

# C12 - 3.0 - Max/Min/Concavity Derivative Test Review

**Domain:**  $x \in \mathbb{R}$       **Range:**  $y \in \mathbb{R}$

*VA, Roots, Logs  $f' = \infty$  etc:* None

**Horizontal Asymptotes (HA):** None

$y = x^3 + 12x^2 + 36x$

$\lim_{x \rightarrow \infty} x^3 + 12x^2 + 36x = \infty$   
 $\lim_{x \rightarrow -\infty} x^3 + 12x^2 + 36x = -\infty$

$y' = 3x^2 + 24x + 36 = 0$   
 $x^2 + 8x + 12 = 0$   
 $(x + 6)(x + 2) = 0$   
 $x = -6, -2$

**Sign Analysis**

$y' = (x + 6)(x + 2)$

$y'(-10) = (-)(-) = +$   
 $y'(-4) = (+)(-) = -$   
 $y'(0) = (+)(+) = +$

**Critical Points (CP):**

$(-6, 0)$  Max:  
 $(-2, -32)$  Min:

**Intervals of Inc/Dec**

Increasing:  $(-\infty, -6), (-2, \infty)$   
 Decreasing:  $(-6, -2)$

$y = x^3 + 12x^2 + 36x$   
 $y = (-6)^3 + 12(-6)^2 + 36(-6)$   
 $y = 0$

$y = x^3 + 12x^2 + 36x$   
 $y = (-2)^3 + 12(-2)^2 + 36(-2)$   
 $y = -32$

$y'' = 6x + 24 = 0$   
 $6(x + 4) = 0$   
 $x = -4$

**Sign Analysis**

$y'' = 6(x + 4)$

$y''(-10) = +(-) = -$   
 $y''(0) = +(+) = +$

**Inflection Point (IP):**

$(-4, -16)$  (IP)

**Intervals of Concavity**

Concave Up:  $(-4, \infty)$   
 Concave Down:  $(-\infty, -4)$

**Instructions**

$\uparrow$   
 $\oplus$   
 $\ominus$   
 $=$   
 $\rightarrow$

**$x$  - intercepts**

$y = x^3 + 12x^2 + 36x$   
 $0 = x^3 + 12x^2 + 36x$   
 $0 = x(x^2 + 12x + 36)$   
 $0 = x(x + 6)(x + 6)$

$x = 0, -6$   
 $(0, 0)$   $(-6, 0)$

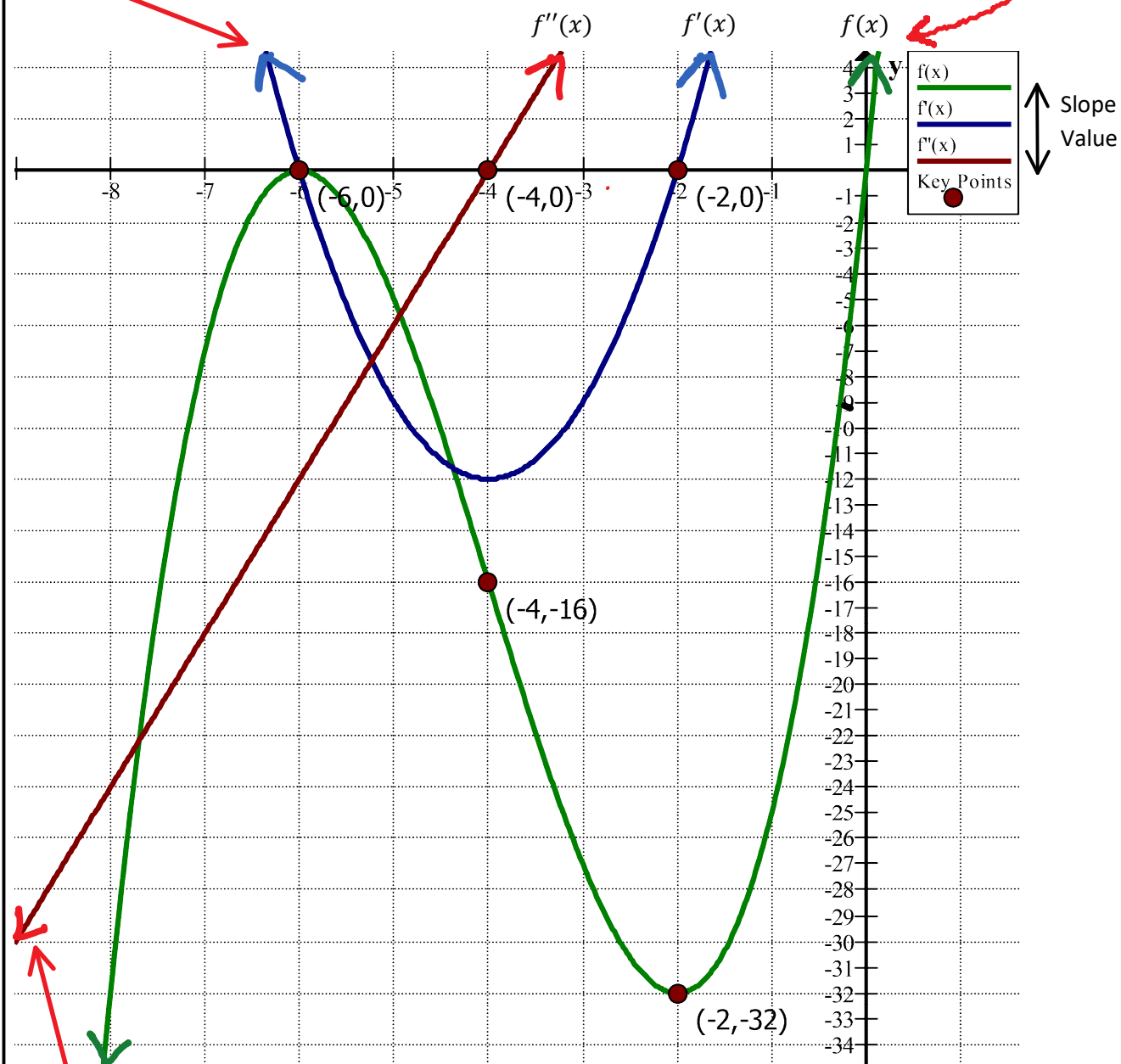
**$y$  - intercepts**

$y = x^3 + 12x^2 + 36x$   
 $y = (0)^3 + 12(0)^2 + 36(0)$   
 $y = 0$   
 $(0, 0)$

# C12 - 3.0 - Derivative Graphing Review

$$y = x^3 + 12x^2 + 36x \text{ (Cubic)}$$

$$y' = 3x^2 + 24x + 36 \text{ (Quadratic)}$$



$$y'' = 6x + 24 \text{ (Linear)}$$