Worksheet 9

Problem 1. Use substitution to evaluate the following.

a) $\displaystyle\int (-4t+1)^3\,dt$

b) $\displaystyle\int \frac{3\,du}{\sqrt{3u-5}}$

c) $\displaystyle\int \frac{e^{\sqrt{y}}}{2\sqrt{y}}\,dy$

d) $\displaystyle\int \frac{\ln x}{x}\,dx$

e) $\displaystyle\int \frac{x^3+2x}{x^4+4x^2+7}\,dx$

f) $\displaystyle\int re^{-r^2}\,dr$

g) $\displaystyle\int p(p+1)^5\,dp$

h) $\displaystyle\int \frac{2x}{(x+5)^6}\,dx$

Problem 2. The total amount of a biochemical compound excreted at time t is $f(t)$, and the rate of excretion is given by

$$f'(t) = 0.01e^{-0.01t}.$$

Find the total amount excreted at time 10 if 0 units are excreted at time 0.

Problem 3. An epidemic is growing in a region at the rate

$$N'(t) = \frac{100t}{t^2+2}$$

people per day, where $N(t)$ is the number of people infected after t days. Find a formula for the number of people infected after t days, given that 37 people were infected at day 0.

Problem 4. A company incurs debt at a rate of

$$D'(t) = 90(t+6)\sqrt{t^2+12t}$$

dollars per year, where t is the amount of time in years since the company began. By the fourth year, the company has accumulated \$16,260 in debt. How many years must pass before the total debt exceeds \$40,000?

Problem 5. An object is dropped from a plane flying at 6400 ft from the ground. Its initial velocity is 0 ft/s, and as it is falling, the acceleration of the object is constantly -32 ft/s^2. How long will it take the object to hit the ground?

Problem 6. A small rocket is launched straight up from a platform. After 5 seconds, it reaches a maximum height of 412 ft. Find the initial velocity and height of the rocket. (The acceleration of the rocket is constantly -32 ft/s^2.)