

COURSES

derived from

The Common Curriculum Framework

for

K–12 MATHEMATICS

Grade 10 to Grade 12

Western Canadian Protocol for Collaboration in Basic Education

Call for Resources

JUNE 1996

APPLIED MATHEMATICS 12

derived from

The Common Curriculum Framework

for

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Grade 10 to Grade 12

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APPLIED MATHEMATICS 12: 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 12 course.

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

CLUSTERS IN THE APPLIED MATHEMATICS 12 COURSE

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

The common cluster, numbered C6, is part of the mathematics expected of all students completing a K to 12 mathematics program.

Applied clusters, numbered A6 to A9, 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, C2 – 6._(PR53) is the 6th specific outcome in Common Cluster 2 and the 53rd specific outcome in the Patterns and Relations strand.

Applied Mathematics 12

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

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[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
<p>Describe and apply operations on matrices to solve problems, using technology as required.</p> <p><i>(continued)</i></p>	<p>A6-1. (N17) Show an understanding of matrices and perform the operations of addition, scalar multiplication and matrix multiplication. [C, T]</p>	<p>1.1 Calculate each of the following:</p> <p>a) $\begin{pmatrix} 4 & 6 \\ 2 & -1 \end{pmatrix} + \begin{pmatrix} 3 & 8 \\ 2 & -5 \end{pmatrix}$ b) $4 \begin{pmatrix} 2 & 3 & -4 \\ 1 & 0 & 5 \end{pmatrix}$ c) $\begin{pmatrix} 3 & 2 \\ -1 & 4 \end{pmatrix} \begin{pmatrix} 4 & 1 & -2 \\ 3 & 5 & 0 \end{pmatrix}$.</p> <p>1.2 Represent a real-world situation, using a matrix.</p> <p>a) For towns participating in a local hockey league, create hockey standings, including home, away and combined records.</p> <p>b) Diagram various networking strategies, such as those found in an office, in a telephone system, in a roadway system.</p> <p>1.3 Singh's Grocery sells several different kinds of breakfast cereal, each at a different price. Cereal A is 2.65/bx. Cereal B is 3.73/bx. Cereal C is 3.15/bx. Cereal D is 2.99/bx.</p> <p>Write the price list as a row matrix.</p> <p>On Wednesday, they sold the following: 5 boxes of Cereal A 8 boxes of Cereal B 7 boxes of Cereal C 10 boxes of Cereal D.</p> <p>Write Wednesday's sales as a column matrix. Use matrix multiplication to find Wednesday's total revenues.</p>

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<p><i>(continued)</i></p>	<p>A6-2. Solve problems, using the operations of addition, subtraction, scalar multiplication and matrix multiplication on matrices. [PS, R, T, V]</p> <p style="text-align: right;"><i>(continued)</i></p>	<p>2.1 A store sells items that are tax-free, items that have a 7% GST charge on the base price and items that have both a 7% GST and a 9% PST charge on the base price. A weekend's sales, before tax, can be represented by:</p> <table style="margin-left: 40px;"> <tr> <td></td> <td style="text-align: center;">Saturday</td> <td style="text-align: center;">Sunday</td> </tr> <tr> <td style="text-align: right;">Tax free</td> <td style="text-align: center;">500</td> <td style="text-align: center;">700</td> </tr> <tr> <td style="text-align: right;">$S =$ GST only</td> <td style="text-align: center;">1250</td> <td style="text-align: center;">400</td> </tr> <tr> <td style="text-align: right;">GST and PST</td> <td style="text-align: center;">800</td> <td style="text-align: center;">700</td> </tr> </table> <p>a) What does the matrix $A = \begin{pmatrix} 0 & 0 \\ 1250 & 400 \\ 800 & 700 \end{pmatrix}$ represent?</p> <p>b) What does the matrix $B = \begin{pmatrix} 0 & 0 \\ 0 & 0 \\ 800 & 700 \end{pmatrix}$ represent?</p> <p>c) What does the matrix $(S + 0.07A + 0.09B)$ represent?</p> <p>d) Write a matrix to represent the total tax collected. What are the entries for this matrix?</p> <p>e) Budgets change the tax rates to 5% for GST and 12% for PST. Write a new matrix for the total taxes collected in this new situation. What are the entries for this new matrix?</p> <p>2.2 Sales of economy cars were 200 in 1993 and rose by 3% in 1994. Sales of midsize cars were 300 in 1993 and rose by 10% in 1994. Sales of luxury cars were 40 in 1993 and fell by 5% in 1994. Show that 1994 sales can be represented by the matrix multiplication shown.</p> $\begin{pmatrix} 1.03 & 0 & 0 \\ 0 & 1.10 & 0 \\ 0 & 0 & 0.95 \end{pmatrix} \begin{pmatrix} 200 \\ 300 \\ 40 \end{pmatrix} = \begin{pmatrix} 206 \\ 330 \\ 38 \end{pmatrix}$		Saturday	Sunday	Tax free	500	700	$S =$ GST only	1250	400	GST and PST	800	700
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<i>(continued)</i>	<i>(continued)</i>	<p>2.3 Soccer has been experimenting with using league standings to discourage tie games, especially those with no goals. The traditional scheme of 2 points for a win and 1 point for any tie has been replaced by 3 points for a win and 1 point for any tie. Proposed schemes have included 3 points for a win, 1 point for ties that have goals scored and 0 points for ties with no goals; as well as a scheme with 5 points for a win, 3 points for a tie with goals scored and 0 points for a tie with no goals. In a local soccer league the top four team records after 42 games are:</p> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>Wins</th> <th>Ties with Goals</th> <th>Ties with no Goals</th> <th>Losses</th> </tr> </thead> <tbody> <tr> <td>Tigers</td> <td>30</td> <td>2</td> <td>8</td> <td>2</td> </tr> <tr> <td>Irish</td> <td>24</td> <td>9</td> <td>2</td> <td>7</td> </tr> <tr> <td>Colts</td> <td>25</td> <td>7</td> <td>0</td> <td>10</td> </tr> <tr> <td>Jets</td> <td>26</td> <td>1</td> <td>10</td> <td>5</td> </tr> </tbody> </table> <p>a) Multiply the matrix above by $\begin{pmatrix} 2 \\ 1 \\ 1 \\ 0 \end{pmatrix}$ to get the traditional points.</p> <p>b) Multiply the matrix above by $\begin{pmatrix} 3 \\ 1 \\ 1 \\ 0 \end{pmatrix}$, by $\begin{pmatrix} 3 \\ 1 \\ 0 \\ 0 \end{pmatrix}$ and by $\begin{pmatrix} 5 \\ 3 \\ 0 \\ 0 \end{pmatrix}$ to get the points under the alternative systems.</p> <p>c) Which of the alternative scoring systems can make the Irish second in the standings?</p> <p>d) Which of the alternative scoring systems can make the Colts second in the standings?</p> <p>e) Which of the alternative scoring systems can make the Jets second in the standings?</p> <p>f) Design a system that would drop the Tigers out of first place. Is it a fair system?</p>		Wins	Ties with Goals	Ties with no Goals	Losses	Tigers	30	2	8	2	Irish	24	9	2	7	Colts	25	7	0	10	Jets	26	1	10	5
	Wins	Ties with Goals	Ties with no Goals	Losses																							
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General Outcomes	Specific Outcomes	Illustrative Examples
<i>(continued)</i>	<i>(continued)</i>	<p>2.4 Diplomacy in the Asia-Pacific region is complicated by different alliances. The exchange of diplomats in 1996 can be represented by the matrix D, where:</p> $D = \begin{matrix} & \begin{matrix} \text{NK} & \text{SK} & \text{Ch} & \text{T} & \text{Can} \end{matrix} \\ \begin{matrix} \text{North Korea} \\ \text{South Korea} \\ \text{China} \\ \text{Taiwan} \\ \text{Canada} \end{matrix} & \begin{pmatrix} 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 \end{pmatrix} \end{matrix}$ <p>An entry of 1 represents an exchange of ambassadors; an entry of 0 represents no exchange of ambassadors.</p> <p>a) Draw a network diagram to represent the matrix.</p> <p>Powers of the matrix D represent the number of diplomatic channels available for the exchange of data. The matrix D^2 represents channels with one intermediary, matrix D^3 represents channels with two intermediaries, and matrix D^4 represents channels with three intermediaries. The channels can be listed after the number of channels are identified.</p> <p style="text-align: right;"><i>(continued)</i></p>

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General Outcomes	Specific Outcomes	Illustrative Examples
<i>(continued)</i>	<i>(continued)</i>	<p>2.4 <i>(continued)</i></p> <p>b) Verify that the matrix D^2 is given by:</p> $\begin{pmatrix} 1 & 0 & 0 & 0 & 1 \\ 0 & 2 & 1 & 0 & 0 \\ 0 & 1 & 2 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 & 2 \end{pmatrix}$ <p>Explain why there are no zero entries along the diagonal between top left and bottom right.</p> <p>c) Verify that D^3 is the matrix:</p> $\begin{pmatrix} 0 & 1 & 2 & 0 & 0 \\ 1 & 0 & 0 & 2 & 3 \\ 2 & 0 & 0 & 1 & 3 \\ 0 & 2 & 1 & 0 & 0 \\ 0 & 3 & 3 & 0 & 0 \end{pmatrix}$ <p>Trace the channel between China and Taiwan.</p> <p>d) The matrix D^4 is given by:</p> $\begin{pmatrix} 2 & 0 & 0 & 1 & 3 \\ 0 & 5 & 4 & 0 & 0 \\ 0 & 4 & 5 & 0 & 0 \\ 1 & 0 & 0 & 2 & 3 \\ 3 & 0 & 0 & 3 & 6 \end{pmatrix}$ <p>Trace out the path that a message would take to go from North Korea to Taiwan, using three intermediaries.</p> <p><i>(continued)</i></p>

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General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	(continued)	<p>2.4 (continued)</p> <p>e) The matrix $D + D^2 + D^3$ is given by:</p> $\begin{pmatrix} 1 & 1 & 3 & 0 & 1 \\ 1 & 2 & 1 & 3 & 4 \\ 3 & 1 & 2 & 1 & 4 \\ 0 & 3 & 1 & 1 & 1 \\ 1 & 4 & 4 & 1 & 2 \end{pmatrix}$ <p>This matrix represents all those channels that need two or fewer intermediaries. Trace out the one channel between Canada and Taiwan and all four channels between Canada and South Korea.</p> <p>3.1 A washing powder is sold in 6 L and 10 L packages. Market research shows that 7% of the users of the 6 L size switch to the 10 L size for their next purchase, and 3% of the users of the 10 L size switch to the 6 L size for their next purchase.</p> <p>a) If the original market share was 60% for 6 L and 40% for 10 L, what is the market share for each size in the next round of purchases?</p> <p>b) What is the market share for each size for the third round of purchases?</p> <p>c) Rewrite the processes for a) and b) in terms of a 2×2 transition matrix and a 2×1 market share matrix.</p> <p>d) What would be the final market share?</p> <p>e) Use iteration to estimate how quickly the final market share for each size is approached.</p> <p>3.2 A car manufacturer makes three models of car: full size, compact and economy. Of full size car buyers, 13% will switch to compact and 2% to economy. Of compact car buyers, 5% will switch to full size and 4% to economy. Of economy car buyers, 21% will switch to compact and 3% to full size.</p> <p>a) If the initial market share is 30% full size, 20% compact and 50% economy, what is the market share for each model for the next round of purchases?</p> <p>b) What is the market share for each model for the third round of purchases?</p> <p>c) Write a 3×3 matrix T that represents the switching behaviour.</p> <p>d) Find the final market share for each model.</p>
	<p>A6-3. Use matrices and matrix operations to model and to solve consumer, network and schedule problems. [C, CN, PS, R, T, V]</p>	

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<p>Design or use a spreadsheet to make and justify financial decisions.</p> <p><i>(continued)</i></p>	<p>A8-1. (N20) Design or modify a financial spreadsheet template to allow users to input their own variables. [C, PS, T]</p>	<p>1.1 For the following invoice, develop a spreadsheet that calculates the totals and that requires the operator to input a minimum number of entries.</p> <p style="text-align: center;">ACME AUTO PARTS</p> <p><u>Customer Inquiries</u></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Item No.</th> <th>Auto Parts</th> <th>Quantity</th> <th>Unit Price</th> <th>Total</th> <th colspan="2">Labour</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Brake Pads</td> <td>1</td> <td>26.34</td> <td>26.34</td> <td rowspan="3">O/H Front Brakes 1.5 hrs. @ 37.00/hr. Machined and Replaced Rotor</td> <td>51.25</td> </tr> <tr> <td>2</td> <td>Wheel Seals</td> <td>2</td> <td>5.25</td> <td>10.50</td> <td>10.00</td> </tr> <tr> <td>3</td> <td>Rotor</td> <td>1</td> <td>30.16</td> <td>30.16</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td style="text-align: right;">Total Labour</td> <td>61.25</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td style="text-align: right;">Total Parts</td> <td>67.00</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td style="text-align: right;">Total Parts</td> <td>67.00</td> <td>PST on Parts (8%)</td> <td>5.36</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>GST (7%)</td> <td>8.98</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td style="text-align: right;">TOTAL</td> <td>142.59</td> </tr> </tbody> </table>	Item No.	Auto Parts	Quantity	Unit Price	Total	Labour		1	Brake Pads	1	26.34	26.34	O/H Front Brakes 1.5 hrs. @ 37.00/hr. Machined and Replaced Rotor	51.25	2	Wheel Seals	2	5.25	10.50	10.00	3	Rotor	1	30.16	30.16							Total Labour	61.25						Total Parts	67.00					Total Parts	67.00	PST on Parts (8%)	5.36							GST (7%)	8.98						TOTAL	142.59
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General Outcomes	Specific Outcomes	Illustrative Examples
<p><i>(continued)</i></p>	<p>A8-2. (N21) Use spreadsheets to analyze renting or buying an increasing asset (home) under different sets of circumstances. [C, PS, T]</p> <p>A8-3. (N22) Use spreadsheets to analyze leasing or buying a decreasing asset (vehicle, computer) under different sets of circumstances. [C, PS, T]</p>	<p>2.1 The Wong family is faced with a move and has the choice of buying a home for \$145 000 with a \$25 000 down payment, or renting a similar house for \$975 per month. Four options are available.</p> <ol style="list-style-type: none"> 1. Buy the house with a 20-year mortgage and continue investing at the same rate after the mortgage is paid. 2. Buy the house with a 30-year mortgage. 3. Rent a house and invest the \$25 000. 4. Rent a house and invest both the \$25 000 and the difference each month between the rent and the mortgage payment. <p>The analysis spreadsheets must include the following inputs:</p> <ol style="list-style-type: none"> a) mortgage interest rate, taking 8.5% as a starting value b) taxation rate, taking 1.5% of market value as a starting value c) annual rent increase, taking 5% per annum as a starting value d) annual increase in house value, taking 4% per annum as a starting value e) investment return, taking 7.0% as a starting value. <p>Try different scenarios, varying from 1 year to 30 years. Summarize circumstances in which buying makes sense, and summarize circumstances when renting makes sense.</p> <p>3.1 A car lease runs for 36 months at \$305 per month, with a down payment of \$1105, a lease-end value of \$7105 and an interest rate of 11.6%. Maintenance is the purchaser's responsibility. Set up a spreadsheet to include the monthly values of the opening balance, interest paid, lease payment and closing balance. Use the spreadsheet to answer the following questions.</p> <ol style="list-style-type: none"> a) What part of the \$305 is used to pay the interest on the \$7105? b) What total price is being charged for the car? c) What is the change in the monthly lease payment, if the lease-end value is reduced to \$5700? d) What is the monthly payment for a straight purchase over 36 months with a 20% down payment? e) What is the annual percentage depreciation rate assumed with the \$7105 lease-end value?

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General Outcomes	Specific Outcomes	Illustrative Examples
<i>(continued)</i>	<p>A8-4. (N23) Use spreadsheet(s) to analyze an investment or life insurance portfolio, applying such concepts as capital gains, interest rate, inflation rate, risk, total rate of return and after-tax rate of return. [C, PS, T]</p>	<p>4.1 The time needed for an investment to double in value can be estimated using the rule of 72, which states that $n = \frac{72}{i}$ where i is the annual percentage interest rate and n the number of years.</p> <p>a) Compare the rule of 72 doubling time with the exact doubling time for the following interest rates:</p> <ul style="list-style-type: none"> • 4% per annum, compounded annually • 8% per annum, compounded annually • 24% per annum, compounded annually. <p>b) What general conclusion can be drawn as to the accuracy of rule of 72 calculations?</p> <p>4.2 An average car in 1996 costs \$20 000.</p> <p>a) If this money were invested for 15 years at 8% per year, compounded yearly, and cars did not increase in price, how many cars could be bought in 2011?</p> <p>b) If the average inflation rate were 3.5% per year, how many cars could be bought in 2011 with the proceeds from the investment?</p> <p>c) What is the real, after inflation, rate of return for the investment?</p> <p>d) How do the answers change, if 40% of the interest is taken in income tax every year?</p> <p>4.3 A retirement portfolio of \$300 000 is to be invested for a 10-year period. A middle-risk stock has a probability of 0.80 of making a 110% capital gain and paying annual dividends of 3.2%; there is a 0.20 probability of making a 30% capital loss and paying no annual dividends. Term deposits are guaranteed to pay interest at 7.5% per year, compounded annually.</p> <p>a) What is the best net worth, if all the capital is invested in stocks and the stocks make the maximum capital gain?</p> <p>b) What is the worst net worth, if all the capital is invested in stocks and the stocks take the maximum capital loss?</p> <p>c) Compare the expected net worth from the stocks to the guaranteed net worth from the term deposits.</p> <p>d) How would the numbers in the problem be different for high-risk stocks and for low-risk stocks?</p> <p>e) Modify the calculations to allow for 40% of the gains to be paid yearly in income tax.</p>

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<p><i>(continued)</i></p>	<p>A8-5. Analyze car or house insurance needs and premiums, using such concepts as loss, probability of loss, compulsory coverage, optional coverage, deductible and claims record. [CN, E, R, T]</p>	<p>5.1 Obtain collision damage figures for inexperienced drivers and for experienced drivers from an insurance company, and then calculate a fair insurance premium for \$1 000 000 liability, \$250 deductible collision and \$100 deductible comprehensive theft/glass coverage. Do the calculation twice, once for each type of driver.</p> <p style="padding-left: 40px;">What change in premium would be fair, if the deductible for collision were raised to \$1000?</p> <p>5.2 At what point is it worth it to drop collision coverage on an older vehicle? Show a strategy, and explain the supporting calculations.</p> <p>5.3 How long does a home security system need to be installed before the cost of the system is paid for by the savings in insurance premiums? Obtain data for your area from an insurance agent. Show a strategy, and explain the supporting calculations.</p>

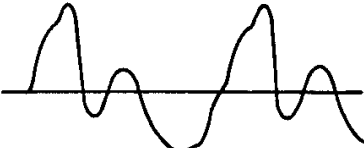
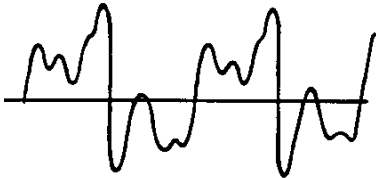
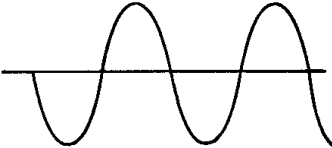
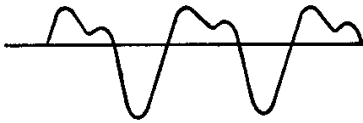
Applied Mathematics 12

Strand: Patterns and Relations (Patterns)

Students will:

- use patterns to describe the world and to solve problems.

- | | |
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| | [V] Visualization |

General Outcomes	Specific Outcomes	Illustrative Examples
<p>Generate and analyze cyclic, recursive and fractal patterns.</p> <p><i>(continued)</i></p>	<p>A7-1. From cyclic data produce a periodic graph. [C, PS, V] (PR10)</p> <p>A7-2. Predict results from graphs that represent periodic events. [E, R, V] (PR11)</p>	<p>1.1 Research the sunrise time for a period of one year, and graph it. From your graph, determine the time of sunrise for March 12.</p> <p>2.1 The following are graphs showing the patterns produced on an oscilloscope when four different musical instruments are played.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>violin</p> </div> <div style="text-align: center;">  <p>clarinet</p> </div> </div> <div style="display: flex; justify-content: space-around; align-items: flex-start; margin-top: 20px;"> <div style="text-align: center;">  <p>tuning fork</p> </div> <div style="text-align: center;">  <p>organ pipe</p> </div> </div> <p>From <i>Fundamentals of Physics</i> by Martindale et al. Reprinted by permission of ITP Nelson Canada.</p> <p>For each instrument:</p> <ol style="list-style-type: none"> find the amplitude find the period sketch the graph, if the instrument is played louder sketch the graph, if the instrument is used to play a higher note.

Applied Mathematics 12

Strand: Patterns and Relations (Patterns)

Students will:

- use patterns to describe the world and to solve problems.

[C] Communication

[CN] Connections

[E] Estimation and

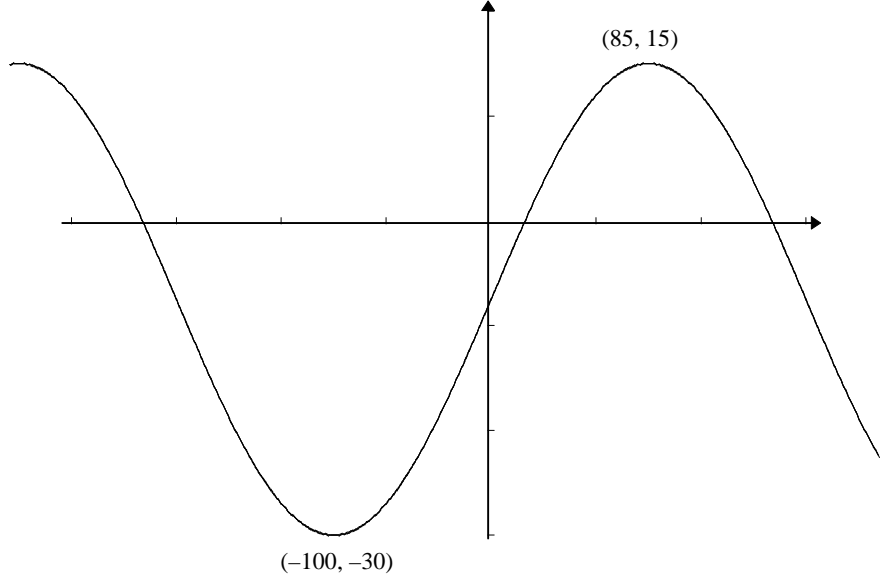
Mental Mathematics

[PS] Problem Solving

[R] Reasoning

[T] Technology

[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
<i>(continued)</i>	<p>A7-3. Describe periodic events, including sinusoidal curves, using correct terminology. [C, V]</p>	<p>3.1 A temperature–time graph was drawn for a northern Saskatchewan town. The variable plotted on the horizontal axis is the calendar date, with April 1 as zero and the unit being days. The variable plotted on the vertical axis is the temperature in degrees Celsius. The graph is drawn below. Find the:</p> <ol style="list-style-type: none"> amplitude period maximum and minimum values vertical shift date for the maximum temperature date for the minimum temperature. 

Applied Mathematics 12

Strand: Patterns and Relations (Patterns)

Students will:

- use patterns to describe the world and to 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
<p><i>(continued)</i></p>	<p>A7-4. (PR13) Collect sinusoidal data; sketch the graph of the data; and, using degrees, represent the data with an equation of the form:</p> <ul style="list-style-type: none"> • $y = a \sin(kt) + c$ <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> • $y = a \cos(kt) + c.$ <p>[CN, PS, T, V]</p> <p>A7-5. (PR14) Develop sinusoidal equations, using degrees, to represent periodic behaviour. [CN, PS, T]</p>	<p>4.1 Collect data from real-world situations, such as:</p> <ol style="list-style-type: none"> hours of daylight low tide and high tide average low and average high temperatures on different dates of the year. <p>Plot the data, and determine an approximate equation for the data in the form of: $y = a \sin(kt) + c$ or $y = a \cos(kt) + c.$</p> <p>5.1 Sketch a graph, and build an equation to represent the following situation.</p> <p>The average daily maximum temperature in Vancouver follows a sinusoidal pattern with a highest value of 24°C and a lowest value of 8°C. The highest value occurs on July 15 and the lowest value on January 15.</p>

Applied Mathematics 12

Strand: Patterns and Relations (Patterns)

Students will:

- use patterns to describe the world and to solve problems.

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

General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	<p>A7-6. Use technology to generate and graph finite or infinite sequences whose recursive definition may or may not be given. [PS, T, V]</p> <p>A7-7. Identify sequences that appear to be: [PR16]</p> <ul style="list-style-type: none"> • divergent • convergent • oscillating • static. <p>[C, V]</p>	<p>6.1 For the Fibonacci sequence 1, 1, 2, 3, 5, . . . , determine a recursive form.</p> <p>6.2 Find the 20th term of the sequence $t_n = t_{n-1} + 2$, where $t_1 = 1$, by generating a table or graph.</p> <p>6.3 A sequence is defined by $t_n = 3t_{n-1} + 2t_{n-2}$. Determine the value of t_9, given $t_0 = 5$ and $t_1 = 3$. Use a spreadsheet to find t_{100} and the first term of the sequence that has a value of more than 1 million.</p> <p>7.1 Calculate several terms of the following sequences where the n^{th} term is defined as follows:</p> <ol style="list-style-type: none"> $a_n = 6^{n+1}$ $a_n = (-2)^n$ $a_n = 6$ $a_n = \frac{1}{2n}$. <p>Graph the results. Use this information to hypothesize each of the sequences as divergent, convergent, oscillating or static.</p> <p>7.2 The monthly closing balances of a loan form a sequence. Under what conditions will these balances form a divergent sequence?</p> <p>7.3 Regular polygons of n sides are inscribed in a circle of radius 10 cm. The perimeters P_n of these regular polygons form a sequence. Is this sequence convergent? Estimate the value of P_n, if n is very large.</p>

Strand: Patterns and Relations (Patterns)

Students will:

- use patterns to describe the world and to solve problems.

[C] Communication

[CN] Connections

[E] Estimation and

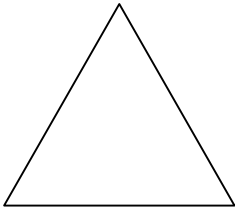
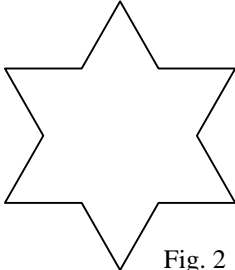
Mental Mathematics

[PS] Problem Solving

[R] Reasoning

[T] Technology

[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
<p><i>(continued)</i></p>	<p>A7–8. (PR17) Construct a fractal pattern by repeatedly applying a procedure to a geometric figure. [CN, R, V]</p> <p>A7–9. (PR18) Use the concept of self-similarity to compare and/or predict the perimeters, areas and volumes of fractal patterns. [CN, R, V]</p> <p style="text-align: right;"><i>(continued)</i></p>	<p>8.1 The following example is the Koch snowflake curve. Construct an equilateral triangle (Fig. 1). Trisect each side, construct an equilateral triangle on each middle third, and delete the middle third (Fig. 2).</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Fig. 1</p> </div> <div style="text-align: center;">  <p>Fig. 2</p> </div> </div> <p>For each segment in Fig. 2, repeat the above.</p> <p>8.2 Construct your own fractal pattern.</p> <p>9.1 For illustrative example 8.1, predict the perimeter of the fifth pattern.</p>

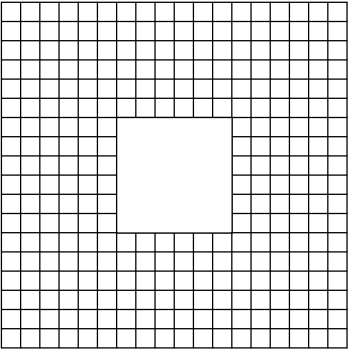
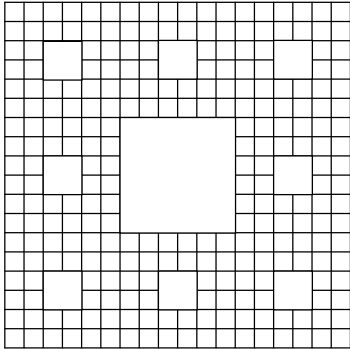

Applied Mathematics 12

Strand: Patterns and Relations (Patterns)

Students will:

- use patterns to describe the world and to solve problems.

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

General Outcomes	Specific Outcomes	Illustrative Examples
(continued)	(continued)	<p>9.2 Fractal Carpet</p> <p>A fractal can be generated by a pattern of iteration. This fractal design is called the Sierpinski carpet after the mathematician who invented it in 1916. The general rule is to start with a square and take a square out. Look at the first iteration and describe the rule that was used to determine the size of the square that was removed. Now compare the first two iterations and describe the rule that was used to construct the second from the first. Apply the rule you have stated to construct the third iteration in the space provided.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>Iteration 1</p>  </div> <div style="text-align: center;"> <p>Iteration 2</p>  </div> <div style="text-align: center;"> <p>Iteration 3</p>  </div> </div> <p>Now examine the third iteration you have constructed, and record the length of the side of the new squares you drew. Compare this length to the lengths of the sides of the previous squares. Write the lengths of the sides of all the squares in descending order. If you construct the fourth iteration, what will the lengths of the sides of the squares need to be? Now look at the first iteration again. What is the area of the square that was removed? What is the area of each individual square that was removed in the next two iterations? Write these areas in descending order. What is the area of each individual square to be removed in the fourth iteration?</p> <p>Challenge: Find the perimeter of all the squares in the third iteration. Find the area of the figure that remains once all the squares are removed in the third iteration.</p> <p><small>Excerpted and adapted with permission from <i>Geometry from Multiple Perspectives (Curriculum and Evaluation Standards Addenda Series, Grades 9–12)</i>, copyright 1991 by the National Council of Teachers of Mathematics. All rights reserved.</small></p>

Applied Mathematics 12

Strand: Patterns and Relations (Patterns)

Students will:

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[C] Communication

[CN] Connections

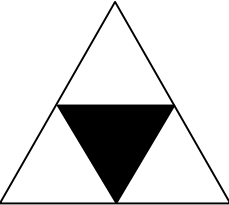
[E] Estimation and
Mental Mathematics

[PS] Problem Solving

[R] Reasoning

[T] Technology

[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
<p><i>(continued)</i></p>	<p><i>(continued)</i></p>	<p>9.3 The Sierpinski triangle can be created by using dilations and isometries. You may begin with an arbitrary triangle. An equilateral triangle is used for the procedures described below.</p> <ol style="list-style-type: none"> Draw an equilateral triangle. Reduce the triangle by a factor of $\frac{1}{2}$. Make three copies of the reduced triangle. Place the three reduced similar triangles on the original, one at each vertex. Eliminate the remaining portion of the original triangle by blackening it. <p>Your work should result in the figure shown here.</p>  <p>Answer the following questions:</p> <ol style="list-style-type: none"> Let the area of the original triangle be 1 area unit. What area remains? What area has been removed? Let the side of the original triangle be 1 length unit. What is the perimeter of the figure with the dark region removed? <p>Repeat steps a) through d) of the original procedure for each of the triangular regions remaining in the figure shown. Sketch the result of your work.</p> <p>Answer the following questions:</p> <ol style="list-style-type: none"> What is the area of the remaining triangular region? What is the perimeter of the new “holey” triangular region? What would the next iteration of the procedure look like? Make a sketch. Write an expression for the area of the Sierpinski triangle after carrying out the procedure n times. Write an expression for the perimeter of the Sierpinski triangle after carrying out the procedure n times. How would your expressions differ, if you began with a triangle other than an equilateral triangle? <p>Excerpted and adapted with permission from <i>Geometry from Multiple Perspectives (Curriculum and Evaluation Standards Addenda Series, Grades 9–12)</i>, copyright 1991 by the National Council of Teachers of Mathematics. All rights reserved.</p>

Applied Mathematics 12

Strand: Patterns and Relations (Patterns)

Students will:

- use patterns to describe the world and to solve problems.

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

General Outcomes	Specific Outcomes	Illustrative Examples
<i>(continued)</i>	<i>(continued)</i>	<p>9.4 Construct a cylinder with the dimensions: $r = 10$ cm, $h = 20$ cm. A second figure is constructed by halving the previous radius and height. A third is constructed by halving the second and so on.</p> <ol style="list-style-type: none"> Predict the surface area and the volume of the sixth pattern. Write an expression for the surface area after carrying out the procedure n times. Write an expression for the volume after carrying out the procedure n times.

Applied Mathematics 12

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

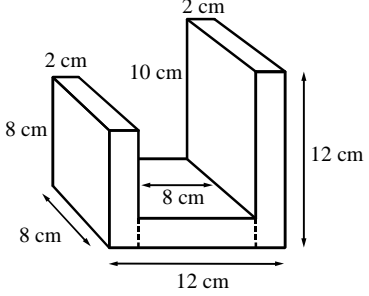
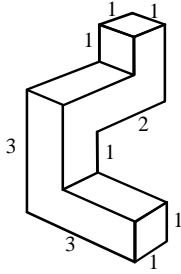
Mental Mathematics

[PS] Problem Solving

[R] Reasoning

[T] Technology

[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
<p>Analyze objects, shapes and processes to solve cost and design problems.</p> <p style="text-align: right;"><i>(continued)</i></p>	<p>A9-1. (SS15) Use dimensions and unit prices to solve problems involving perimeter, area and volume. [E, PS, V]</p> <p style="text-align: right;"><i>(continued)</i></p>	<p>1.1 Determine the volume of the plastic book end shown below.</p>  <p>If the book end is constructed using an injection mold, find the development cost if the plastic ingredients cost 6¢ per cubic centimetre.</p> <p>1.2 In the following diagram of an outside storage system component, all the angles are right angles and the lengths are in centimetres. Find the volume.</p>  <p>A special aluminum latex coating is applied to all outside surfaces of the object. What is the cost of the latex coating, if it costs 28¢ per cm²?</p>

Applied Mathematics 12

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

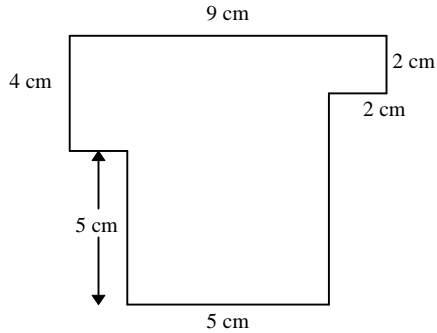
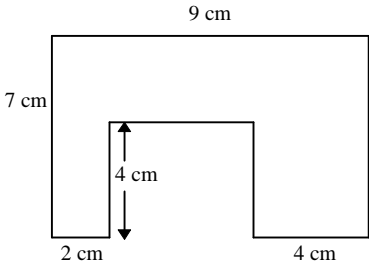
Mental Mathematics

[PS] Problem Solving

[R] Reasoning

[T] Technology

[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
<p><i>(continued)</i></p>	<p style="text-align: center;"><i>(continued)</i></p> <p>A9–2. Solve problems involving estimation and costing for objects, shapes or processes when a design is given. [C, E, PS]</p> <p style="text-align: right;"><i>(continued)</i></p>	<p>1.3 A dressmaker cuts pairs of the following shapes from a rectangular piece of gabardine that is 1 m by 0.5 m. Determine the maximum number of pairs that can be cut from the piece of gabardine. Identify any assumptions.</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>2.1 A swimming pool is 50 m by 21 m. The deep end is 4.0 m deep and extends out 12 m. The shallow end is 1.2 m deep and extends out 12 m. There is a uniform slope connecting the deep and shallow ends.</p> <ol style="list-style-type: none"> Draw scale diagrams showing the top view and the side view of the pool. Calculate the cost of filling it with water at \$2.00/m³. Waterproofing of the underwater surfaces costs \$17/m². Determine the cost of waterproofing. <p>2.2 A window cleaner has been asked by the owner of a large office tower to submit a quotation for cleaning the windows of the building. The window cleaner has the following information:</p> <ol style="list-style-type: none"> there are 24 floors there are 14 windows per side on each floor there are 4 sides to the building. <p>From experience, the window cleaner knows that the transfer time between windows on the same floor and same side of the building is 60 seconds. The transfer time between sides of the building is 120 seconds and between floors is 30 seconds. The time to clean one window is 120 seconds. The window cleaner has a base charge of \$120. The maximum period of time he works at one stretch is 3 hours, then he takes a 30 minute rest. In addition to his rate of \$25/hour, he wants to make 25% profit from the job for reinvestment in his business. What would be the best quote?</p>

Applied Mathematics 12

Strand: Shape and Space (Measurement)

Students will:

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

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

General Outcomes	Specific Outcomes	Illustrative Examples															
(continued)	<p style="text-align: center;">(continued)</p> <p>A9–3. Design an object, shape, layout or process within a specified budget. [PS, R, V]</p> <p style="text-align: center;">(continued)</p>	<p>2.3 To satisfy the building code, an auditorium has to have 1200 m² of washroom space. In a washroom for males, the average space needed is 1.9 m² per user and the average usage time is 97 s. In a washroom for females, the average space needed is 2.4 m² per user and the average usage time is 145 s. Determine the required washroom space:</p> <p>a) on the basis of equal areas for males and females</p> <p>b) on the basis of equal users per hour for males and females.</p> <p>3.1 Tin plate for making cylindrical cans comes in sheets that are 240 cm by 160 cm and costs \$3.20 per sheet. Cans are 6 cm in diameter and 11 cm high, and they have 3 seals each. Seals cost 0.8¢ each to make. One sheet of tin plate is used for making pieces for ends, and two sheets are used for making pieces for sides.</p> <p>a) How many ends and how many sides can be made from the three sheets of tin plate?</p> <p>b) How many cans can be made from the three sheets, and what is the cost per can?</p> <p>c) Is there another way of making more cans from the three sheets, or the same number of cans from less tin plate?</p> <p>d) How much money is saved doing it the second way?</p> <p>3.2 To produce a voters' list for a riding, a sum of \$1.70 per voter is allocated. Four methods of enumerating are possible:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Method</th> <th>Cost per Voter</th> <th>Probability of Return</th> </tr> </thead> <tbody> <tr> <td>Hand deliver enumeration form, mail return</td> <td>\$0.91</td> <td>0.700</td> </tr> <tr> <td>Mail form both ways</td> <td>\$1.07</td> <td>0.740</td> </tr> <tr> <td>Telephone until voter reached</td> <td>\$2.21</td> <td>0.920</td> </tr> <tr> <td>Enumerator calls until voter reached</td> <td>\$5.26</td> <td>0.995</td> </tr> </tbody> </table> <p>For a total of 40 000 voters, find the maximum number of voters who can be enumerated within the budget and the minimum budget needed to be sure of enumerating 98% of the potential voters.</p> <p>Note: This problem connects to outcomes in clusters A5 and C6.</p>	Method	Cost per Voter	Probability of Return	Hand deliver enumeration form, mail return	\$0.91	0.700	Mail form both ways	\$1.07	0.740	Telephone until voter reached	\$2.21	0.920	Enumerator calls until voter reached	\$5.26	0.995
Method	Cost per Voter	Probability of Return															
Hand deliver enumeration form, mail return	\$0.91	0.700															
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Telephone until voter reached	\$2.21	0.920															
Enumerator calls until voter reached	\$5.26	0.995															

Applied Mathematics 12

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

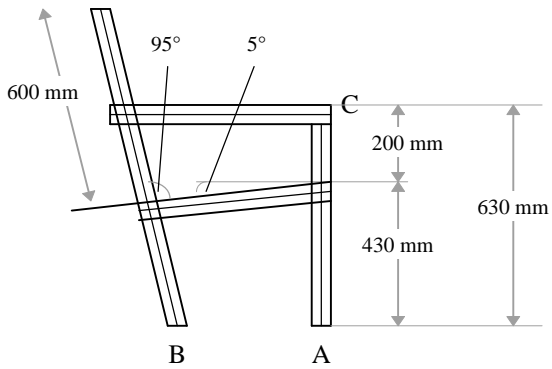
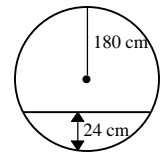
Mental Mathematics

[PS] Problem Solving

[R] Reasoning

[T] Technology

[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
<p><i>(continued)</i></p>	<p><i>(continued)</i></p> <p>A9-4. Use simplified models to estimate the solutions to complex measurement problems. [E, V]</p>	<p>3.3 One side of a wooden chair is being built. The front of the seat should be 430 mm above the ground and should slope back at 5° from the horizontal. The seat depth is 450 mm, and the angle between the seat and the back of the chair is 95°. The required length of the back of the chair, measured from the seat, is 600 mm. The height of the horizontal chair arm is 200 mm above the front of the seat. Draw a scale diagram, and use it to calculate the lengths of wooden components A, B and C. What is the maximum cost per metre for the wood needed to make this side of the chair, if the cost cannot exceed \$20?</p>  <p>4.1 Estimate the area of the Yukon Territory, by:</p> <ol style="list-style-type: none"> counting squares splitting the area into rectangles and triangles. <p>Which method is most accurate? Which type of map gives the most reliable estimate for the area of the Yukon Territory? Where are the main sources of error in the estimate?</p> <p>4.2 A water tank is a sphere of diameter 3.6 m. Estimate the volume of water in the tank, if the depth of water is 24 cm.</p> 

Applied Mathematics 12

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

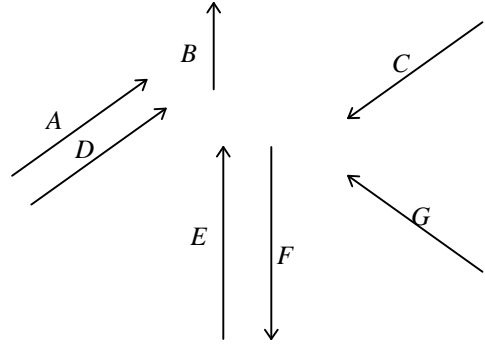
[E] Estimation and
Mental Mathematics

[PS] Problem Solving

[R] Reasoning

[T] Technology

[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples								
<p>Solve problems involving polygons and vectors, including both 3-D and 2-D applications.</p> <p style="text-align: right;"><i>(continued)</i></p>	<p>A6-4. (SS30) Use and give 3-D and 2-D examples of vector terminology and notation, including:</p> <ul style="list-style-type: none"> vector (direction, magnitude) scalar unit vector collinear vectors opposite vectors parallel vectors resultant vectors. <p>[C, CN]</p>	<p>4.1</p>  <p>Given the above vectors, complete the following chart.</p> <table border="1" data-bbox="1311 812 1841 1006"> <tbody> <tr> <td>opposite vectors</td> <td></td> </tr> <tr> <td>parallel vectors</td> <td></td> </tr> <tr> <td>resultant vectors</td> <td></td> </tr> <tr> <td>collinear vectors</td> <td></td> </tr> </tbody> </table> <p>4.2 Car A is travelling at 110 km/h and Car B is travelling at 100 km/h.</p> <ol style="list-style-type: none"> Give an example where the magnitude of $A - B$ is equal to 210 km/h. Give an example where the magnitude of $A - B$ is equal to 10 km/h. If A and B are at right angles, what is the magnitude of $A - B$? 	opposite vectors		parallel vectors		resultant vectors		collinear vectors	
opposite vectors										
parallel vectors										
resultant vectors										
collinear vectors										

Applied Mathematics 12

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

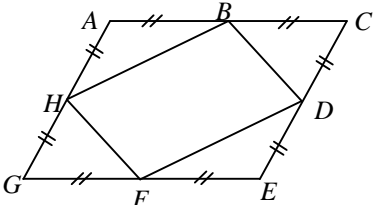
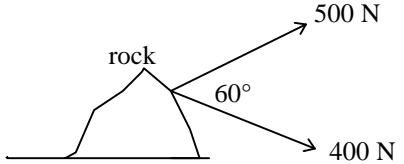
[E] Estimation and
Mental Mathematics

[PS] Problem Solving

[R] Reasoning

[T] Technology

[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
<p>(continued)</p>	<p>A6-5. Assign meaning to the multiplication of a vector by a scalar. [CN]</p> <p>A6-6. Perform vector additions and subtractions, using triangle or parallelogram methods. [V]</p> <p>A6-7. Determine the magnitude and direction of a resultant vector, using triangle, parallelogram or component methods. [CN, T, V]</p>	<p>5.1 The vector \vec{a} is 40 km/h east. Make a scale drawing of each of the following vectors:</p> <ol style="list-style-type: none"> $3\vec{a}$ $7\vec{a}$ $-3\vec{a}$ $1.6\vec{a} + 4\vec{a}$. <p>5.2 A price list is represented in Canadian dollars by the vector $\vec{p} = (27, 38, 14, 26)$. If the Canadian dollar is worth \$0.71 US, what does the vector $\vec{q} = 0.71\vec{p}$ represent?</p> <p>6.1</p> <div style="text-align: center;">  </div> <p>Using the above diagram of a rhombus $ACEG$, determine the vector addition of each of the following:</p> <ol style="list-style-type: none"> $\vec{AH} + \vec{HG}$ $\vec{GF} + \vec{BC}$ $\vec{GF} + \vec{CB}$ $\vec{FD} + \vec{DE}$. <p>6.2 A ski jumper encounters a horizontal friction of 85 N backward, a vertical weight of 750 N downward and an air resistance of 340 N upward. Draw the vector addition of these forces, and use the drawing to find the magnitude and direction of the resultant force.</p> <p>7.1 A boat is travelling across a river with a forward velocity of 14 m/s, and there is a current of 3 m/s down the river. How fast is the boat travelling?</p> <p>7.2 John and Marie are using two ropes to pull a rock. Draw a vector diagram to estimate the magnitude and direction of the resultant force. Verify the estimate by a calculation, using components.</p> <div style="text-align: right;">  </div>

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

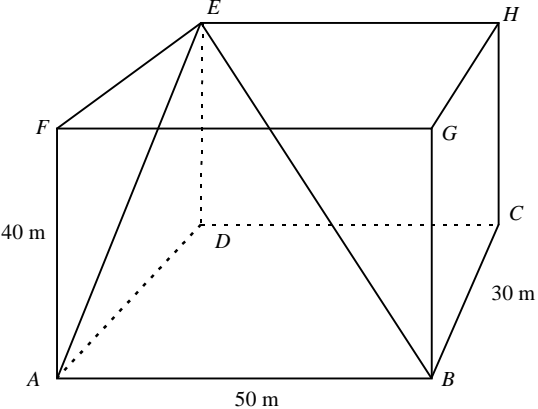
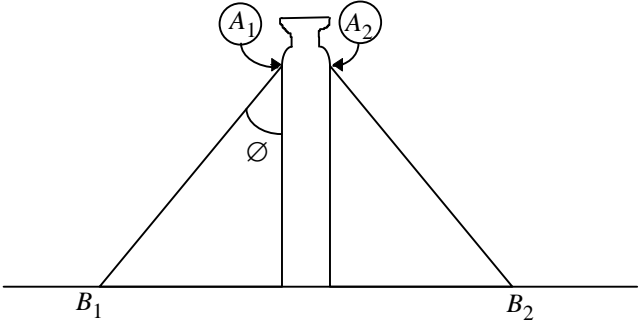
Mental Mathematics

[PS] Problem Solving

[R] Reasoning

[T] Technology

[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
<p>(continued)</p>	<p>A6–8. Use vector diagrams and trigonometry to analyze and solve practical problems in 3-D and 2-D. [CN, PS, V]</p> <p style="text-align: right;">(continued)</p>	<p>8.1 In the diagram, ED is a vertical transmission tower. EA and EB are two of the guy wires. Use the information in the diagram to calculate the angle between guy wires AE and EB.</p> <div style="text-align: center;">  </div> <p>8.2 The support cables for a gas plant flare attach at points A_1 and A_2. The angle of attachment (\emptyset) is 28°. If a horizontal wind from left to right exerts a force of 1200 N at point A_1, what is the force lifting the anchor at point B_1?</p> <div style="text-align: center;">  </div> <p>8.3 An aircraft flying horizontally on a heading of 285° is pushed by a wind from 195°. Angles are measured clockwise from north. The indicated air speed of the aircraft is 300 km/h. The wind is constant at 90 km/h. After 1 hour and 15 minutes of flight, what will be the aircraft's change in location?</p>

Applied Mathematics 12

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
<i>(continued)</i>	<i>(continued)</i>	<p>8.4 Model, by drawing a diagram, Jack's jogging route, if he jogs north at 15 km/h for 30 minutes and then turns east and jogs at 12 km/h for 20 minutes. How far has he jogged in total? How far is he from his starting point? In what direction does he need to go to return to the start by the shortest path?</p>

Applied Mathematics 12

Strand: Statistics and Probability (Chance and Uncertainty)

Students will:

- use experimental or theoretical probability to represent and solve problems involving uncertainty.

[C] Communication

[CN] Connections

[E] Estimation and
Mental Mathematics

[PS] Problem Solving

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General Outcomes	Specific Outcomes	Illustrative Examples																														
<p>Use normal and binomial probability distributions to solve problems involving uncertainty.</p> <p style="text-align: right;"><i>(continued)</i></p>	<p>C6–1. (SP11) Find the population standard deviation of a data set or a probability distribution, using technology. [CN, E, T, V]</p> <p>C6–2. (SP12) Use z-scores and z-score tables to solve problems. [PS, R, T, V]</p> <p style="text-align: right;"><i>(continued)</i></p>	<p>1.1 Measure the height of each student in a class, and calculate the mean and standard deviation.</p> <p>1.2 A company uses an automated packaging device to produce 50-g bags of Karmel Korn. The machine needs frequent checking to see if it is actually putting 50 g in each bag. The following are the masses, in grams, of thirty bags of Karmel Korn.</p> <table border="1" data-bbox="1346 594 2107 760"> <tbody> <tr><td>54</td><td>50</td><td>47</td><td>50</td><td>51</td><td>50</td></tr> <tr><td>53</td><td>50</td><td>47</td><td>51</td><td>50</td><td>51</td></tr> <tr><td>52</td><td>49</td><td>46</td><td>52</td><td>50</td><td>49</td></tr> <tr><td>52</td><td>48</td><td>48</td><td>53</td><td>49</td><td>49</td></tr> <tr><td>51</td><td>48</td><td>49</td><td>52</td><td>49</td><td>50</td></tr> </tbody> </table> <p>a) Calculate the mean and standard deviation of this data. b) What problems will be encountered, if the standard deviation gets too high?</p> <p><i>Dottori et al., Foundations of Mathematics 11, p. 392. Adapted with permission.</i></p> <p>2.1 The volume of the contents of a soft drink can is normally distributed about a mean of 350 mL, with a standard deviation of 1.5 mL.</p> <p>a) Calculate the z-score for a can with a volume of 355 mL. b) What percentage of production will consist of cans having content volumes between 350 mL and 355 mL? c) What percentage of production will consist of cans having content volumes less than 355 mL? d) If cans containing less than 346 mL must be rejected, how many cans will be expected to be rejected in a run of 50 000?</p>	54	50	47	50	51	50	53	50	47	51	50	51	52	49	46	52	50	49	52	48	48	53	49	49	51	48	49	52	49	50
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Strand: Statistics and Probability (Chance and Uncertainty)

Students will:

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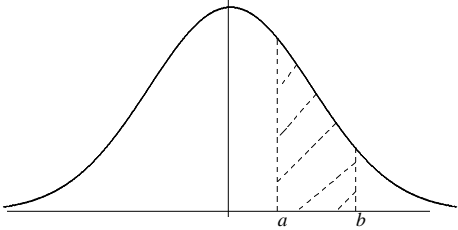
[E] Estimation and
Mental Mathematics

[PS] Problem Solving

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[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
<i>(continued)</i>	<i>(continued)</i>	<p>2.2</p>  <p>a) What is the area under this curve? b) If $P(a < z < b) = 0.4$, what is the area under the curve for the interval $a < z < b$? c) If $P(z < b) = 0.9$, calculate $P(z > b)$, and calculate the value of b.</p> <p>2.3 For entry into the Canadian Armed Forces, the standards for height used to be set at 158 cm to 194 cm for males, and 152 cm to 184 cm for females. Use the concept of z-score to test if these two height standards are equivalent. Assume means of 176 cm and 163 cm and standard deviations of 8 cm and 7 cm respectively.</p> <p>2.4 A sample of 122 people gives a mean body temperature of 36.8°C, with a standard deviation of 0.35°C. Assuming a normal distribution, find: a) the expected number of people with temperatures above 37.0°C b) the expected number of people with temperatures below 36.0°C.</p> <p>Also, estimate the range of temperatures contained within the sample.</p> <p>2.5 In the general population, the IQ scores of individuals is normally distributed with a mean of 110 and a standard deviation of 10. If a large group of people is tested: a) What proportion of this group is expected to have IQs between 100 and 120? b) What is the probability that an individual in the group has an IQ greater than 120?</p>

Applied Mathematics 12

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[C] Communication	[PS] Problem Solving
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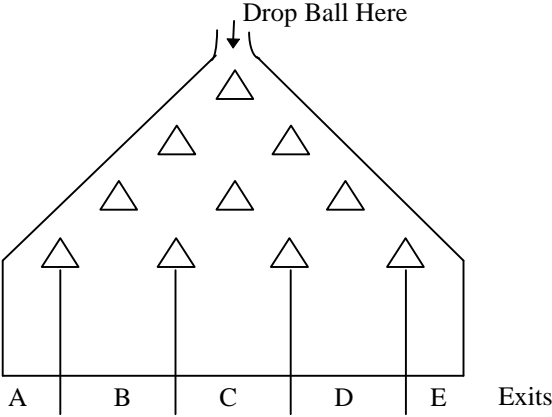
General Outcomes	Specific Outcomes	Illustrative Examples
<i>(continued)</i>	<p>C6-3. (SP13) Use the normal distribution and the normal approximation to the binomial distribution to solve problems involving confidence intervals for large samples. [CN, E, PS]</p>	<p>3.1 The heights of males employed by a manufacturer follow a normal distribution with a mean of 169 cm and a standard deviation of 8 cm.</p> <p>a) Establish a symmetric 95% confidence interval for the average height in a random sample of 36 male employees.</p> <p>b) What happens to the width of the symmetric 95% confidence interval, if the sample size is increased from 36 to 225?</p> <p>3.2 Pollsters estimate that the number of decided voters in favour of a particular bylaw is 64%, and the number opposed is 36%.</p> <p>a) If the sample size is 250, find the expected mean and standard deviation of <i>yes</i> voters.</p> <p>b) Estimate, for this sample, the expected percentage of <i>yes</i> voters, with a symmetric 95% confidence interval used to establish the margin of error.</p> <p>c) If the margin of error for the percentage of <i>yes</i> voters must be less than $\pm 1.0\%$, what would be the minimum sample size required?</p> <p>3.3 The probability that a car salesperson will complete a sale is 0.10. If the salesperson has 200 customers in the next month, establish a symmetric 95% confidence interval for the number of completed sales for the month.</p>

Strand: Statistics and Probability (Chance and Uncertainty)

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- | | |
|--|----------------------|
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| [E] Estimation and
Mental Mathematics | [T] Technology |
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General Outcomes	Specific Outcomes	Illustrative Examples
<p>Solve problems based on the counting of sets, using techniques such as the fundamental counting principle, permutations and combinations.</p>	<p>C6-4. (SP14) Solve pathway problems, interpreting and applying any constraints. [PS, R]</p> <p>C6-5. (SP15) Use the fundamental counting principle to determine the number of different ways to perform multistep operations. [PS, R]</p>	<p>4.1 Given the following “pinball” situation, what is the probability of the ball reaching each of the exits?</p>  <p style="text-align: center;">Drop Ball Here</p> <p style="text-align: center;">A B C D E Exits</p> <p>What assumptions are made in the solution?</p> <p>5.1 Joe has three different shirts, two different pairs of pants and five different pairs of shoes. List all possible outfits in such a way as to ensure that all have been counted and none have been counted twice. How many possible outfits are there? Use the fundamental counting principle to determine the number of outfits there should be. Do your answers match?</p> <p>5.2 An airline pilot reported that in seven days she spent one day in Winnipeg, one day in Regina, two days in Edmonton and three days in Yellowknife. How many different itineraries are possible? What difference would it make if the first day and the last day had to be spent in Yellowknife?</p>

Applied Mathematics 12

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General Outcomes	Specific Outcomes	Illustrative Examples
<p>Model the probability of a compound event, and solve problems based on the combining of simpler probabilities.</p>	<p>C6–6. (SP20) Construct a sample space for two or three events. [PS, R, V]</p> <p>C6–7. (SP21) Classify events as independent or dependent. [C]</p> <p>C6–8. (SP22) Solve problems, using the probabilities of mutually exclusive and complementary events. [CN, PS, R]</p>	<p>6.1 List the sample space for rolling a 6-sided die and flipping a coin.</p> <p>6.2 Draw or list the sample space for the following situation. A bus is scheduled to arrive at a train station at any time between 07:05 and 07:15 inclusive. A train is scheduled to arrive between 07:11 and 07:17 inclusive. The arrival of a bus at 07:06 and a train at 07:14 can be represented by the point (6, 14). Times are expressed in whole minutes.</p> <p>a) How many points are there in this sample space? b) How many points have the bus and the train arriving at the same time? c) How many points have the bus arriving after the train? d) What is the probability of the bus arriving after the train?</p> <p>7.1 Classify the following events as independent or dependent: a) tossing a head in a coin toss and rolling a 6 on a die b) drawing an ace for the first card and another ace for the second, if the experiment is carried out without replacement c) drawing a king for the first card and a queen for the second, if the experiment is carried out with replacement.</p> <p>7.2 Sixty per cent of young drivers take driver training, and 25% of young drivers have an accident in their first year of driving. Statistics show that 10% of those who do take driver training have an accident in their first year. Are taking driver training and having an accident in the first year independent events?</p> <p>8.1 If the probability of winning a game is $\frac{1}{31}$, what is the probability of losing the game?</p> <p>8.2 A shootout consists of teams A and B taking alternate shots on goal. The first team to score wins. Team A has a probability of 0.3 of scoring with any one shot. Team B has a probability of 0.4 of scoring with any one shot. a) If Team A shoots first, what is the probability of Team B winning on its first shot? b) If Team A shoots first, what is the probability of Team A winning on its third shot?</p>