COURSES

derived from

The Common Curriculum Framework

for

K–12 MATHEMATICS

Grade 10 to Grade 12

Western Canadian Protocol for Collaboration in Basic Education

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Call for Resources

JUNE 1996

APPLIED MATHEMATICS 11

derived from

The Common Curriculum Framework

for

K–12 MATHEMATICS

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JUNE 1996

APPLIED MATHEMATICS 11:
GENERAL OUTCOMES, AND SPECIFIC OUTCOMES WITH ILLUSTRATIVE EXAMPLES, ORGANIZED BY STRAND AND SUBSTRAND

This section elaborates on the general outcomes and specific outcomes by providing illustrative examples, by strand and substrand, for the Applied Mathematics 11 course.

The coding for mathematical processes follows the same scheme as in the *Common Curriculum Framework.*

CLUSTERS IN THE APPLIED MATHEMATICS 11 COURSE

There are 5 clusters identified, each representing 20 to 25 hours of instructional time for an average student taking the cluster.

Common clusters, numbered C4 to C5, are part of the mathematics expected of all students completing a K to 12 mathematics program.

Applied clusters, numbered A3 to A5, emphasize applications of mathematics rather than precise mathematical theory. The approaches used are primarily numerical and geometrical.

CODING FOR ILLUSTRATIVE EXAMPLES (IEs)

The illustrative examples (IEs) listed on the following pages are organized by strand and substrand and have been correlated to specific outcomes (SOs). The numbers are taken directly from the *Common Curriculum Framework.*

NUMBERING SYSTEM

The specific outcomes are cross-referenced to the General Outcomes and Specific Outcomes section (pages 30 to 59 of the *Common Curriculum Framework*). For example, $\underset{(PR53)}{C2-6.}$ is the 6th specific outcome in Common Cluster 2 and the 53rd specific outcome in the Patterns and Relations strand.

Strand: Number (Number Operations)

Students will:

- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
Solve consumer problems, using arithmetic operations.	C4–1. (N12) Solve consumer problems, including: • wages earned in various situations • property taxation • exchange rates • unit prices. [CN, E, PS, R, T]	1.1 Calculate and compare wage situations involving minimum wage rates, regular pay, overtime pay, gratuities, piecework, straight commission, salary and commission, salary plus quota and graduated commission. 1.2 Jane has a choice of two restaurants at which to work. Mario's pays $8/h, and tips average $24 daily. Teppan's pays $5.50/h, and tips average $35 daily. If Jane works 30 hours weekly, spread over four days, how much would she earn at each restaurant? 1.3 Identify and calculate various payroll deductions, including income tax, CPP, UI, medical benefits, union and professional dues and life insurance premiums. 1.4 Estimate, calculate and compare gross and net pay for various wage or salary earners in your community. 1.5 The Ningart property has a market value of $105 000. The assessed values in the area are 60% of market values. The tax rate is 32.3 mills of assessed value. What is the Ningarts' monthly tax payment? 1.6 The exchange rate on a given day in the United States is 28% and in Canada 38.8%. Explain why this is possible. 1.7 A Canadian traveller goes from Switzerland to Germany. She knows that one Swiss franc is equivalent to $1.26 Canadian (including exchange cost) and that one German mark is $0.97 Canadian (including exchange cost). How many German marks does she get for 100 Swiss francs? 1.8 Which provides better value for tomato soup, $0.69 for 284 mL or $1.79 for 907 mL?

(continued)

Strand: Number (Number Operations)

Students will:

- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	C4–2. (N13) Reconcile financial statements including: • cheque books with bank statements • cash register tallies with daily receipts. [CN, PS, T]	2.1 The following petty cash transactions occurred during the first week of March. March 4 $100 cheque was received to establish the fund. March 5 Bought $12.50 worth of postage stamps. March 5 Spent $10 to have something delivered by taxi. March 6 Spent $6.50 for lunch. March 7 Paid a courier service $25 for deliveries. March 7 Bought flowers for opening day, $28. March 8 Replenished the fund by $25. March 9 Postage stamps purchased for $21.50. Determine if a final balance of $20 is correct. If not, provide an explanation for the difference, and indicate possible ways to correct the problem. 2.2 Complete the table below to determine the cost of credit for using a department store charge account for the period shown. Monthly credit charges are 1.4% of the balance due.

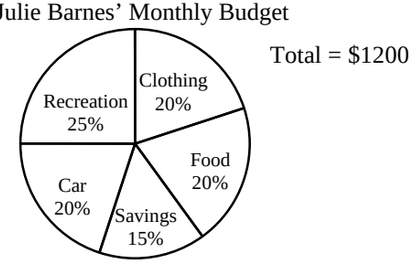
Month	Previous Balance	– Payment Made	+ Purchases Charged	⇒ Balance Due	+ Credit Charges	⇒ New Balance
February	$314.65	$100.00	$193.75		$5.72	$414.12
March		$150.00	$ 59.60			
April		$140.00	$421.83			$618.62
May	$618.62	$200.00	$ 39.65			
June		$250.00	$ 58.11			
July		$150.00	$ 77.21			
August	$206.68	$120.00	$163.09		$3.50	$253.27

Strand: Number (Number Operations)

Students will:

- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	C4–3. (N14) Solve budget problems, using graphs and tables to communicate solutions. [C, PS, T, V]	3.1 Research and calculate the cost of running a car for a year. Decide how to classify each cost, how to collect the data and how to display the results. 3.2 As a project, prepare a monthly budget for one of the following: a) the family b) an assumed persona; e.g., Wayne Gretzky c) a school d) a vacation e) a fishing/hunting/shopping trip f) a municipality. 3.3 The diagram shows Julie's monthly budget of $1200. She wants to move to her own apartment that costs $450 per month. Construct a new budget that will include her rent. Explain the choices and changes that Julie could make. Julie Barnes' Monthly Budget  Total = $1200
	C4–4. (N15) Plot and describe data of exponential form, using appropriate scales. [C, T, V]	4.1 The growth of the value of a $7000 RRSP is as follows: Time (years) / Value ($) 0 / 7 000 1 / 7 630 2 / 8 316 3 / 9 065 4 / 9 881 5 / 10 770 Plot this data, estimate the time needed for the RRSP to reach $14 000, and determine the value of the RRSP after 12 years.
	(continued)	

Strand: Number (Number Operations)

Students will:

- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

[C] Communication
[CN] Connections
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[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	*(continued)*	4.2 Plot the world population on the vertical axis and the date on the horizontal axis. Use the graph to predict the date when the population reached 4 billion and to predict the present population of the world. **Date** / **Population** 1650 — 500 000 000 1850 — 1 100 000 000 1930 — 2 000 000 000 1950 — 2 500 000 000 1970 — 3 600 000 000 1988 — 5 100 000 000
	C4–5. (N16) Solve investment and credit problems involving simple and compound interest. [CN, PS, T]	5.1 Determine the effective annual interest rate on a loan of $1000 at 10% per year, compounded quarterly. 5.2 Calculate the compound amount, after one year, of a deposit of $1000. Assume the current nominal annual interest when the interest is compounded: a) annually b) monthly c) daily. 5.3 A bank offers an interest rate of 8% per year, compounded annually. A second bank offers an interest rate of 8% per year, compounded quarterly. If $2000 were deposited, for ten years, in each bank, how much more income would be gained in the second bank than in the first? 5.4 Calculate the interest paid on various forms of credit, including: a) credit cards b) loans c) mortgages. 5.5 A loan of $5000 carries an interest rate of 9% per year, compounded monthly. Adele makes a payment of $350 every month. Use a spreadsheet to determine how much she still owes after making 12 payments. 5.6 Compare two investments in an RRSP for one year with contributions starting January 1. a) $100 is invested monthly at 10% per annum, compounded monthly. b) $600 is invested semi-annually at 10% per annum, compounded semi-annually.

Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

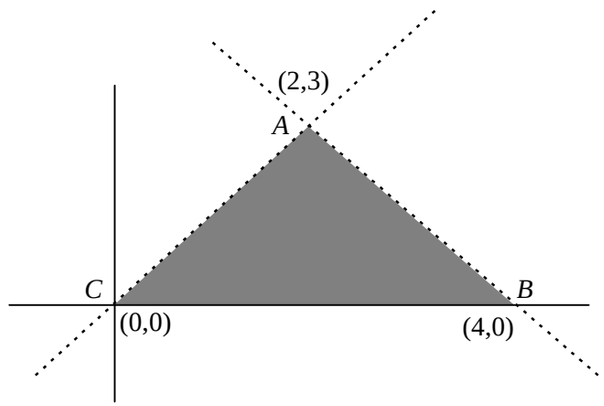
General Outcomes	Specific Outcomes	Illustrative Examples
Represent and analyze situations that involve expressions, equations and inequalities.	C5–1. (PR29) Graph linear inequalities, in two variables. [PS, V]	1.1 Solve, algebraically and graphically, for x: $2x + 5 > 3x - 1$. 1.2 A target is described in terms of coordinates (x, y), where x and y are measured in metres. All of the following are true: • $x \leq 6$ • $y \geq 7$ • (x, y) is in the first quadrant • $x + y \leq 10$. What is the shape and the area of the target?
	C5–2. (PR30) Solve systems of linear equations, in two variables: • algebraically (elimination and substitution) • graphically. [CN, PS, T, V]	2.1 Solve this system of equations, using the elimination method: $x + 2y = 10$ $2x + 3y = 14$. 2.2 Solve this system of equations, using the substitution method: $3x + 4y = 15$ $x - y = 5$. 2.3 A principal of \$42 000 is invested partly at 7% and partly at 9.5%. If the interest is \$3700, how much is invested at each interest rate? 2.4 Plot the graphs of $2x + 3y = 11$ and $2x - 3y = 17$. What is their point of intersection?
	C5–3. (PR31) Solve nonlinear equations, using a graphing tool. [CN, T, V]	3.1 Using a graphing tool, solve $x^2 + 6x - 11 = 0$. 3.2 Solve $x^3 + x = 30$ graphically, using two different methods. Which method gives solutions that are freer from rounding errors and other inaccuracies? 3.3 Where does the line $y = 4x + 5$ cut the curve $y = 2^x$? Use a graphing tool to find the points of intersection.

Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
Use linear programming to solve optimization problems.	A5–1. (PR36) Solve, graphically, systems of linear inequalities, in two variables, using technology. [CN, PS, T, V]	1.1 Graph the solution to the following system of inequalities: $3x - y > 4$ $2x + y \leq 6$. 1.2 Given the following diagram, provide the system of inequalities whose solution is the interior of ΔABC. 
	A5–2. (PR37) Design and solve linear and nonlinear systems, in two variables, to model problem situations. [C, CN, PS, R, V]	2.1 A farmer has chickens and turkeys. He has fewer than 100 birds. He sells chickens for \$10 each and turkeys for \$30 each, and he earns more than \$1500. Represent the situation graphically, and shade the region containing possible solutions. 2.2 A desktop publisher has to design formats for rectangular data tables and uses graphing grids as a design tool. Shade the region on the grid that represents the possible dimensions of rectangles in which the length is less than twice the width, the perimeter is at most 48 cm, and the area is at least 32 cm^2.

(continued)

(continued)

Strand: Patterns and Relations (Variables and Equations)

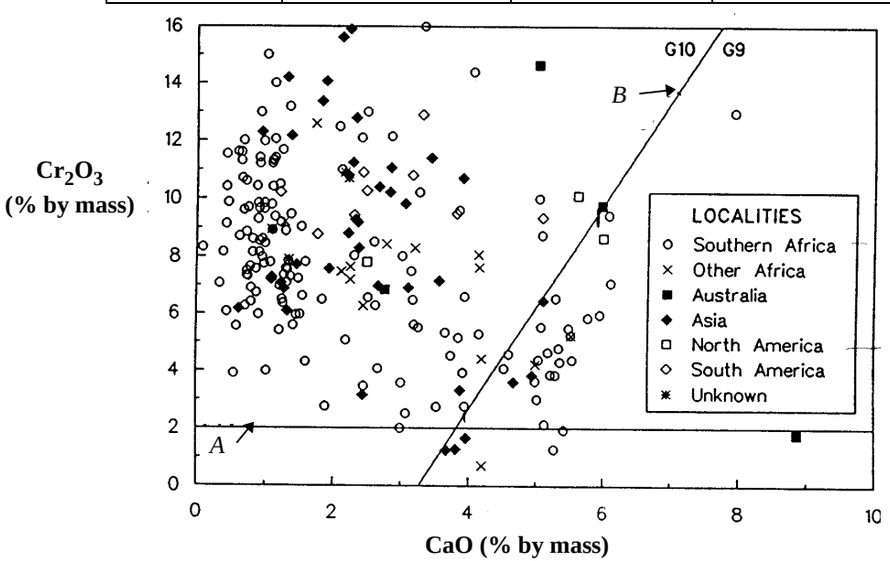
Students will:

- represent algebraic expressions in multiple ways.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	*(continued)*	2.3 Diamond prospecting is done by testing the garnets found in rocks called kimberlites for the per cent content of Cr_2O_3 and CaO. The following graph shows the Cr_2O_3 to CaO ratio for diamond-bearing rocks worldwide. Diamonds occur 85% of the time with garnets classed as G10. This G10 area is defined by the function lines *A* and *B*. a) Define the system of linear inequalities that determines the G10 area. b) Which of the following samples would indicate that further prospecting is warranted?

Garnet Sample No.	Garnet mass (g)	Cr_2O_3 mass (g)	CaO mass (g)
1	16.1	1.71	1.35
2	8.7	0.094	0.72
3	4.2	0.35	0.051
4	12.0	1.80	0.61



Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	A5–3. (PR38) Apply linear programming to find optimal solutions to decision-making problems. [C, PS, R, T, V]	3.1 An agricultural club has a 10 ha plot of land available for a market garden project. It has selected corn and potatoes to plant and has $4000 for the project. The corn will cost $300/ha to grow and will generate $375/ha gross income. The potatoes will cost $500/ha to grow and will generate $650/ha gross income. a) Construct the function that describes the revenue from the project. b) Construct the inequalities that describe the restrictions. c) Plot this system of inequalities. d) Identify the feasible solutions. e) Determine the optimal solution. 3.2 A manufacturing company originally has three employees. The company directive is to hire additional persons to build widgets. Widgets can only be built by teams of 2 people. Eight teams can produce 500 widgets and 10 teams can produce 600 widgets. It is assumed that a linear relation exists between the number of teams and the number of widgets produced. The plant has the capacity to produce 1000 widgets. The Department of Health limits the total number of employees in the building to 15, due to the air quality problem. Using multimedia techniques and linear programming, write a presentation to the board of directors explaining how to optimize production. 3.3 Find the maximum and minimum values of the quantity C, where $C = 2x - 5y$, given the constraints: $x \geq 0$ $y \geq 0$ $x \leq 12$ $y \leq x + 8$ $x + 2y \leq 28$ $3x + y \leq 39$.

Strand: Patterns and Relations (Relations and Functions)

Students will:

- use algebraic and graphical models to generalize patterns, make predictions and solve problems.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

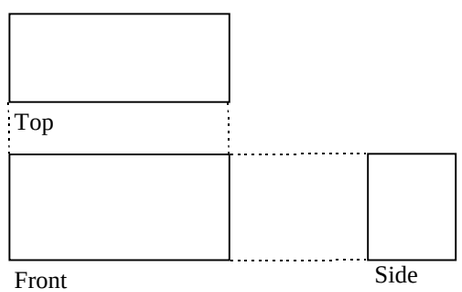
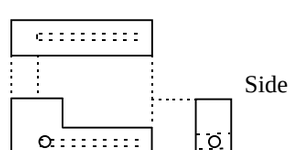
General Outcomes	Specific Outcomes	Illustrative Examples
Represent and analyze quadratic, polynomial and rational functions, using technology as appropriate.	C5–4. (PR57) Determine the following characteristics of the graph of a quadratic function: • vertex • domain and range • axis of symmetry • intercepts. [C, PS, T, V]	4.1 Given the graph of any quadratic function, determine the following: a) vertex b) domain c) range d) axis of symmetry e) intercepts. 4.2 Use technology to graph $f(x) = x^2 - 6x + 4$ and to determine the vertex, domain, range, axis of symmetry and intercepts. 4.3 One model concerning the rate of population growth of Earth has the annual rate of increase varying jointly as the population and the unused carrying capacity of Earth. The equation of the model is: $y = 0.001x(21 - x)$, where y = the rate of increase in population (in billions per year), and x = the present population (in billions). a) Plot this model of growth. b) The present population of Earth is 5.8 billion. What is the annual increase in population at present? c) What is the population when the rate of increase in population is at its greatest? d) What is the population when the rate of increase is zero? e) What is the projected maximum population that Earth can accommodate, according to this model?

Strand: Shape and Space (Measurement)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

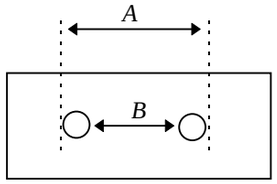
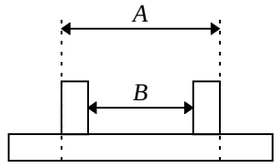
General Outcomes	Specific Outcomes	Illustrative Examples
Demonstrate an understanding of scale factors, and their interrelationship with the dimensions of similar shapes and objects.	A3–1. (SS3) Enlarge or reduce a dimensioned object, according to a specified scale. [C, CN, PS, V]	1.1 A classroom has dimensions of nine metres by eight metres. Produce a scale drawing of the classroom to a scale of 1:50. 1.2 Using surveyor's chains, tapes or other linear measuring devices, measure a chosen plot of land, and calculate its area. Make a scale drawing, using the same measurement system for the drawing as was used with the measurement instruments. 1.3 From the scale drawing below, construct an actual sized model of the box.  Scale = 1:3 1.4 To better visualize an object, architects often build clay models. Use molding clay to build a model of the object that is shown in the plan below. Scale = 2:3 

Strand: Shape and Space (Measurement)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
Use measuring devices to make estimates and to perform calculations in solving problems.	A3–2. (SS12) Calculate maximum and minimum values, using tolerances, for lengths, areas and volumes. [PS, R, V]	2.1 The diagrams represent the top and side views of a drawer handle. If the tolerance specifications are as shown below, determine the maximum and minimum dimensions for the distance between the two centres.  Figure 1: Top View  Figure 2: Side View $A = 10.50 \pm 0.02$ cm $B = 8.20 \pm 0.04$ cm 2.2 To carry a high electric current to an LRT car, a wire must have a cross-sectional area of 45 ± 2 mm^2. What are the maximum and minimum diameters allowed for this wire? 2.3 Steel ball bearings have a diameter of 0.80 ± 0.02 cm. Find the volume of one ball bearing, in cm^3, with the tolerance included. What is the maximum number of such ball bearings that can be made from 1000 cm^3 of steel?
	A3–3. (SS13) Solve problems involving percentage error when input variables are expressed with percentage errors. [PS, R, V]	3.1 A rectangular table was measured to be 420 cm long and 170 cm wide. The length was measured with an error of 1.5% and the width with an error of 2%. Calculate the maximum and minimum possible areas, and estimate the percentage error in the calculated area. 3.2 An experiment is done to find the density of a ball bearing. The mass is measured to be 473 g, with a percentage error of 4%. The diameter is measured to be 5.1 cm ± 2%. a) Calculate the density of the ball bearing, showing its percentage error. b) Which is more effective in reducing percentage error: using a new balance that gives a mass of 473 g ± 1.5%, or using a new calliper that gives a diameter of 5.1 cm ± 1%? Justify your answer with appropriate calculations.

(continued)

Strand: Shape and Space (Measurement)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

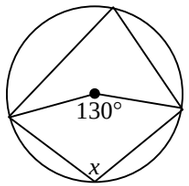
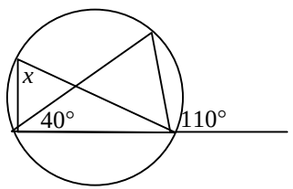
General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	A3–4. (SS14) Design an appropriate measuring process or device to solve a problem. [E, PS, V]	4.1 Design and construct a measuring device; e.g., a planimeter with a horizontal vernier scale and cardboard wheel, graduated accordingly. Apply the constructed instrument to find, according to scale, the areas of large, irregular shapes. 4.2 To calculate the loss of wheat after a hailstorm, a farmer counts the number of broken wheat heads in a small area, calculates the proportion of broken heads in the sample and extrapolates this proportion to the entire field. Explain the process used to gather the data, and explain how the estimate of loss is determined.

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Students will:

- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

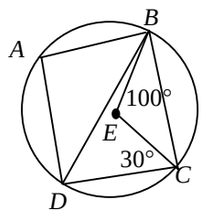
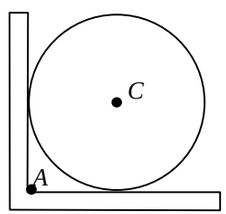
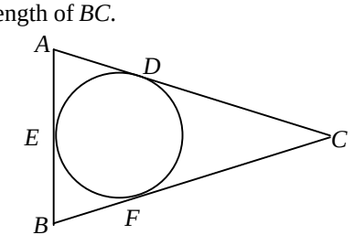
General Outcomes	Specific Outcomes	Illustrative Examples
Develop and apply the geometric properties of circles and polygons to solve problems.	C5–5. (SS26) Use technology and measurement to confirm and apply the following properties to particular cases: • the perpendicular from the centre of a circle to a chord bisects the chord • the measure of the central angle is equal to twice the measure of the inscribed angle subtended by the same arc • the inscribed angles subtended by the same arc are congruent • the angle inscribed in a semicircle is a right angle • the opposite angles of a cyclic quadrilateral are supplementary • a tangent to a circle is perpendicular to the radius at the point of tangency • the tangent segments to a circle, from any external point, are congruent • the angle between a tangent and a chord is equal to the inscribed angle on the opposite side of the chord • the sum of the interior angles of an n-sided polygon is $(2n - 4)$ right angles. [PS, R, T, V]	5.1 A plate, with a diameter of 20 cm, is placed on a square place mat, with no overhang. Calculate the length of the diagonal of the square. 5.2 Determine the measure of angle x.  5.3 Determine the measure of angle x.  5.4 Draw a semicircle with diameter AB. Draw an angle, ACB, with C being any point on the semicircle. What is the measure of angle ACB? Repeat for two other points, C' and C'', on the semicircle. What pattern emerges?
(continued)	*(continued)*	

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Students will:

- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

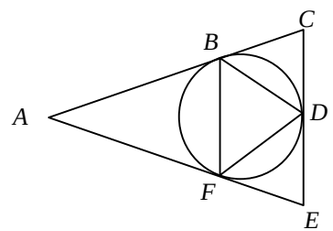
General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	*(continued)*	5.5 Determine the measure of $\angle ECB$, $\angle BDC$, $\angle BAD$ and $\angle DBE$, where E is the centre of the circle.  5.6 How far from the inside corner of the shelf, A, is the centre C of the plate, if the plate has a diameter of 20 cm?  5.7 The perimeter of the isosceles triangle ABC, with $AC = BC$, is 54 cm. If AD = 5 cm, and D, E and F are points of tangency, find the length of BC. 

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Students will:

- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	*(continued)*	5.8 Determine the measure of $\angle CAE$, if $\angle BDF = 60°$ and $\angle FDE = 70°$. 

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Students will:

- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

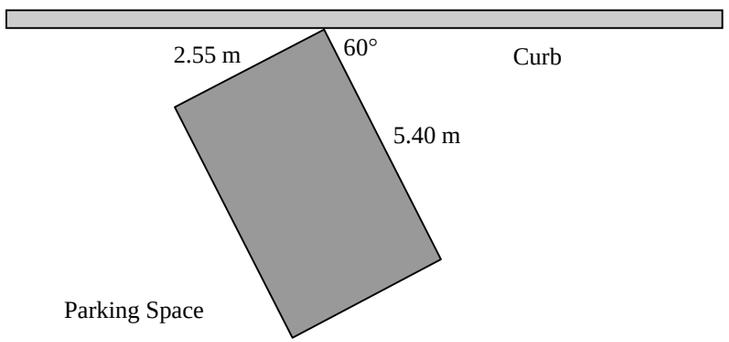
General Outcomes	Specific Outcomes	Illustrative Examples
Develop and apply the geometric properties of circles and polygons to solve problems. *(continued)*	A3–5. (SS27) Use properties of circles and polygons to solve design and layout problems. [CN, PS, V] *(continued)*	5.1 The pattern on a piece of vinyl flooring consists of a square and four equilateral triangles. Each equilateral triangle has as its base one side of the square. Circles are inscribed in each triangle and in the square. a) Start with a square of side length 6 cm. Draw the design, full size. b) Determine the ratio of the area of the small circle to the area of the large circle. 5.2 A standard sheet of paper is 22 cm by 28 cm. The margins are 3 cm on the left, on the right and at the top. The bottom margin is 4 cm. A project summary consists of one table that is 10 cm by 6 cm, three tables that are 8 cm by 5 cm each and 50 cm^2 of text that can be arranged in any shape(s). a) Prepare a possible layout, assuming that the tables can be oriented with their long sides parallel to any edge of the paper. b) Prepare a possible layout, assuming that the long side of any table must be parallel to the top edge of the paper. c) What is the maximum area of text that can be included with the four tables, if each table must have at least 1 cm margins? 5.3 A school has 325 students, all of whom have pictures to be put in the yearbook. The yearbook pages are 9.5 inches by 12 inches. The inside margins are 1.5 inches, the outside margins are 1 inch, the top margin is 1.2 inches, and the bottom margin is 1.5 inches. Each photograph is 53 mm by 35 mm. The minimum space between sides of pictures is 0.5 inches and between the bottom of one picture and the top of the next is 0.9 inches. a) How many photographs can be put on a single page? b) If the number of pages used must be divisible by 8, design a layout so that all 325 photographs can be included, without having any blank pages.

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Students will:

- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

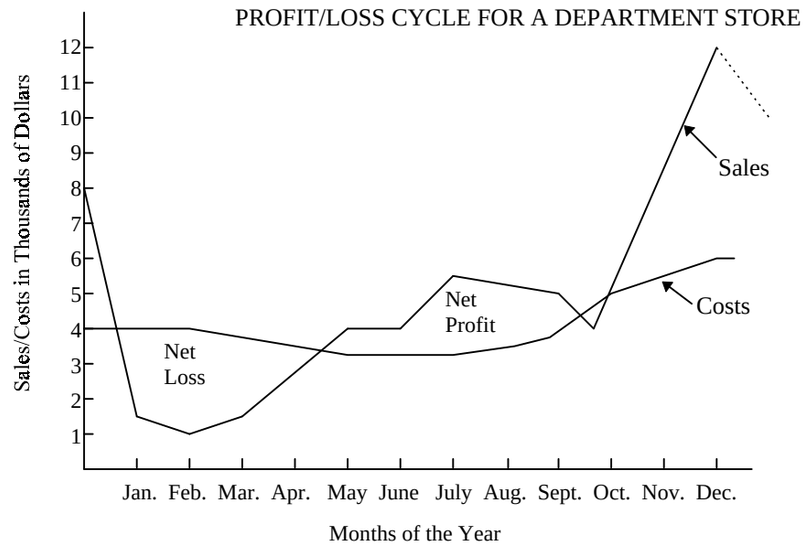
General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	*(continued)*	5.4 An average automobile requires an angle parking space with dimensions of 2.55 m wide and 5.40 m long. If spaces are being calculated for parallel parking, each automobile will require an additional length of 1.20 m as manoeuvring room. A small town's main street currently uses 60° angle parking.  The town council has contracted you to provide information for town planning decisions regarding parking capacity. 1. Develop a formula for the number of spaces *N* for a given curb length *L* for 60° angle parking. 2. Two years later, increased traffic along the main street makes angle parking unsafe. The town council wants to know how many spaces *N* they will have for a given curb length *L*, if they switch to parallel parking. The town's main street is 200 m long. If the town council wants to retain the same parking capacity as before, how many additional spaces will have to be developed away from the main street in order to offset the spaces lost by the switch to parallel parking? Alberta Education, *Mathematics at Work in Alberta*, p. 9. Adapted with permission. 5.5 A cylindrical can is 12 cm high and 6 cm in diameter. The can is closed, top and bottom. It is cut from a rectangular sheet of metal, and then the pieces are sealed together to form the can. a) Determine the smallest rectangle that can be used to make one can. b) What percentage of the metal is wasted in part a)? c) If seams require 2 mm of extra metal per join, what are the new dimensions of the smallest rectangle?

Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
Analyze graphs or charts of given situations to derive specific information.	A4–1. (SP6) Extract information from given graphs of discrete or continuous data, using: • time series • glyphs (custom pictorial representations) • continuous data • contour lines. [C, CN, E, PS, R, V]	1.1 Sometimes points representing discrete data are joined, even though specific values for intermediate points may not be available. Give examples where such a practice is acceptable and other examples where it is not. 1.2  A department store may experience “peaks” and “troughs” in its revenue (sales). Christmas season and summer holidays are the two strongest periods. January to April can be the weakest period. If net profits are greater than net losses over the year, the business can stay in operation. a) During periods of net loss, what might the business do for finances? b) Over which of the two curves, Sales or Costs, does the business have the most managerial control? c) Discuss the net profit for May.

(continued)

(continued)

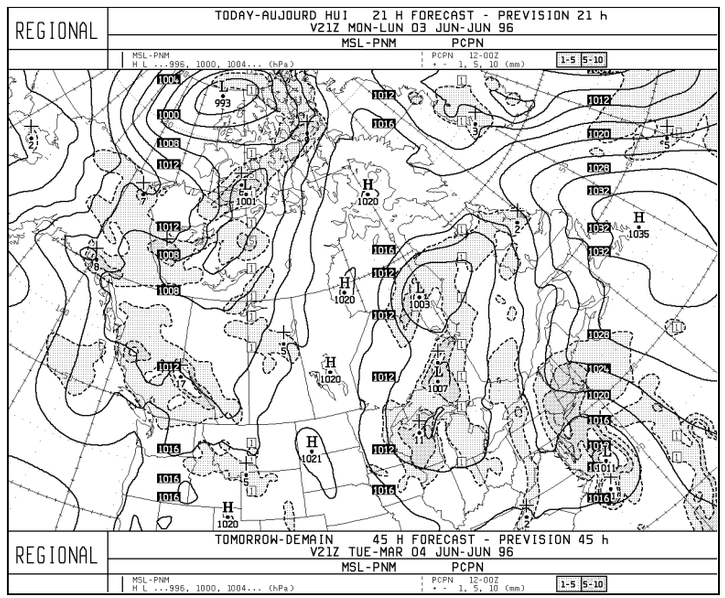
Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	*(continued)*	1.3 The map below shows the atmospheric pressure, measured in hectopascals, forecast at various weather stations for June 3, 1996. A current Environment Canada map can be found on the Internet at: http://www.cmc.doe.ca/cmc/images/charts/125_100.gif



From Environment Canada, on line, June 2, 1996, with permission.

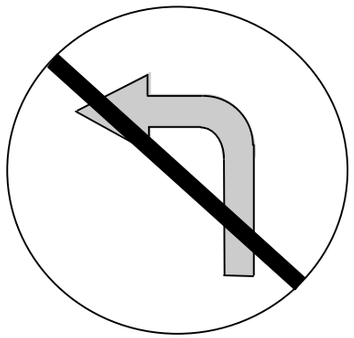
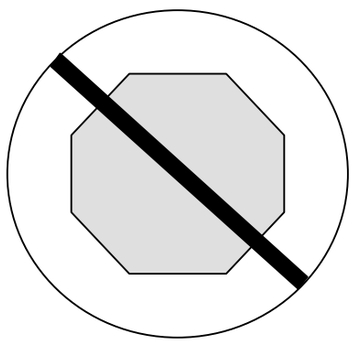
a) Using a current map, estimate the forecasted atmospheric pressure at your location.
b) What is the lowest pressure recorded in Canada for the date on your map?
c) What is the highest pressure recorded in Canada for the date on your map?
d) Shaded areas show where rain is falling. What connection is there between atmospheric pressure and rainfall?

Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	*(continued)*	1.4 Pictorial road signs, as used in Canada and most other countries, are examples of glyphs. They use shapes and sizes to convey the type of sign; then levels of symbols are used to convey meaning. Thus, the sign for *no left turn*, shown in the diagram below, is a two-level glyph that has a circular shape, a left turn arrow and a bar through the arrow.  a) What does the circular shape represent? b) What does the bar mean? c) What is the meaning of the sign below, and how is the meaning conveyed?  d) Design a three-level glyph for *no right turn for trucks*. Why is there no such sign in provincial operator manuals?

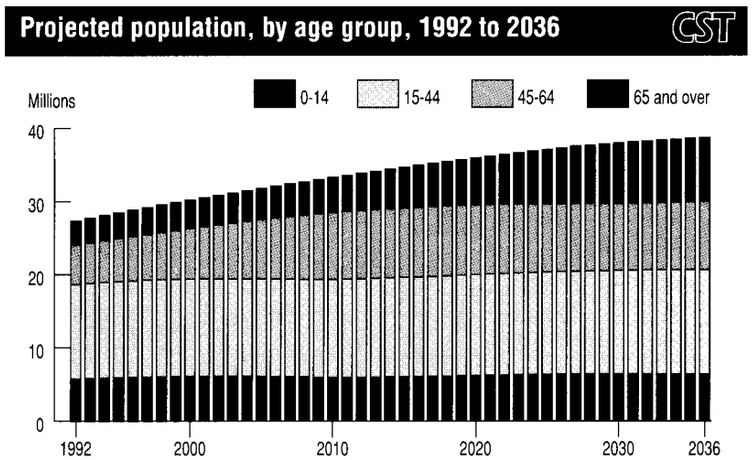
Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	A4–2. (SP7) Draw and validate inferences, including interpolations and extrapolations, from graphical and tabular data. [CN, E, PS, V]	2.1 The bar graph below shows the projected Canadian population, by age group, for the period from 1992 to 2036.



Source: Statistics Canada, Demography Division, unpublished data, projection 3 modified to use T.F.R. of 1.84, annual immigration of 250,000, annual emigration of 86,886.

Reproduced by authority of the Minister of Industry, 1996, Statistics Canada, *Canadian Social Trends*, Catalogue 11–008E, Number 29 Summer 1993, p. 6.

a) What year is Canada's population expected to reach 30 million?
b) Describe the rate of increase of Canada's population, both overall and by age group.
c) Estimate the median age of the Canadian population in 1992 and in 2036.
d) Estimate when Canada's population will reach 40 million.

(continued)

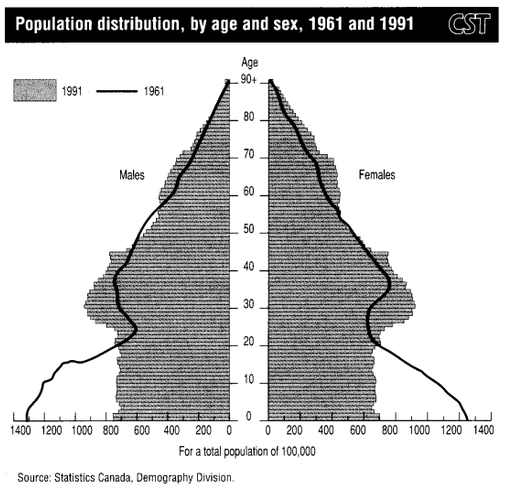
Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	*(continued)*	2.2 The population pyramids shown below are for Canada for 1961 and 1991. Separate data are shown for males and females.



Source: Statistics Canada, Demography Division.

Reproduced by authority of the Minister of Industry, 1996, Statistics Canada, *Canadian Social Trends*, Catalogue 11–008E, Number 29 Summer 1993, p. 6.

a) What is the approximate ratio of male births to female births? Has this ratio changed from 1961 to 1991? Describe any change, and make a hypothesis for the change.
b) The baby boom was a period of time that was characterized by a greater number of births than in the years before or after. What evidence is there for a baby boom, and what were the years of the baby boom?
c) The birth rate was low during the years of the Depression (1931–39) and World War II (1939–45). Where is there evidence for this?
d) The shapes of the population pyramids, especially the 1961 pyramid, show a marked lack of symmetry between the data for males and the data for females. Identify where the lack of symmetry is greatest, and make hypotheses for the lack of symmetry. How could these hypotheses be tested?
e) Sketch a population pyramid for the year 2011, identifying any assumptions made. Use the graph from illustrative example 2.1 as necessary.

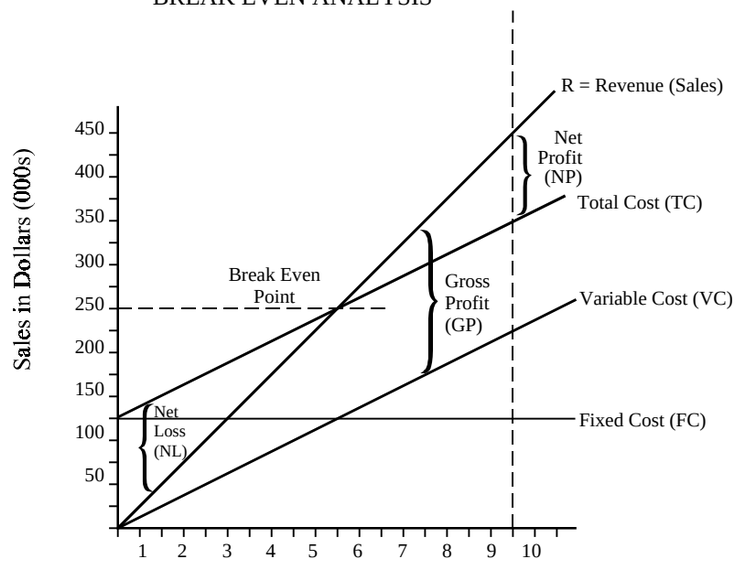
Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	*(continued)*	2.3 BREAK EVEN ANALYSIS



A small store in a shopping mall sells neckties for $50 each. The ties cost the merchant $25 each. Yearly operating expenses, such as wages, rent, utilities and insurance, are $125 000.

VC + FC = TC, R – VC = GP, GP – FC = NP, R – TC = NP (or NL)

If the store sold 100 ties, the sales (R) would not pay for the expenses; therefore, the store would be losing money. At $250 000 in sales, the store's sales just cover all the cost of the goods sold (VC) and expenses (FC). Therefore, the store just breaks even. If the store sells 9000 ties in a year:

a) What is the net profit?
b) What is the gross profit?
c) What is the fixed cost?

Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

[C] Communication **[CN]** Connections **[E]** Estimation and Mental Mathematics **[PS]** Problem Solving **[R]** Reasoning **[T]** Technology **[V]** Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	A4–3. (SP8) Design different ways of presenting data and analyzing results, by focusing on the truthful display of data and the clarity of presentation. [C, CN, T, V]	3.1 Collect an example from a newspaper or magazine in which a graph has been presented in a potentially deceptive manner. Identify the source from which the graph was taken. Explain briefly the ways in which the graph might have been deceptively presented and then show ways the data might be presented more fairly or in a less distorted fashion. Include the graph with the project, and cite its source. Excerpted and adapted with permission from *Data Analysis and Statistics* (*Curriculum and Evaluation* Addenda Series, Grades 9–12), copyright 1992 by the National Council of Teachers of Mathematics. All rights reserved. 3.2 **3.2 CANADA'S POPULATION[1] (THOUSANDS)** See table below. [1] *As of June 1.* [2] *Final postcensal estimates.* [3] *Updated postcensal estimates.* **Sources** **Employment and Immigration Canada** **Statistics Canada** Reproduced by authority of the Minister of Industry, 1996, Statistics Canada, *Canada Year Book 1994*, Catalogue No. 11–402E/1994, p. 112. Using data for 10-year intervals, starting in 1921 and ending in 1991, design an honest presentation of the data that can be included in different term papers dealing with each of the following topics: a) the increase in Canada's population b) the westward shift of Canada's population c) the population of Saskatchewan d) the dominant position of Ontario and Quebec within Canada. Explain your choice of data selection and data presentation.

	Nfld.	PEI	NS	NB	Que.	Ont.	Man.
1921	. . .	88.6	523.8	387.9	2,360.5	2,933.7	610.1
1931	. . .	88.0	512.8	408.2	2,874.7	3,431.7	700.1
1941	. . .	95.0	578.0	457.4	3,331.9	3,787.7	729.7
1951	361.4	98.4	642.6	515.7	4,055.7	4,597.6	776.5
1956	415.1	99.3	694.7	554.6	4,628.4	5,404.9	850.0
1961	457.9	104.6	737.0	597.9	5,259.2	6,236.1	921.7
1966	493.4	108.5	756.0	616.8	5,780.8	6,960.9	963.1
1971	522.1	111.6	789.0	634.6	6,027.8	7,703.1	988.2
1976	557.7	118.2	828.6	677.3	6,234.5	8,264.5	1,021.5
1981	567.7	122.5	847.4	696.4	6,438.2	8,624.7	1,026.2
1986	568.3	126.6	873.2	710.4	6,540.2	9,113.0	1,071.2
1987[2]	568.1	127.3	878.0	712.3	6,592.6	9,265.0	1,079.0
1988[2]	568.8	128.5	881.9	714.3	6,640.8	9,431.1	1,084.1
1989[2]	571.1	129.9	888.3	717.8	6,698.2	9,589.6	1,086.3
1990[2]	572.7	130.7	895.1	722.6	6,768.2	9,749.6	1,089.0
1991[2]	575.7	131.2	901.0	727.6	6,847.4	9,917.3	1,094.4
1992[3]	577.5	130.5	906.3	729.3	6,925.2	10,098.6	1,096.8

	Sask.	Alta.	BC	YT	NWT	Canada
1921	757.5	588.5	524.6	4.1	8.1	8,787.4
1931	921.8	731.6	694.3	4.2	9.3	10,376.7
1941	896.0	796.2	817.8	5.0	12.0	11,506.7
1951	831.7	939.5	1,165.2	9.1	16.0	14,009.4
1956	880.7	1,123.1	1,398.5	12.2	19.3	16,080.8
1961	952.2	1,332.0	1,629.1	14.6	23.0	18,265.3
1966	955.4	1,463.2	1,873.7	14.4	28.7	20,014.9
1971	926.2	1,627.9	2,184.6	18.4	34.8	21,568.3
1976	921.3	1,838.0	2,466.6	21.8	42.6	22,992.6
1981	968.3	2,237.3	2,744.2	23.2	45.7	24,341.7
1986	1,010.2	2,375.1	2,889.0	23.5	52.2	25,353.0
1987[2]	1,015.8	2,377.7	2,925.0	24.5	52.0	25,617.3
1988[2]	1,013.5	2,388.7	2,980.2	25.2	52.2	25,909.2
1989[2]	1,006.7	2,425.9	3,048.3	25.5	52.9	26,240.3
1990[2]	997.1	2,473.1	3,132.5	26.0	53.9	26,610.4
1991[2]	994.2	2,521.6	3,212.1	26.7	55.2	27,004.4
1992[3]	993.2	2,562.7	3,297.6	27.9	56.5	27,402.1