Ex $f(x) = 2x^3 - 3x^2 - 36x + 14$

Critical numbers:

$$f'(x) = 6x^2 - 6x - 36$$
$$= 6(x^2 - x - 6)$$
$$0 = 6(x-3)(x+2)$$
$$x = 3, \quad x = -2$$

Interval	Test Value	Sign of $f'(x)$	Conclusions
$(-\infty, -2)$	$x = -3$	$f'(-3) = 36 > 0$	increase
$x=-2$ $(-2, 3)$	$x = 0$	$f'(0) = -36 < 0$	decreasing
$x=3$ $(3, \infty)$	$x = 4$	$f'(4) = 36 > 0$	increase

At $x = -2$, relative maximum

At $x = 3$, relative minimum

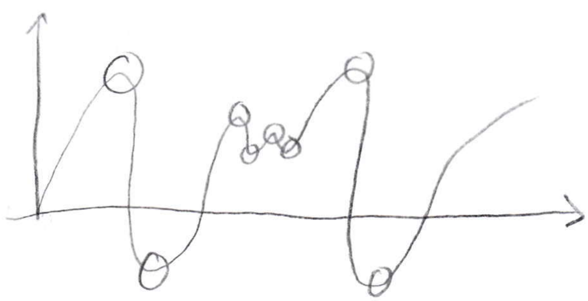
Ex $f(x) = 2x - 3x^{2/3}$

$$f'(x) = 2 - 3\left(\frac{2}{3}\right)x^{-1/3}$$
$$= 2 - 2x^{-1/3} = 2 - \frac{2}{x^{1/3}} = \frac{2(x^{1/3} - 1)}{x^{1/3}} \star$$

$f'(x)$ undefined at $x = 0$

$f'(x) = 0$ at $x = 1$

Critical numbers



Interval	Test	Sign	Conclusion
$(-\infty, 0)$	-1	$+$	increasing
$(0, 1)$	$1/2$	$-$	decreasing
$(1, \infty)$	2	$+$	increasing

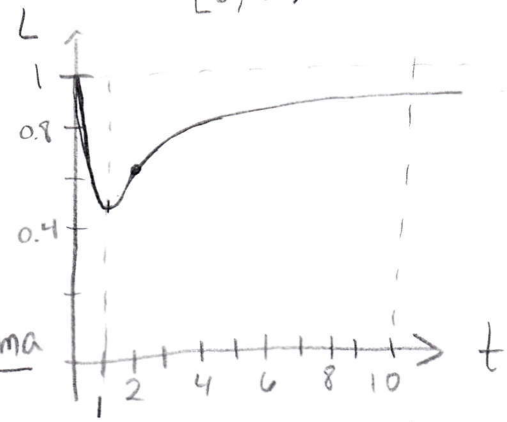
At $x = 0$, relative maximum

At $x = 1$, relative minimum

Polluted pond. Oxygen level may be modeled by

$$L = \frac{t^2 - t + 1}{t^2 + 1}, \quad t \geq 0$$

$[0, \infty)$



$[0, 10]$

When is the oxygen level lowest?

$$\frac{dL}{dt} = \frac{(t^2+1)(2t-1) - (t^2-t+1)(2t)}{(t^2+1)^2}$$

$$= \frac{t^2-1}{(t^2+1)^2}$$

$= 0$ when $t = 1$ Critical number

Absolute extrema

$L(1) = \frac{1}{2}$

$L(0) = 1$

Interval	Test	Sign	Concl
$(0, 1)$	$1/2$	$-$	decrease
$(1, \infty)$	2	$+$	increase

plug into derivative

sign of f' / L'

What is the lowest level?

$L(1) = \frac{1}{2}$