Form A

5. (6 points) Suppose a producer has determined that its cost function, measured in dollars, is given by C(x) = 1000 + 10x where x is the number of units produced and sold. The firm's revenue function, in dollars, is given by $R(x) = 200x - \frac{1}{2}x^2$.

a. Specify the profit function P(x). $P(x) = 200x - \frac{1}{2}x^2 - 1000 - 10x$

the profit function is $\boxed{P(x) = 190x - \frac{1}{2}x^2 - 1000}$

b. Specify the marginal profit for any x.

the marginal profit is $\boxed{P'(x) = 190 - x}$

c. Find P'(100) and interpret the result.

$\boxed{P'(100) = 90} \Rightarrow$ $90 is approximate profit due to sale of 101^{st} item.

d. What is the producer's maximum profit? How many units produced and sold yield that maximum profit?

Profit is maximized when $\boxed{190}$ are produced and sold

that profit is $P(190) = 1\cancel{9000 - \frac{1}{2}(10000) - 1000} = \boxed{\$17050}$

Form A

6. (7 points) The population of a city is increasing at the rate given by $P'(t) = 2000e^{0.04t}$, where t is time in years from the beginning of 2000 and P(t) is the population of the city t years after the beginning of 2000, 2001,

a. At what rate was the population growing at the beginning of 2003?

$P'(3) = 2000e^{0.04(3)} = 2255$ people/year

At the beginning of 2003 the population is growing by 2255 people/YR.

b. Show how to use integration to help you determine the change in population from the beginning of 2000 and the beginning of 2004.

$$\int_0^4 2000e^{0.04t}\,dt \approx 8676$$

The population increases by 8676 people during the period.

c. What was the city's population at the beginning of 2000?

$P(t) = 50,000\,e^{0.04t}$

So, $P(0) = 50,000$

At the beginning of 2000 the population was 50,000