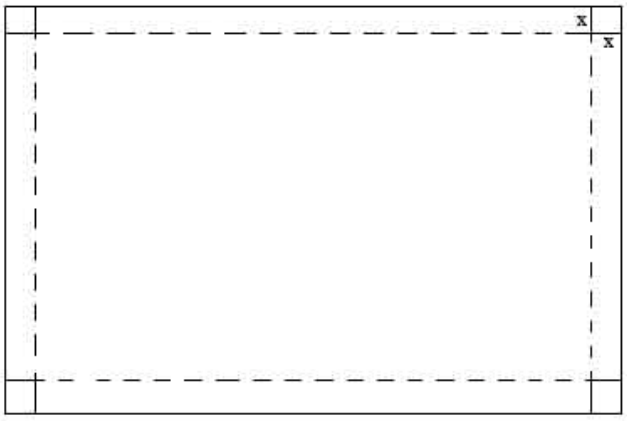
Word Problems

Refer to the following diagram for problems 1 and 2.



1) You are given a rectangular sheet of metal that is 32 inches by 24 inches. You are required to cut a length from each corner of the sheet so that you may fold up the ends and create a box. What is the domain of the function you will use to find the volume of the box? Explain your answer.

2) You are given a 14 inch by 8 inch rectangular sheet of metal from which you are to construct a box. You are to cut a length, x, from each corner of the sheet of metal so that you can fold up the sides creating a box. Find the value of x that will yield the maximum volume of the box. Round your solution to the nearest hundreth.

3) A rectangular field is twice as long as it is wide. If 3 feet are taken from the width, and 4 feet taken from the length, the resultant area of the field is $180\ \text{ft}^2$. Find the area of the original field.

4) The attendance A (in millions) at NCAA women's college basketball games for the year 1997 through 2003 is shown in the table, where t represents the year, with $t = 7$ corresponding to 1997.

Year, t	7	8	9	10	11	12	13
Attendance A	6.7	7.4	8.0	8.7	8.8	9.5	10.2

a) Use the regression feature of a graphing calculator to find a cubic model for the data.

b) Use the graphing utility to create a scatter plot of the data. Then graph the model and the scatter plot in the same viewing window. How do they compare?

c) According to the model found in part A, in what year did attendance reach 9 million?

d) According to the right hand behavior of the model, will the attendance continue to increase? Explain:

5) The table below shows the yield (in mg) of a chemical reaction in the first 6 minutes.

Time(minutes)	1	2	3	4	5	6
Yield (mg)	1.2	6.9	9.3	12.7	14.1	15.7

a) Create a scatter plot of the data. b) Find the best model to fit the data.

c) Using the model, determine in how many minutes will the yield be 20 mg.

6) The number y (in thousands) of hairdressers and cosmetologists in the United States for the years 1994 through 2002 are shown in the table.

year, x	1994	1995	1996	1997	1998	1999	2000	2001	2002
y	753	750	737	748	763	784	820	854	908

a) Use the graphing utility to create a scatter plot of the data. Let x represent the year with $x = 4$ corresponding to 1994.

b) Use the regression feature of the graphing utility to find a quadratic model for the data.

c) Use the graphing utility to graph the model in the same viewing window as the scatter plot. How well does the model fit the data?

d) Use the model to predict the number of hairdressers and cosmetologists in 2008.

7) The average monthly basic rates R (in dollars) for cable television in the United States for the years 1992 though 2002 are shown in the table, where t represents the year with $t = 2$ corresponding to 1992.

Year, t	2	3	4	5	6	7	8	9	10	11	12
Rate, R	19.08	19.39	21.62	23.07	24.41	26.48	27.81	28.92	30.37	32.87	34.71

a) Use a graphing utility to create a scatter plot of the data.

b) Use the regression feature of the graphing utility to find a cubic model for the data. Then graph the model in the same viewing window as the scatter plot. Compare the model with the data.

c) Use synthetic division to evaluate the model for the year 2008.

8) The population present in a bacteria culture over 5 days is given in the table below:

Time(days)	0	1	2	3	4	5
population	30	133	214	337	527	819

a) Create a scatter plot of the data. b) Find a good model for the data.

c) Estimate the population after 7 days.

9) A company decides to develop a cost equation based on the quantity of the product produced in a day. They collected the following data:

Quantity produced	20	35	50	65	80	95	110
cost	642.35	766.48	858.82	928.83	1005.32	1078.82	1140.79

a) Create a scatter plot of the data. b) Find a good model for the data

c) According to the model, how much will producing 195 units cost the company?

d) How many units could be produced for $800.

For the questions below, determine all intercepts and asymptotes in order to sketch the graph of the function. Then, separately, draw the graph for only the appropriate domain. Label the axes and show units.

10) The parks and wildlife commission introduces fish into a man-made lake. The population of the fish, in thousands, is given by $N(t) = \dfrac{20(4+3t)}{(1+0.05t)}$ where t is the time in years.

a) sketch the function for the appropriate domain.

b) Find the limiting number of fish in the lake.

c) Explain how you know the number of fish introduced into the lake.

11) A drug is administered to a patient and the concentration of the drug in the bloodstream is monitored. At the time (hrs) since the administration of the drug, they concentration in mg/L is given by $C(t) = \dfrac{43t}{(t^2+2)}$.

a) When the concentration dips below 4.5 mg/L, a new dose is administered. When does this need to occur?

b) Using your graphing calculator, determine the highest concentration of the drug, and when it occurs.

12) The cost C (in millions of dollars) of removing p% of the industrial and municipal pollutants discharged into a river is given by:

$$C = \frac{255p}{100-p}, \quad 0 \le p < 100$$

a) Use a graphing utility to graph the cost function.

b) Find the costs of removing 10%, 40%, and 75% of the pollutants.

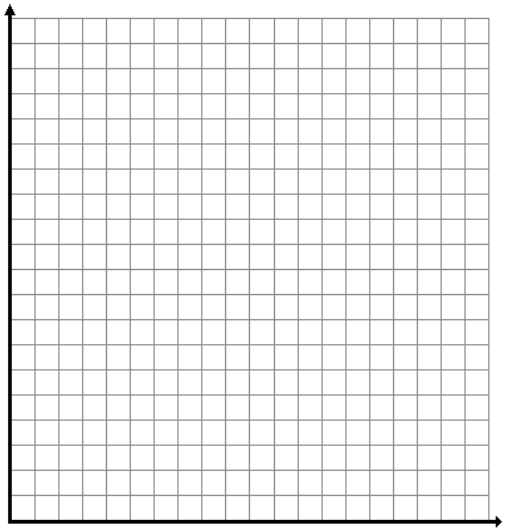
c) According to this model, would it be possible to remove 100% of the pollutants? Explain.

13) The game commission introduces 100 deer into newly aquired state game lands. The population N of the herd is modeled by: $N = \dfrac{20(5+3t)}{1+0.04t}$, $t \ge 0$, where t is time in years.

a) Find the populations when $t = 5,\ t = 10,\ and\ t = 25.$

b) What is the limiting size of the herd as time increases?

4



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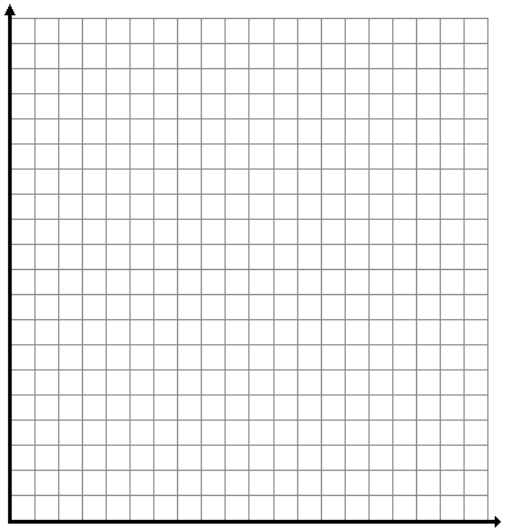

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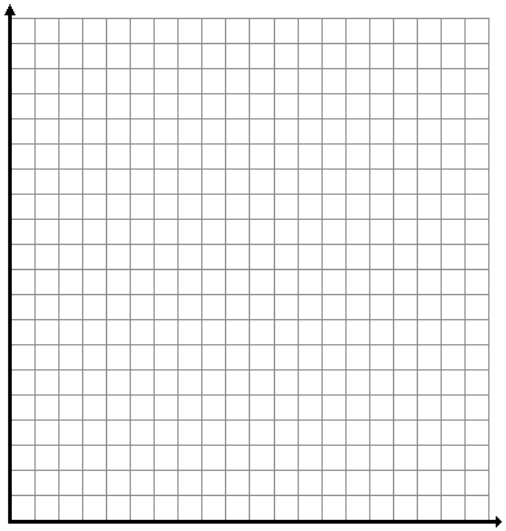

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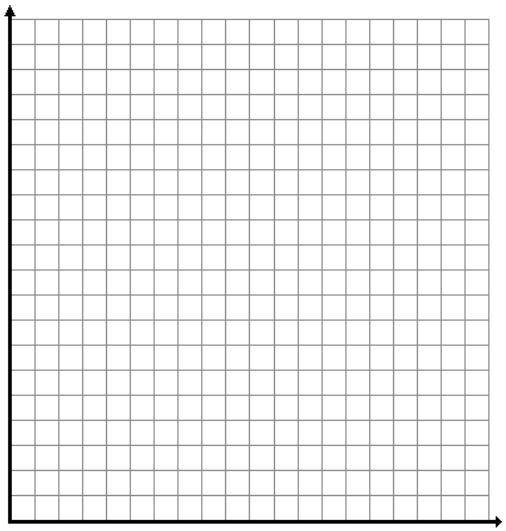

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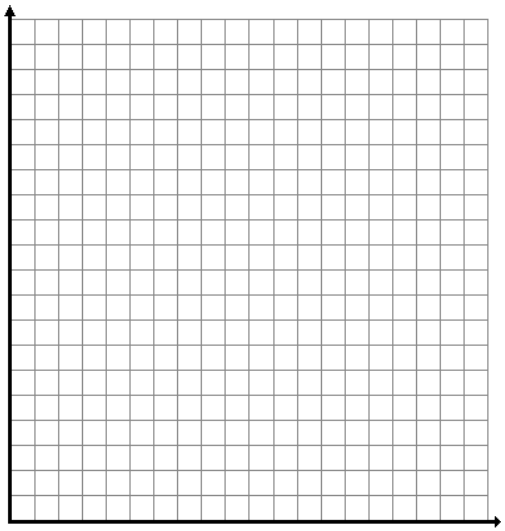

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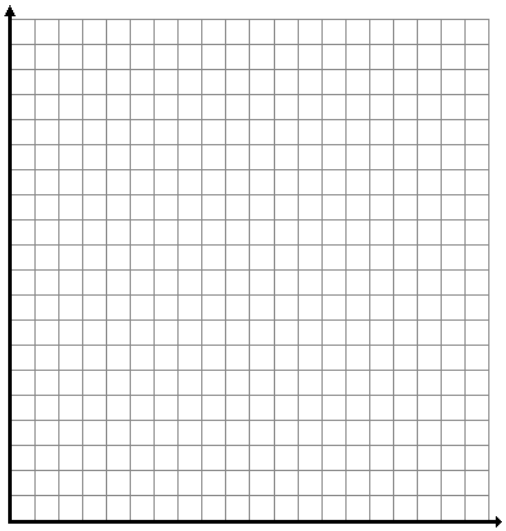

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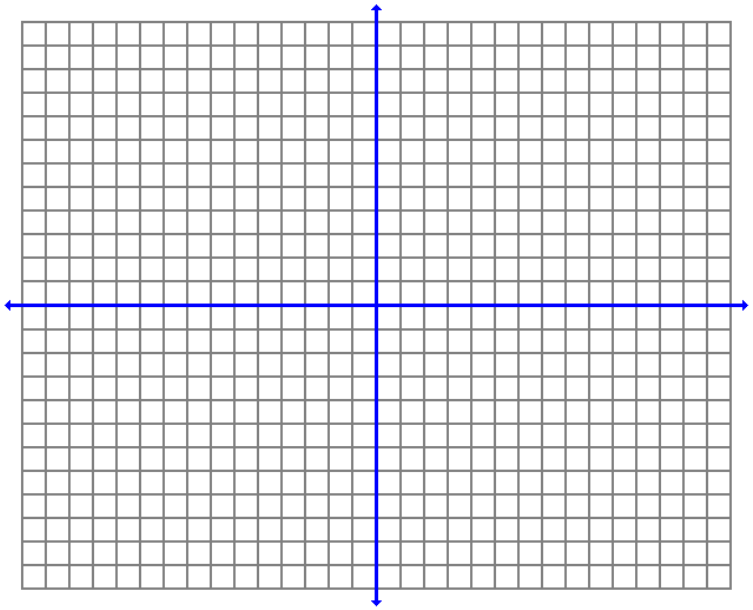

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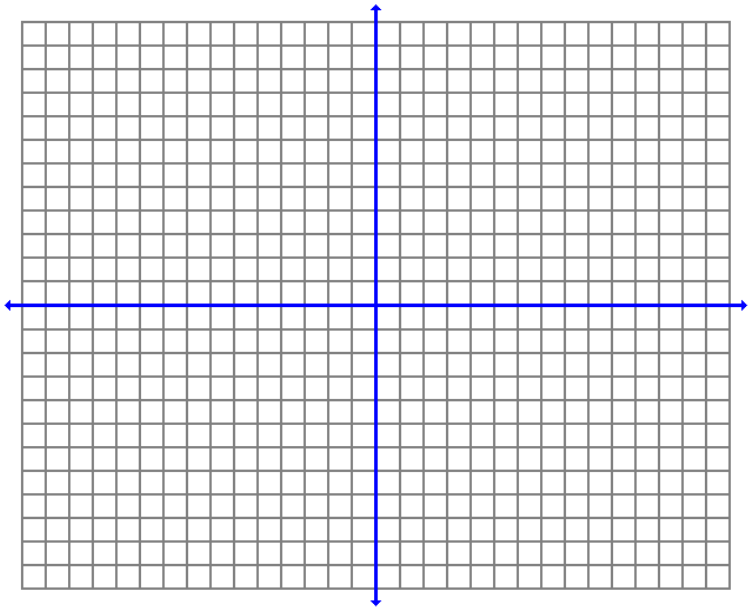

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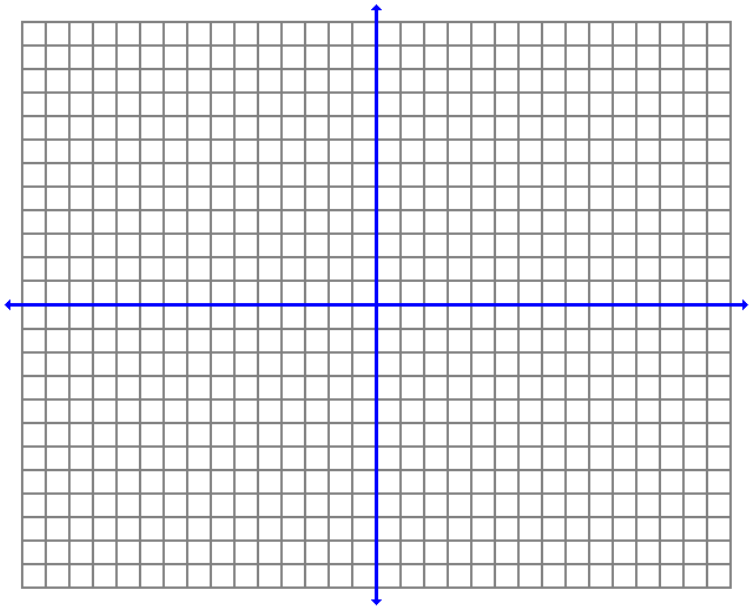

13