EXPONENTIAL GROWTH AND DECAY WORD PROBLEMS   NAME:
                                                   HOUR:

1.   From 1990 to 1997, the number of cell phone subscribers S (in thousands) in the US can be modeled by, $S = 5535.33(1.413)^t$ where t is number of years since 1990

      a.   Identify the growth factor and annual percent increase
      b.   Sketch a graph of the model
      c.   In what year was the number of cell phone subscribers about 31 million?
      d.   According to the model, in what year will the number of cell phone subscribers exceed 90 million?
      e.   Estimate the number of subscribers in 2010.
      f.   Do you think this model can be used to predict future number of cell phone subscribers?   Explain.

2.   From 1991 to 1995, the number of computers C per 100 people worldwide can be modeled by $C = 25.2(1.15)^t$ where t is the number of years since 1991

      a.   Identify the initial amount, the growth factor and the annual percent increase
      b.   Sketch a graph of the model
      c.   Estimate the number of computers in 2000

3.   Ten grams of Carbon 14 is stored in a container. The amount C (in grams) of Carbon 14 present after t years can be modeled by $C = 10(0.99987)^t$. How much is present after 1000 years?

4.   You deposit $2000 in an account that earns 5% annual interest. Find the balance after 1 year if the interest is compounded with the given frequency.
      A. annually   B. quarterly   C. monthly

5.   A customer purchases a television for $800 using a credit card. The interest is charged on an unpaid balance at a rate of 18% per year compounded monthly. If the customer makes no payment for one year, how much is owed at the end of the year?

6.   A diamond ring was purchased twenty years ago for $500. The value of the ring increased by 8% each year. What is the value of the ring today?

7.   In 1990 the tuition at a private college was $15000. During the next 9 years, tuition increased by about 7.2% each year.
       a.   Write a model giving the cost C of tuition at the college t years after 1990
       b.   Sketch a graph of the model
       c.   Estimate the year the tuition is $20,000
       d.   Estimate the tuition in 2010

8.   You deposit $1000 in an account that earns 2.5% annual interest. Find the balance after 3 years if the interest compounds with the given frequency.
       a.   monthly   b.   daily

9.   A house was purchased for $90,000 in 1995. If the value of the home increases 5% per year, what is it worth in the year 2020?

10. From 1990 to 1998, the value of the dollar has been shrinking. The value can be modeled by $V = 1.24(0.973)^t$ where t is the number of years since 1990

   a. How much was a dollar worth in 1993
   b. Sketch a graph of the model
   c. Estimate the year in which the dollar was worth $1.07

11. A tool & die business purchased a piece of equipment of $250,000. The value of the equipment depreciates at a rate of 12% each year.

   a. Write an exponential decay model for the value of equipment.
   b. What is the value of equipment after 5 years?
   c. Graph the model.
   d. Estimate when the equipment will have a value of $70,000

12. The number of newly reported cases of tuberculosis T (in thousands) in the US from 1991 to 1996 can be approximated by the equation, $T = 28.5(0.9567)^t$ where t represents the number of years since 1991

   a. Identify the initial amount, decay factor and annual percent decrease
   b. Sketch graph of model
   c. In what year was the number of newly reported cases in US approximately 25,000
   d. When will the number of newly reported cases be about 16,000
   e. Estimate the number of newly reported cases in 2005

Answers WS #2

1A)1.413 1B)See Graphs   ** 1C)In approx. 5yrs so 1995;Values are given in thousands 31 million= 31,000 thousand .Find approx. x value that gives y-value 0f 31,000   ** 1D) In approx. 8-9 yrs but closer to 8 so in 1998; 90 million = 90,000thousand. Find approx. x value that gives y-value 0f 90,000.   1E) 2010 gives t= 20.

$$S = 5535.33(1.413)^{20} = 5.57\,E6 = 5{,}570{,}000{,}000 \; subscribers.$$

1F)No eventually the market will become saturated.

2A) Int. Amt. 25.2, growth factor 1.15, % inc. 15%   2B) See Graphs 2C) when t=9 about 88.6 computers per 100 people.

3) when t = 1,000 years C = 8.78 grams.

4A) $A = 2000\left(1 + \dfrac{.05}{1}\right)^{1} = \$2{,}100$ 4B) $A = 2000\left(1 + \dfrac{.05}{4}\right)^{1(4)} = \$2{,}101.89$

4C) $A = 2000\left(1 + \dfrac{.05}{12}\right)^{1(12)} = \$2{,}102$ 5) $A = 800\left(1 + \dfrac{0.18}{12}\right)^{1(12)} = \$956.49$

6) $V = 500(1.08)^{20} = \$2{,}330.48$

$\quad$ *Growth factor* 1.08 ; *% increase* 8%

7A) $C = 1500(1.072)^{t}$ 7B) See Graphs   * *7C)Est. from graph when C = \$20,000; 4 yrs so 1994

7D) 20 yrs =t; \$ 60, 254.15

8 A) $A = 1000\left(1 + \dfrac{1.05}{12}\right)^{36} = 1{,}077.80$ 1B) $A = 1000\left(1 + \dfrac{1.05}{365}\right)^{36} = \$1{,}077.88$

9) $C = 90{,}000(1.05)^{25} = \$304{,}771.94$

10A) $1.24(0.973)^{3} = \$1.14$ 10B) See graphs   ** 10C) Est from graph when V= \$1.07 t=5 so in 1995

11A) $V = 250{,}000(0.88)^{t}$ 11B) $V = 250{,}000(0.88)^{5} = \$131{,}932.98$ 11C) See Graphs **11D)Est. from graph 10 years latter

12A) 28.5 thousand, 0.9567, 4.33%   12B)See graphs   12C) 2.8 yrs. Latter—1993

12D) 12 yrs latter—2003 12E) 15.34 thousand

12A) 28.5, 0 .9567, 4.33% 12B) See Graphs   **12C) plug in 25 for T(b/c values are entered in thousands.) Find approx. x value that gives y-value of 25. Between 2 & 3 yrs. approx 2.9 yrs. closer to 1994   **12D) plug in 16 for T (b/c values are entered in thousands.) Find approx. x value that gives y-value of 16. t approx. 12-13 yrs from 1991 so closer to 2004.   12E) t=14; 15.336 thousand= 15, 336

** C & D we can only estimate using the graph until studying logs. Then, we will be able to determine algebraically