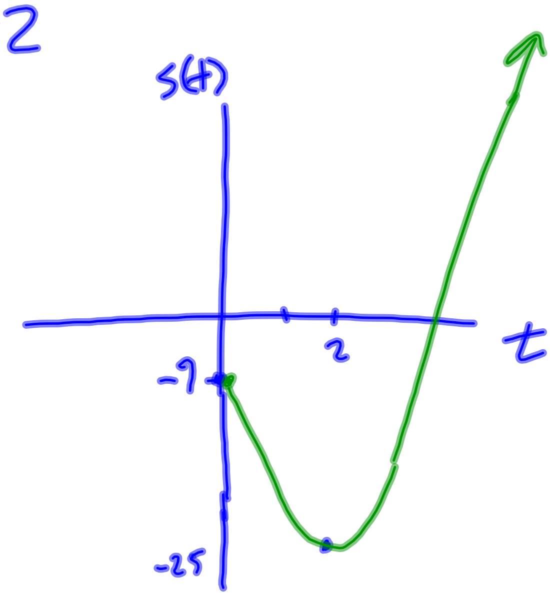
p. 129

$t \geq 0$

13b) $s(t) = t^3 - 12t - 9$

$s'(t) = v(t) = 3t^2 - 12$



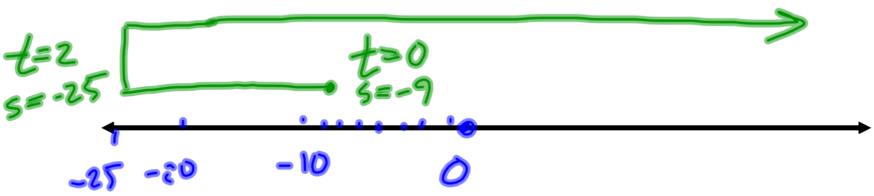
$s''(t) = v'(t) = a(t) = 6t$

Set $s'(t) = 0$

$0 = 3t^2 - 12$

$t = \pm 2 \quad t \geq 0$

$t = 2$



$$s(t) = \begin{cases} 0, & t < 0 \\ \dfrac{t^3}{t^2+1}, & \text{if } t \geq 0 \end{cases}$$

$$v(t) = \frac{3t^2(t^2+1) - (2t)(t^3)}{(t^2+1)^2} \quad , t \geq 0$$

$$= \frac{3t^4 + 3t^2 - 2t^4}{(t^2+1)^2}$$

$$= \frac{t^4 + 3t^2}{(t^2+1)^2}$$

$$a(t) = \frac{(4t^3+6t)(t^2+1)^2 - 2(t^2+1)(2t)(t^4+3t^2)}{(t^2+1)^4}$$

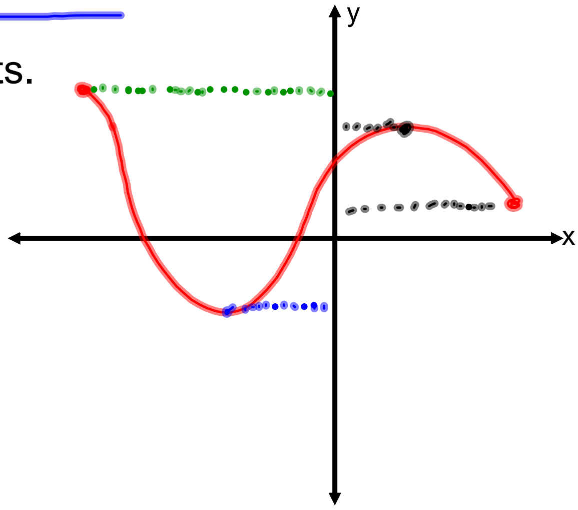
$a(0) = 0$ ✓

L2 (3.2) Max & Min Values on an Interval

The following is a section of quartic polynomial function.

a) Identify the absolute max and min points.

b) Identify the local max & min points.



To find the max & min values (a.k.a. extreme values)

1- Solve $f'(x) = 0$ and find all points in the given interval.

2- Evaluate $f(x)$ at the endpoints.

3- Compare the y-values found in steps 1 & 2.

Ex1: Find all local and extreme max & min values of the function on the given interval.

$$f(x) = 3x^4 - 4x^3 - 36x^2 + 20, \ \ x \in [-3, \ 4]$$

$f'(x) = 12x^3 - 12x^2 - 72x \ , \ x \in [-3, 4]$

Set $f'(x) = 0$

$0 = 12x^3 - 12x^2 - 72x$

$0 = 12x(x^2 - x - 6)$

$0 = 12x(x-3)(x+2)$

$x = 0, 3, -2$

$f(0) = 20$

$f(3) = -169$ ← EXTREME MIN.

$f(-2) = -44$

To get endpoints use the info from interval.

$f(-3) = 47$ ← EXTREME MAX.

$f(4) = -44$

Ex2: The amount of light intensity on a point is given by the function $I(t) = \dfrac{t^2 + 2t + 16}{t+2}$, where t is the time in seconds and $t \in [0, 14]$.

a) Determine the time of minimal intensity.
b) What is the minimal intensity?

a) Find endpoints:

$I(0) = 8$

$I(14) = 15$

$$I'(t) = \frac{(2t+2)(t+2) - t^2 - 2t - 16}{(t+2)^2}$$

$$= \frac{2t^2 + 6t + 4 - t^2 - 2t - 16}{(t+2)^2}$$

$$= \frac{t^2 + 4t - 12}{(t+2)^2}$$

$$= \frac{(t+6)(t-2)}{(t+2)^2}$$

Set $I'(t) = 0$

$$0 = \frac{(t+6)(t-2)}{(t+2)^2}$$

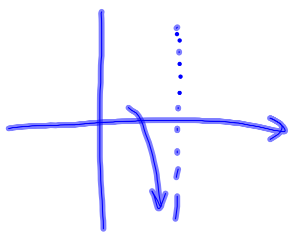
$t = -6, 2$ but $t \in [0, 14]$

So $t = 2$

$I(2) = 6$

$\therefore$ After comparing intensities for all local minimums, the lowest intensity is 6 units which occurs at 2 seconds.

Think about $f(x) = \dfrac{x^2+5}{x-2}$, $x \in [0, 15]$, $x \neq 2$



Assigned Work:

p136-138 # 2ab, 3d, 4ab,
6, 7a, 8, 9