Integration problems.

1. Calculate integrals

a) $\int x^7 dx$

b) $\int 5x^3 dx$

c) $\int (3x^5 + 7x^{10}) dx$

d) $\int (x^3 + 10) 3x^2 dx$

e) $\int (x^6 + 6x)(x^5 + x) dx$

f) $\int (2x/(x^2 + 3)^2) dx$

g) $\int x^2 \sqrt{x^3 + 2} dx$

A couple of problems related to differentiation.

2. Water is pored into a conical bucket at a rate 50 cubic inches per minute.

How fast is the water level in the bucket rising at the moment when the area of the water surface is 100 sqare inches?

3. A sperical balloon is pumped up at 5 cubic inches per second. How fast

is its area growing when its radius is 10 inches?

More integration problems.

4. Figure out what is wrong with the proof that $0 = 1$ on page 17 of the text.

5. Conservation of energy via chain rule (see pages 17-19 of the text).

a) Check that the gravity force pulling the stone down is equal to $-dP/dy$ where $P(y)$ is the potential energy of the stone.

b) Check that Newton's Second law can be rewritten as $my'' + dP/dy = 0$.

c) Use the chain rule to calculate the time derivative E' of the energy and use the equation from b) to show that $E' = 0$, which implies that E does not change with time, i.e. energy is conserved.

6. Additional integration problems

a) $\int (x^5 + 3x^4 - 7)^{10} (5x^4 + 12x^3) dx$

b) $f''(x) = x^5 + x^3 + 7x^2 + 1$, $f(0) = 1$, $f(1) = 3$. Find f