EMT 121 - Worksheet II

Monday April 12, 2010

1. Evaluate the following.

   (a) $\int \sin \sqrt{x}\, dx$

   (b) $\int_1^4 e^{\sqrt{x}}\, dx$

   (c) $\int x^5 e^{x^2}\, dx$

2. Evaluate $\int x\sqrt{x+1}\,dx$ using

(a) substitution.

(b) integration by parts.

(c) Show that the answer for part (a) is the same as that for part (b).

3. Use Integration by parts to prove the reduction formula.

(a) $\displaystyle\int (\ln x)^n \, dx = \; x(\ln x)^n - n \int (\ln x)^{n-1} \, dx$

(b) $\displaystyle\int x^n e^x \, dx = \; x^n e^x - n \int x^{n-1} e^x \, dx$

4. A rocket accelerates by burning its onboard fuel, so its mass decreases with time. Suppose the initial mass of the rocket at liftoff (including its fuel) is m, the fuel is comsumed at rate r, and the exhaust gases are ejected with constant velocity v_e (relative to the rocket). A model for the velocity of the rocket at time t is given by the equation

$$v(t) = -gt - v_e \ln \frac{m - rt}{m}$$

where g is the acceleration due to gravity and t is not too large. If $g = 9.8m/s^2$, $m = 30000kg$, $r = 160kg/s$, and $v_e = 3000m/s$, find the height of the rocket one minute after liftoff.

5. The table below gives the power consumption in megawatts in a certain city from midnight to 6:00 A.M. on a certain date. Use Simpson's Rule to estimate the energy used during that time period.(Use the fact that power is the derivative of energy.)

t	P	t	P
0:00	1814	3:30	1611
0:30	1735	4:00	1621
1:00	1686	4:30	1666
1:30	1646	5:00	1745
2:00	1637	5:30	1886
2:30	1609	6:00	2052
3:00	1604		