Quiz 2 **Calculus 1** **1/27/2006**

Each problem is worth 5 points. Clear and complete justification is required for full credit.

1. Suppose that a population of nasty mutant flesh-eating bacteria is doubling every 5 hours, and that initially there were 300 bacteria. Give a formula for the size of the population after t hours.

$$\boxed{P(t) = 300 \cdot 2^{t/5}}$$

t	$P(t)$
0	300
5	600
10	1200

Excellent

2. Suppose that the amount of radioactive strontium in a town's water supply is given by $S(t) = 5000 \cdot 2^{-t/29}$, where t is in years and $S(t)$ is in grams. How long will it take until less than 1000 grams remain?

$$s(t) = 5000 \cdot \left(\tfrac{1}{2}\right)^{t/29}$$

when will

$$1000 < 5000 \cdot \left(\tfrac{1}{2}\right)^{t/29}$$

$$\frac{1000}{5000} < \cdot \tfrac{1}{2}^{t/29}$$

$$\ln\left(\tfrac{1}{5}\right) < \ln\left(\tfrac{1}{2}\right)^{t/29}$$

$$\frac{\ln\left(\frac{1}{5}\right)}{\ln\left(\frac{1}{2}\right)} < t/29$$

Well done

$$\frac{\ln 1 - \ln 5}{\ln 1 - \ln 2} < t/29$$

$$\frac{-\ln 5}{-\ln 2} < t/29$$

$$29\left(\frac{\ln 5}{\ln 2}\right) < t$$

$$\boxed{t > 67.3359 \text{ yrs}}$$

check: $s(67.3359) = 5000 \left(\tfrac{1}{2}\right)^{67.3359/29}$

$= 1000$

$s(67.3360) = 5000 \cdot \tfrac{1}{2}^{67.3360/29}$

$= 999.9979$

true