Unit 2 REVIEW --> page 116 #1 - 4, 6, 7, 9, 10, 11, 13

Day 1 - AROC
- slope of the secant b/w 2 pts.
- $AROC_{[a,b]} = \frac{f(b)-f(a)}{b-a}$ => slope formula as well

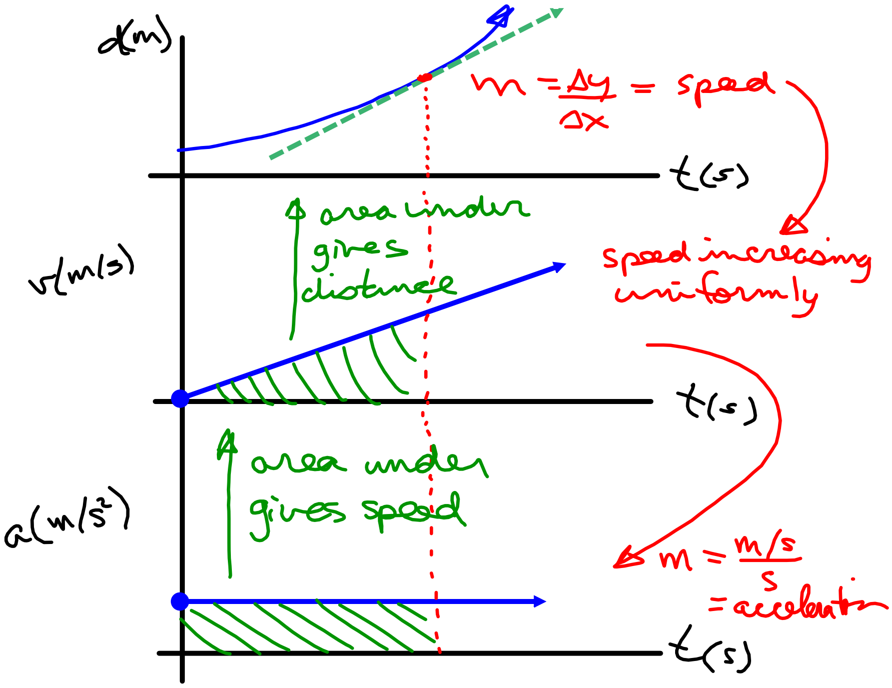
Day 2 - IROC
- many AROC calculations
- → preceeding / following or centered intervals
- → good for questions w/ TOVs

Day 3 - DQ
IROC = $m_{tangent}$

$$DQ_{x=a} = \frac{f(a+h)-f(a)}{h}$$

* h = tiny (0.001 or less)

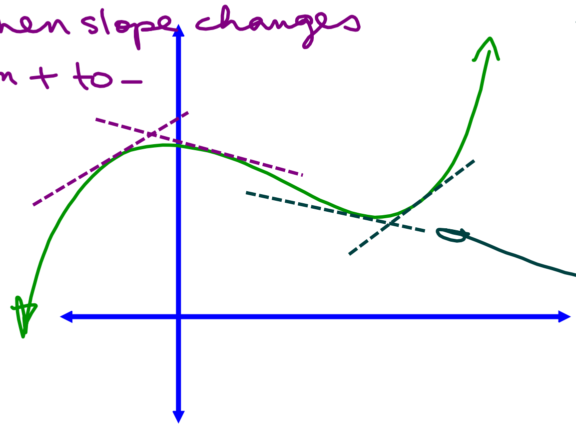
Day 4 - Graphical Models



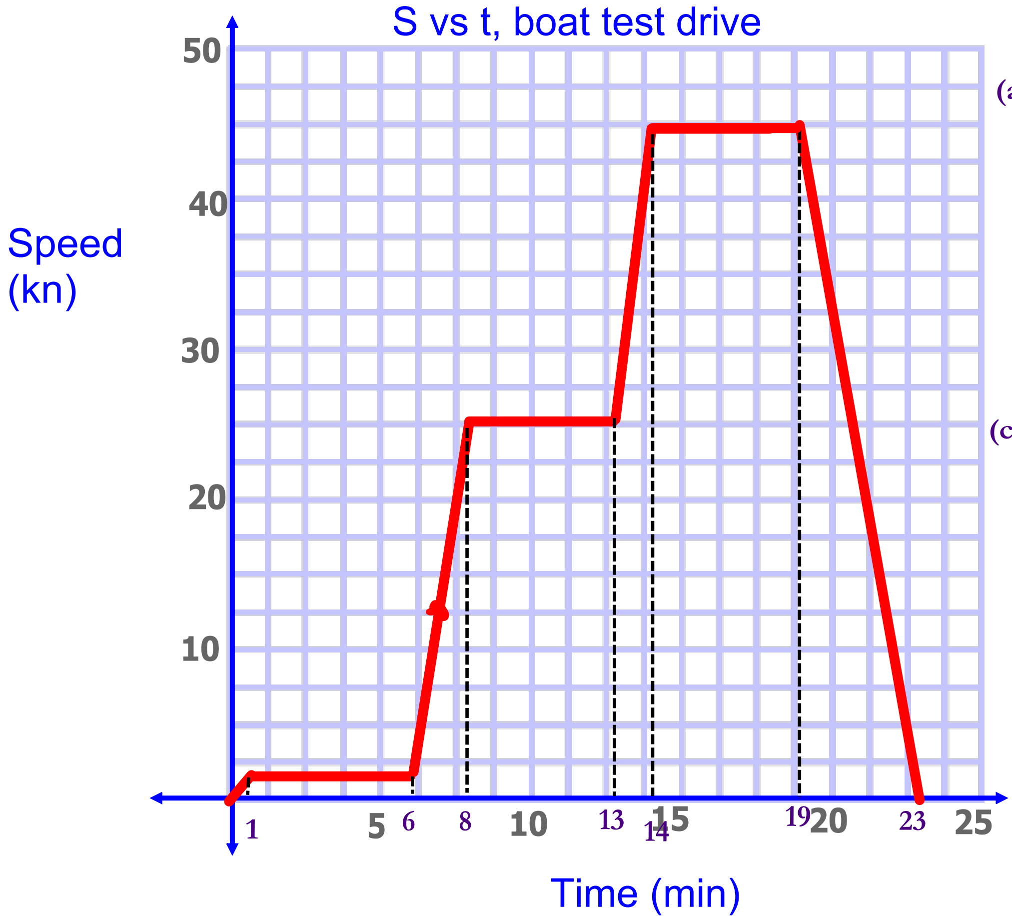
Day 5 - Finding max/min with IROC

max values occur when slope changes from + to −

min values... when slope changes from − to +



1. A speedboat driver is testing a new boat. He begins the test by steadily increasing the boat's speed until he reaches 3 kn (knots) over a period of 1 min. Because he is in a no-wake zone, he stays at this speed for 5 min. After leaving the no-wake zone, he steadily increases the speed of the boat to 25 kn over a period of 2 min. He stays at this speed for 5 min and then increases the speed of the boat to 45 kn over a period of 1 min. After staying at this speed for 5 min, he decelerates the boat at a steady rate over a period of 4 min until he comes to a stop.
   a) Draw a graph of the boat's speed versus time. Remember to label your data points.
   b) What is the average rate of change in speed from $t = 6$ to $t = 8$ and from $t = 8$ to $t = 13$? How are the two rates different? What does this tell you about the speed of the boat during these two intervals of time?
   c) What is the instantaneous rate of change in speed at $t = 7$?

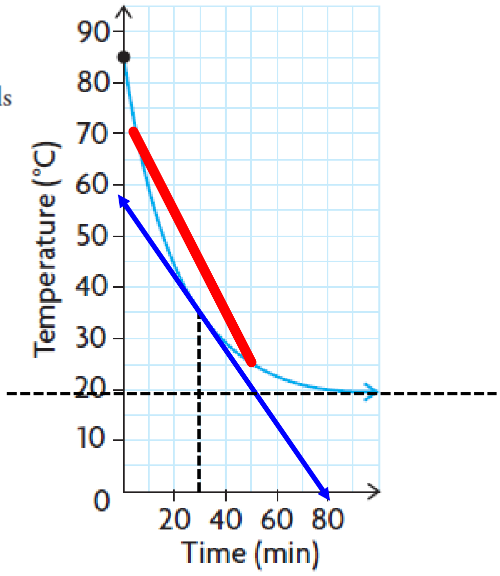


(a) 6 to 8
11kn/min

8 to 13
0 kn/min

(c) t = 7
11kn/min

2. A cup of hot cocoa left on a desk in a classroom had its temperature measured once every minute. The graph shows the relationship between the temperature of the cocoa, in degrees Celsius, and time, in minutes.
   a) Determine the slope of the secant line that passes through the points (5, 70) and (50, 25).
   b) What does the answer to part a) mean in this context?
   c) Estimate the slope of the tangent line at the point (30, 35).
   d) What does the answer to part b) mean in this context?
   e) Discuss what happens to the rate at which the cup of cocoa cools over the 90 min period.



(a) m = - 1^{o}C/min

(b) between 5min and 50min the average rate of change is one degree Celsius per minute

(c) my tangent line passes through (80, 0) and (0, 56) so that is a slope of -0.7^{o}C/min

(d) at that instant (30min) the rate of cooling is -0.7^{o}C/min

(e) the rate of cooling slows as time increases

3. The profit $P(x)$ of a cosmetics company, in thousands of dollars, is given by $P(x) = -5x^2 + 400x - 2550$, where x is the amount spent on advertising in thousands of dollars.

a) Calculate the average rate of change in profit on the interval $8 \leq x \leq 10$.

b) Estimate the instantaneous rate of change in profit when $x = 50$.

c) Discuss the significance of the signs in your answers to parts a) and b).

(a) $AROC_{[8,10]} = \frac{P(10)-P(8)}{10-8}$

$= (1250 - 630)/2$

$= 310$

Thus, the AROC is $310 000 per $1000 of advertising

(b) $DQ = \frac{P(50.001) - P(50)}{0.001}$

$= -100.005$

Thus when the advertising budget is $50 000, the company is losing $100 of profit per dollar spend on advertising

4. Estimate the instantaneous rate of change for each function at each point given. Identify any point that is a maximum/minimum value.

a) $h(p) = 2p^2 + 3p$; $p = -1, -0.75$, and 1

b) $k(x) = -0.75x^2 + 1.5x + 13$; $x = -2, 4$, and 1

(a) evaulate the DQ at	p=-1	p=-.75	and	p=1
DQ =	-0.998	0.002		7.002
(b) evaulate the DQ at	x=-2	x=4	and	x=1
DQ =	4.49925	-4.50075		-0.00075

-7.5E-4

so...

there is probably a minimum in (a) at p = -0.75

and a maximum in (b) at x = 1