Opener

Calculator

The graph of the function $y = x^3 + 6x^2 + 7x - 2\cos x$ changes concavity at $x =$

(A) -1.58 (B) -1.63 (C) -1.67 (D) -1.89 (E) -2.33

Non-Calculator

$y' = 3x^2 + 12x + 7 + 2\sin x$

$y'' = 6x + 12 + 2\cos x$

The graph of $y = 3x^4 - 16x^3 + 24x^2 + 48$ is concave down for

(A) $x < 0$

(B) $x > 0$

(C) $x < -2$ or $x > -\frac{2}{3}$

(D) $x < \frac{2}{3}$ or $x > 2$

(E) $\frac{2}{3} < x < 2$

Oct 31-9:16 AM

4-3 day 3 The Second Derivative Test for Local Extrema

Learning Objectives:

I can use the second derivative test to classify local extrema of a function.

Oct 24-11:45 AM

Exploration #2 on pg 214

EXPLORATION 2 **Finding f from f' and f''**

A function f is continuous on its domain $[-2, 4]$, $f(-2) = 5$, $f(4) = 1$, and f' and f'' have the following properties.

	inc & ccu		dec ccu		dec ccd
x	$-2 < x < 0$	$x = 0$	$0 < x < 2$	$x = 2$	$2 < x < 4$
f'	$+$	does not exist	$-$	0	$-$
f''	$+$	does not exist	$+$	0	$-$

1. Find where all absolute extrema of f occur.
2. Find where the points of inflection of f occur.
3. Sketch a possible graph of f.

Abs Max @ $x=0$ Abs Min @ $x=4$

inf pt @ $x=2$

Oct 24-12:30 PM

Ex1. Given the function

$$f(x) = 2x^3 + 3x^2 - 12x + 6$$

a.) Find the critical points.

$$f'(x) = 6x^2 + 6x - 12$$
$$0 = 6(x^2 + x - 2)$$
$$0 = (x+2)(x-1)$$
$$x = -2, 1$$

b.) Find the second derivative at each of these points.

Oct 24-11:45 AM

$f' = 6x^2 + 6x - 12$ $f'' = 12x + 6$

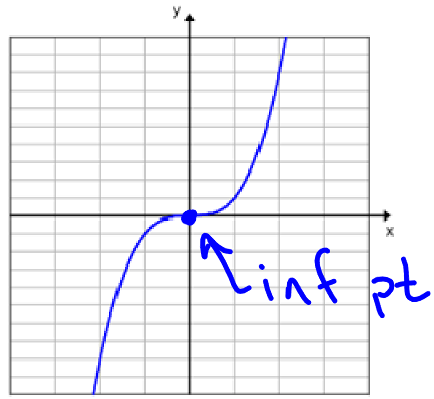
x	f'	f''	Max/Min
x=1	0	+18	$x=1$ Min
x=-2	0	-18	$x=-2$ Max

Oct 24-11:45 AM

The 2nd Derivative Test for Classifying Local Extrema

- If f'(c) = 0 and f'' (c) > 0, then x = c is a local minimum.
- If f'(c) = 0 and f'' (c) < 0, then x = c is a local maximum.

However, if f'(c) = 0 and f'' (c) = 0, then the 2nd der test cannot be used to classify that extrema.

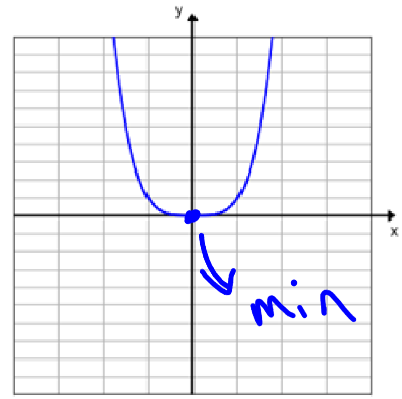


$y = x^3$

$y' = 3x^2$ @ $x = 0$, $y' = 0$

$y'' = 6x$ @ $x = 0$, $y'' = 0$

Inflection Point



$y = x^4$

$y' = 4x^3$ @ $x = 0$, $y' = 0$

$y'' = 12x^2$ @ $x = 0$, $y'' = 0$

Minimum

If $f'(c) = 0$ and $f''(c) = 0$, the Second Derivative Test is inconclusive.

Ex2. Find and classify the extrema

$f(x) = 2\cos(x) + \cos(2x)$ on $0 \le x \le 2\pi$

Homework

pg 215 # 25-30, 33, 36-40, 48, 51, 52, 55-59