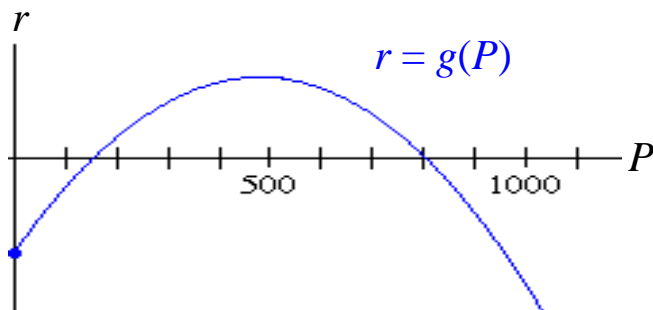
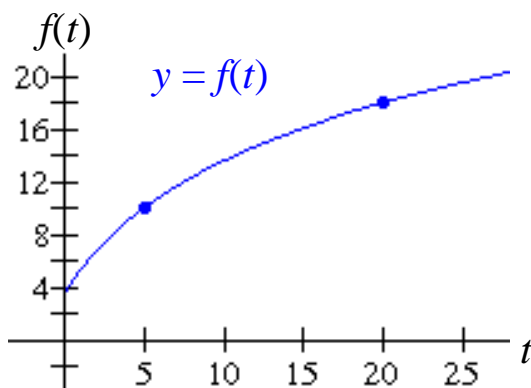


1. The growth rate,  $r$ , for a population is a function of the current population,  $P$ . The graph of this function is shown below. This particular relationship gives rise to a logistic growth model that includes *harvesting*.



- (a) The values of  $P$  for which  $r = 0$  are called *equilibrium points*. Estimate the equilibrium points for this population.
- (b) For what size populations is the growth rate negative?
- (c) For what population size is the growth rate an absolute maximum?
- (d) For what size populations is the growth rate,  $r$ , increasing?
2. Suppose  $f(t)$  is the length of fur (in millimeters) of Eddie the dog  $t$  days since his last haircut. The graph of  $f(t)$  is shown.



Briefly explain what each expression represents in practical terms. Then find or estimate the value of each expression using the graph. Include units with your answer.

- (a)  $f(5)$
- (b)  $f(20) - f(5)$
- (c)  $\frac{f(20) - f(5)}{20 - 5}$