

MATH. 125, QUIZ 3 - Section 3.4 and 3.5 (first part) (25points = 5% final grade) -
NO CALCULATOR ALLOWED - Fall 2009

1. (5 points each) Find exact solutions of the following equations; **show your work**; circle the final answer.

(a)

$$5^{3-x} = 25^{2x}$$

Solution: $5^{3-x} = 25^{2x} = (5^2)^{2x} = 5^{4x}$ so $3 - x = 4x$ so $3 = 5x$ and finally $x = \frac{3}{5}$

(b)

$$\log_2(2x + 1) + \log_2 2 = \log_2(x + 11)$$

Solution: $\log_2(2x + 1) + \log_2 2 = \log_2[(2x + 1) \times 2] = \log_2(x + 11)$ so $2(2x + 1) = x + 11$ so $4x + 2 = x + 11$ so $3x = 9$ and finally $x = 3$

(c)

$$\ln 10 - \ln(x + 3) - \ln x = 0$$

Solution: $0 = \ln 10 - \ln(x + 3) - \ln x = \ln \frac{10}{(x+3)x}$ so $\frac{10}{(x+3)x} = 1$ so $10 = (x + 3)x$ so $x^2 + 3x - 10 = 0$ so $x = 2$ or $x = -5$, the second one is not a valid solution since we can not take \ln of a negative number, so $x = 2$.

2. Half-life of bismuth-210 is 5 days. Assume the exponential model of decay $A = A_0 e^{kt}$.

(a) (1 point) After 15 days we shall have the following percentage of the original amount. Circle the correct answer.

- i. 5%
- ii. 12.5%
- iii. 15%
- iv. 25%
- v. 50%
- vi. 75%
- vii. non of the above

(b) (5 points) Initially we had 10 grams of bismuth-210; after 7 days we shall have the following number of grams left. Circle the correct answer.

- i. 7
- ii. 3
- iii. $10e^{-7 \ln 2}$
- iv. $10e^{-\ln 2}$
- v. $10e^{7 \ln 5}$
- vi. $10e^{\frac{7}{5} \ln 2}$
- vii. $10e^{-\frac{7}{5} \ln 2}$
- viii. $10e^{\frac{5}{7} \ln 5}$
- ix. non of the above

3. According to the US Census Bureau in the summer of 2000 the population of USA was approximately 281 millions. In the summer of 2008 the population was approximately 304 millions. Assume that the population is changing according to the standard exponential model: $A = A_0 e^{kt}$ (counting in millions), in which t is the number of years after 2000. Find the values of A_0 and of k ; circle the right answers.

$$(a) \text{ (2 points)} \left\{ \begin{array}{lll} A_0 = 2000 & A_0 = 2008 & \boxed{A_0 = 281} \\ A_0 = 304 & A_0 = \frac{281}{304} & \text{none of the above} \end{array} \right.$$

$$(b) \text{ (4 points)} \left\{ \begin{array}{llll} k = 2000 & k = 2008 & k = 8 & k = \frac{281}{304} \\ k = \ln \frac{281}{304} & k = \frac{\ln 281}{\ln 304} + 8 & k = 1 & \\ k = (\ln \frac{281}{304}) \div 8 & k = (\ln \frac{281}{304}) - 2000 & \boxed{\text{none of the above}} & \end{array} \right.$$