

7. Find the following:

(a) $\int (3x e^{-4x}) dx$ (b) $\int_{-1}^1 \frac{1}{(2-x)^3} dx$ (c) $\int \frac{\ln x}{x} dx$

8. The length of a fish of age t grows according to $L'(t) = K(L_\infty - L)$ so $L(t) = L_\infty(1 - e^{-K(t-t_0)})$ with $L_\infty = 40$ cm, $K = .2/\text{month}$ and $L(0) = 3$ cm. (a) How fast is the fish growing in length at birth? (b) At what age will the fish reach 1/2 of its largest length?

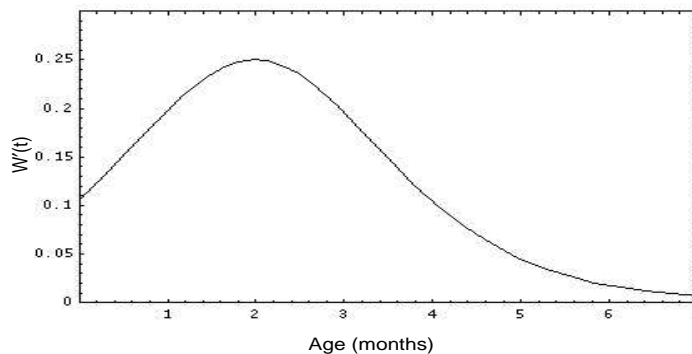
9. How much work is necessary to pump the contents of a tank of liquid of density 40 kg per cubic meter just over the top of the tank if the tank is cone shaped with a circular base of radius 6 meters and a circular top of radius 3 meters with the top being 12 meters above the ground. The tank is half full of liquid at the start (e.g. the level of liquid in the tank is 6 meters above the bottom of the tank).

10. Find (a) the solution of $y' = (2t+1)y$ if $y(0) = 4$.
 (b) all solutions of $\frac{dN}{dt} = \frac{N}{2t}$

Answers

1. If $A(t)$ = area of fungal culture at time t , $A'(t) = kA(t)$ implies $A(t) = A(0)e^{kt}$. So measure $A(t)$ at several times (e.g. t_1, t_2, t_3, \dots) and since $\ln A(t) = kt + \ln A(0)$, plot t_i versus $\ln A(t_i)$ on regular graph paper. If this gives a linear graph, accept the hypothesis, otherwise reject it. (Note: you could calculate R^2 from the linear regression and reject the hypothesis if R^2 is not above .5 say)

2. By Definition $W'(t) = \lim_{h \rightarrow 0} \frac{W(t+h) - W(t)}{h}$ gives the growth rate of the fish at a particular instant t , in kg/month and $W'(2)$ is approximately .25 kg/month



3. (a) $y'(t) = 4 \ln(2t+1) + 8t/(2t+1)$ (b) $g' = \frac{1}{(x+1)^2}$ (c) $f' = \frac{-6(3y+1)}{(3y^2+2y)^4}$
 (d) $y'(t) = -4(\sin 4t)e^{\cos 4t}$