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Section 5.2 Quadratic Models

1. Use finite differences to determine if the data in each table is linear, quadratic, or neither.

a)

x	*y*
0	0
1	3
2	8
3	15
4	24

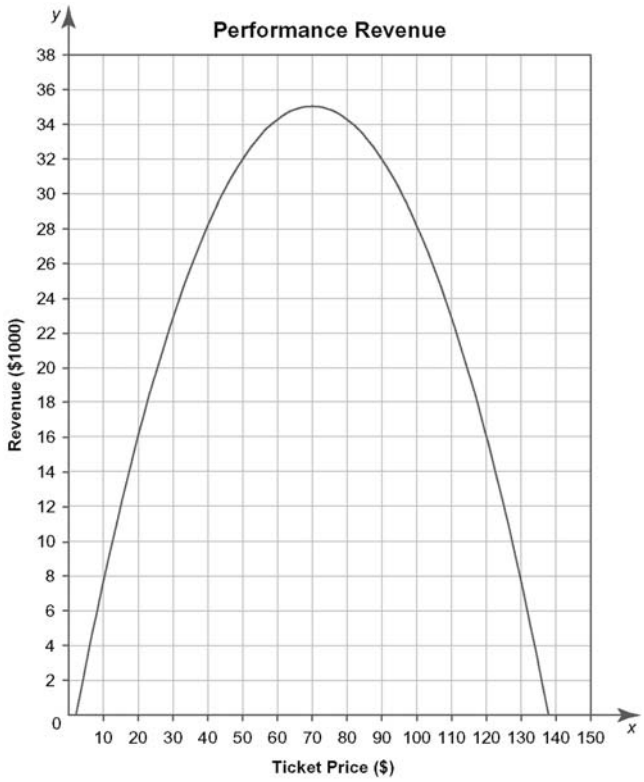
b)

x	*y*
0	0
2	6
4	12
6	18
8	22

2. Complete the table so that the data shown represents a quadratic relation.

x	*y*	First Differences	Second Differences
0	0		
1	2	2	
2			2
3	12	6	
4			2
5	30	10	

3. The Two Scary Masks Theatre Company charges $50 per ticket. The average performance has an attendance of 600 people. If the price is increased, fewer people will attend each performance. The graph represents data collected by a market research company.



a) Describe the relationship between ticket price and revenue.

b) Use the graph to estimate the revenue for ticket prices of $50 and $60.

c) If the ticket price doubles, will the revenue also double? Explain.

d) Consider the rate of change of revenue with respect to ticket price. What are the appropriate units for this rate of change?

e) Is the rate of change of revenue with respect to ticket price increasing, constant, or decreasing? Give a reason for your answer.

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4. Jeff owns an Internet café and charges patrons by the half-hour for computer use. The table shows his pricing plan.

Time (min)	Cost ($)
30	5.00
60	9.50
90	13.50
120	17.00
150	20.00
180	22.50

a) Does the Time column show equal intervals?
b) Does the Cost column imply a linear relation? Explain.
c) Calculate the first differences. Do they imply an increasing, constant, or decreasing rate of change of cost with respect to time?
d) Calculate the second differences. Do they imply a quadratic model?

5. Since 1998, there has been a huge increase in Internet use. The table shows the operating revenue of Canadian Internet Service Providers (ISPs) for eight years.

Year	Operating Revenue ($, billions)
1998	0.277
1999	0.579
2000	0.998
2001	1.268
2002	1.435
2003	1.555
2004	1.699
2005	1.855

Source: Statistics Canada, CANSIM Tables 354-0006, Database: E-STAT

a) Let 1998 be year 0. Use technology to graph the data.
b) Describe the trend between 1998 and 2005 in words.
c) Which model, linear or quadratic, would best fit the data? Justify your answer.
d) Use technology to find the equation of best fit for your chosen model.
e) Use your model to predict the operating revenue of Canadian ISPs in 2006.
f) The actual operating revenue of Canadian ISPs was $2 052 000 000. How does this compare with your model? Suggest reasons for any discrepancy.

6. A retail clothing chain is ordering new clothing from the manufacturer. The average cost per unit of clothing depends on the number of units ordered, as shown in the table.

Number of Units Ordered	Average Cost per Unit ($)
1000	21.00
2000	18.00
3000	15.50
4000	13.50
5000	12.00

a) Can the average cost per unit be modelled using a quadratic relation? Provide evidence for your answer.
b) Sketch a graph of the data. Does the graph appear to support your answer to part a)?
c) Use technology to find the equation of best fit for a quadratic model.
d) Explain why the model shows there will be a number of units ordered that results in a minimum average cost per unit.
e) Use technology to determine the minimum average cost per unit and the number of units ordered that generates this minimum.

978-0-07-013108-8