Relative Extrema

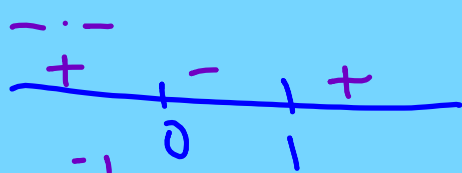
First Derivative Test

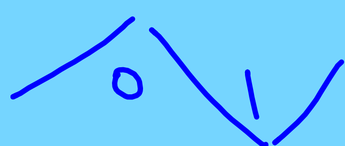
$f(x) = 2x^3 - 3x^2 - 4$

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

$6x(x-1) = 0$

$x = 0, 1$

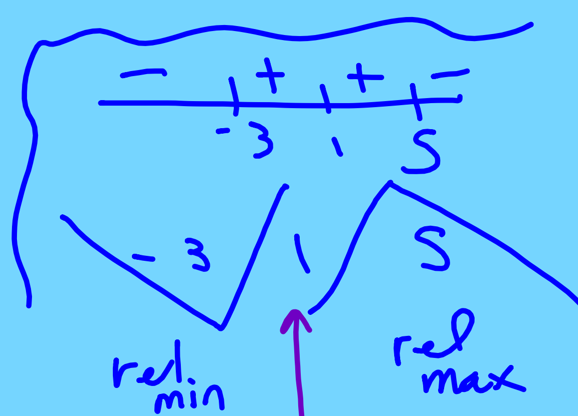




0	-4
1	-5

rel. max $(0, -4)$
rel min $(1, -5)$

1) Find critical points
   $f'(x) = 0$
2) Build intervals & test points
3) Do the mountain test to determine rel. max & mins
4) Write answers as coordinates



not a rel. max or min.

2ND DERIV TEST

$f(x) = x^3 + 3x^2 + 16$

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

$3x(x+2)$

$x = 0, -2$

$\cup$

$\cap$

$f''(x) = 6x + 6$

$f''(0) = +$ $\cup$

$f''(-2) = -$ $\cap$

0	16
-2	20

Rel min $(0,16)$
Rel max $(-2,20)$

1) Find the crit. pts.
2) Test crit pts in f'' for concave up/down

$f''(4) = 0$

inconclusive

Go back to 1st. Deriv. test

2ND DERIV TEST

$$f(x) = \sqrt[3]{4 - x^2} = (4 - x^2)^{1/3}$$

$$f'(x) = \frac{1}{3}(4 - x^2)^{-2/3} \cdot -2x$$

$$\Rightarrow \quad = \frac{-2x}{3\sqrt[3]{(4 - x^2)^2}} = 0 \quad \Leftarrow$$

f'' is difficult
- use f' test

$-2x = 0$

$x = 0$

Pts of non-diff.

$4 - x^2 = 0$

$\sqrt{4} = \sqrt{x^2}$

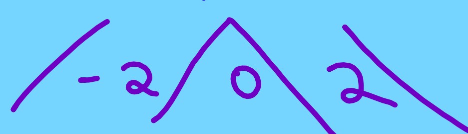
$\pm 2 = x$

$\frac{+}{+}$ $\quad \frac{+}{+}$ $\quad \frac{-}{+}$ $\quad \frac{-}{+}$

$+ \quad + \quad - \quad -$

$-2 \quad 0 \quad 2$

$-3 \quad -1 \quad 1$



rel max $(0, \sqrt[3]{4})$