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Section 5.4 Analyse Graphical Models

1. Samantha bought an $800 GIC that pays 8% interest per year, compounded annually. Gustavo bought a $1000 GIC that pays 4% interest per year, compounded annually. Which statement is true?

A The difference between the values of the GICs will always be constant.
B One GIC will always have a higher value than the other.
C The GICs will be equal in value after approximately six years.
D The GICs will be equal in value after approximately two years.

2. Keiji has two options for a $20 000 small business loan. Bank A will charge 10% per year simple interest while Bank B will charge 8% per year, compounded annually. Which bank would you advise Keiji to take the loan from, if he plans to repay the loan in full after five years? Explain.

3. Aveline purchased several shares of stock in a growing company. She recorded the share value each day for a week.

Day	Share Value ($)
0	31.12
1	32.25
2	33.65
3	34.89
4	36.23
5	37.51
6	38.84
7	41.26

a) Aveline's friend Hussein suspects that the share value is following a linear model. Why might he think this?
b) Aveline insists that the share value is following a quadratic model. Does the table support her claim? Explain.
c) Use technology to determine a linear and quadratic model for the data. Record the regression equations.
d) Which model fits the situation best if the share value on day ten is $44.70? $46.70?

4. Ms Reeves heated a cup of water to 50.0°C and then allowed it to cool outside. After one minute, the temperature of the water was 40.0°C. Ms Reeve's students proposed two models for the cooling pattern. The temperatures predicted by the two models are shown in the table.

Time (min)	Temperature Using Linear Model (ºC)	Temperature Using Exponential Model (ºC)
0	50.0	50.0
1	40.0	40.0
2	30.0	32.0
3	20.0	25.6
4	10.0	20.5
5	0.0	16.4
6	–10.0	13.1

a) What are suitable units for the rates of change of the temperatures?
b) Draw a graph for each temperature model on the same set of axes, with time on the horizontal axis and temperature on the vertical axis.
c) Ms Reeves measured the outside temperature and found it to be 0.5°C. Which model does this information support? Explain.

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5. Two neighbouring towns both have an initial population of approximately 12 000. Town A's population is growing at a rate of 1500 people/year. Town B's population is growing at a rate of 10%/year.

a) Calculate the population of Town A after every year for seven years.
b) Use technology to determine a line of best fit for the population of Town A.
c) Calculate the population of Town B after every year for seven years.
d) Use technology to determine a curve of best fit for the population of Town B.
e) Determine the time when the two populations are the same.

6. A large company has grown consistently for the previous seven years. The yearly number of people employed at this company is shown in the table.

Year	Number of Employees
1	4160
2	4328
3	4500
4	4680
5	4868
6	5060
7	5264

a) Show that a linear model could be used to represent the data.
b) Show that a quadratic model could be used to represent the data.
c) Show that an exponential model could be used to represent the data.
d) Determine a linear, a quadratic, and an exponential model for the data.
e) Use the models in part d) to predict the number of employees after ten years.
f) After how many years will the number of employees reach 7500, according to each model?

7. Summerfallow is the traditional farming practice of skipping a year of crop planting to increase soil moisture levels. The practice has been replaced by modern farming practices and its use has been steadily decreasing. The table shows the total area of land, in hectares (ha), used for summerfallow in the Canadian prairies from 1990 to 1998.

Year	Total Summerfallow Area (ha, millions)
1990	8.134
1991	7.781
1992	7.319
1993	7.123
1994	6.799
1995	6.779
1996	6.192
1997	5.645
1998	5.402

Source: Statistics Canada, CANSIM Table 001-0004
Database: E-STAT

a) Sketch a scatter plot for the data. Let 1990 be year 0.
b) According to the scatter plot, which model appears most suitable: linear, quadratic, or exponential?
c) Confirm your answer to part b) using technology.
d) Determine a model for the data. If more than one model appears to work, determine all models and use the coefficient of determination to select the one that fits the best.
e) Represent your model of best fit using a graph and an equation.
f) Predict when the total area of land used for summerfallow dropped to 4 000 000 ha by using the graph or equation from part e).

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