KEY

AP Calculus – Additional Semester 1 Review Problems

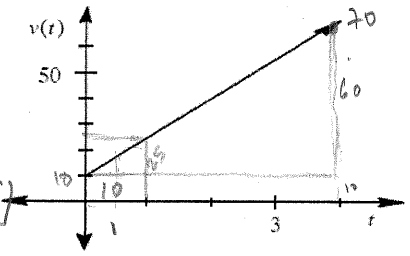
While driving to work, Mr. Matlack's velocity was $v(t) = 15t + 10$, where t is hours and $v(t)$ is miles per hour. Determine how far Mr. Matlack lives from school if it takes him:

a. 1 hour to get to work. $10t + \frac{1}{2}(1)(15)$ 17.5

b. 4 hours to get to work. $4(10) + \frac{1}{2}(4)(60) =$ 160

c. $\frac{1}{2}$ hour to get to work. $\frac{1}{2}(10) + \frac{1}{2}(\frac{1}{2})(15(\frac{1}{2}) + 10 - 10) =$ 6.875

d. t hours to get to work.



$10t + \frac{1}{2}(t)(15t)$

$10t + \frac{15}{2}t^2$ OR $S v(t) = \frac{15}{2}t^2 + 10t$

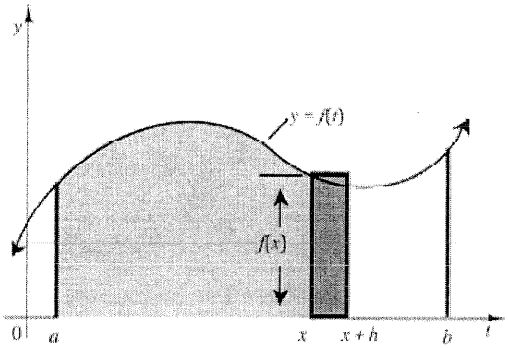
Now examine $A'(x)$ analytically.

If $A(x) = \int_c^x f(t)\,dt$ then:

$A'(x) = \frac{d}{dx}\int_c^x f(t)\,dt$

$A'(x) = \frac{d}{dx}(F(x) - F(c))$

$A'(x) = \frac{d}{dx}(F(x)) - \frac{d}{dx}(F(c))$



How can we further simplify $\frac{d}{dx}(F(x)) - \frac{d}{dx}(F(c))$?

↑ Constant = 0

$f(x) + 0$

Use the Fundamental Theorem of Calculus to evaluate each expression and compare the results.

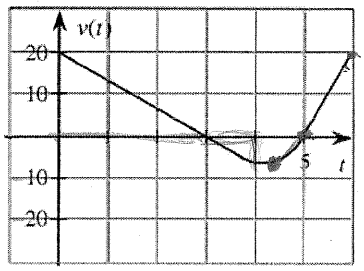
a. $\frac{d}{dx}\int_3^x (3x-5)\,dx$ $3x-5$

b. $\int_3^x \frac{d}{dx}(3x-5)\,dx$ $f(b) - f(a)$ $3x - 3(3)$ $= 3x - 9$

c. $\frac{d}{dx}\int_3^5 (3x-5)\,dx$ 0

d. $\int \frac{d}{dx}(3x-5)\,dx$ $3x + C$

The graph at right shows the velocity (in miles per hour) of a car during a road trip. At time $t = 0$, the car was on the Golden Gate Bridge heading north.



(5,0) (6,20)

$m = \frac{20}{1} = m = 20$

$y = mx + b$

$0 = 20(5) + b$

$-100 = b$

$y = 20x - 100$

a. Find a function for $v(t)$.

$$v(t) = \begin{cases} \frac{-20}{3}t + 20 & 0 \le t \le 4.5 \\ 20t - 100 & 4.5 < t \le 5 \end{cases}$$

b. How far north has the car traveled at 3 hours? At 4 hours?

$\frac{1}{2}(3)(20) =$ 30 miles

$\frac{1}{2} \cdot b \cdot h$

$30 + \frac{1}{2}(1)\left|\frac{20}{3}(4) + 20\right| = \frac{100}{3}$

c. Explain what happened to the car between $3 \le t \le 5$ hours.

Changed direction

d. Set up an integral to represent the displacement from $0 \le x \le 5$.

$\int_0^5 v(t)\,dt$

e. Set up an integral to represent the total distance from $0 \le x \le 5$.

Total dist $= \int_0^5 |v(t)|\,dt$

need only (+) !!