**AP Calculus AB** **Name**_____

***Using derivatives to graph a function without a calculator #1***

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

a. Find the x intercepts. $x^5 - 5x^4 = 0$

$x^4(x-5) = 0 \quad x = 0, 5$

(0,0) (5,0)

b. Find the y intercepts

$f(0) = 0$ (0,0)

c. Find any asymptotes (horizontal and vertical)

none

d. Find the end behavior.

$\lim_{x \to \infty} f(x) = \infty$ $\lim_{x \to -\infty} f(x) = -\infty$

e. Find the first derivative (get a common denominator).

$f'(x) = 5x^4 - 20x^3$

f. Find the critical points. (hint: set numerator=0 and denominator = 0)

$5x^4 - 20x^3 = 0$

$5x^3(x-4) = 0$

$x = 0 \quad x = 4$

g. Use the critical points to find any max/mins. (hint: use a sign line)


max at (0,0)

min at (4, -256)

h. State intervals of increase and decrease.

f is increasing $(-\infty, 0) \cup (4, \infty)$

f is decreasing $(0, 4)$

i. Find the second derivative (get a common denominator).

$f''(x) = 20x^3 - 60x^2$

j. Find all possible points of inflection. (hint: numer = 0 and denom = 0)

$20x^2(x-3) = 0$

$x = 0 \quad x = 3$

poi $(3, -162)$

k. Find intervals of concavity. (hint: use a sign line)

$f''$ : $-$ | $-$ | $+$ (0, 3)

Concave up $(3, \infty)$

Concave down $(-\infty, 0) \cup (0, 3)$

l. Sketch the graph of $f(x)$. Label intercepts, asymptotes, and max/mins.