

## MA 16010 LESSON 5: INSTANTANEOUS RATES OF CHANGE (PROBLEM SET)

**Example 1:** The initial population of a culture of bacteria is 1000. The population after  $t$  hours,  $P(t)$ , is given by

$$P(t) = 2t^2 + 8t + 1000$$

a) Find the number of bacteria present after 5 hours.

b) Find the rate of change of the population after 5 hrs.

**Example 2:** The population of a city since the year 2000 can be modeled by

$$P(t) = 500t^2 - 400t + 20000$$

where  $t = 0$  corresponds to the year of 2000. In which year is the population increasing at the rate of 8600 people per year?

**Example 3:** An object is shot upward from the surface of Earth. The position function is

$$s(t) = -4.9t^2 + 98t$$

a) Find  $v(t)$

b) Find  $v(3)$

c) What is the velocity of the object when it hits the ground?

d) When is the object at its highest point?

**Example 4:** Let  $C = 2\pi r$ . What is the rate of change of  $C$  with respect to  $r$ ?

**Example 5:** Let  $p = 3q - 5$ .

a) What is the rate of change of  $p$  with respect to  $q$ ?

b) What is the rate of change of  $q$  with respect to  $p$ ?