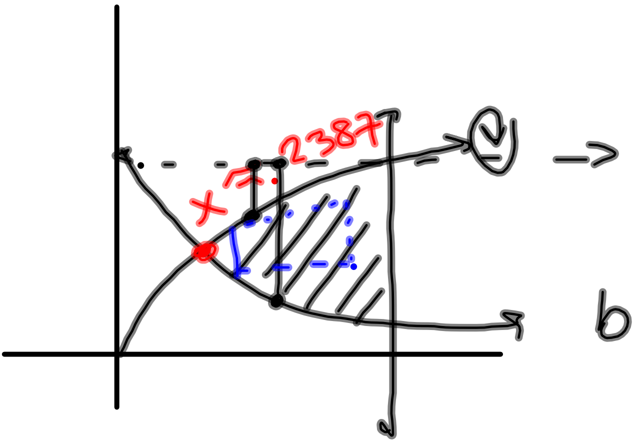
2003 FR

bounds: 1

1.



a. $A = \int_{.2387}^{1} \underline{(\sqrt{x} - e^{-3x})dx}$ 1

$\approx \underline{.443}$ 1

b. $V = \pi \int_{.2387}^{1} \underline{[(1-e^{-3x})^2 - (1-\sqrt{x})^2]} dx$ 2

$\approx \underline{1.424}$ 1

c. $A = lh$

$= \underbrace{(\sqrt{x} - e^{-3x})}_{l} \cdot \underbrace{5(\sqrt{x} - e^{-3x})}_{h}$

$= 5(\sqrt{x} - e^{-3x})^2$

$V = \int_{.2387}^{1} \underline{5(\sqrt{x} - e^{-3x})^2 dx}$ 2

$\approx \underline{1.554}$ 1

2. a. $a(t)=v'(t)$

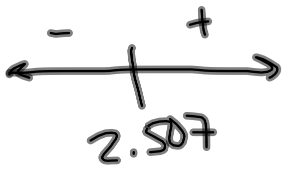
$a(2)=v'(2) \approx \underline{1.588}$ 1

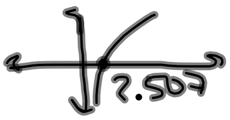
$\underline{v(2)=-3\sin 2<0 \text{, but } a(2)>0 \text{ so speed is dec.}}$ 1

b. $v(t)=0$

$\underline{t \approx 2.507}$ 1

Since 1 $\underline{v(t) \text{ changes from}}$ neg to pos @ $t \approx 2.507$, the particle changes direction.





c. $\left|\int_0^{2.507} v(t)dt\right| + \int_{2.507}^{3} v(t)dt$ $\qquad \int_0^3$ 1

1 $\approx 3.265 + 1.068 \approx \underline{4.333}$ 1

d. $\int_0^{2.507} v(t)dt \approx \underline{-3.265}$ 1

$s(2.507) = s(0) + \text{disp} = 1 + (-3.265) \approx \underline{-2.265}$

1

3. a. $R'(45) \approx \underline{\frac{R(50)-R(40)}{50-40}} = \frac{55-40}{10} = \underline{1.5 \text{ gal/min}^2}$

1 1

b. $\underline{R'(45) \text{ is a max}}$, so $\underline{R''(45) = 0}$.

1 1

c. $\int_0^{90} R(t)\,dt \approx 20(30)+30(10)+40(10)+55(20)+65(20)$

$\approx \underline{3700 \text{ gal}}$ 1

$\underline{\text{this approx is less than}}$ the actual value b/c R(t) is inc.

1

d. 1 $\left\{ \int_0^b R(t)\,dt \right.$ is the total amt. of fuel consumed for the first b minutes. (in gallons)

1 $\left\{ \frac{1}{b}\int_0^b R(t)\,dt \right.$ is The average value of the fuel consumed in gal/min for b minutes.

Units: 1

4. a. f is inc $\underline{\text{when } f' \text{ is pos}}$: $\underline{[-3,-2)}$ 1 1

b. $\underline{f' \text{ has max/min}}$: $\underline{x=0 \quad x=2}$ 1 1

c. $(0,3)$

m: $f'(0) = -2$

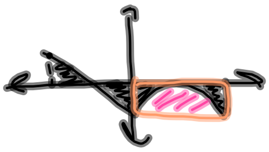
$\underline{y-3=-2(x-0)}$ 1

$y = -2x+3$

d. $f(-3) = f(0) + \text{disp}$

$f(0) + \int_0^{-3} f'(t)\,dt$

$f(0) - \int_{-3}^{0} f'(t)\,dt$



$3 - \underline{\left(\frac{1}{2}(1)(1) - \frac{1}{2}(2)(2)\right)} = \underline{\frac{9}{2}}$ 1 1

$f(4) = f(0) + \int_0^4 f'(t)\,dt$

$3 + \underline{\left(\underline{-8} - (\underline{-2\pi})\right)} = \underline{-5+2\pi}$ 1 1

5.

a. $V=\pi r^2 h$

$V=25\pi h$

1 $\boxed{\frac{dV}{dt}}=25\pi\frac{dh}{dt}$

$\boxed{\frac{dV}{dt}}=-5\pi\sqrt{h}$ 1

$$\frac{\cancel{25\pi}\frac{dh}{dt}}{\cancel{25\pi}}=-\frac{\overset{1}{\cancel{5\pi}}\sqrt{h}}{\underset{5}{\cancel{25\pi}}}$$

$\frac{dh}{dt}=\frac{-\sqrt{h}}{5}$ 1

b. $h(0)=17$ $\frac{dh}{dt}=\frac{-\sqrt{h}}{5}$

$\int\frac{dh}{\sqrt{h}}=\int-\frac{1}{5}\,dt$ 1

1 $2\sqrt{h}=-\frac{1}{5}t\boxed{+C}$ 1

1 $2\sqrt{17}=0+C$

$C=2\sqrt{17}$

$2\sqrt{h}=-\frac{1}{5}t+2\sqrt{17}$

$\sqrt{h}=-\frac{1}{10}t+\sqrt{17}$

$h=\left(-\frac{1}{10}t+\sqrt{17}\right)^2$ 1

c. $h(t)=0$

$\left(-\frac{1}{10}t+\sqrt{17}\right)^2=0$

$-\frac{1}{10}t+\sqrt{17}=0$

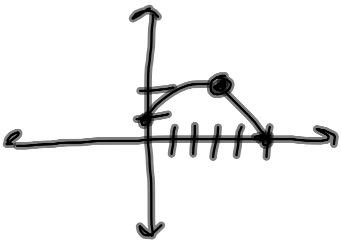
$-\frac{1}{10}t=-\sqrt{17}$

$t=10\sqrt{17}$ 1

6. a.

x	y
0	1
3	2

x	y
3	2
5	0



graph or L&R lim : 1

OR $\lim_{x\to3^-} f(x) = 2$ and $\lim_{x\to3^+} f(x) = 2$

f(x) is cont. b/c $\lim_{x\to3} f(x) = f(3)$ 1

b. $av(f) = \frac{1}{5-0}\int_0^5 f(x)dx$

$= \frac{1}{5}\left(\int_0^3 \overset{\sqrt{x+1}}{f(x)}dx + \int_3^5 f(x)dx\right)$ 1

$= \frac{1}{5}\left(\frac{2}{3}(x+1)^{\frac{3}{2}}\Big|_0^3 + \left(5x-\frac{1}{2}x^2\right)\Big|_3^5\right)$

1 1

$= \frac{1}{5}\left(\frac{20}{3}\right) = \frac{4}{3}$ 1

c. $K\sqrt{3+1} = 3m+2$

deriv are =

$K\left(\frac{1}{2\sqrt{x+1}}\right) = m$

y-val are = $2K = 3m+2$ 1

$\frac{K}{2\sqrt{3+1}} = m$

$\frac{K}{4} = m$ 1

$2K = 3\left(\frac{K}{4}\right)+2$

$\frac{5K}{4} = 2$

1 $K = \frac{8}{5}$ $m = \frac{2}{5}$