1 \quad x=8$ |
| Y-intercept | $(0, -8)$ |
| Intervals of Increase | $(-\infty, 4.5)$ |
| Intervals of Decrease | $(4.5, \infty)$ |
| Relative Maximum | $y=12.25$ |
| Relative Minimum | none |
| Absolute Maximum | $y=12.25$ |
| Absolute Minimum | none |
| Even/Odd | no Symm. |
| End Behavior | $x \rightarrow \infty, f(x) \rightarrow -\infty$ $x \rightarrow -\infty, f(x) \rightarrow -\infty$ |

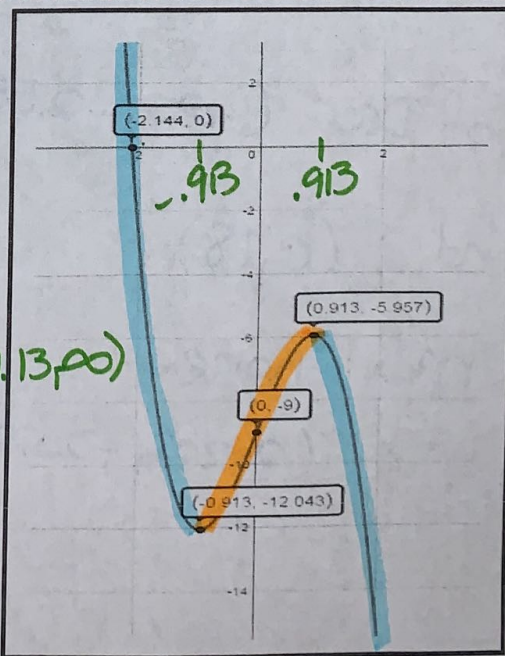


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Positive: $(1, 8)$
 Negative: $(-\infty, 1) \cup (8, \infty)$

EXAMPLE # 4: DESCRIBE THE CHARACTERISTICS FOR THE FUNCTION GIVEN BY THE GRAPH.

| | |
|-----------------------|------------------------------------------------------------------------------------------------------|
| Domain | $(-\infty, \infty)$ |
| Range | $(-\infty, \infty)$ |
| X-intercept | $(-2.144, 0)$ |
| Zeros | $x=-2.144$ |
| Y-intercept | $(0, -9)$ |
| Intervals of Increase | $(-9.13, 9.13)$ |
| Intervals of Decrease | $(-\infty, -9.13) \cup (9.13, \infty)$ |
| Relative Maximum | -5.957 |
| Relative Minimum | -12.043 |
| Absolute Maximum | none |
| Absolute Minimum | none |
| Even/Odd | no Symm. |
| End Behavior | $x \rightarrow \infty, f(x) \rightarrow -\infty$ $x \rightarrow -\infty, f(x) \rightarrow \infty$ |



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Positive: $(-\infty, -2.144)$ x's that are above x-axis
 Negative: $(-2.144, \infty)$

Calculator

$$y = x^4 + x^3 - 11x^2 - 9x + 18$$

$$\text{Domain: } (-\infty, \infty)$$

$$\text{Range: } [-20.967, \infty)$$

$$\text{Zeros: } -3, -2, 1, 3$$

$$\text{Rel. max: } (-.399, 19.802)$$

$$\text{Rel. min: } (-2.557, -4.877) + (2.206, -20.967)$$

$$\text{Int. of Inc. } (-2.557, -.399) \cup (2.206, \infty)$$

$$\text{Int. of Decr. } (-\infty, -2.557) \cup (-.399, 2.206)$$

$$\text{y-int: } (0, 18)$$

$$\text{Abs. max: none}$$

$$\text{Abs. min: } (2.206, -20.967)$$