

On your own paper work out the first and second derivatives.

$f(x) = (4-x^2)^5$	$f' = -10x(4-x^2)^4$	$f'' = 10(4-x^2)^3(9x^2-4)$
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Use f

HA	none (b.c. polynomial)
VA	none
x-intercept	(2,0) (-2,0)
y-intercept	(0, 4 ⁵)

Use f'

Critical #'s	$x = -2, 0, 2$
increasing	$(-\infty, 0)$
decreasing	$(0, \infty)$
extrema	max (0, 4 ⁵)

Use f''

Concave Up	$(-2, -\frac{2}{3}) \cup (\frac{2}{3}, 2)$
Concave Down	$(-\infty, -2) \cup (-\frac{2}{3}, \frac{2}{3}) \cup (2, \infty)$
POI	$x = -2, -\frac{2}{3}, \frac{2}{3}, 2$

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

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

$$0 = 4-x^2$$

$$x^2 = 4$$

$$x = \pm 2$$

$$y = (4-0)^5$$

$$y = (4)^5$$

$$f'(x) = -10x(4-x^2)^4$$

$$-10x = 0$$

$$x = 0$$

$$(4-x^2)^4 = 0$$

$$(4-x^2) = 0$$

$$x^2 = 4$$

$$x = \pm 2$$

$$f'(-3) = (+)(+)$$

$$f'(-1) = (+)(+)$$

$$f'(1) = (-)(+)$$

$$f'(3) = (-)(+)$$

$$f''(x) = 10(4-x^2)^3(9x^2-4)$$

~~10=0~~
garbage

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

$$x = \pm 2$$

$$9x^2 - 4 = 0$$

$$9x^2 = 4$$

$$x^2 = \frac{4}{9}$$

$$x = \pm \frac{2}{3}$$

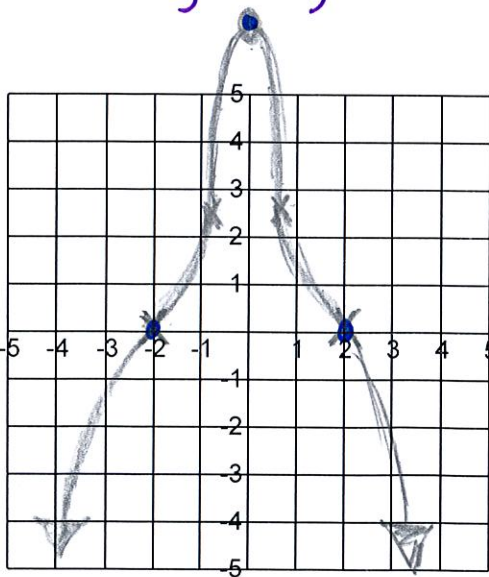
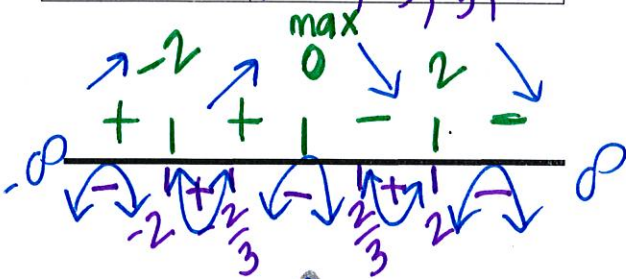
$$f''(-3) = (+)(-)(+)$$

$$f''(-1) = (+)(+)(+)$$

$$f''(0) = (+)(+)(-)$$

$$f''(1) = (+)(+)(+)$$

$$f''(3) = (+)(-)(+)$$



On your own paper work out the first and second derivatives.

$f(x) = \frac{x}{x^2 - 9}$	$f' = \frac{-x^2 - 9}{(x^2 - 9)^2}$	$f'' = \frac{2x(x^2 + 27)}{(x^2 - 9)^3}$
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Use f

HA	$y = 0$ (Lo)
VA	$x = \pm 3$
x-intercept	$(0, 0)$
y-intercept	$(0, 0)$

Use f'

Critical #'s	$x = \pm 3$
increasing	none
decreasing	$(-\infty, -3) \cup (-3, 3) \cup (3, \infty)$
extrema	none

Use f''

Concave Up	$(-3, 0) \cup (3, \infty)$
Concave Down	$(-\infty, -3) \cup (0, 3)$
POI	$x = 0$

VA (bottom=0)

$$x^2 - 9 = 0$$

$$x^2 = 9$$

$$x = \pm 3$$

xint (top=0)

$$x = 0$$

yint (0 in for x & solve for y)

$$y = \frac{0}{0-9} \quad y = 0$$

$$-x^2 - 9 = 0$$

$$x^2 = -9$$

garbage

$$(x^2 - 9)^2 = 0$$

$$x^2 - 9 = 0$$

$$x^2 = 9$$

$$x = \pm 3$$

$$f'(-4) = \frac{-}{+}$$

$$f'(0) = \frac{-}{+}$$

$$f'(4) = \frac{-}{+}$$

$$2x = 0$$

$$x = 0$$

$$x^2 + 27 = 0$$

$$x^2 = -27$$

garbage

$$(x^2 - 9)^3 = 0$$

$$x^2 = 9$$

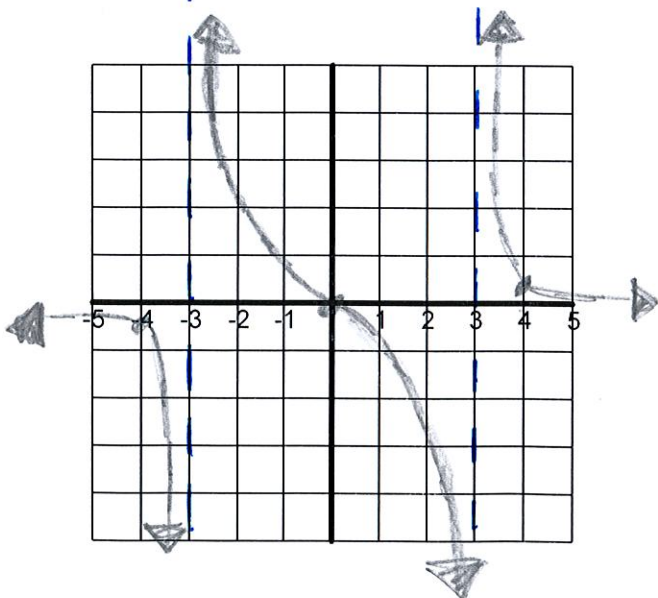
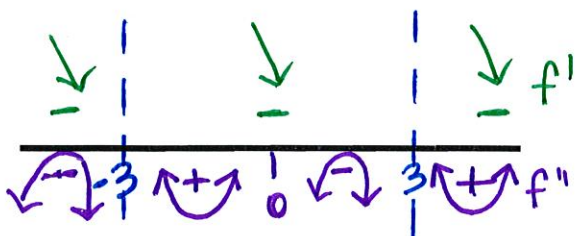
$$x = \pm 3$$

$$f''(4) \frac{(+)(+)}{+}$$

$$f''(1) \frac{(+)(+)}{-}$$

$$f''(-1) \frac{(-)(+)}{-}$$

$$f''(-4) \frac{(-)(+)}{+}$$



$$\boxed{1.} f(x) = (4 - x^2)^5$$

$$f'(x) = 5(4 - x^2)^4(-2x)$$

$$f'(x) = -10x(4 - x^2)^4$$

$$f''(x) = -10x(4)(4 - x^2)^3(-2x) + (4 - x^2)^4(-10)$$

$$f''(x) = 10(4 - x^2)^3 [8x^2 - 1(4 - x^2)]$$

$$f''(x) = 10(4 - x^2)^3 [8x^2 - 4 + x^2]$$

$$f''(x) = 10(4 - x^2)^3 [9x^2 - 4]$$

$$\boxed{2.} f(x) = \frac{x}{x^2 - 9}$$

$$f'(x) = \frac{(x^2 - 9)(1) - (x)(2x)}{[x^2 - 9]^2}$$

$$f'(x) = \frac{x^2 - 9 - 2x^2}{(x^2 - 9)^2}$$

$$f'(x) = \frac{-x^2 - 9}{(x^2 - 9)^2}$$

$$f''(x) = \frac{(x^2 - 9)^2(-2x) - (-x^2 - 9)(2)(x^2 - 9)'(2x)}{(x^2 - 9)^4}$$

$$f''(x) = \frac{2x(x^2 - 9)[- (x^2 - 9) - 2(-x^2 - 9)]}{(x^2 - 9)^4 \cdot 3}$$

$$f''(x) = \frac{2x[-x^2 + 9 + 2x^2 + 18]}{(x^2 - 9)^3}$$

$$f''(x) = \frac{2x[x^2 + 27]}{(x^2 - 9)^3}$$