**3.3 Rates of Change in the Natural Sciences**

Remember: a derivative can be interpreted as a rate of change

Instantaneous rate of change =

A spherical weather balloon is being inflated. Find the rate of change of the volume with respect to the radius when the radius is 10 cm.

The function  is the number of individuals in a bacteria or animal population at time *t*. The change in colony size is  over the time period .

Therefore, the average rate of growth =

The instantaneous rate of growth =

The population of a bacteria culture after *t* hours is given by . Find the rate of growth after 5 hours.

The linear density, , of a rod or piece of wire is defined as . If a rod is not homogeneous (uniform), then its mass is measured by  from its left hand end to a variable point *x* on the rod.

Therefore, the average density =

The linear density at any given point *x* =

The mass of the left-hand *x* metres of a rod is .

1. Find the average density of the part of the rod given by 
2. Find the linear density at 