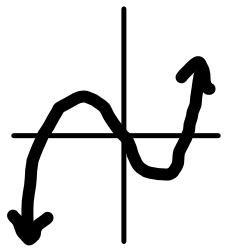
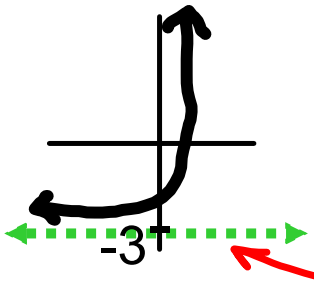
End behaviors: As the graph travels left, it goes up, down or towards an asymptote? As it travels right, it goes up, down or towards an asymptote?

Examples:



$x \to -\infty \quad y \to -\infty$

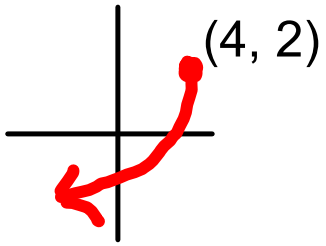
$x \to +\infty \quad y \to +\infty$



$x \to -\infty \quad y \to -3$

$x \to +\infty \quad y \to +\infty$

asymptote



$x \to -\infty \quad y \to -\infty$

$x \to +\infty \quad y \to 2$

x-intercepts/zeros: Plug in zero for y and solve.
x-int are only the REAL solutions

Notice for polynomials you must factor completely first!!

Sample: Deg: 8

$$y = 3x^2(3x^2 - 7)(x^2 + 24)(x^2 - 7x - 5)$$

$\frac{3x^2}{3} = \frac{0}{3}$

$x = 0$ mult. of 2

$3x^2 - 7 = 0$

$+7 \quad +7$

$\frac{3x^2}{3} = \frac{7}{3}$

$\sqrt{x^2} = \sqrt{\frac{7}{3}}$

$x = \pm\frac{\sqrt{7}\cdot\sqrt{3}}{\sqrt{3}\cdot\sqrt{3}}$

$x = \pm\frac{\sqrt{21}}{3}$

$x^2 + 24 = 0$

$\sqrt{x^2} = \sqrt{-24}$

$x = \pm 2i\sqrt{6}$

y-intercept: Plug in zero for x and solve.

Sample y-int:

a. $y = 9x^5 + 8x^4 - 11x - 43$

y-int: $(0, -43)$

b. $f(x) = -2(x + 5)(2x^3 - 4)(x - 2)^4$

$-2(5)(-4)(-2)$

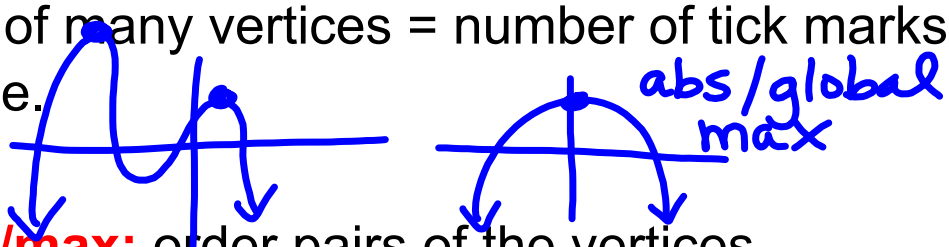
$(0, -80)$

c. $g(x) = 3x^4(x - 9)(x^2 + 5)$

$0(-9)(5) = 0$

$(0, 0)$

Intervals: Goes from left to right. Use number line to help. number of many vertices = number of tick marks on number line.



Relative min/max: order pairs of the vertices

Extrema min/max: highest/lowest y-value of the vertices unless going to -∞ or ∞ then **NONE** (see **range** for help)

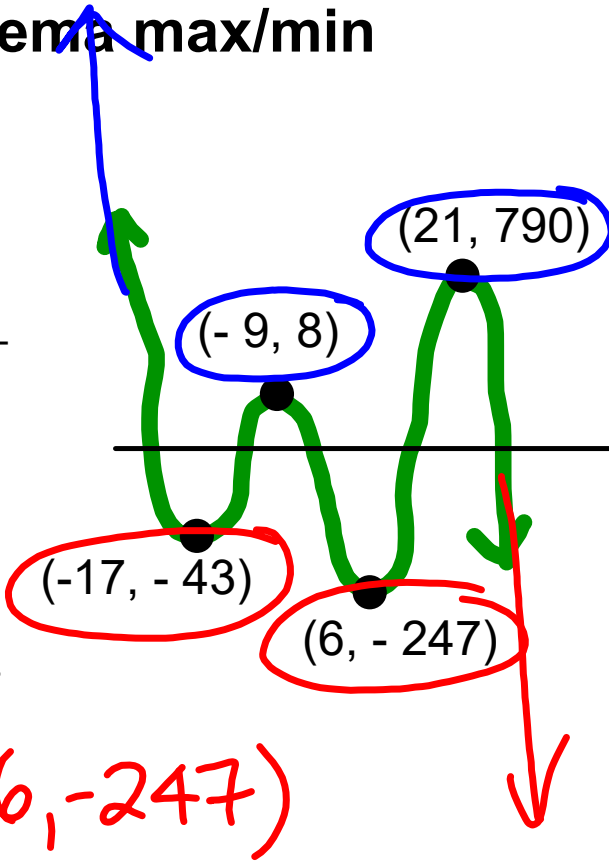
Relative vs Extrema max/min

Extreme max: none

Relative max: (-9, 8)
(21, 790)

Extreme min: none

Relative min: (-17, -43) (6, -247)



Interval of increase/decrease

read from left to right – x-values

Int of increase

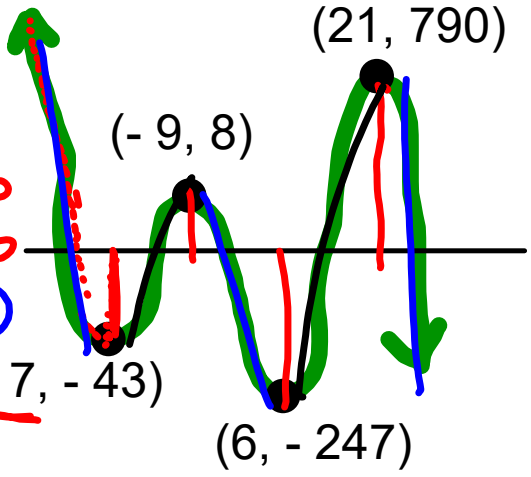
D | I | D | I | D

$-\infty$ -17 -9 6 21 ∞

Dec: $(-\infty, -17)(-9, 6)(21, \infty)$

Inc: $(-17, -9)(6, 21)$

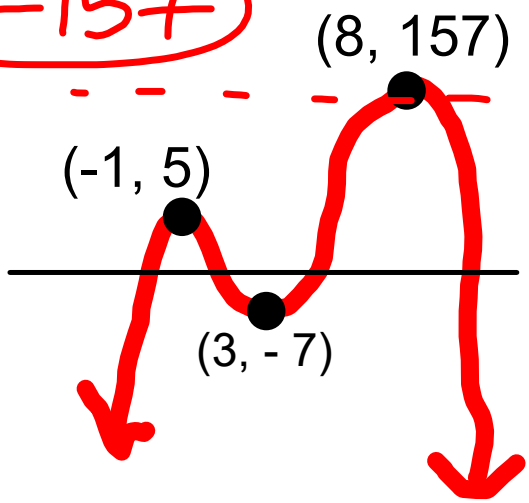
Int. of decrease



Relative vs Extrema max/min

Extreme max: (8, 157) y = 157

Relative max: (-1, 5)



Extreme min: none

Relative min: (3, -7)

Interval of increase/decrease

Int of increase $(-\infty, -1)$ $(3, 8)$

Int. of decrease $(8, \infty)$ $(-1, 3)$