Day 22 is Tuesday, October 16, 2012

Start with analytical examples involving Section 5-1 Concepts.

Example #1 $f(x) = 2x^3 - 3x^2 - 36x$

Find critical values.

Solution $f'(x) = 6x^2 - 6x - 36$

Notice $f'(x)$ is polynomial, so $f'(x)$ always exists.

Are there any x-values that will cause $f'(x) = 0$?

Set $f'(x) = 0$ and solve for x

$$6x^2 - 6x - 36 = 0$$

factor this.

Factor out 6 first

$$6(x^2 - x - 6) = 0$$

$$6(x+2)(x-3) = 0$$

Solutions: $x = -2, \quad x = 3$

these are partition numbers for $f'(x)$
(because they cause $f'(x) = 0$)

Are they critical values for $f(x)$?

$f(x)$ exists for every x value.

So any x-value that is a partition number for $f'(x)$ is also a critical value for $f(x)$.

So critical values are $x = -2,\ x = 3$.

Harder example: $f(x) = 4x^3 + 39x^2 - 144x + 2$

Find critical values.

Solution: $f'(x) = 12x^2 + 78x - 144$

How do you factor that?!?

from wolfram: $f'(x)$ factors as $f(x) = 6(x+8)(2x-3)$

So $f'(x) = 0$ when $x = -8$ or $x = \frac{3}{2}$

Example #3 $f(x) = -x^4 + 50x^2$

Find intervals where $f(x)$ is increasing or decreasing.

Find the local max + mins (x-values)

Find the y-coordinates of local max or mins.

Solution Study the sign of $f'(x)$.

$$f'(x) = -4x^3 + 100x = -4x(x^2 - 25)$$

$$= -4x(x+5)(x-5)$$

critical values $x = 0$ $x = -5$ $x = 5$

These are the x-values where $f'(x) = 0$.

Study sign of $f'(x)$ by making a sign chart.