

Discussion Problems

Section 3.4, 3.5, 3.6

↑
make
sure to
do
157, 158

* No class this Monday 5/29
in observance of Memorial Day

* Exam 2 Monday June 5th,
Covering sections 3.3-3.8, maybe 3.9

Section 3.4

(151) $s(t) = 2t^3 - 15t^2 + 36t - 10 \quad t \geq 0.$

$$v(t) = s'(t) = 6t^2 - 30t + 36$$

$$a(t) = v'(t) = s''(t) = 12t - 30$$

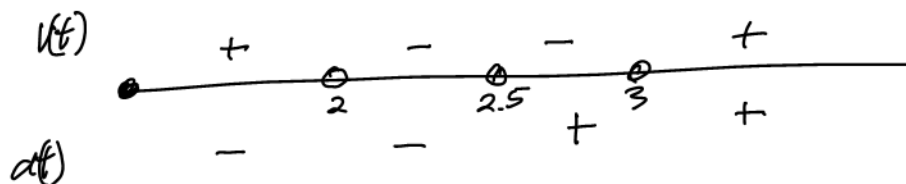
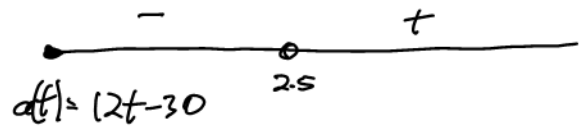
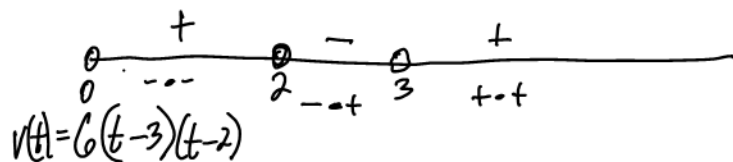
$$6t^2 - 30t + 36 = 0$$

$$t^2 - 5t + 6 = 0$$

$$(t-3)(t-2) = 0$$

$$12t - 30 = 0$$

$$t = \frac{30}{12} = \frac{10}{4} = 2.5$$



slowing down $0 < t < 2$ and $2.5 < t < 3$
speeding up $2 < t < 2.5$ and $3 < t$

$$(152) \quad s(t) = \frac{t}{t^2+1}$$

$$v(t) = s'(t) = \frac{1-t^2}{t^2+2t^2+1}$$

$$a(t) = s''(t) = \frac{-2t(t^2+2t^2+1) - (4t^3+4t)(1-t^2)}{(t^2+2t^2+1)^2}$$

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

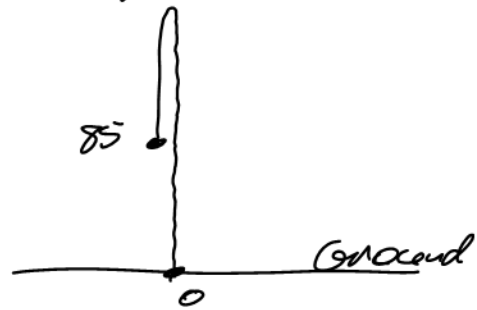
$$= \frac{\cancel{(t^2+1)}(-2t(t^2+1) - 4t(1-t^2))}{(t^2+1)^3}$$

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

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

(157)

$s(t) = -16t^2 + 100t + 85$ ft above the ground at $t \geq 0$ seconds



$$v(t) = s'(t) = -32t + 100 \text{ ft/sec}$$

$$a(t) = s''(t) = -32 \text{ ft/sec}^2$$

(a) $V(0.5) = -32(0.5) + 100 = 84$ ft/sec upward
 $V(5.75) = -32(5.75) + 100 = -84$ ft/sec downward

(b) speed is 84 ft/sec at both $t = 0.5$ and 5.75 sec.

(c) $-32t + 100 = 0$ is when potato reaches max height

$$t = \frac{100}{32} = \frac{25}{8} \text{ seconds.}$$

$$\begin{aligned} \text{max height} &= s\left(\frac{25}{8}\right) = -16\left(\frac{25}{8}\right)^2 + 100\left(\frac{25}{8}\right) + 85 \\ &= 241.25 \text{ feet} \end{aligned}$$

(d) $a(t) = -32$ ft/sec² at all times t .

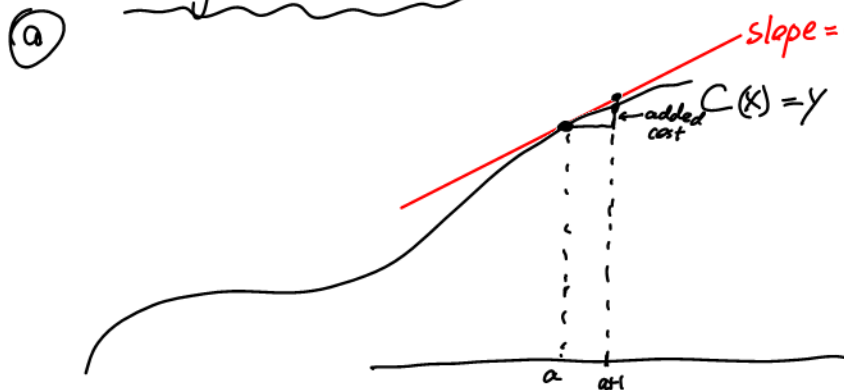
(e) hit the ground when $0 = s(t) = -16t^2 + 100t + 85$

$$t = 7.008 \text{ seconds.}$$

(f) $V(7.008) = -32(7.008) + 100 \approx -124$ ft/sec.

(160) $C(x) = 200 + \frac{7}{x} + \frac{x^2}{7} = 200 + 7x^{-1} + \frac{1}{7}x^2$ dollars

"marginal cost function" $C'(x) = -7x^{-2} + \frac{2}{7}x$ dollars/item.



After having manufactured a items, the $(a+1)^{st}$ item's added or "marginal" cost is approximately $C'(a)$.

(b) $C'(13) = -7(13)^2 + \frac{2}{7}(13) \approx 3.67$ dollars

The actual cost of producing the 13th item

$C(13) - C(12) \approx 3.53$ dollars

Similar.

(165) $N(t) = 3000\left(1 + \frac{4t}{t^2+100}\right) = 3000 + 12000 \frac{t}{t^2+100}$

(a) $N'(t) = 12,000 \left(\frac{t^2+100 - 2tt}{(t^2+100)^2} \right) = 12,000 \frac{100-t^2}{(t^2+100)^2}$ bacterium/hour

(b) $N'(0) = 120$ b/h

$N'(10) = 0$ b/h

$N'(20) = -\frac{22}{5} = -4.4$ b/h

$N'(30) = -\frac{47}{5} = -9.6$ b/h

$N'(40) = -\frac{1700}{289} = -6.23$ b/h

(c) Population increases for first 10 hours then starts to decrease where the rate of decrease slows as time moves forward.