1.) (15 pts.) Consider the function $f(x) = \dfrac{x^2}{x-3}$. Compute the FIRST derivative and set up a sign chart for f' . Identify relative extrema (You need NOT determine absolute extrema.), including y-values, and state the open intervals on which f is increasing ($\uparrow$) and decreasing ($\downarrow$). You need NOT graph the function.

$$Y = \frac{X^2}{X-3} \xrightarrow{D} Y' = \frac{(X-3)\cdot 2X - X^2(1)}{(X-3)^2} = \frac{2X^2 - 6X - X^2}{(X-3)^2}$$

$$= \frac{X^2 - 6X}{(X-3)^2} = \frac{X(X-6)}{(X-3)^2} = 0$$

NO

$+ \quad 0 \quad - \quad \vdots \quad - \quad 0 \quad +$ $\quad Y'$

$X=0$, $Y=0$ rel. max.

$X=3$

$X=6$, $Y=12$ rel. min.

f is $\uparrow$ for $X<0$, $X>6$,

f is $\downarrow$ for $0<X<3$, $3<X<6$

2.) (15 pts.) Assume that the SECOND derivative of function $f(x)$ is $f''(x) = x^4 - x^3 - 6x^2$. Determine the x-values for which f has inflection points.

$$f''(x) = x^4 - x^3 - 6x^2$$
$$= x^2(x^2 - x - 6)$$
$$= x^2(x-3)(x+2) = 0$$

$+ \quad 0 \quad - \quad 0 \quad - \quad 0 \quad +$ $\quad f''$

$x=-2 \qquad x=0 \qquad x=3$

Inflection points at $x=-2$, $x=3$