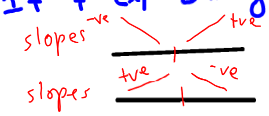
First Derivative Test

① Find $f'(x)$ and critical values of $f(x)$
② Make a number line chart
③ If $f'(x)$ changes from:



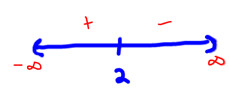
-ve to +ve → relative minimum
+ve to -ve → rel. max
no change → neither max nor min

Recall

Number line steps
① Find $f'(x)$ in factored form
② Find the zeroes and write on a number line
③ Test values around the zeroes for +ve or -ve
* signs alternate except around a double root

ex.1 Show that $y = -x^2 + 4x + 5$ has a max value.

$y' = -2x + 4$
$0 = -2x + 4$
$x = 2$



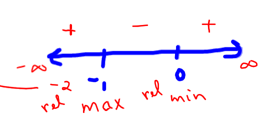
← sub into derivative
* First Derivative Test

∴ max @ $x = 2$

If we want the max. value we sub $x = 2$ into $y = -x^2 + 4x + 5$
the original fcn

ex.2 Find the extreme values of $y = 2x^3 + 3x^2$

$y' = 6x^2 + 6x$
$0 = 6x^2 + 6x$
$6(-2)(-2+1)$
$0 = 6x(x+1)$
$x = 0 \quad x = -1$



sub into $y = 2x^3 + 3x^2$
$f(-1) = 1$ max of 1 @ $x = -1$
$f(0) = 0$ min of 0 @ $x = 0$

worksheet
3 a - c
5 a, c, e
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$y = -x^2 + 4x + 5$

$0 = -(x^2 - 4x - 5)$

$(x-5)(x+1) = 0$

$x = 5 \quad x = -1$

$y = -(2)^2 + 4(2) + 5$