

fall '00

Pre-calculus

(note: could be adapted for
Algebra or Advanced Algebra)

Name:

Date:

Contextually found Mathematics: Turnover rate

In many industries and institutions, retaining workers is an important issue in building community and continuity. McLane Company is a large distribution center owned by Wal-Mart that distributes goods and products to convenience stores nationwide. The management at McLane have been working hard to reduce turnover through their Leadership 2000 project in order to make a stronger company—stronger in morale, which, they implied, leads to stronger commitment from workers and stronger financial health. Perhaps this drive to keep the people they hire could also be seen as a necessary step in their goal to be the number one distributor to convenience stores world-wide.

They provided the following data on turnover rates at McLane since 1996:

Year	% turnover, McLane overall	% turnover, Distr. Center only
1996	62.8	90
1997	38	42.44
1998	29.9	35
1999	19.5	22

What is *turnover*?

1) Explain in words what it means to have 90% turnover in the distribution center in 1996:

2) Explain why you think that the turnover rates in the distribution center alone are higher than the turnover rates for McLane as a whole:

3) List some factors that might contribute to turnover:

4) List some factors that might contribute to reducing turnover:

Some natural questions...

...might be:

- How are the turnover rates decreasing? Is there a pattern? Several possible patterns?
- What can McLane expect the turnover rates to be in the year 2000? In the year 2005?
- What might have been the turnover rates in 1995? In 1990?
- Will McLane ever reduce the turnover rate to zero? Why or why not?

5) What other questions would you want to ask about the data?

Examining the Data and Making Predictions

6) Recode the year data so that 1996 = year 1. We do this to simplify the regression equations we will use to model the data. Using a graphing calculator, graph **year versus % turnover in McLane** and **year versus % turnover in the Distribution Center only**.

Describe the trend(s) you see and suggest possible types of functions to model the data.

Make a sketch of the graphs here:

7) Fit an exponential model to the **year versus % turnover in McLane** data, using your graphing calculator.

a) Write down your model for the data. Round all values to three decimal places.

b) How well does model fit the data? Explain your answer.

c) Your model is likely in the form of $y = a \cdot b^x$. Explain what the values of a and b mean in the context of the situation.

d) Use the model to predict the turnover rate at McLane overall in the year 2000 and 2005. Are the predictions reasonable? Explain why or why not.

e) Use the model to suggest the turnover rates at McLane overall in 1995 and 1990. Are the predictions reasonable? Explain why or why not.

8) Fit an exponential model to the **year versus % turnover in the Distribution Center only** data, using your graphing calculator.

a) Write down your model for the data. Round all values to three decimal places.

b) How well does model fit the data? Explain your answer.

c) Your model is likely in the form of $y = a \cdot b^x$. Explain what the values of a and b mean in the context of the situation.

d) Use the model to predict the turnover rate in the distribution center in the year 2000 and 2005. Are the predictions reasonable? Explain why or why not.

e) Use the model to suggest the turnover rates in the distribution center in 1995 and 1990. Are the predictions reasonable? Explain why or why not.

Deep Thoughts

9) According to the models given, will McLane ever reduce the turnover rate to zero? Why or why not? Explain.

10) According to the models, will the percent turnover rate in the distribution center alone ever equal the percent turnover rate at McLane overall? Demonstrate and explain how you determined your answer.

11) Would a different function provide a better model for the data? Try a linear model for the each set of data. Compare the predictions for turnover rates in 1990, 1995, 2000, and 2005 with exponential models and linear models. Which seem the most reasonable? Why?

12) Are there any other functions you might use to model the data? Explain why or why not. If you have an idea for another model, try it out. Which model tried above seems to fit the data the best? Explain.

13) Imagine you are a consultant, helping McLane to improve itself as a company. Write a memo to the management in which you explain your analysis of their decreasing turnover rate. Indicate what they might expect over the next five years according to the model you chose in #12. Also explain any limitations of this model, and suggest ways that McLane might overcome those limitations—that is, how they might adapt the model so that it can be a better prediction tool.

Evaluation...

	needs work...		pretty good		stellar job!
1) mathematically correct analysis of turnover rate using model	1	2	3	4	5
2) clear explanation of analysis	1	2	3	4	5
3) thorough, clear, correct discussion of limitations of model	1		2		3
4) suggestions for overcoming limitations	1		2		3
5) clear and professional format and presentation	0		1		2
6) correct spelling, grammar, etc.	0		1		2
Extra Credit: <i>exceptional work</i>					_____/ 2
TOTAL:					_____/ 20

Suggestions/Ideas for Modifications of Turnover Rate Activity

For Algebra:

- Focus on the relationship between the data values in the table. Look for constant differences versus constant multipliers or ratios. Discuss whether and/or how to make predictions using these patterns.
- Find the equation of a line to model the data by using a pair of points (such as the first and last data point) and discuss how well the line fits the data (including limitations.)
- Examine graphing by hand (rather than by calculator) in order to give students practice setting up graphs of real data—that is, you can discuss how to represent the independent variable on x-axis. (Should we start at zero? Could we start at zero? Why would we want to start at zero? Why would we not want to? Would the way we set up the axes depend on how we plan to use the graph? On where it will be shown or published?)

For Advanced Algebra:

- Focus on the relationship between the numbers on the table to determine a b-value for an exponential function. Then use this b-value to find an a-value. Discuss how well this model fits the data.
- Find the equation of a line to model the data by using a pair of points (such as the first and last data point) and discuss how well the line fits the data. Compare this model with the exponential model.