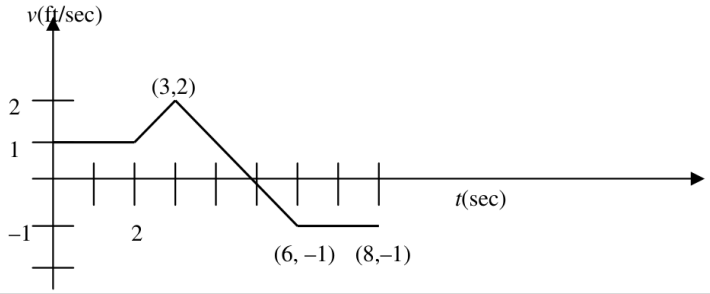
Exponential Growth & Decay

Numberbender | WORKSHEET

Name: _____ Date: _____ Score: _____

Solve each differential equation and application problem. Show all work.

Calculus I
Worksheet # 84

1	If $\frac{dN}{dt} = \frac{1}{5}$ N, and N(0) = 500, then N(t) =
2	The rate of increase of a population is given by $\frac{dN}{dt} = \frac{1}{2}$ N. If the initial population is 1000, then find the equation that will give the population at any time t.
3	The rate of mass decay for a certain radioactive substance is given by $\frac{dM}{dt} = -\frac{M}{50}$, where M is in grams and t is in years. If the initial mass of the substance is 250 grams, what mass will remain when t = 100ln 2 years?
4	Consider the curve $y^2 = 4 + x$ and the chord AB joining points A(–4,0) and B(0,2) on the curve. a) Find the x and y coordinate of the point on the curve where the tangent line is parallel to the chord AB. b) Find the area of the region R enclosed by the curve and the chord AB. c) Find the volume of the solid generated when the region R, defined in part (b), is revolved about the x-axis.
5	Find the first point of intersection of the curves f(x) = sin x and $g(x) = e^{-x}$.
	The graph is for **Questions 6 through 8**. It shows the velocity, in ft/sec for 0<t<8, of an object moving along a straight line. 
6	Find the object's average speed (in ft/sec) for this eight second interval.
7	When did the object return to the position it occupied at $t = 2$?
8	Find the object's average acceleration (in ft/sec^2) for this 8-second interval.
9	If $f(t) = \int_0^{t^2} \frac{1}{1+x^2}\,dx$, find $f'(t)$.

Answer key — for instructor use only.

10	Find the maximum value of the function $f(x) = x^4 - 4x^3 + 6$ on the interval [1,4].

Answers:

1) $500e^{\frac{t}{5}}$	2) $N = 1000e^{\frac{1}{2}}$	3) 62.5 g	4a) (-3, 1) b) $\frac{4}{3} \approx 1.333$ c) $\frac{8\pi}{3} \approx 8.378$	5) $x = 0.589$
6) 1	7) never	8) $-\frac{1}{4}$	9) $\frac{2t}{1+t^4}$	10) 6