STRAND: STATISTICS AND PROBABILITY (DATA ANALYSIS)

GENERAL OUTCOME Develop and implement a plan for the display and analysis of data.

SPECIFIC OUTCOME 1. Read and interpret graphs that are provided. [C, E, PS, R] (6–7)

MANIPULATIVES

- Newspapers, magazines

SUGGESTED LEARNING RESOURCES

Currently Authorized Resources

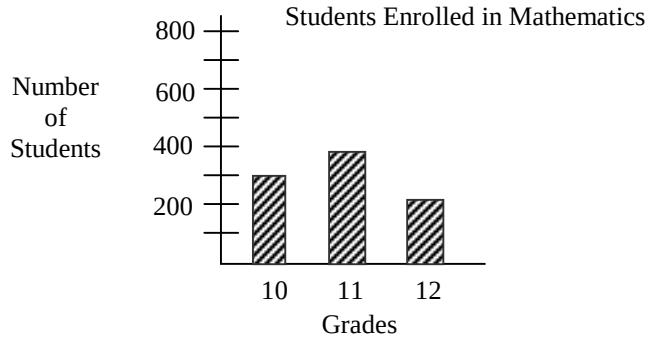
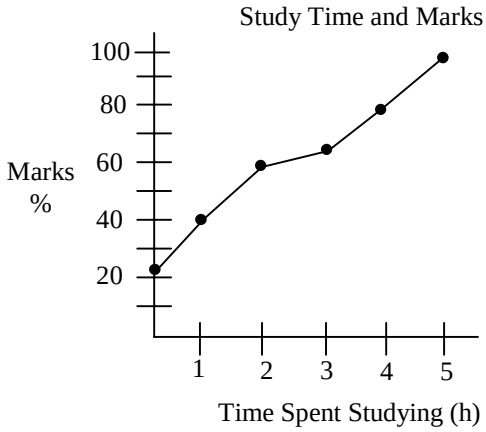
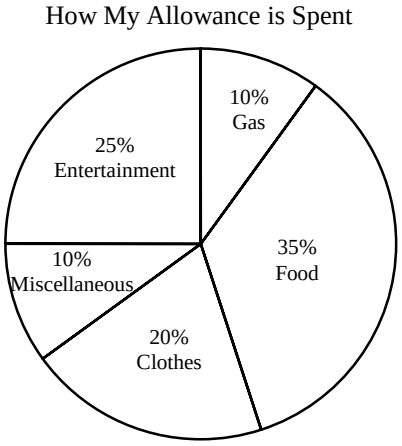
- *Addison-Wesley Mathematics 10*, pp. 245, 250–254
- *Interactions 7*, pp. 9–12, 20–22, 128, 205
- *Interactions 8*, pp. 11–13, 48, 160–171, 274, 312
- *Interactions 9*, pp. 95, 145
- *Mathpower 7*, pp. 326–341
- *Mathpower 8*, pp. 320–331
- *Mathpower 9*, pp. 130–131
- *Minds on Math 7*, pp. 202–215, 248
- *Minds on Math 8*, pp. 215, 220, 227–230, 296–297
- *Minds on Math 9*, pp. 56–63
- *TLE 7*, Reading and Interpreting Graphs, Student Refresher pp. 82–83
- *TLE 9*, Drawing Conclusions, Student Refresher pp. 102–103, Teacher's Manual pp. 216–219

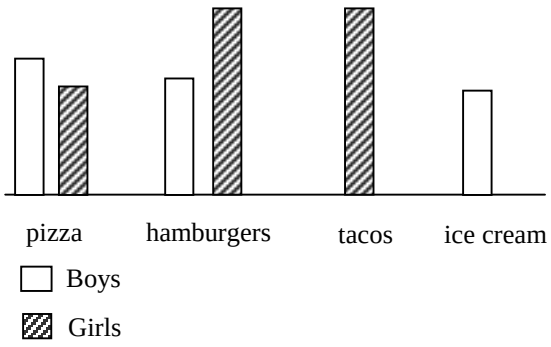
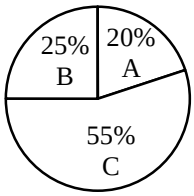
Previously Authorized Resources

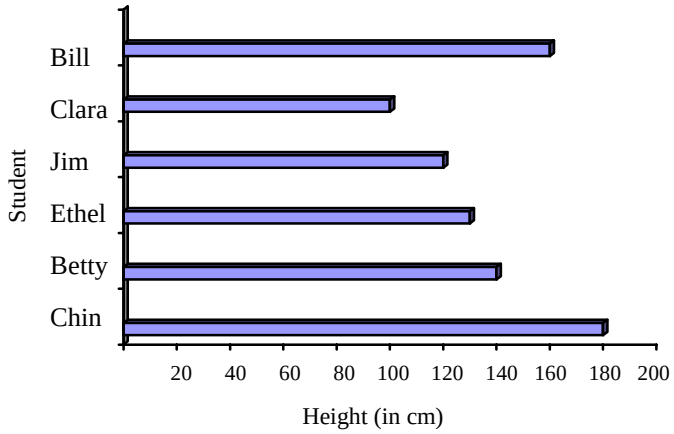
- *Journeys in Math 8*, pp. 307, 310–318
- *Journeys in Math 9*, pp. 335–337, 342–348
- *Mathematics 9*, pp. 436–439

TECHNOLOGY CONNECTIONS

	INSTRUCTIONAL STRATEGIES/SUGGESTIONS
Teaching Notes	Recognizing and Identifying Graphs • Have students find examples of graphs in local newspapers and magazines. • Identify graphs as: – bar graphs – line graphs (broken line graphs) – circle graphs (pie graphs) – pictographs. Use of Graphs in Providing Information • What information is given? (title, labels) • How were scales, pictures, data grouping used? • Does the graph present information clearly? • Is the graph visually appealing? • What graphs best represent certain situations? – line graphs for time – bar graphs to compare quantities – circle graphs to compare parts of a whole

	INSTRUCTIONAL STRATEGIES/SUGGESTIONS
Teaching Notes	Examples of graphs. Bar graph:  Line graph:  Circle graph: 

	TASKS FOR INSTRUCTION AND/OR ASSESSMENT
Teaching Notes	**Portfolio** 1. Make a scrapbook of various kinds of graphs. Collect as many as possible, and separate them into categories according to type; e.g., bar, line, circle. Discuss what conclusions can be made from each. **Paper and Pencil** 1.  a. What conclusions could you make from this graph? b. What important information is missing? c. Could this be true in your school? 2. Reading graphs for information. a. What percentage of the students received a mark of A? B? C? b. What fraction of students received a mark of B? C? c. If there were 80 students, how many received a B? Grade 10 Mathematics Marks 

	TASKS FOR INSTRUCTION AND/OR ASSESSMENT
Teaching Notes	3. Class "XY" Heights  a. How tall is Bill? b. Who is about 130 cm tall? c. Who might be a future basketball player? **Interview/Discussion/Journal** 1. Give students three or four graphs, and ask them to select the one that best represents a given situation. Discuss why one is better than the others. 2. Given a partial graph; e.g., title, label or scale missing, discuss what the graph describes and justify your responses. 3. Have students describe a situation when it is best to use each of the following graphs: a. bar graph b. line graph c. circle graph d. pictograph.

STRAND: STATISTICS AND PROBABILITY (DATA ANALYSIS)

GENERAL OUTCOME

Analyze experimental results expressed in two variables.

SPECIFIC OUTCOMES

2. Create scatterplots for discrete and continuous variables. [C, V] (9–2)
3. Interpret a scatterplot to determine if there is an apparent relationship. [E, R] (9–3)

MANIPULATIVES

- Grid paper
- Ruler

SUGGESTED LEARNING RESOURCES

Currently Authorized Resources

- *Addison-Wesley Mathematics 10*, pp. 448–449
- *Interactions 9*, pp. 8–10, 295
- *Mathpower 9*, pp. 330–333
- *Minds on Math 9*, pp. 66–70
- *TLE 9*, Scatter Plots, Student Refresher pp. 96–97, Teacher's Manual pp. 204–211

Previously Authorized Resources

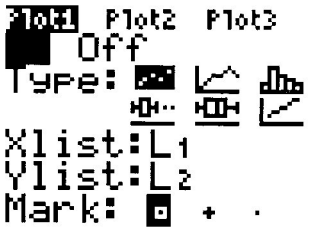
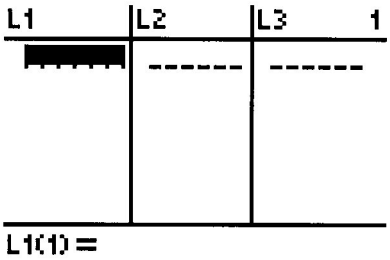
- *Math Matters: Book 2*, pp. 267–269

TECHNOLOGY CONNECTIONS

- TI-83 graphing calculator (optional)
- Spreadsheet software

	INSTRUCTIONAL STRATEGIES/SUGGESTIONS
Teaching Notes Wherever possible, use data that is relevant to student interest or can be obtained by measuring.	Scatterplots are graphs used to analyze trends or relationships between bivariate data. It is useful to present data to students in the form of a problem and then have students form a hypothesis of what they expect the relationship to be. Scatterplots can be created to test their hypothesis and to observe any trends or correlations in the data. From these observations, predictions can be made; e.g., Is there a relationship between a student's height and his/her mass? Is there a relationship between a student's month of birth and shoe size? **Collecting Data and Creating a Scatterplot** What is the relationship between the number of students and the length of time it takes all classmates to introduce themselves? Have students gather data, using the following procedure.

	INSTRUCTIONAL STRATEGIES/SUGGESTIONS
Teaching Notes Alternative names for the independent variable include manipulated and input. Alternative names for the dependent variable include responding and output.	1. Start the timer—the time must be continuous. 2. The first student stands and states: My name is _____ . I like to _____ . 3. The first student sits down and the next student completes part 2. 4. The continuous/cumulative time should be recorded after each student finishes. number of students | time 5. Create a scatterplot. Title Time (dependent variable) Number of students (independent variable) Optional: Creating a scatterplot using a graphing calculator (instructions given are for a TI-83 graphing calculator) Assume the following data set was obtained from the activity above: Number of students: 30, 25, 6, 10, 15 Time in seconds: 85, 75, 10, 20, 35 Ensure that all equations are turned off: "Y=" Delete all equations using the "DELETE" button. **OR** Toggle down to each = sign and hit "ENTER" to ensure the = sign is not highlighted.

	INSTRUCTIONAL STRATEGIES/SUGGESTIONS
Teaching Notes Spreadsheet software can also be used to create scatterplots and lines of best fit.	Ensure that all "stat plot" are off: "2nd" "Y=" "4" "ENTER"  Turn only 1 stat plot on: "2nd" "Y=" "1" "ENTER"  Ensure that all lists are free: "2nd" "+" "4" "ENTER" Enter data into lists: "STAT" "1" "ENTER"  In L1, type in the independent data (the number of students). In L2, type in the dependent data (time). It is easier for students if they type the independent data into L1 and the dependent data into L2. This will match the calculator defaults.

	INSTRUCTIONAL STRATEGIES/SUGGESTIONS
Teaching Notes Setting the minimum and maximum values manually for *x* and *y*, as well as the scale, are important skills for students to have for later mathematics courses.	Create the scatterplot: "2nd" "Y=" "1" Toggle down using the down arrow to "Type" and select scatterplot Ensure that Xlist is L1 (independent) Ensure that Ylist is L2 (dependent) Select a marker using the down arrow.  "GRAPH" To fit the data automatically: "ZOOM" "9" To fit the data using windows: "WINDOWS" and set the windows using appropriate values. **Interpreting a Scatterplot** The interpretation of a scatterplot is important to highlight trends or relationships within the data. There are three basic trends/correlations: 1. no relationship (zero correlation) 2. a positive relationship (shows an upward trend) 3. a negative relationship (shows a downward trend). The scatterplot from the above exercise can be analyzed for its trend. Make an overhead of the scatterplot, and place a clear plastic ruler in the direction the data points go. Does the data represent: an upward trend? a downward trend? no trend at all? How does this observed trend relate to your hypothesis?

	TASKS FOR INSTRUCTION AND/OR ASSESSMENT
Teaching Notes	**Paper and Pencil/Technology**

1. Is there a relationship between the age of 14 randomly chosen students and the number of days they were absent?

Age:	23	24	23	27	26	26	26	26	27	28	26	25	37	24
Absent:	8	6	11	7	11	8	10	11	10	8	5	8	9	10

2. Is there a relationship between the mass of a car and the fuel consumption (FC), in litres per 100 km, for combined city and highway driving?

Mass (kg):	700	1000	1100	1200	1300	1500	1700	1800
FC (L/100 km):	5.0	6.5	7.5	9.0	11.0	12.0	12.0	12.0

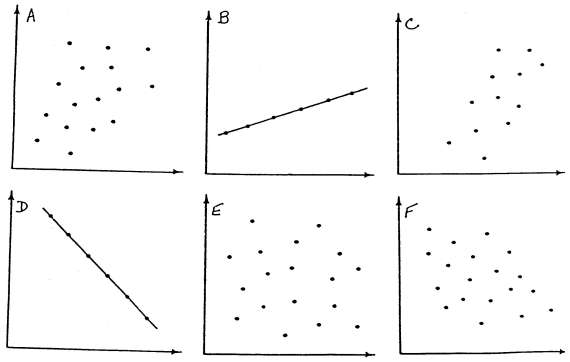
Predict the combined fuel consumption for a car with a mass of 1400 kg.

3. Does the mass of a bike affect its jumping height?

Mass (kg):	10.9	10.8	7.8	9.9	9.0	8.0	10.3	8.6	10.7
Height (cm):	24.3	24.5	26.3	24.9	25.6	26.2	24.8	26.0	24.7

John has entered a competition where his bike is expected to be able to jump at least 25 cm. To the nearest tenth of a kilogram, what is the maximum mass the bike should be?

4. There are six scatterplots shown below labelled A to F.
   a. Which of these show a positive correlation?
   b. Which of these show a negative correlation?
   c. Which of these has a correlation coefficient that is closest to zero? Describe what a correlation coefficient of zero tells us about the variables.
   d. The correlation coefficients of the scatterplots below are as follows: 1, 0.75, 0.5, 0, –0.5, –1. Identify the scatterplot associated with each of these correlation coefficients.



	TASKS FOR INSTRUCTION AND/OR ASSESSMENT
Teaching Notes	5. State whether you expect a strong positive, strong negative, weak positive, weak negative or no correlation between the variables in each case. a. waist size and the time to run a long-distance race b. IQ and shoe size c. price of an airline ticket and the distance travelled by the airplane d. hours of homework and grade point average e. number of absences and test marks f. age and test marks g. penalty minutes and number of goals scored h. ski sales and air temperature **Journal/Interview** 1. a. Describe what correlation means. b. Compare and contrast the three main types of correlation. c. How are scatterplots used to analyze data? d. Describe how predictions can be made about the data. 2. If a strong positive correlation exists between the amount that people smoke and their chance of getting cardiovascular disease (CVD), does this prove that smoking causes CVD? Discuss.

STRAND: STATISTICS AND PROBABILITY (DATA ANALYSIS)

GENERAL OUTCOME Analyze experimental results expressed in two variables.

SPECIFIC OUTCOME 4. Determine the line of best fit from a scatterplot for an apparent linear relationship by inspection. [E, PS] (9–4)

MANIPULATIVES

- Ruler
- Grid paper

SUGGESTED LEARNING RESOURCES

Currently Authorized Resources

- *Addison-Wesley Mathematics 10*, pp. 162–163, 214, 232, 450–451
- *Interactions 9*, pp. 11–12, 153, 295
- *Mathpower 9*, pp. 334–339, 341
- *Minds on Math 9*, pp. 71–75
- *TLE 9*, Line of Best Fit, Student Refresher pp. 100–101, Teacher's Manual pp. 212–215

Previously Authorized Resources

- *Math Matters: Book 2*, pp. 270–273

TECHNOLOGY CONNECTIONS TI-83 graphing calculator (optional)

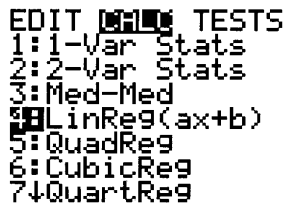
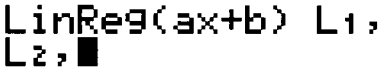
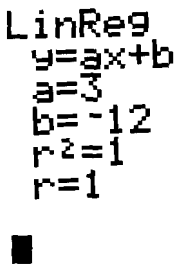
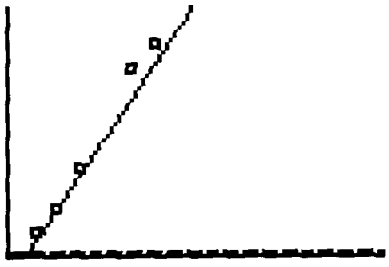
	INSTRUCTIONAL STRATEGIES/SUGGESTIONS
Teaching Notes	Line of Best Fit—The line that best illustrates the relationship between the variables. A clear or transparent ruler works best for drawing a line of best fit by inspection. By covering the majority of the points, the line of best fit will show the trend. Put the ruler along a line that shows the trend such that the following is seen: • approximately the same number of points above or below (covered and uncovered) • approximately equal distances from these points to the line. Use the following data to determine the line of best fit. a. b. c. students' heights and arm spans What predictions can you make based on the line of best fit?

a.

mass of car (kg)	700	1000	1100	1200	1300	1500	1700	1800
fuel consumption (L/100 km)	5.0	6.5	7.5	9.0	11.0	12.0	12.0	12.0

b.

mass of bike (kg)	10.9	10.8	7.8	9.9	9.0	8.0	10.3	8.6	10.7
height of jump (cm)	24.3	24.5	26.3	24.9	25.6	26.2	24.8	26.0	24.7

	INSTRUCTIONAL STRATEGIES/SUGGESTIONS
Teaching Notes	Optional: Finding a line of best fit using a graphing calculator (instructions given are for a TI-83 graphing calculator) To select a linear regression: "STAT" "CALC" "4"  To specify which lists data is stored in: "2nd" "1" "," "2nd" "2" "," "VARS" "Y-VARS"  To store the equation in "Y=" and to display the equation: "," "VARS" "Y-VARS" "ENTER" "ENTER" "ENTER"  To view the scatterplot with the line of best fit: "GRAPH" 

	TASKS FOR INSTRUCTION AND/OR ASSESSMENT
Teaching Notes	

Journal/Interview

1. Describe how you would draw a line of best fit and how to use it to make predictions.

2. How does a line of best fit relate to the trend of the data?

Portfolio

1. Find examples of data with which you would use a line of best fit; e.g., sports statistics. Plot the data and determine the line of best fit.

Paper and Pencil/Technology

1. Plot the data below and draw a line of best fit.

Mass (kg)	100 m time (s)	Mass (kg)	100 m time (s)
42	12.3	47	14.0
43	12.4	48	14.7
44	12.9	46	13.5
41	12.0	45	13.1
40	12.0	51	15.6

2. Below is an approximate comparison of the actual age of a dog and its equivalent age in "human years." Plot the data and draw a line of best fit.

Age of Dog (years)	1	2	4	6	8	10	14	18	20	21
Approximate Human Age (years)	15	24	32	40	48	56	72	90	94	101

STRAND: STATISTICS AND PROBABILITY (DATA ANALYSIS)

GENERAL OUTCOME

Analyze experimental results expressed in two variables.

SPECIFIC OUTCOME

5. Draw and justify conclusions from the line of best fit by:
   - interpolation
   - extrapolation.

   [C, R] (9–5)

MANIPULATIVES

- Ruler
- Grid paper

SUGGESTED LEARNING RESOURCES

Currently Authorized Resources

- *Addison-Wesley Mathematics 10*, pp. 162–163, 214, 232
- *Interactions 9*, pp. 11–16, 295
- *Mathpower 7*, p. 212
- *Mathpower 9*, pp. 334–339
- *Minds on Math 7*, pp. 242–243
- *Minds on Math 9*, pp. 71–75
- *TLE 9*, Drawing Conclusions, Student Refresher pp. 102–103, Teacher's Manual pp. 216–219

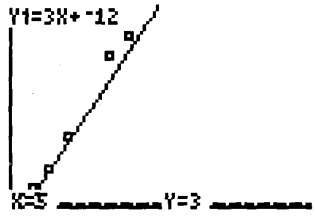
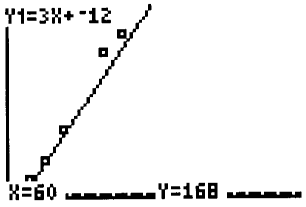
Previously Authorized Resources

- *Journeys in Math 9*, pp. 310–312
- *Math Matters: Book 2*, pp. 151, 152

TECHNOLOGY CONNECTIONS

TI-83 graphing calculator (optional)

	INSTRUCTIONAL STRATEGIES/SUGGESTIONS
Teaching Notes	A line of best fit is an important tool to predict values within the data set (interpolation) and outside the data set (extrapolation). ***Terminology*** *Interpolate*—To estimate (or calculate) a value between two values that are already known. *Extrapolate*—To estimate (or calculate) a value, by using the established pattern and going beyond known values. Use the data below to create a scatterplot and line of best fit and to answer the following questions. Number of students: 30, 25, 6, 10, 15 Time to introduce in seconds: 85, 75, 10, 20, 35 1. How long will it take five students to introduce themselves?

	INSTRUCTIONAL STRATEGIES/SUGGESTIONS
Teaching Notes	2. Did you interpolate or extrapolate to obtain your result in question 1? 3. How long will it take 60 students to introduce themselves? 4. Did you interpolate or extrapolate to obtain your result in question 3? 5. If your data set included five students, why is the time in the data set the same as or different from the predicted value obtained from using the line of best fit? 6. If it took 70 seconds for a group to introduce themselves, estimate how many people were in that group? 7. Did you interpolate or extrapolate to obtain your result in question 6? Optional: Interpolating and extrapolating values from a scatterplot, using a graphing calculator (instructions given are for a TI-83 graphing calculator)
This is beyond the scope of the Mathematics Preparation 10 curriculum.	The view screen should indicate the scatterplot with the line of best fit. To predict a *y* value (dependent value), given an *x* value (independent value): To answer question 1 above: "2nd" "TRACE" "1" "5" "ENTER"  To answer question 3 above: "2nd" "TRACE" "1" "60" "ENTER"  Note: The view screen may show "err:invalid". If this occurs, the value typed in for *x* is out of the window settings. Go back to "WINDOWS" and adjust the maximum and minimum values for *x* and *y* accordingly. Then repeat the calculator sequence above to predict a time for *x* students.

	TASKS FOR INSTRUCTION AND/OR ASSESSMENT
Teaching Notes	

Journal/Interview

1. What is the difference between interpolation and extrapolation?

2. In what data situations would you use interpolation? extrapolation?

Paper and Pencil/Technology

1. Some feedlot calves gain three pounds per day. A 650 pound calf is placed in a pen and weighed every 5 days. The following weights are recorded. How long will it take the calf to reach 975 pounds?

Days	Weight (pounds)
0	650
5	664
10	684
15	695
20	710

2. Pairs of American bald eagles have increased in the last forty years as indicated in the chart below. Graph the data and find a line of best fit. From the line of best fit, predict:
   a. the number of bald eagle pairs in 1982 and 1994
   b. the number of bald eagle pairs in 2010.
   Would it be better to use a curve of best fit for this data? Explain your reasoning.

Year	Estimated Number of Bald Eagle Pairs
1963	400
1974	800
1981	1200
1984	1800
1988	2500
1991	3400
1993	4000
1996	5000
1999	5800

REFERENCES

General References

Manitoba Education and Training. *Grades 5 to 8 Mathematics: A Foundation for Implementation*. Winnipeg, MB: Manitoba Education and Training, 1997.

Manitoba Education and Training. *Senior 1 Mathematics: A Foundation for Implementation*. Winnipeg, MB: Manitoba Education and Training, 1997.

Nova Scotia Department of Education and Culture. *Atlantic Canada Mathematics Curriculum: Grade 7*. Halifax, NS: Nova Scotia Department of Education and Culture, 1999.

Nova Scotia Department of Education. *Atlantic Canada Mathematics Curriculum: Grade 8*. Halifax, NS: Nova Scotia Department of Education, 1999.

Nova Scotia Department of Education. *Atlantic Canada Mathematics Curriculum: Grade 9 Implementation Draft*. Halifax, NS: Nova Scotia Department of Education, 1999.

Province of British Columbia Ministry of Education. *Mathematics 8 to 10: Integrated Resource Package*. Victoria, BC: Province of British Columbia Ministry of Education, 1996.

Currently Authorized Resources

Adomeit, Joanne et al. *The Learning Equation: Mathematics 7. Student Refresher*. Toronto, ON: ITP Nelson, 1998.

Adomeit, Joanne et al. *The Learning Equation: Mathematics 7. Teacher's Manual*. Toronto, ON: ITP Nelson, 1999.

Adomeit, Joanne et al. *The Learning Equation: Mathematics 8. Student Refresher*. Toronto, ON: ITP Nelson, 1999.

Adomeit, Joanne et al. *The Learning Equation: Mathematics 8. Teacher's Manual*. Toronto, ON: ITP Nelson, 1999.

Alexander, Robert and Brendan Kelly. *Addison-Wesley Mathematics 10*. Don Mills, ON: Addison-Wesley, 1998.

Alexander, Robert et al. *Minds on Math 7*. Don Mills, ON: Addison-Wesley Publishers Limited, 1996.

Alexander, Robert et al. *Minds on Math 8*. Don Mills, ON: Addison-Wesley Publishers Limited, 1996.

Alexander, Robert et al. *Minds on Math 9*. Don Mills, ON: Addison-Wesley Publishers Limited, 1996.

Allison, Paula et al. *The Learning Equation Mathematics 9. Student Refresher*. Toronto, ON: ITP Nelson, 1998.

Allison, Paula et al. *The Learning Equation Mathematics 9. Teacher's Manual*. Toronto, ON: ITP Nelson, 1998.

Boucher, Randy et al. *The Learning Equation: Mathematics 10. Student Refresher*. Toronto, ON: ITP Nelson, 1998.

Boucher, Randy et al. *The Learning Equation: Mathematics 10. Teacher's Manual*. Toronto, ON: ITP Nelson, 1998.

Elchuck, Larry et al. *Interactions 7*. Scarborough, ON: Prentice Hall Ginn Canada, 1996.

Elchuck, Larry et al. *Interactions 8*. Scarborough, ON: Prentice Hall Ginn Canada, 1996.

The Geometer's Sketchpad (Macintosh Version 3.0). Berkeley, CA: Key Curriculum Press, 1995.

The Geometer's Sketchpad (Windows Version 3.03). Berkeley, CA: Key Curriculum Press, 1995.

Hope, Jack et al. *Interactions 9*. Scarborough, ON: Prentice Hall Ginn Canada, 1996.

Knill, George et al. *Mathpower 7* (Western Edition). Toronto, ON: McGraw-Hill Ryerson Limited, 1996.

Knill, George et al. *Mathpower 8* (Western Edition). Toronto, ON: McGraw-Hill Ryerson Limited, 1996.

Knill, George et al. *Mathpower 9* (Western Edition). Toronto, ON: McGraw-Hill Ryerson Limited, 1996.

Knill, George et al. *Mathpower 10* (Western Edition). Toronto, ON: McGraw-Hill Ryerson Limited, 1998.

Previously Authorized Resources

Bober, William C. et al. *Journeys in Math 9*. Ginn Publishing Canada Inc., 1988.

Connelly, Ralph D. et al. *Journeys in Math 8*. Ginn Publishing Canada Inc., 1987.

Ebos, Frank et al. *Math Matters: Book 2*. Scarborough, ON: Nelson Canada, 1989.

Kelly, Brendan et al. *Mathematics 9*. Don Mills, ON: Addison-Wesley, 1981.

Additional Resources

Alberta Education. *Kindergarten to Grade 9 Mathematics Resources: Annotated Bibliography*. Edmonton, AB: Alberta Education, 1997.

Burns, Marilyn. *Spaghetti and Meatballs for All!: A Mathematical Story*. New York, NY: Scholastic, 1997.