Review

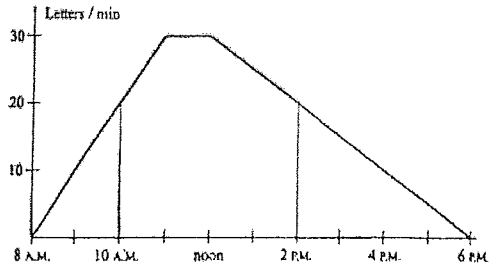
Calculus Application Questions – CH 4

Question 1:

(a) In order to investigate mail-handling efficiency, each hour one morning a local post office checked the rate (letters/min) at which an employee was sorting mail. Use the results shown in the table to estimate the total number of letters he may have sorted that morning.

Time	8	9	10	11	12
Letters/min	10	12	8	9	11

(b) Hoping to speed things up a bit, the post office tested a sorting machine that can process mail at the constant rate of 20 letters per minute. The graph shows the rate at which letters arrived at the post office and were dumped into this sorter.



Find how many letters were sorted from 8am to noon.

(c) The function A(t) uses the graph from part b and call the function graphed L(t).

$$A(x) = \int_0^x L(t)dt \text{ for } 0 \le x \le 10 \text{ where } x \text{ is the hours after 8am}$$

Find A(6)

Find the average value of L(t)

Question 2: The velocity of a particle in m/s is described by $v(t) = .5t - 2$.

A. Find the distance the particle travels from time $t = 2$ to $t = 5$.
B. Find the function for displacement, called $s(t)$, if $s(4) = 0$
C. Find the equation of the tangent line to $s(t)$ at $t = 6$
D. Find the average velocity from $t=1$ to $t=9$

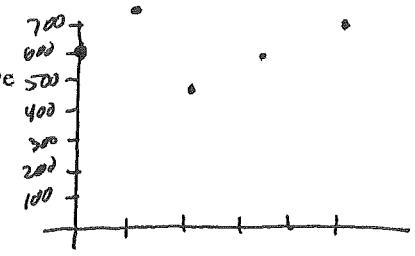
Review

Calculus Application Questions – CH 4

Question 1:

(a) In order to investigate mail-handling efficiency, each hour one morning a local post office checked the rate (letters/min) at which an employee was sorting mail. Use the results shown in the table to estimate the total number of letters he may have sorted that morning.

Time	8	9	10	11	12
Letters/min	10	12	8	9	11
×60	600	720	480	540	660



L: 600+720+480+540 = 2340L

R: 660+540+480+720 = 2400L

Trap: (2340+2400)/2 = 2370 Letters

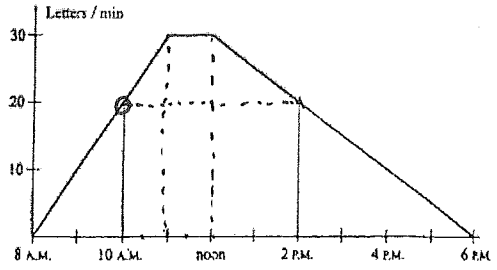
(b) Hoping to speed things up a bit, the post office tested a sorting machine that can process mail at the constant rate of 20 letters per minute. The graph shows the rate at which letters arrived at the post office and were dumped into this sorter.

L/hr

1800

1200

600



Find how many letters were sorted from 8am to noon.

8+010

$\frac{2(1200)}{2} = 1200L$

2(1200) = 2400L

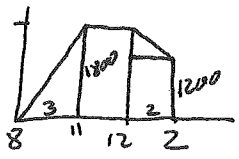
3600L.

(c) The function A(x) uses the graph from part b and call the function graphed L(t).

$$A(x) = \int_0^x L(t)dt \text{ for } 0 \le x \le 10 \text{ where } x \text{ is the hours after 8am}$$

Find A(6)

S_0^6



2700
1800
2400
600
7500 Letters Dumped into the machine

Find the average value of L(t)

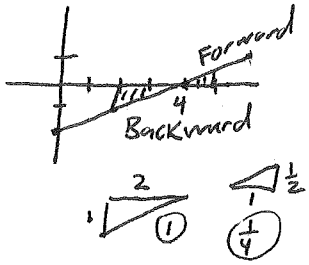
*

$\frac{7500}{6} = 1250$ Letters/hour.

Question 2: The velocity of a particle in m/s is described by v(t) = .5t – 2.

A. Find the distance the particle travels from time t = 2 to t = 5.
B. Find the function for displacement, called s(t), if s(4) = 0
C. Find the equation of the tangent line to s(t) at t = 6
D. Find the average velocity from t=1 to t=9

(A) $\int_2^5 |.5t-2|\,dt = 1 + \frac{1}{4} = \boxed{1.25\text{m}}$ $\left|\int_2^4 (.5t-2)\,dt\right| + \left|\int_4^5 (.5t-2)\,dt\right|$



(B) $\int v(t) = \int (.5t-2)\,dt = \frac{1}{4}t^2 - 2t + C$

$s(4) = 0$

$0 = \frac{1}{4}(4)^2 - 2(4) + C$

$0 = 4 - 8 + C$

$4 = C$

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

(C) $y - 1 = 1(x - 6)$

$s(6) = \frac{1}{4}(6)^2 - 2(6) + 4$

$s(6) = 1\text{m}$

$s'(6) \to v(6) = \frac{1}{2}(6) - 2 = 1\text{m/s}$

(D) $\frac{1}{8}\int_1^9 \left(\frac{1}{2}t - 2\right)dt$

$\frac{1}{8}\left[\frac{1}{4}t^2 - 2t\Big|_1^9\right]$

$\frac{1}{8}\left(\left(\frac{1}{4}(9)^2 - 2(9)\right) - \left(\frac{1}{4}(1)^2 - 2(1)\right)\right)$

$\left(\frac{1}{2}\right)\text{m/s}$

Calc Problems for Test 3

(1) $f(x) = \sqrt{\frac{10}{x}}$

a) find $f'(x)$

b) find $F(x)$ given $F(1) = 1$

(2) $\int_1^2 x\sqrt{x+10}\,dx$

(3) $g(x) = \int_2^x \tan(4t)\,dt$ find $g'(x)$

(4) $\int \frac{x^4 + x^3 - \sqrt{x} + 4x^2}{x^2}\,dx$

Calc Problems for Test 3

(1) $f(x) = \sqrt{\frac{10}{x}} = \frac{\sqrt{10}}{\sqrt{x}} = \sqrt{10}\,x^{-1/2}$

a) find $f'(x) = \sqrt{10}\left(-\frac{1}{2}\right)x^{-3/2}$

b) find $F(x)$ given $F(1) = 1$

$F(x) = \sqrt{10}\int x^{-1/2}dx = 2\sqrt{10}\,x^{1/2} = 2\sqrt{10x} + C$

$1 = 2\sqrt{10(1)} + C$ $\quad F(x) = 2\sqrt{10x} - 5.32$

$C = -5.32$

(2) $\int_1^2 x\sqrt{x+10}\,dx$ $\quad u = x+10$ $\quad x = u-10$ $\quad du = dx$

$\int (u-10)u^{1/2}du = \int \left(u^{3/2} - 10u^{1/2}\right)du = \frac{2}{5}u^{5/2} - 10\left(\frac{2}{3}\right)u^{3/2} = \frac{2}{5}(x+10)^{5/2} - \frac{20}{3}(x+10)^{3/2}\Big|_1^2$

$-77.6 - (-82.7) = 5.1$

(3) $g(x) = \int_2^x \tan(4t)\,dt$ $\quad$ find $g'(x)$

constant

$\tan(4x)$

(4) $\int \frac{x^4 + x^3 - \sqrt{x} + 4x^2}{x^2}dx$

$\int \left(x^2 + x - \frac{x^{1/2}}{x^2} + 4\right)dx$

$\int \left(x^2 + x - x^{-3/2} + 4\right)dx$

$\frac{1}{3}x^3 + \frac{1}{2}x^2 + 2x^{-1/2} + 4x + C$

Key

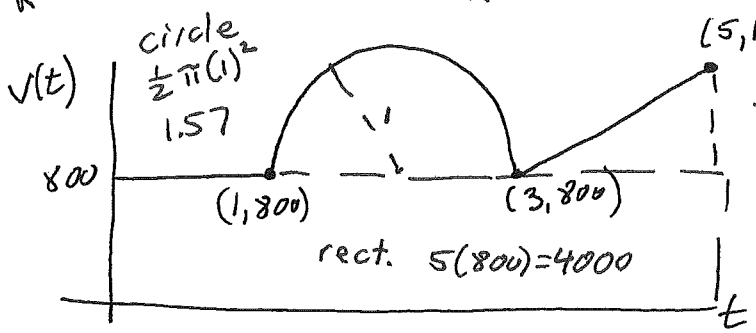
CC Runner's Velocity

Runner 1

min	0	1	2	3	4	5
ft/min	0	1000	900	950	1100	900

L: 0+1000+900+950+1100 = 3950 } Trap Rule
R: 1000+900+950+1100+900 = 4850 } 4400ft

Runner 2



+triangle $\frac{1}{2}(400)(2)=400$

+total = 4401.57

$\int_0^5 (800+80t)dt = 800t+40t^2\Big|_0^5$
$= 5000$

Runner 3 $v(t) = 800 + 80t$
$a(t) = 80$
$s(t) = 800t + 40t^2$

a) Find accel. of each at $t=4$

1: $\frac{900-950}{6-3} = \frac{-50}{2} = -25$ ft/min^2
2: $\frac{1200-800}{5-3} = \frac{400}{2} = 200$ ft/min^2
3: 80 ft/min^2

b) Find displacement from $t=0$ to $t=5$, who is ahead?
1: 4400ft 2: 4401.57ft 3: 5000ft

c) Find $s(t)$ for runner 3 knowing that time 0 is the start of the race. $s(t) = 800t+40t^2$

d) Find the ave. velocity of each runner from $t=0$ to $t=5$
1: 880 ft/min 2: 880.3 ft/min 3: 1000 ft/min

e) If $A(x) = \int_0^x v(t)\,dt$, find $A(4)$ and find $A'(x)$ for runner 3

$A'(x) = 800+80x$

$A(4) = \int_0^4 (800+80t)dt$

$800t+40t^2\Big|_0^4$

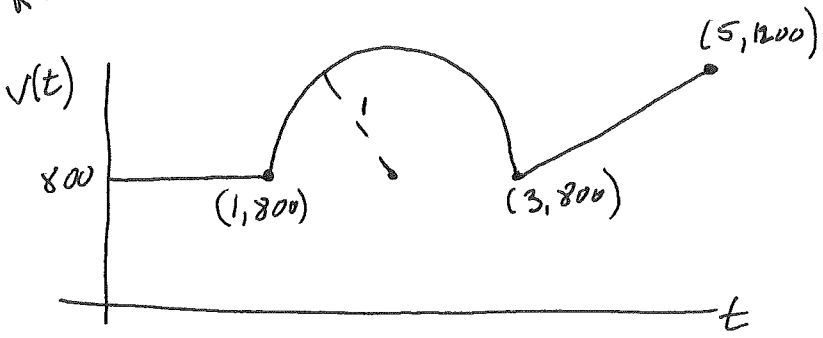
3840ft

CC Runner's Velocity

Runner 1

min	0	1	2	3	4	5
ft/min	0	1000	900	950	1100	900

Runner 2



Runner 3 $v(t) = 800 + 80t$

a) Find accel. of each at $t = 4$

b) Find displacement from $t = 0$ to $t = 5$, who is ahead?

c) Find $s(t)$ for runner 3 knowing that time 0 is the start of the race.

d) Find the ave. velocity of each runner from $t = 0$ to $t = 5$

e) If $A(x) = \int_0^x v(t)\,dt$. Find $A(4)$ and find $A'(x)$ for runner 3