

$$2. \quad s(t) = -16t^2 + 40t + 4, \quad t \geq 0$$

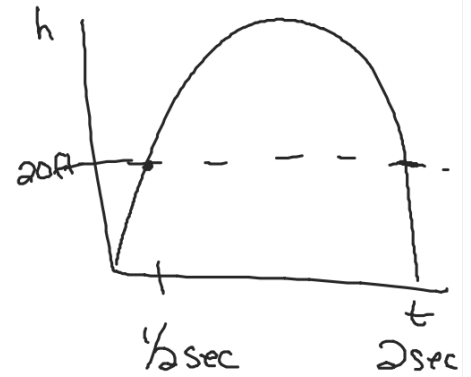
$$c) \quad 20 = -16t^2 + 40t + 4$$

$$5 = -4t^2 + 10t + 1$$

$$0 = -4t^2 + 10t - 4$$

$$0 = (2t - 1)(2t - 4)(-4)$$

$$\begin{array}{ccc} \downarrow & & \downarrow \\ 2t = 1 & & 2t = 4 \\ t = \frac{1}{2} \text{ s} & & t = 2 \text{ sec} \end{array}$$



$$3) \quad s(t) = \frac{t}{e^t} \quad \text{Sim m an tins}$$

$$1a) \quad v(t) = \frac{1-t}{e^t}$$

$$s(t) = t \cdot e^{-t}$$

$$s'(t) = t \cdot e^{-t}(-1) + e^{-t}(1)$$

$$= -te^{-t} + e^{-t}$$

$$= e^{-t}(-t + 1)$$

$$= \frac{-t+1}{e^t}$$

$$= \frac{1-t}{e^t}$$

$$s'(t) = \frac{e^t(1) - t(e^t)}{(e^t)^2} = \frac{\cancel{e^t}(1-t)}{e^{\cancel{t}}} = \frac{1-t}{e^t}$$

(b) $v(t) = s'(t)$

$$e^t \cdot 0 = \frac{1-t}{e^t} \cdot e^t$$

$$0 = 1-t$$

$$\underline{t = 1 \text{ sec}}$$

acceleration function: the gradient of velocity

$$a(t) = \lim_{h \rightarrow 0} \frac{v(t+h) - v(t)}{h} = v'(t) = s''(t)$$

Note:
gas $a(t) > 0$ velocity is increasing
brakes $a(t) < 0$ velocity is decreasing
cruise $a(t) = 0$ velocity is constant

Ex) for $s(t) = 2t^3 - 21t^2 + 60t + 3, t \geq 0$
 $v(t) = s'(t) = 6t^2 - 42t + 60, t \geq 0$

Slope
of secant
line going
thru 2 points

a) Find the average acceleration from $t=1$ to $t=4$

code for - ARoC $(1, 24)$ and $(4, -12)$

$$\frac{\Delta v}{\Delta t} = \frac{v_2 - v_1}{t_2 - t_1} = \frac{24 - (-12)}{4 - 1} = \text{points}$$

-12 m s^{-2}

$v(t) = 6t^2 - 42t + 60$

b) Find the instantaneous acceleration at $t = 3$ sec and Explain what it means

code for -
slope of tangent line
at $t = 3$

$$a(t) = v'(t) = s''(t) = 12t - 42, \quad t \geq 0$$

$$\begin{aligned} a(3) &= 12(3) - 42 \\ &= 36 - 42 = -6 \text{ m s}^{-2} \end{aligned}$$

This means that the velocity is decreasing 6 meters per second each second at time $t = 3$ seconds.

* Speed is the absolute value of velocity
why it's true:

$v(t) > 0$ particle \longrightarrow

$v(t) < 0$ particle \longleftarrow

* velocity - tells us both the speed and
the direction of particle

* when velocity and acceleration have
the same sign, the object is speeding
up

* when velocity and acceleration have
different signs, the particle is
slowing down.