WORKSHEET #3

1. We need to solve the equation

$$92 = 20 \log\left(\frac{P}{2 \times 10^{-5}}\right) \quad \text{or}$$

$$\log\left(\frac{P}{2 \cdot 10^{-5}}\right) = \frac{92}{20} = 4.6$$ Now convert to its exponential form (it is $\log = \log_{10}$)

so $$10^{4.6} = \frac{P}{2 \cdot 10^{-5}}$$ Hence $P = 2 \cdot 10^{-5} \cdot 10^{4.6}$

or $$P = 2 \cdot 10^{-5+4.6} = 2 \cdot 10^{-0.4} \cong \underline{\underline{0.7962}}$$

2. The exponential decay formula for a mass $m(t) = m_0 e^{rt}$ can be written as

$$m(t) = m_0 \left(\frac{1}{2}\right)^{t/h}$$ when t is the half-life

Thus $$\boxed{m(t) = 20\left(\frac{1}{2}\right)^{t/5730}}.$$ If we plug in $t = 2{,}000$ we obtain

$$m(2{,}000) = 20\left(\frac{1}{2}\right)^{\frac{2000}{5730}} \approx 15.7021$$

3. In this problem we use the formula for the growth of a population or a certain amount of principal in a bank

$$P(t) = P_0 (1+r)^t \qquad r = \text{rate of growth}$$

If r is negative (rate of decay) we have

$$P(t) = P_0 (1-r)^t \qquad \left(\text{a formula of decay}\right)$$

Thus in our case $A(t)$ = amount of drug in a patient's bloodstream is

$$= 5 \cdot (1 - 0.11)^t = \underline{5 \cdot (0.89)^t}$$

4. (1.) $N(t) = N_0 e^{rt} = 300 e^{rt}$

To find r we know that $N(5) = 5{,}000$

So $5000 = 300 e^{5r}$ OR $e^{5r} = 50/3$

Take "ln" to get $5r = \ln(50/3)$

or $r = \frac{1}{5} \ln(50/3) \approx \underline{0.5627}$

(2) We need to solve $\boxed{10{,}000 = 300 e^{\frac{1}{5}\ln\left(\frac{50}{3}\right) t}}$

Check that $t = 5 \cdot \dfrac{\ln(100/3)}{\ln(50/3)} \approx \underline{6.2318 \text{ hours}}$