

Multiplicity: tells us how often a zero occurs

• you can determine multiplicity from a graph or a factored equation.

Multiplicity 1

- single root
- crosses through the x-axis

Multiplicity 2

- double root
- bounces back at the x-axis

Multiplicity 3

- triple root
- crosses through the x-axis but flattens.

ODD: cross through x-axis

EVEN: bounce back at x-axis.

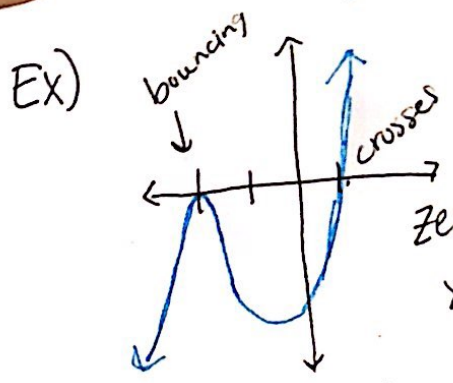
Ex) $f(x) = (x+13)^2 (x-1)^3 (x+5)^1$

Zeros:

- $x = -13$ multiplicity 2
- $x = 1$ mult. 3
- $x = -5$ mult 1

Ex) $f(x) = (x+7)^3 (x-2)^5$

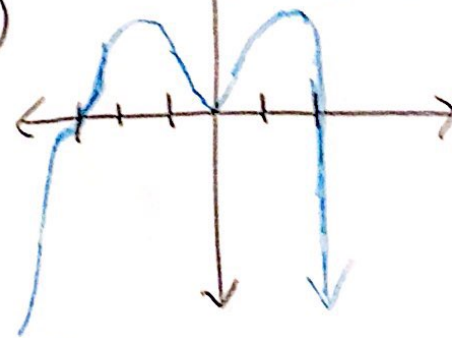
- Zeros: $x = -7$ mult 3
 $x = 2$ mult 5



- Zeros: $x = -2$ mult 2
 $x = 1$ mult. 1

Factored Form:
 $y = (x+2)^2 (x-1)$

- Ex)
- Zeros: $x = -3$ mult 3
 $x = 2$ mult 1
 $x = 0$ mult 2



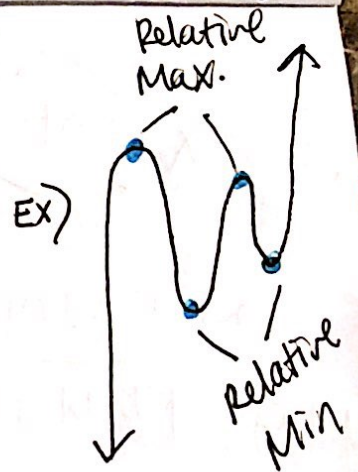
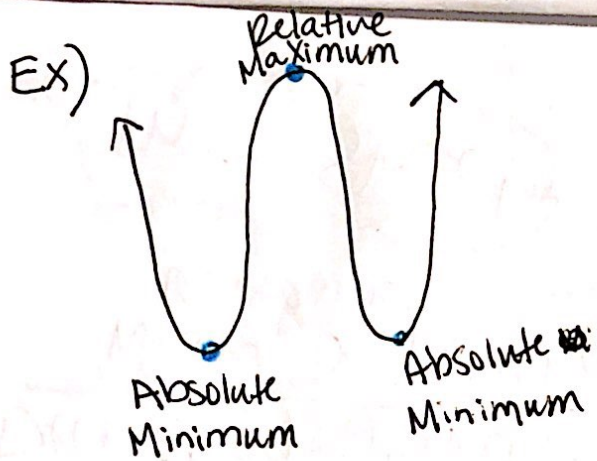
Factored Form:
 $y = (x+3)^3 (x-2) x^2$

Multiplicity

End Behavior

Extrema: high and low points on a graph.

- Absolute Extrema - the highest or lowest points on a function.
 - Absolute maximum - highest
 - Absolute minimum - lowest
- Relative Extrema - points higher or lower than others nearby
 - Relative Maximum - highest pt nearby
 - Relative Minimum - ~~lowest~~ pt nearby



Increasing $(-2, -1)$ & $(-1, 1)$
Increasing/Decreasing

Negative
Positive/Negative

Extrema

Zeros

Polynomial Vocabulary

Multiplicity

End Behavior

$$y = (x+1)^2 - 1$$

Increasing Interval:

Where x-values are increasing.

Decreasing Intervals:

Where x-values are decreasing

Think Slope!

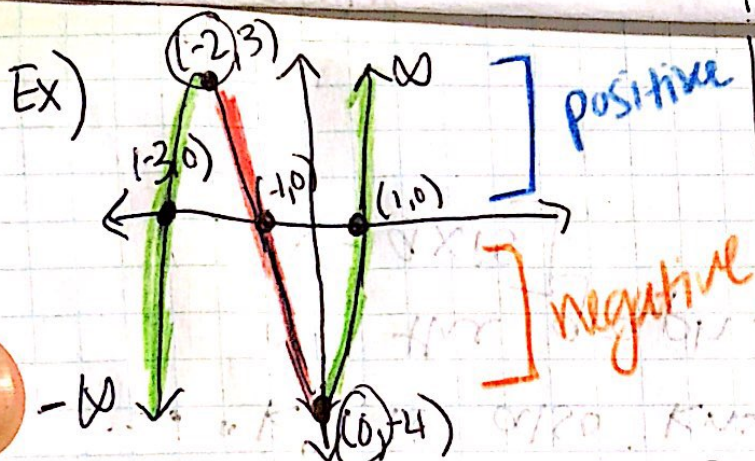
Positive Interval: (Above)

Where y-values are positive

Negative Interval: (Below)

Where y-values are negative

Above/Below the x-axis



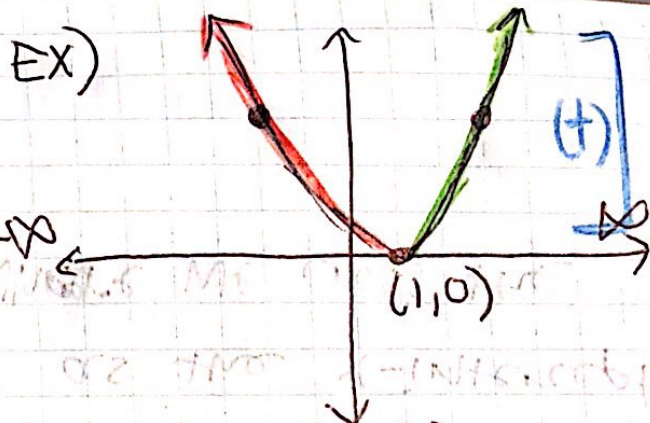
Increasing: $(-\infty, -2)$ & $(0, \infty)$

Decreasing: $(-2, 0)$

Positive: $(-3, -1)$ & $(1, \infty)$

Negative: $(-\infty, -3)$ & $(-1, 1)$

Increasing/Decreasing



Increasing: $(1, \infty)$

Decreasing: $(-\infty, 1)$

Positive: $(-\infty, \infty)$

Negative: None!

Positive/Negative

Zeros

Polynomial Vocabulary

Multiplicity

End Behavior