Ch 5.3 FUNDAMENTAL THM INTERPRETATIONS $\boxed{\text{DAY 86}}$ ©

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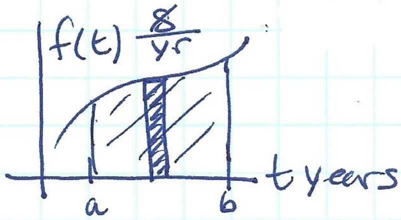
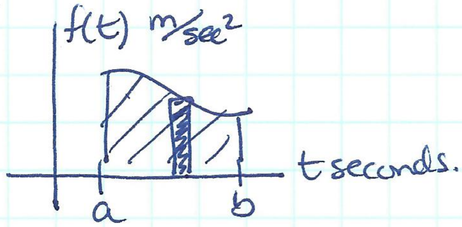
(1)



$$\int_a^b f(t)\,dt = \left(\frac{\$}{yr}\right)(yr) = \$$$

$\int_a^b f(t)\,dt$ is the total change in $\underline{\text{dollars}}$ (cost?) from $t=a$ to $t=b$. measured in $\underline{\$}$.

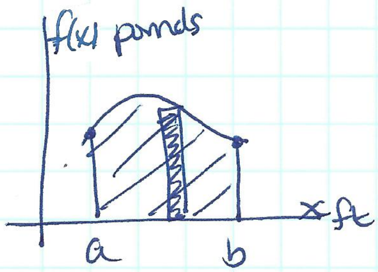
(2)



$$\int_a^b f(t)\,dt = \left(\frac{m}{sec^2}\right)(sec) = \frac{m}{sec}$$

$\int_a^b f(t)\,dt$ is the total change in $\underline{\text{velocity}}$ from $t=a$ to $t=b$ measured in $\underline{\text{meters per second}}$.

(3)



$\int_a^b f(x)\,dx$ is the total change in $\underline{\text{WORK}}$ measured in $\underline{\text{foot-pounds}}$.

$$\int_a^b f(x)\,dx = (\text{pounds})(\text{feet})$$

(4) $\int_1^3 v(t)\,dt$ $\quad v(t)\ \frac{m}{sec}$ $\quad t$ in sec

is the total change in $\underline{\text{position}}$ from $t=1$ to $t=3$ seconds measured in $\left(\frac{\text{meters}}{\text{sec}}\right)(\text{sec}) = \text{meters}$.

(5) $\int_0^6 a(t)\,dt$ $\quad a(t)\ \frac{m}{sec^2}$ $\quad t$ in sec.

is the total change in $\underline{\text{velocity}}$ from $t=0$ to $t=6$ seconds measured in $\left(\frac{m}{sec^2}\right)(sec) = \frac{\text{meters}}{\text{seconds}}$.

(6) $\int_{2005}^{2011} f(t)\,dt$ $\quad f(t)\ \frac{\text{billions of people}}{\text{year}}$ $\quad t$ in years.

is the total change in population from year 2005 to 2011 measured in $\left(\frac{\text{billions of people}}{\text{year}}\right)(\text{year}) = \text{billions of people}$.

12AY86

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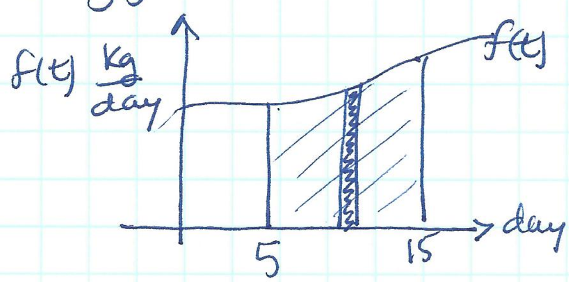
(19) Pollution removed from a lake on day t at a rate of f(t) kg/day.

a) $f(12) = 500$ On the 12th day pollution is being removed at a rate of 500 kg/day.

b) $\int_5^{15} f(t)\,dt = 4000$



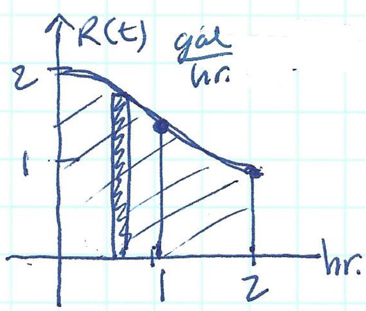
$\left(\frac{kg}{day}\right)(day) = kg$

c) On the interval from day 5 to day 15, a total of 4000 kg of pollution were removed from the lake.

(21) Water leaks out of a tank at a Rate of R(t) $\frac{gallons}{hour}$ where t is in hours.

a) $\int_0^2 R(t)\,dt$ = the total amount of water that has leaked out of the tank in the first two hours.

b)



estimates
$R(0) = 2$
$R(1) = 1.625$
$R(2) = 0.88$

c) use graph in textbook.

upper estimate: $LHS = 1\,(2 + 1.625) = 3.625$ gallons

under estimate: $RHS = 1\,(1.625 + .88) = 2.505$ gallons.

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(23) Rate of world oil is consumed (in billions of barrels per year) $r = f(t)$
t (in years) since 2004. $\to t = 0$.

a) $\int_0^5 f(t)\,dt$ = total Qty of oil consumed btwn 2004 & 2009.

b) $r(t) = 32e^{0.05t}$

	2004	2005	2006	2007	2008	2009
t	0	1	2	3	4	5
$r(t)$	32	33.641	35.365	37.179	39.085	41.089

$\to$ LHS $= (1)(r(0) + r(1) + r(2) + r(3) + r(4))$
$= 1(177.2697285)$
$= 177.269$ or 177.270 billions of barrels of oil consumed from 2004–2009

RHS $= (1)(r(1) + r(2) + r(3) + r(4) + r(5))$
$= 1(186.3585418)$
$= 186.358$ or 186.359 billions of barrels of oil consumed from 2004–2009.

c) LHS $= \underset{\boxed{\text{width of each interval}}}{(1 \text{ year})} \cdot (r(0) + r(1) + r(2) + r(3) + r(4))$

$r(0)$: rate of oil consumption in 2004 in barrels per year.

rate of oil consumption in barrels per year: $r(1)$ in 2005, $r(2)$ in 2006, $r(3)$ in 2007, $r(4)$ in 2008

(24) Bungee jumper velocity $v(t) = -4t^2 + 16t$ meters/sec. on $0 \le t \le 5$ seconds.

a) $\int_0^5 v(t)\,dt \Rightarrow$ total number of meters the jumper travels downward in the first 5 seconds
$= 33\frac{1}{3}$ meters

b) The jumper is $33\frac{1}{3}$ meters below the platform from which jumped

c) see part (a).

(26) Annual U.S. coal production (in billion tons per year) btwn 1997–2009. $r = f(t)$ = rate of production.

Yr	97	99	01	03	05	07	09
Rate	1.090	1.094	1.121	1.072	1.132	1.147	1.073

$\int_0^{12} f(t)\,dt$

year $= 1997 \to t = 0$
$2009 \to t = 12$