1. Sketch the graph. Be sure to state the degree, extrema, end behavior, y-intercept and zeros.

$$f(x) = -x^4 + 5x^2 + 36$$

$$-1(x-3)(x+3)(x^2+4) = 0$$

$$0 = -1(x^4 - 5x^2 - 36)$$

$$0 = -1(x^2 - 9)(x^2 + 4)$$

# of extrema: __3__    Degree: __4__

Leading coeff ⟹ -1

Y-intercept: __(0, 36)__

End behavior:

$x \to$ __+__ $\infty$    $y \to$ __-$\infty$__

$x \to$ __-$\infty$__    $y \to$ __-$\infty$__

Roots: __3, -3, ±2i__
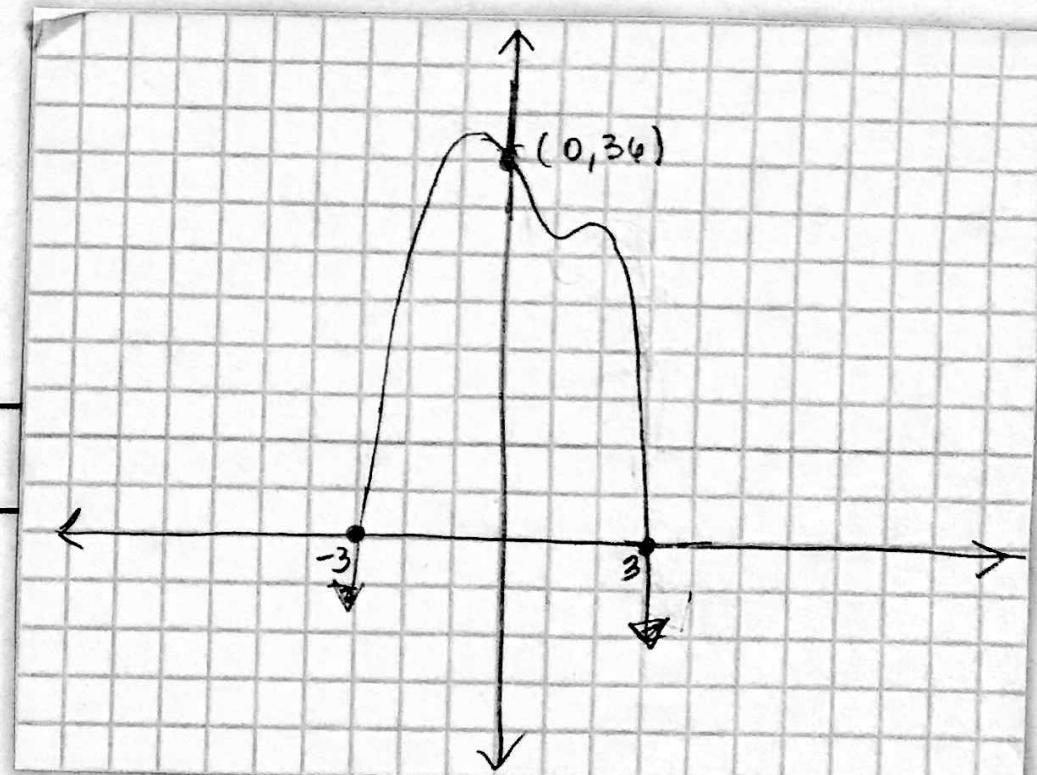
2. Sketch the graph. Be sure to state the degree, extrema, end behavior, y-intercept and zeros.

$$f(x) = (x^2 + 5x - 14)^2$$
$$[(x + 7)(x - 2)]^2$$

# of extrema: ___3___   Degree: ___4___

Leading coeff => 1

Y-Intercept: ___(0, 196)___

End behavior:

$x \to$ ___$+\infty$___   $y \to$ ___$+\infty$___

$x \to$ ___$-\infty$___   $y \to$ ___$+\infty$___

Roots: ___$x = 2$ $x = -7$___
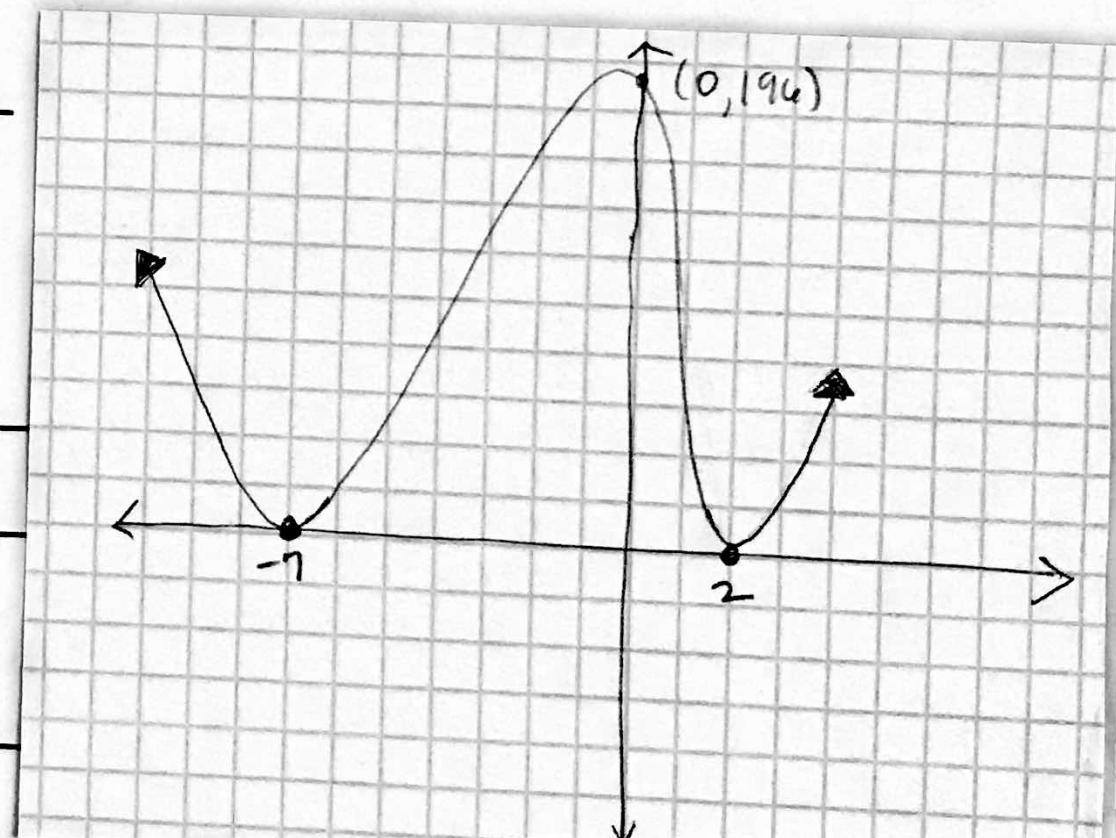
3. Sketch the graph. Be sure to state the degree, extrema, end behavior, y-intercept and zeros.

$$f(x) = (x + 2)^3 - (x + 2)$$

$(0+2)^3 - (0+2)$

$8 - 2$

$6$

$x+2 \left[(x+2)^2 - 1\right]$

$(x+2)(x+2-1)(x+2+1)$

$(x+2)(x+1)(x+3)$

# of extrema: ___2___    Degree: ___3___

Leading coeff ⟹ 1

Y-Intercept: __(0, 6)__

End behavior:

$x \to$ __$+\infty$__    $y \to$ __$+\infty$__

$x \to$ __$-\infty$__    $y \to$ __$-\infty$__

Roots: __$x = -2, -1, -3$__
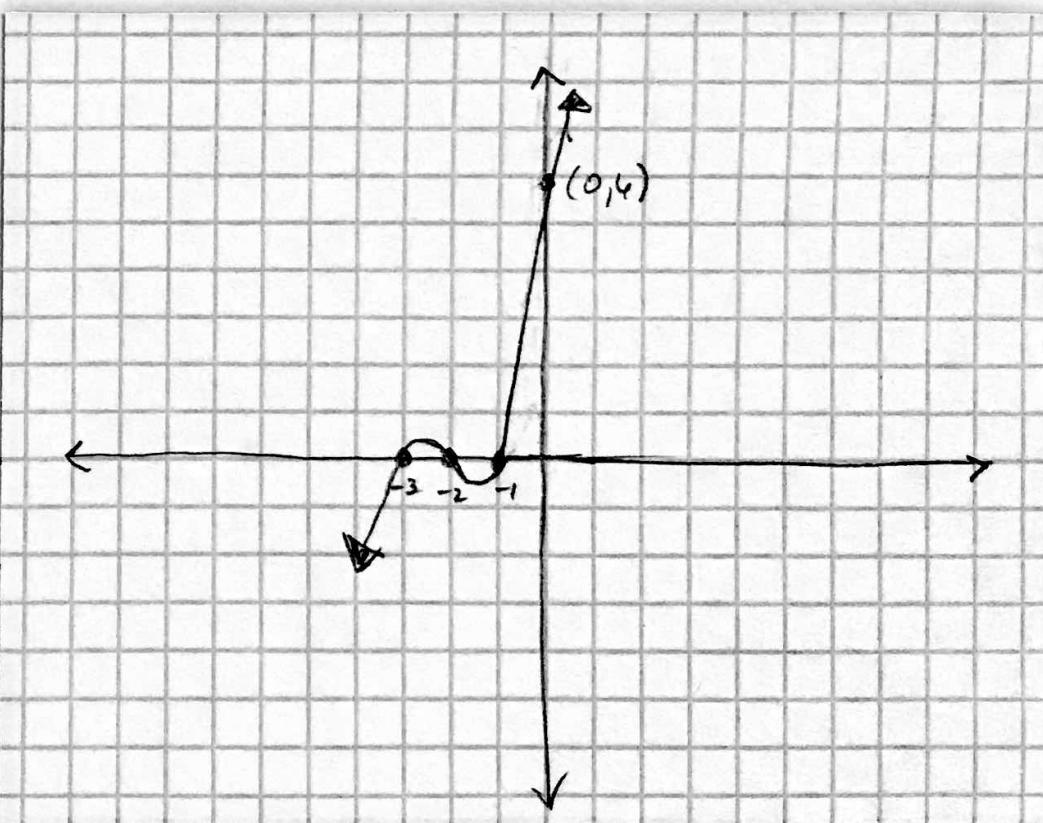
4. Sketch the graph. Be sure to state the degree, extrema, end behavior, y-intercept and zeros.

$$f(x) = -x^3(x-4) + 12x^2$$

$$-x^4 + 4x^3 + 12x^2$$

$$-x^2(x^2 - 4x - 12)$$

$$-x^2(x-6)(x+2)$$

$$x = 0, 6, -2$$

# of extrema: __3__    Degree: __4__

Leading coeff => -1

Y-Intercept: __(0,0)__

End behavior:

$x \rightarrow$ __$+\infty$__    $y \rightarrow$ __$-\infty$__

$x \rightarrow$ __$-\infty$__    $y \rightarrow$ __$-\infty$__

Roots: __$x = 0, 6, -2$__
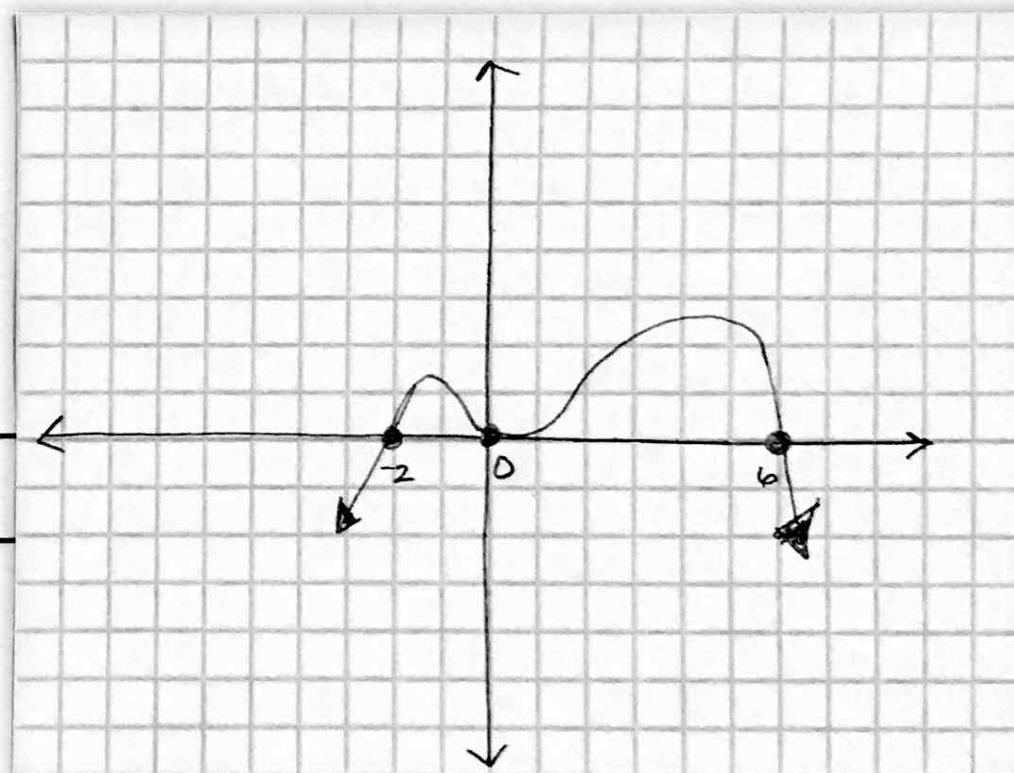
5. Sketch the graph. Be sure to state the degree, extrema, end behavior, y-intercept and zeros.

$$f(x) = -x^3 - 6x^2 + 27x$$

$-x(x^2 + 6x - 27)$

$-x(x + 9)(x - 3)$

# of extrema: ___2___     Degree: ___3___

Leading coeff $\Rightarrow$ $-1$

Y-Intercept: ___(0,0)___

End behavior:

$x \to +\infty$ ___     $y \to$ ___$-\infty$___

$x \to -\infty$ ___     $y \to$ ___$+\infty$___

Roots: ___$x = 0, -9, 3$___
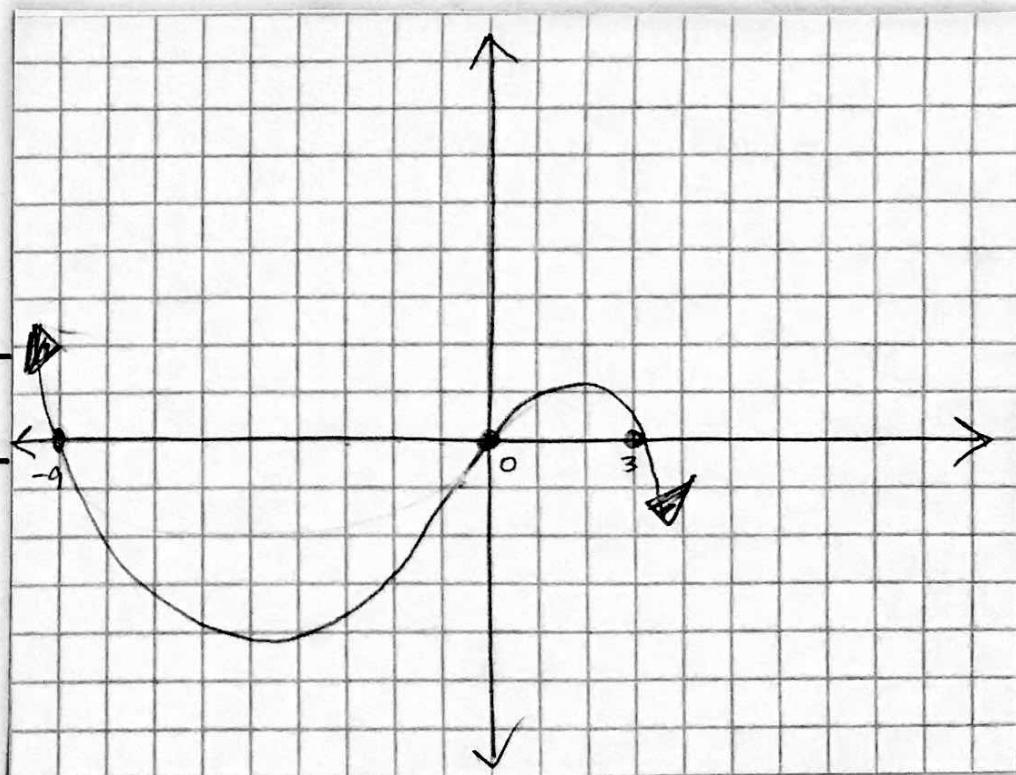
6. Sketch the graph. Be sure to state the degree, extrema, end behavior, y-intercept and zeros.

$(x-2)\left[(x-2)^2 - 16\right]$

$$f(x) = (x - 2)^3 - 16(x - 2)$$

$(0-2)^3 - 16(0-2)$

$(-2)^3 - 16(-2)$

$(x-2)(x-2-4)(x-2+4)$

$(x-2)(x-6)(x+2)$

# of extrema: _____2_____    Degree: _____3_____

Leading coeff $\Rightarrow 1$

Y-Intercept: ___(0,24)___

End behavior:

$x \rightarrow$ ___$+\infty$___    $y \rightarrow$ ___$+\infty$___

$x \rightarrow$ ___$-\infty$___    $y \rightarrow$ ___$-\infty$___

Roots: ___$x = 2, 6, -2$___
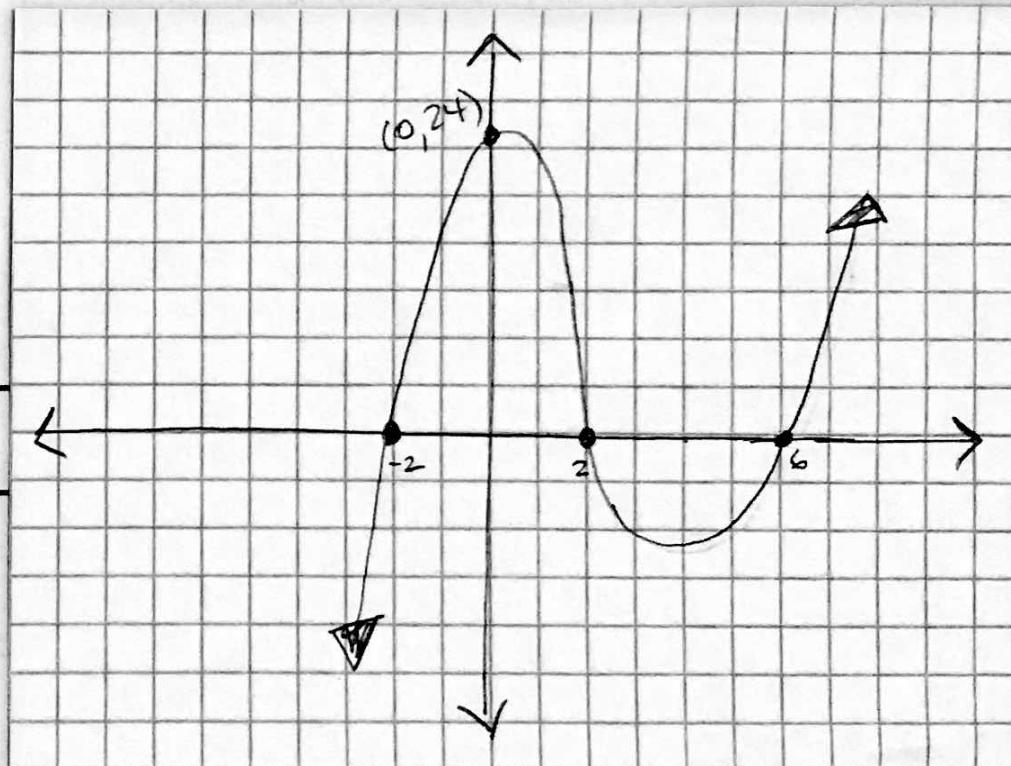
7. Sketch the graph.  Be sure to state the degree, extrema, end behavior, y-intercept and zeros.

$$f(x) = x^3 + 8$$

$(x+2)(x^2 - 2x + 4)$

$x = -2$

$x = \dfrac{2 \pm \sqrt{4 - (4 \cdot 1 \cdot 4)}}{2}$

$x = \dfrac{2 \pm \sqrt{-12}}{2} = \dfrac{2 \pm \sqrt{-4 \cdot 3}}{2}$

$= \dfrac{2 \pm 2i\sqrt{3}}{2}$

$1 \pm i\sqrt{3}$

**# of extrema:** _____2_____  **Degree:** _____3_____

Leading coeff. $\Rightarrow 1$

**Y-Intercept:** ___$(0, 8)$___

**End behavior:**

$x \to \underline{+\infty} \qquad y \to \underline{+\infty}$

$x \to \underline{-\infty} \qquad y \to \underline{-\infty}$

**Roots:** ___$-2, 1 \pm i\sqrt{3}$___
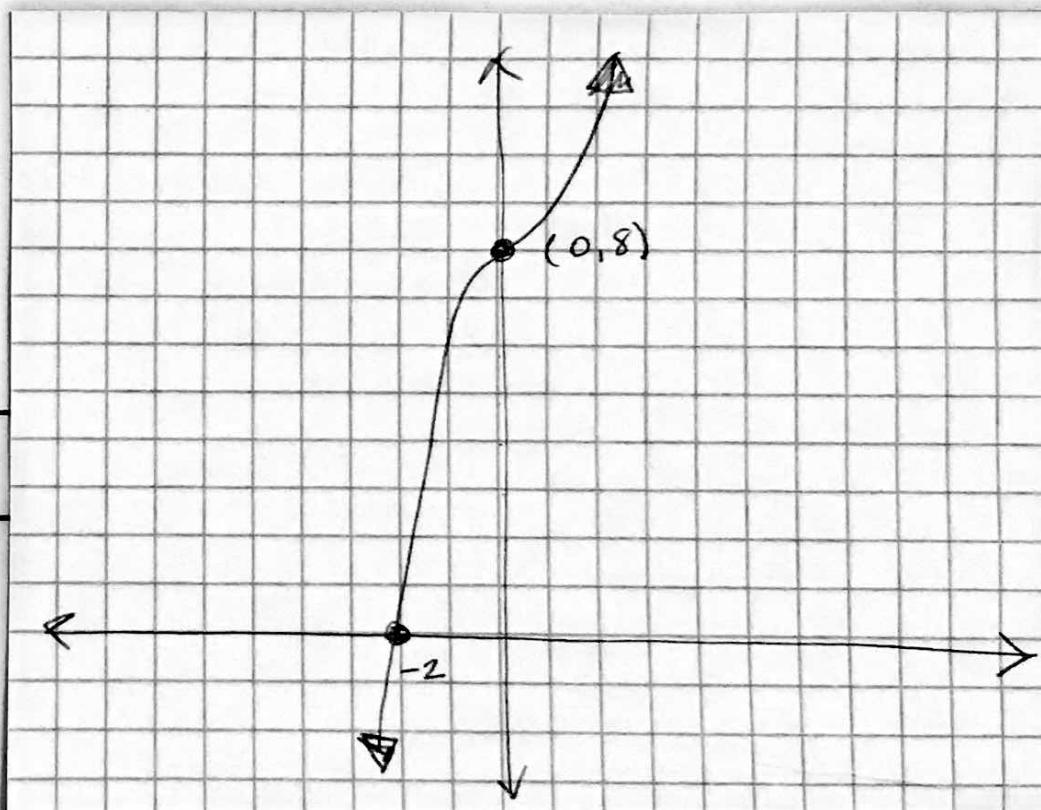
8. Sketch the graph. Be sure to state the degree, extrema, end behavior, y-intercept and zeros.

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

$-2x^2 - 2 + 5x$

$-2x^2 + 5x - 2$

$-1(2x^2 - 5x + 2)$

$-1(2x - 1)(x - 2)$

# of extrema: ___1___        Degree: ___2___

Leading coeff $\Rightarrow -2$

Y-Intercept: $(0, -2)$

End behavior:

$x \rightarrow +\infty$    $y \rightarrow -\infty$

$x \rightarrow -\infty$    $y \rightarrow -\infty$

Roots: $x = \frac{1}{2}, 2$
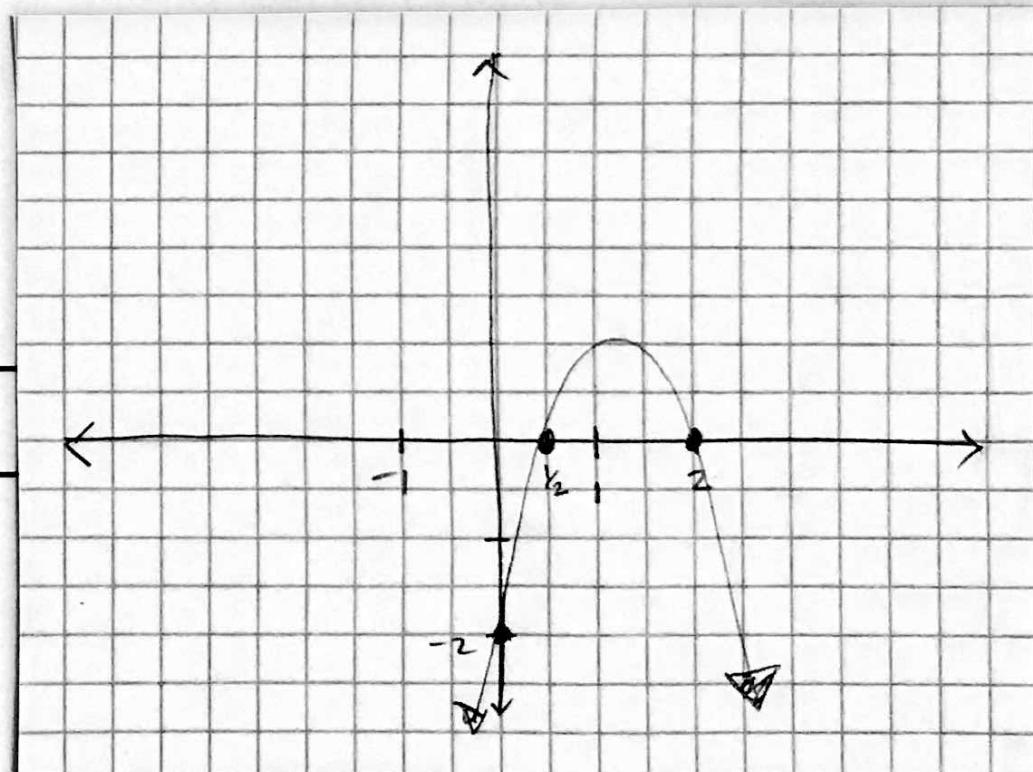
9. Sketch the graph. Be sure to state the degree, extrema, end behavior, y-intercept and zeros.

$$f(x) = -(x^2 + 3x - 4)^2(x - 3)$$
$$- \left[ (x - 1)(x + 4) \right]^2 (x - 3)$$

# of extrema: _____4_____  Degree: ____5____

Leading coeff. => -1

Y-Intercept: __(0, 48)__

End behavior:

$x \to$ __+∞__   $y \to$ __-∞__

$x \to$ __-∞__   $y \to$ __+∞__

Roots: __x=1__ , __x=-4__ , __x=3__
         dr      dr
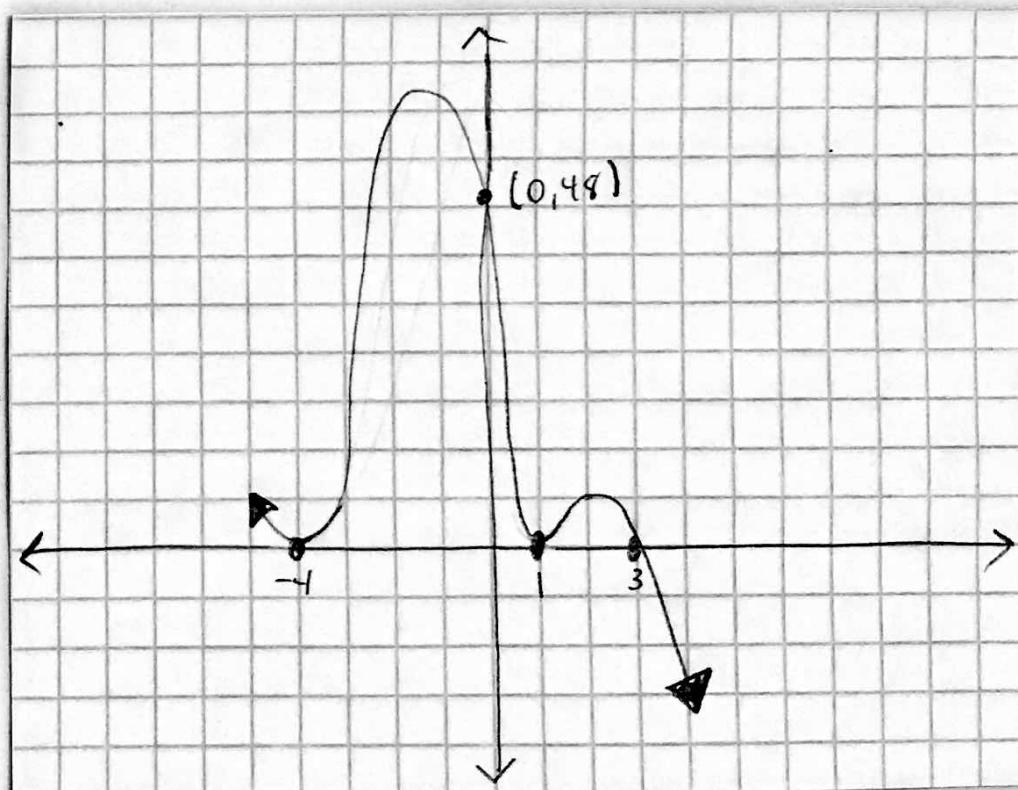
10. Sketch the graph. Be sure to state the degree, extrema, end behavior, y-intercept and zeros.

$$f(x) = -(x-4)^3$$

# of extrema: _____2_____ Degree: ____3____

Leading Coeff $\Rightarrow -1$

Y-Intercept: ____$(0, 64)$____

End behavior:

$x \rightarrow$ _____$+\infty$_____ $y \rightarrow$ _____$-\infty$_____

$x \rightarrow$ _____$-\infty$_____ $y \rightarrow$ _____$+\infty$_____

Roots: _____$x = 4 (tr)$_____