1. Compute $\int x^2(3-x)\,dx$ $= \int (3x^2 - x^3)\,dx$

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

2. Compute $\int \left(9\sqrt{x} - 3\sec(x)\tan(x)\right) dx$ $= \int \left(9x^{\frac{1}{2}} - 3\sec x \tan x\right) dx$

$= 9 \cdot \frac{2}{3} x^{3/2} - \sec x + C$

$= 6x^{3/2} - \sec x + C$

3. Find an antiderivative of $f(x) = \frac{1}{x^2}$ that does not have the form $-1/x + C$.

$f(x) = x^{-2}$, $F(x) = -x^{-1}$ oh, yeah, right...

$$F(x) = \begin{cases} -x^{-1} + 1 & \text{for } x > 0 \\ -x^{-1} + 10 & \text{for } x < 0 \end{cases}$$

4. Snow is falling on my garden at a rate of

$$A(t) = 10e^{-2t}$$

kilograms per hour for $0 \le t \le 2$, where t is measured in hours.

a. If $m(t)$ is the total mass of snow on my garden, how are $m(t)$ and $A(t)$ related to each other?

$m'(t) = A(t)$

b. What does $m(2) - m(0)$ represent?

How much snow fell in the first two hours in kg.

c. Find an antiderivative of $A(t)$.

$F(t) = -5e^{-2t}\ (+C)$

any constant including 0 will be ok.

d. Compute the total amount of snow accumulation from $t = 0$ to $t = 1$.

$F(1) - F(0) = -5e^{-2} - (-5) = 5 - \frac{5}{e^2} = 5\left(1 - \frac{1}{e^2}\right)$

e. Compute the total amount of snow accumulation from $t = 0$ to $t = 2$.

$F(2) - F(0) = -5e^{-4} - (-5) = 5\left(1 - \frac{1}{e^4}\right)$

f. From the information given so far, can you compute $m(2)$?

Nope.

g. Suppose $m(0) = 9$. Compute $m(1)$ and $m(2)$.

$m(1) = 9 + 5(1 - e^{-2})$

$m(2) = 9 + 5(1 - e^{-4})$

An

5. A airplane is descending. Its rate of change of height is $r(t) = -4t + \frac{t^2}{10}$ meters per second.

a. if $A(t)$ is the altitude of the airplane in meters, how are $A(t)$ and $r(t)$ related?

$$A'(t) = r(t)$$

b. What physical quantity does $\int_1^3 r(t)\,dt$ represent?

The net change in altitude from the first to the third second.

c. Compute $A(3) - A(1)$.

$$A(3) - A(1) = \int_1^3 r(t)\,dt = \int_1^3 -4t + \frac{t^2}{10}\,dt$$

$$= -2t^2 + \frac{1}{30}t^3 \Big|_1^3$$

$$= \left(-2 \cdot 3^2 + \frac{3^3}{30}\right) - \left(-2 + \frac{1}{30}\right) = -18 + 2 + \frac{27}{30} - \frac{1}{30} = -16 + \frac{26}{30}$$

$$\approx -15.13 \text{ m}$$

6. Gravel is being added to a pile at a rate of rate of $1 + t^2$ tons per minute for $0 \le t \le 10$ minutes. If $G(t)$ is the amount of gravel (in tons) in the pile at time t, compute $G(10) - G(0)$.

$$G(10) - G(0) = \int_0^{10} (1 + t^2)\,dt = t + \frac{1}{3}t^3 \Big|_0^{10} = \left(10 + \frac{10^3}{3}\right) - (0)$$

$$= 10 + \frac{1000}{3} \approx 343.3 \text{ tons}$$