

## Math 22 Section 9

### Quiz 10

1. Solve for  $x$ :

(a)  $2^{3x} = 16$

$$\log_2(2^{3x}) = \log_2 16$$

$$3x = 3, \text{ so } x = 1$$

(b)  $2\log x = \log 2 + \log(3x - 4)$

$$\log(x^2) = \log(6x - 8)$$

$$x^2 = 6x - 8$$

$$x^2 - 6x + 8 = 0$$

$$(x - 4)(x - 2) = 0$$

$$x = 4 \text{ or } x = 2$$

2. Recall that population growth can be modeled using  $p(t) = p_0 e^{rt}$  where  $r$  is the relative rate of growth and  $p_0$  is the initial population. If the population of a culture of bacteria doubles every hour, find the corresponding relative rate of growth  $r$ .

$$p(1) = 2p_0 = p_0 e^{r(1)} = p_0 e^r$$

$$\text{so } 2 = e^r \Rightarrow r = \ln 2$$

3. The mass (in grams) of a sample of thorium-234 remaining after  $t$  days is given by  $m(t) = 40e^{-.0277t}$ . After how many days will there be only 10 grams left?

$$10 = m(t) = 40e^{-.0277t}$$

$$\frac{1}{4} = e^{-.0277t}$$

$$\ln\frac{1}{4} = -.0277t$$

$$-2\ln 2 = -.0277t$$

$$t = \frac{2\ln 2}{.0277}$$

Extra Credit

Find all solutions to  $e^x - 12e^{-x} - 1 = 0$

Multiply both sides by  $e^x$  to get a quadratic

$$e^{2x} - e^x - 12 = 0$$

Factoring,

$$(e^x - 4)(e^x + 3) = 0$$

So  $e^x = 4$  or  $e^x = -3$

i.e.  $x = 2\ln 2$

This is the only solution because  $e^x = -3$  has no solution.