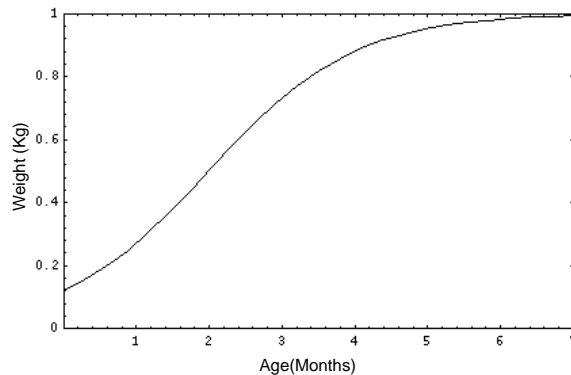


Math 152 - Sample Final Exam - Spring 2005

1. As a laboratory assignment in a biology class, you are asked to make observations on a fungal culture in a petri dish to test the hypothesis that the growth rate of the culture is proportional to the culture's size. How could you do this assuming that the easiest observation you can make is the area of the fungal colony? Give a condition under which you would conclude this hypothesis is refuted.

2. The growth in weight of a fish is given by



If  $W(t)$  gives the fish weight on month  $t$ , (a) Define  $W'(t)$  and state its units. (b) Estimate  $W'(2)$ . (c) Sketch a graph of how (approximately)  $W'(t)$  changes from age zero to age 6 months.

3. Find the following:

- (a)  $D_t y(t)$  if  $y(t) = 4t \ln(2t+1)$       (b)  $g'(x)$  if  $g(x) = x/(x+1)$   
 (c)  $\frac{df}{dy}$  if  $f(y) = \frac{1}{(3y^2 + 2y)^3}$       (d)  $D_t y(t)$  if  $y(t) = e^{\cos(4t)}$

4. The above ground biomass of a uniform age stand of trees is given by

$$B(a) = \frac{1500}{10 + 90 e^{-a/10}} \quad \text{tons/hectare where } a \text{ is the stand age in years.}$$

(a) If  $K$  = long-term biomass in this stand, find  $K$ . (b) What is the growth rate of the stand biomass? (c) At what age will the stand biomass be 1/2 of the long-term biomass (e.g. find  $a$  so that  $B(a) = K/2$ ). (d) It can be shown that

$$B'(a) = r B \left( \frac{K - B}{K} \right) \quad \text{where } r = 1/10 \text{ and } K \text{ is the value found in (a)}$$

Show that  $B'(a)$  is maximized when  $B(a) = K/2$  and thus state in words why you might wish to harvest the stand at the age you found in (c)

5. Find  $N(t)$  if  $N''(t) = 3t + 1$  and  $N'(0) = 4$  and  $N(0) = 2$

6. Find the area bounded between the graphs of  $y = 2x^2$  and  $y = 4x$ .