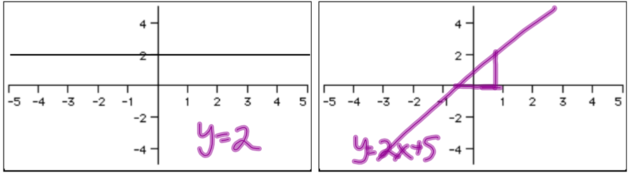
AP Calculus AB
Monday, October 7, 2013

Example 2) You are given a graph of $f'(x)$. Draw a picture of a possible $f(x)$.

a. $f'(x)$ possible $f(x)$.



Find the interval(s) on which f(x) is increasing and/or decreasing.

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

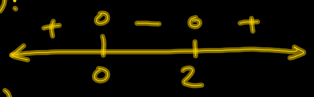
$f'(x) = 3x^2 - 6x$

$3x^2 - 6x = 0$

$3x(x-2) = 0$

$x=0 \quad x=2$

$f'(x)$:



$f'(-1) = 3(-1)^2 - 6(-1)$

$f'(-1) = 9$

$f(1) = 3-6$

$f(3) = 27-18$

Since $f'(x) < 0$ on $(0,2)$, $f(x)$ is decreasing on $(0,2)$. Since $f'(x) > 0$ on $(-\infty, 0) \cup (2, \infty)$, $f(x)$ is increasing on $(-\infty, 0) \cup (2, \infty)$.

When the derivative changes from positive to negative, the function has a relative (local) MAXIMUM. When the derivative changes from negative to positive, the function has a relative (local) MINIMUM.

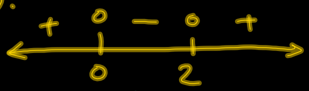
Find all relative extrema of f(x).

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

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

Above we had :

$f'(x)$:



Since $f'(x)$ goes from positive to negative at $x=0$, $f(x)$ has a relative maximum at $x=0$.

The maximum value is $f(0) = 0$.

OR : The relative maximum occurs @ $(0,0)$.

Since $f'(x)$ goes from negative to positive at $x=2$, $f(x)$ has a relative minimum @ $x=2$.

The relative minimum is $f(2) = 2^3 - 3 \cdot 2^2$

$f(2) = -4$.

OR The relative minimum occurs @ $(2,-4)$.

You try:

Find all relative maximum or minimum:

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

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

Soln

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

$$f'(x)=0$$

$$12x^2-4x^3=0$$

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

$$x=0 \qquad x=3$$

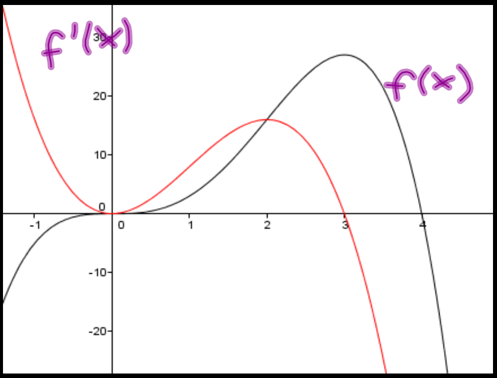
$$f'(x)=12x^2-4x^3$$

$$\begin{array}{ccccc} + & & + & & - \\ \hline & 0 & & 3 & \end{array}$$

Because $f'(x)$ goes from positive to negative @ $x=3$, $f(x)$ has a relative maximum @ $x=3$.

The relative maximum is $f(3)=4\cdot 3^3-3^4$

$$f(3)=108-81=27$$



Find relative max & min for C-F in packet.