

# 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

# MATHEMATICS 10

derived from

The Common Curriculum Framework

for

# K–12 MATHEMATICS

Grade 10 to Grade 12

---

Western Canadian Protocol for Collaboration in Basic Education

---

JUNE 1996



## **MATHEMATICS 10: 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 Mathematics 10 course.

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

### **CLUSTERS IN THE MATHEMATICS 10 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 C1 to C3, are part of the mathematics expected of all students completing a K to 12 mathematics program.

Pure clusters, numbered P1 to P2, place more emphasis on precise mathematical theory. The approaches used are primarily algebraic and graphical.

### **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.<sub>(PR53)</sub> is the 6<sup>th</sup> specific outcome in Common Cluster 2 and the 53<sup>rd</sup> specific outcome in the Patterns and Relations strand.



# Mathematics 10

## Strand: Number (Number Concepts)

Students will:

- use numbers to describe quantities
- represent numbers in multiple ways.

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

General Outcomes	Specific Outcomes	Illustrative Examples																																																																																		
<p>Analyze the numerical data in a table for trends, patterns and interrelationships.</p> <p><i>(continued)</i></p>	<p>C1-1. (N1) Use words and algebraic expressions to describe the data and the interrelationships in a table with rows that are not related recursively (not calculated from previous data). [C, CN]</p>	<p>1.1</p> <table border="1"> <thead> <tr> <th>Price</th> <th>GST</th> <th>PST</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>\$120.00</td> <td>\$ 8.40</td> <td>\$12.84</td> <td>\$141.24</td> </tr> <tr> <td>\$275.00</td> <td>\$19.25</td> <td>\$29.43</td> <td>\$323.68</td> </tr> </tbody> </table> <p>a) What is the rate of GST?            b) What could be the rate of PST?            c) What could be the rule for calculating PST?            d) What is the total GST paid on the two items in the table?            e) What is the total PST paid on the two items in the table?</p> <p>1.2 National Hockey League (NHL)            Western Conference: February 1, 1996</p> <table border="1"> <thead> <tr> <th></th> <th>W</th> <th>L</th> <th>T</th> <th>Points</th> </tr> </thead> <tbody> <tr><td>Detroit</td><td>35</td><td>9</td><td>4</td><td>74</td></tr> <tr><td>Colorado</td><td>26</td><td>14</td><td>9</td><td>61</td></tr> <tr><td>Chicago</td><td>25</td><td>15</td><td>11</td><td>61</td></tr> <tr><td>Toronto</td><td>22</td><td>19</td><td>9</td><td>53</td></tr> <tr><td>St. Louis</td><td>21</td><td>20</td><td>8</td><td>50</td></tr> <tr><td>Winnipeg</td><td>21</td><td>24</td><td>4</td><td>46</td></tr> <tr><td>Vancouver</td><td>17</td><td>20</td><td>12</td><td>46</td></tr> <tr><td>Los Angeles</td><td>17</td><td>22</td><td>11</td><td>45</td></tr> <tr><td>Calgary</td><td>18</td><td>23</td><td>9</td><td>45</td></tr> <tr><td>Edmonton</td><td>18</td><td>25</td><td>6</td><td>42</td></tr> <tr><td>Anaheim</td><td>17</td><td>27</td><td>5</td><td>39</td></tr> <tr><td>Dallas</td><td>14</td><td>24</td><td>10</td><td>38</td></tr> <tr><td>San Jose</td><td>11</td><td>35</td><td>4</td><td>26</td></tr> </tbody> </table> <p>What happens to the NHL standings if wins are worth three points and ties are worth one point?</p>	Price	GST	PST	Total	\$120.00	\$ 8.40	\$12.84	\$141.24	\$275.00	\$19.25	\$29.43	\$323.68		W	L	T	Points	Detroit	35	9	4	74	Colorado	26	14	9	61	Chicago	25	15	11	61	Toronto	22	19	9	53	St. Louis	21	20	8	50	Winnipeg	21	24	4	46	Vancouver	17	20	12	46	Los Angeles	17	22	11	45	Calgary	18	23	9	45	Edmonton	18	25	6	42	Anaheim	17	27	5	39	Dallas	14	24	10	38	San Jose	11	35	4	26
Price	GST	PST	Total																																																																																	
\$120.00	\$ 8.40	\$12.84	\$141.24																																																																																	
\$275.00	\$19.25	\$29.43	\$323.68																																																																																	
	W	L	T	Points																																																																																
Detroit	35	9	4	74																																																																																
Colorado	26	14	9	61																																																																																
Chicago	25	15	11	61																																																																																
Toronto	22	19	9	53																																																																																
St. Louis	21	20	8	50																																																																																
Winnipeg	21	24	4	46																																																																																
Vancouver	17	20	12	46																																																																																
Los Angeles	17	22	11	45																																																																																
Calgary	18	23	9	45																																																																																
Edmonton	18	25	6	42																																																																																
Anaheim	17	27	5	39																																																																																
Dallas	14	24	10	38																																																																																
San Jose	11	35	4	26																																																																																

# Mathematics 10

## Strand: Number (Number Concepts)

Students will:

- use numbers to describe quantities
- represent numbers 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																																																																													
<p><i>(continued)</i></p>	<p>C1–2. Use words and algebraic expressions to describe the data and the interrelationships in a table with rows that are related recursively (calculated from previous data). [C, CN]</p>	<p>2.1 The following table provides data on the repayment of a \$100 000 farm loan. The farmer has negotiated for one annual payment to be made each year after harvest and for the right to make an extra payment, if the harvest is good. Use the table to answer the questions.</p> <table border="1"> <thead> <tr> <th>Year</th> <th>Opening Balance</th> <th>Interest Rate (%)</th> <th>Interest Charged</th> <th>Regular Payment</th> <th>Extra Payment</th> <th>Closing Balance</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>\$100 000.00</td> <td>8</td> <td>\$8000.00</td> <td>\$14 902.95</td> <td></td> <td>\$93 097.05</td> </tr> <tr> <td>2</td> <td>\$ 93 097.05</td> <td>8</td> <td>\$7447.76</td> <td>\$14 902.95</td> <td></td> <td>\$85 641.87</td> </tr> <tr> <td>3</td> <td>\$ 85 641.87</td> <td>8</td> <td>\$6851.35</td> <td>\$14 902.95</td> <td></td> <td>\$77 590.27</td> </tr> <tr> <td>4</td> <td>\$ 77 590.27</td> <td>8</td> <td>\$6207.22</td> <td>\$14 902.95</td> <td></td> <td>\$68 894.54</td> </tr> <tr> <td>5</td> <td>\$ 68 894.54</td> <td>8</td> <td>\$5511.56</td> <td>\$14 902.95</td> <td></td> <td>\$59 503.15</td> </tr> <tr> <td>6</td> <td>\$ 59 503.15</td> <td>8</td> <td>\$4760.25</td> <td>\$14 902.95</td> <td></td> <td>\$49 360.46</td> </tr> <tr> <td>7</td> <td>\$ 49 360.46</td> <td>8</td> <td>\$3948.84</td> <td>\$14 902.95</td> <td></td> <td>\$38 406.34</td> </tr> <tr> <td>8</td> <td>\$ 38 406.34</td> <td>8</td> <td>\$3072.51</td> <td>\$14 902.95</td> <td></td> <td>\$26 575.90</td> </tr> <tr> <td>9</td> <td>\$ 26 575.90</td> <td>8</td> <td>\$2126.07</td> <td>\$14 902.95</td> <td></td> <td>\$13 799.03</td> </tr> <tr> <td>10</td> <td>\$ 13 799.03</td> <td>8</td> <td>\$1103.92</td> <td>\$14 902.95</td> <td></td> <td>\$ 0.00</td> </tr> </tbody> </table> <p>a) What is the period of the loan?            b) What is the amount of the annual payment?            c) How much of the annual payment at the end of Year 5 went toward the opening balance? Show how to determine the answer in two different ways.            d) Create an algebraic expression to find the answer in c).            e) If the interest rate went up to 11% in Year 10, how much would be owing at the end of Year 10?            f) What extra payment at the end of Year 4 would pay the loan off at the end of Year 8?</p>	Year	Opening Balance	Interest Rate (%)	Interest Charged	Regular Payment	Extra Payment	Closing Balance	1	\$100 000.00	8	\$8000.00	\$14 902.95		\$93 097.05	2	\$ 93 097.05	8	\$7447.76	\$14 902.95		\$85 641.87	3	\$ 85 641.87	8	\$6851.35	\$14 902.95		\$77 590.27	4	\$ 77 590.27	8	\$6207.22	\$14 902.95		\$68 894.54	5	\$ 68 894.54	8	\$5511.56	\$14 902.95		\$59 503.15	6	\$ 59 503.15	8	\$4760.25	\$14 902.95		\$49 360.46	7	\$ 49 360.46	8	\$3948.84	\$14 902.95		\$38 406.34	8	\$ 38 406.34	8	\$3072.51	\$14 902.95		\$26 575.90	9	\$ 26 575.90	8	\$2126.07	\$14 902.95		\$13 799.03	10	\$ 13 799.03	8	\$1103.92	\$14 902.95		\$ 0.00
Year	Opening Balance	Interest Rate (%)	Interest Charged	Regular Payment	Extra Payment	Closing Balance																																																																									
1	\$100 000.00	8	\$8000.00	\$14 902.95		\$93 097.05																																																																									
2	\$ 93 097.05	8	\$7447.76	\$14 902.95		\$85 641.87																																																																									
3	\$ 85 641.87	8	\$6851.35	\$14 902.95		\$77 590.27																																																																									
4	\$ 77 590.27	8	\$6207.22	\$14 902.95		\$68 894.54																																																																									
5	\$ 68 894.54	8	\$5511.56	\$14 902.95		\$59 503.15																																																																									
6	\$ 59 503.15	8	\$4760.25	\$14 902.95		\$49 360.46																																																																									
7	\$ 49 360.46	8	\$3948.84	\$14 902.95		\$38 406.34																																																																									
8	\$ 38 406.34	8	\$3072.51	\$14 902.95		\$26 575.90																																																																									
9	\$ 26 575.90	8	\$2126.07	\$14 902.95		\$13 799.03																																																																									
10	\$ 13 799.03	8	\$1103.92	\$14 902.95		\$ 0.00																																																																									

# Mathematics 10

## Strand: Number (Number Concepts)

*Students will:*

- use numbers to describe quantities
- represent numbers in multiple ways.

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

General Outcomes	Specific Outcomes	Illustrative Examples
<p>Explain and illustrate the structure and the interrelationship of the sets of numbers within the real number system.</p>	<p>C1–3. (N3) Classify numbers as natural, whole, integer, rational or irrational, and show that these number sets are nested within the real number system. [C, R, V]</p> <p>C1–4. (N4) Use approximate representations of irrational numbers. [R, T]</p>	<p>3.1 Explain why the number 1.112111211112 . . . is irrational.</p> <p>3.2 Given a set of numbers, place them in their appropriate box in a nested Venn diagram.</p> <p>3.3 Describe, orally and in writing, whether or not a number is irrational.</p> <p>3.4 Demonstrate that a particular real number, such as <math>\sqrt{3}</math>, is rational or irrational.</p> <p>4.1 Compare the results of using different approximations for <math>\sqrt{2}</math> in calculations.</p> <p>a) Calculate <math>\sqrt{2} \times \sqrt{2}</math> as <math>1.4 \times 1.4</math>.</p> <p>b) Calculate <math>\sqrt{2} \times \sqrt{2}</math> as <math>1.41 \times 1.41</math>.</p> <p>4.2 Use a calculator to get the approximate value, to four decimal places, of <math>\sqrt{8}</math> and of <math>2\sqrt{2}</math>.</p>

# Mathematics 10

## 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                        | [PS] Problem Solving |
| [CN] Connections                         | [R] Reasoning        |
| [E] Estimation and<br>Mental Mathematics | [T] Technology       |
|  | [V] Visualization    |

General Outcomes	Specific Outcomes	Illustrative Examples
<p>Use basic arithmetic operations on real numbers to solve problems.</p>	<p>C1–5. Communicate a set of instructions used to solve an arithmetic problem. [C]</p> <p>C1–6. Perform arithmetic operations on irrational numbers, using appropriate decimal approximations. [E, T]</p>	<p>5.1 Write a set of instructions that will allow another student to find:</p> <ol style="list-style-type: none"> <li><math>1 + 2 \div 3</math></li> <li><math>9 \times 4 \div 3 \times 5</math></li> <li>the reciprocal of a square root of a number, using a scientific calculator</li> <li>a 5% commission on a sale of \$40 200.</li> </ol> <p>6.1 Mahal indicates that <math>\sqrt{2} + \sqrt{8}</math> has an approximate value of 3.16. Use estimates to show whether Mahal’s answer is reasonable, and use a calculator to verify the accuracy of Mahal’s answer.</p> <p>6.2 Find a decimal approximation of <math>\left(\frac{3}{\sqrt{5}-\sqrt{2}}\right)</math> to three decimal places.</p> <p>6.3 Arrange the following in order of value from least to greatest: <math>7, 2\sqrt{13}, 3\sqrt{6}, 4\sqrt{5}, 5\sqrt{2}</math>. Use decimal approximations.</p> <p>6.4 Evaluate <math>\sqrt[3]{128} + 4(\sqrt[3]{16})</math> to three decimal places.</p> <p>6.5 Find the length of the base and the height of an equilateral triangle of area <math>24 \text{ cm}^2</math>.</p>

# Mathematics 10

## 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												
<p>Describe and apply arithmetic operations on tables to solve problems, using technology as required.</p> <p><i>(continued)</i></p>	<p>C1–7. (N7) Create and modify tables from both recursive and nonrecursive situations. [PS, T, V]</p>	<p>7.1</p> <table border="1"> <thead> <tr> <th>Price</th> <th>GST</th> <th>PST</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>\$120.00</td> <td>\$ 8.40</td> <td>\$12.84</td> <td>\$141.24</td> </tr> <tr> <td>\$275.00</td> <td>\$19.25</td> <td>\$29.43</td> <td>\$323.68</td> </tr> </tbody> </table> <p>a) Modify the table to allow for a PST of 6.5% of the price before taxes.                      b) If the price after both taxes is \$138.00 and PST is charged on the \$120.00 price before taxes, what is the rate of PST?</p> <p>7.2 In 1993, sales of a particular video game doubled every month. The game was released in May 1993 with sales of 32 000 for May. Prepare a table to illustrate the 1993 monthly sales figures. How many video games were sold in December 1993? Identify the assumptions you made when determining the solution. In 1994, the demand for the video game peaked. Starting in January 1994, and every month thereafter, sales were cut to one quarter of what they were in the previous month. How many video games were sold in April 1994? If April 1994 was the last month of sales, how many video games were sold over the entire twelve months?</p>	Price	GST	PST	Total	\$120.00	\$ 8.40	\$12.84	\$141.24	\$275.00	\$19.25	\$29.43	\$323.68
Price	GST	PST	Total											
\$120.00	\$ 8.40	\$12.84	\$141.24											
\$275.00	\$19.25	\$29.43	\$323.68											

# Mathematics 10

## 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																																																																		
<p><i>(continued)</i></p>	<p>C1–8. Use and modify a spreadsheet template to model recursive situations. (N8) [PS, T, V]</p>	<p>8.1 Modify the given template for a 10-year, \$85 000 farm mortgage with fixed annual payments, to allow for a change in interest rate.</p> <table border="1"> <thead> <tr> <th>Year</th> <th>Opening Balance</th> <th>Interest Rate (%)</th> <th>Interest Charged</th> <th>Regular Payment</th> <th>Closing Balance</th> </tr> </thead> <tbody> <tr><td>1</td><td>\$85 000.00</td><td>8</td><td>\$6800.00</td><td>\$12 667.51</td><td>\$79 132.49</td></tr> <tr><td>2</td><td>\$79 132.49</td><td>8</td><td>\$6330.60</td><td>\$12 667.51</td><td>\$72 795.59</td></tr> <tr><td>3</td><td>\$72 795.59</td><td>8</td><td>\$5823.65</td><td>\$12 667.51</td><td>\$65 951.73</td></tr> <tr><td>4</td><td>\$65 951.73</td><td>8</td><td>\$5276.14</td><td>\$12 667.51</td><td>\$58 560.36</td></tr> <tr><td>5</td><td>\$58 560.36</td><td>8</td><td>\$4684.83</td><td>\$12 667.51</td><td>\$50 577.68</td></tr> <tr><td>6</td><td>\$50 577.68</td><td>8</td><td>\$4046.21</td><td>\$12 667.51</td><td>\$41 956.39</td></tr> <tr><td>7</td><td>\$41 956.39</td><td>8</td><td>\$3356.51</td><td>\$12 667.51</td><td>\$32 645.39</td></tr> <tr><td>8</td><td>\$32 645.39</td><td>8</td><td>\$2611.63</td><td>\$12 667.51</td><td>\$22 589.52</td></tr> <tr><td>9</td><td>\$22 589.52</td><td>8</td><td>\$1807.16</td><td>\$12 667.51</td><td>\$11 729.17</td></tr> <tr><td>10</td><td>\$11 729.17</td><td>8</td><td>\$ 938.33</td><td>\$12 667.51</td><td>\$ 0.00</td></tr> </tbody> </table> <p>a) What alternatives are open to the farmer, if the interest rate increases? b) What alternatives are open to the farmer, if the interest rate decreases?</p> <p>8.2 Modify the template in illustrative example 8.1 to reflect a 25-year home mortgage with monthly payments that gives the customer the option of making an annual extra payment of \$1500 at the end of any year. Interest is charged monthly.</p>	Year	Opening Balance	Interest Rate (%)	Interest Charged	Regular Payment	Closing Balance	1	\$85 000.00	8	\$6800.00	\$12 667.51	\$79 132.49	2	\$79 132.49	8	\$6330.60	\$12 667.51	\$72 795.59	3	\$72 795.59	8	\$5823.65	\$12 667.51	\$65 951.73	4	\$65 951.73	8	\$5276.14	\$12 667.51	\$58 560.36	5	\$58 560.36	8	\$4684.83	\$12 667.51	\$50 577.68	6	\$50 577.68	8	\$4046.21	\$12 667.51	\$41 956.39	7	\$41 956.39	8	\$3356.51	\$12 667.51	\$32 645.39	8	\$32 645.39	8	\$2611.63	\$12 667.51	\$22 589.52	9	\$22 589.52	8	\$1807.16	\$12 667.51	\$11 729.17	10	\$11 729.17	8	\$ 938.33	\$12 667.51	\$ 0.00
Year	Opening Balance	Interest Rate (%)	Interest Charged	Regular Payment	Closing Balance																																																															
1	\$85 000.00	8	\$6800.00	\$12 667.51	\$79 132.49																																																															
2	\$79 132.49	8	\$6330.60	\$12 667.51	\$72 795.59																																																															
3	\$72 795.59	8	\$5823.65	\$12 667.51	\$65 951.73																																																															
4	\$65 951.73	8	\$5276.14	\$12 667.51	\$58 560.36																																																															
5	\$58 560.36	8	\$4684.83	\$12 667.51	\$50 577.68																																																															
6	\$50 577.68	8	\$4046.21	\$12 667.51	\$41 956.39																																																															
7	\$41 956.39	8	\$3356.51	\$12 667.51	\$32 645.39																																																															
8	\$32 645.39	8	\$2611.63	\$12 667.51	\$22 589.52																																																															
9	\$22 589.52	8	\$1807.16	\$12 667.51	\$11 729.17																																																															
10	\$11 729.17	8	\$ 938.33	\$12 667.51	\$ 0.00																																																															

# Mathematics 10

**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                        | [PS] Problem Solving |
| [CN] Connections                         | [R] Reasoning        |
| [E] Estimation and<br>Mental Mathematics | [T] Technology       |
|  | [V] Visualization    |

General Outcomes	Specific Outcomes	Illustrative Examples
<p>Use exact values, arithmetic operations and algebraic operations on real numbers to solve problems.</p>	<p>P1-1. (N10) Explain and apply the exponent laws for powers of numbers and for variables with rational exponents. [C, E]</p>	<p>1.1 Find the exact value of <math>\left(\frac{8}{27}\right)^{\left(-\frac{2}{3}\right)}</math>.</p> <p>1.2 Write the number expression <math>7^{\left(\frac{2}{3}\right)}</math>, using radicals.</p> <p>1.3 Simplify <math>\left(\sqrt[5]{x^3}\right)\left(\sqrt[3]{x^2}\right)</math>.</p> <p>1.4 Show <math>\left(\sqrt[3]{-8}\right)x = -2x</math>.</p> <p>1.5 Write an equivalent expression for <math>\sqrt[3]{2\sqrt{3x^5}}</math>, using exponents.</p> <p>1.6 Prove that <math>\sqrt{2}</math> is an irrational number.</p> <p>1.7 The <math>5 \times 5</math> geoboard shown in the diagram can be used to construct squares whose areas are whole numbers. The sides of the squares can be constructed by joining dots horizontally, vertically or diagonally. What whole number areas can be constructed? Justify your answers with appropriate drawings and calculations.</p> 

## Mathematics 10

### 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
<p>Use exact values, arithmetic operations and algebraic operations on real numbers to solve problems.</p>	<p>P2-1. (N11) Perform operations on irrational numbers of monomial and binomial form, using exact values. [E]</p>	<p>1.1 Show that <math>\sqrt{2} + \sqrt{8} = 3\sqrt{2}</math>.</p> <p>1.2 Find an equivalent form of <math>\left(\frac{3}{\sqrt{5} - \sqrt{2}}\right)</math> that has a whole number as its denominator.</p> <p>1.3 Arrange the following in order from least to greatest: <math>7, 2\sqrt{13}, 3\sqrt{6}, 4\sqrt{5}, 5\sqrt{2}</math>. Do not use decimal approximations.</p> <p>1.4 Find the exact value of <math>\sqrt[3]{128} + 4(\sqrt[3]{16})</math>.</p> <p>1.5 Find an equivalent form of <math>(3\sqrt{5} + 4\sqrt{2})(4\sqrt{5} - 3\sqrt{2})</math>.</p> <p>1.6 An equilateral triangle is inscribed in a circle. If the area of the circle is <math>36\pi</math>, find the exact area of the equilateral triangle.</p>

# Mathematics 10

## 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<br>Mental Mathematics | [T]  | Technology      |
|      |                                      | [V]  | Visualization   |

General Outcomes	Specific Outcomes	Illustrative Examples
<p>Generate and analyze number patterns.</p> <p><i>(continued)</i></p>	<p>P2–2. (PR1) Generate number patterns exhibiting arithmetic growth. [E, R]</p>	<p>2.1 The first modern Olympiad was held in 1896. Every four years after this date the summer Olympics were held. Given such a framework, reveal what should have been the next five summer Olympic years after 1896. Explain why this pattern was never achieved.</p> <p>2.2 The output of a northern gold mine has remained constant at 2200 ounces per year. If, at the end of last year, the total output of the mine was 122 600 ounces of gold, what will be the total output at the end of this year? At the end of next year?</p> <p>2.3 A salesperson receives a base salary of \$12 000 per year, plus \$100 for every unit sold. What is the salary, if 50 units are sold? 51 units? 52 units?</p> <p>2.4 For the arithmetic sequence 16, 23, 30, 37, . . . , find the next three terms.</p> <p>2.5 A pile of bricks is arranged in rows. The numbers of bricks in the rows form an arithmetic sequence. There are 45 bricks in the 5th row and 33 bricks in the 11th row.</p> <p>a) How many bricks are in the first row? b) Write the general term for the sequence. c) What is the maximum number of rows of bricks possible?</p>
	<p>P2–3. (PR2) Use expressions to represent general terms and sums for arithmetic growth, and apply these expressions to solve problems. [CN, PS, R, T]</p>	<p>3.1 For the arithmetic sequence 7, 11, 15, 19, . . . , find the 29th term.</p> <p>3.2 Find the sum of the arithmetic series <math>3 + 7 + 11 + \dots + 483</math>.</p> <p>3.3 Mary’s annual salary is on a range from \$26 785 in the first year to \$34 825 in the seventh year.</p> <p>a) If the salary range is an arithmetic sequence with seven terms, determine the raise Mary can expect each year. b) What is her salary in the fifth year? c) What is the first salary in this range that is greater than \$30 000? d) What is the total amount that Mary earned in the seven years?</p>



# Mathematics 10

## Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

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

General Outcomes	Specific Outcomes	Illustrative Examples
<p>Generalize operations on polynomials to include rational expressions.</p> <p><i>(continued)</i></p>	<p>P1–2. Factor polynomial expressions of the form <math>ax^2 + bx + c</math>, and <math>a^2x^2 - b^2y^2</math>. [E]</p> <p>P1–3. Find the product of polynomials. [E, R]</p>	<p>2.1 Factor: a) <math>5x^2 + 6x - 8</math> b) <math>6x^2 - x - 2</math>.</p> <p>2.2 Factor <math>4x^2 + 20x + 25</math>. a) Compare the two factors. b) For this special product, what is the relationship between the coefficients of the terms of the factors and the coefficients of the terms of the trinomial?</p> <p>2.3 Factor <math>4x^2 - 25</math>. a) Compare the two factors. b) For this special product, what is the relationship between the coefficients of the terms of the factors and the coefficients of the terms of the binomial?</p> <p>2.4 For which integral values of <math>k</math> can <math>4x^2 + kx + 3</math> be factored over the set of rational numbers?</p> <p>2.5 Factor <math>(x + b)^2 + 6(x + b) + 8</math>.</p> <p>2.6 Factor <math>6x^4 - x^2 - 2</math>.</p> <p>3.1 Find the product and simplify: a) <math>(3x - 4)(2x^2 + 3x + 1)</math> b) <math>(2x - y)^3</math>.</p>

# Mathematics 10

## Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

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

General Outcomes	Specific Outcomes	Illustrative Examples
<p><i>(continued)</i></p>	<p>P1–4. (PR24) Divide a polynomial by a binomial, and express the result in the forms:</p> <ul style="list-style-type: none"> <li><math>\frac{P}{D} = Q + \frac{R}{D}</math></li> <li><math>P = DQ + R</math></li> <li><math>P(x) = D(x)Q(x) + R.</math></li> </ul> <p>[E, R]</p> <p>P1–5. (PR25) Determine equivalent forms of simple rational expressions with polynomial numerators, and denominators that are monomials, binomials or trinomials that can be factored.</p> <p>[PS, R]</p>	<p>4.1 Divide <math>(3x^3 + 2x^2 - 7x + 8)</math> by <math>(x + 2)</math>.</p> <p>4.2 Divide <math>(t^2 - 3t - 10)</math> by <math>(t - 3)</math>.</p> <p>4.3 Divide <math>(6x^3 - 2x^2 + 7x - 11)</math> by <math>(3x^2 - 2)</math>.</p> <p>4.4 When the polynomial <math>P(t) = 4t^4 - 17t^2 - 36t - 20</math> is divided by <math>(2t - 5)</math>, the remainder is <math>-60</math>. Express the division in the forms:</p> <p>a) <math>\frac{P(t)}{2t-5} = Q(t) + \frac{R}{2t-5}</math></p> <p>b) <math>P(t) = Q(t)(2t - 5) + R.</math></p> <p>5.1 Change each rational expression to its simplest equivalent form:</p> <p>a) <math>\frac{4x^4 - 6x^3 + 2x^2 - 10x}{2x}</math></p> <p>b) <math>\frac{x^2 - 5x - 6}{x^2 - 36}</math></p> <p>c) <math>\frac{x^2 + 3x}{x^2 + x - 6}</math></p> <p>d) <math>\frac{16x^4 - 81y^4}{(4x^2 + 9y^2)^2 (2x^2 - xy - 3y^2)}.</math></p>

Mathematics 10

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										
<i>(continued)</i>	P1-6. Determine the nonpermissible values for the variable in rational expressions. (PR26) [C, CN]	6.1 For what value(s) of $x$ are each of the following not defined? Explain your conclusion in each case. <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;">                             a) <math>\frac{3}{x}</math> </td> <td style="width: 50%; vertical-align: top;">                             e) <math>\frac{5x}{x^2 - 3x - 4}</math> </td> </tr> <tr> <td style="vertical-align: top;">                             b) <math>\frac{-2}{x+1}</math> </td> <td style="vertical-align: top;">                             f) <math>\frac{5x+y}{3x-y}</math> </td> </tr> <tr> <td style="vertical-align: top;">                             c) <math>\frac{4}{3x-4}</math> </td> <td style="vertical-align: top;">                             g) <math>\frac{7x^2 - 6xy + 3y^2}{4x^2 - 9y^2}</math> </td> </tr> <tr> <td style="vertical-align: top;">                             d) <math>\frac{2x+1}{x^2-4}</math> </td> <td style="vertical-align: top;">                             h) <math>\frac{2}{x^3}</math> </td> </tr> <tr> <td></td> <td style="vertical-align: top;">                             i) <math>\frac{5}{(x^3-1)}</math> </td> </tr> </table>	a) $\frac{3}{x}$	e) $\frac{5x}{x^2 - 3x - 4}$	b) $\frac{-2}{x+1}$	f) $\frac{5x+y}{3x-y}$	c) $\frac{4}{3x-4}$	g) $\frac{7x^2 - 6xy + 3y^2}{4x^2 - 9y^2}$	d) $\frac{2x+1}{x^2-4}$	h) $\frac{2}{x^3}$		i) $\frac{5}{(x^3-1)}$
a) $\frac{3}{x}$	e) $\frac{5x}{x^2 - 3x - 4}$											
b) $\frac{-2}{x+1}$	f) $\frac{5x+y}{3x-y}$											
c) $\frac{4}{3x-4}$	g) $\frac{7x^2 - 6xy + 3y^2}{4x^2 - 9y^2}$											
d) $\frac{2x+1}{x^2-4}$	h) $\frac{2}{x^3}$											
	i) $\frac{5}{(x^3-1)}$											

# Mathematics 10

## 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
<i>(continued)</i>	P1-7. (PR27) Perform the operations of addition, subtraction, multiplication and division on rational expressions. [E, R]	7.1 For each expression perform the indicated operations, and identify any nonpermissible values. a) $\left(\frac{1}{x}\right) + \left(\frac{3}{2x}\right)$ b) $\left(\frac{4}{x+1}\right) - \left(\frac{1}{x-2}\right)$ c) $\left(\frac{2x+1}{x-1}\right) + \left(\frac{x-1}{x^2-x-2}\right)$ d) $\left(\frac{x^2+2x+1}{x-5}\right) \left(\frac{x^2-25}{x^2+6x+5}\right)$ e) $\left(\frac{3x^2+10x+3}{x^2-9}\right) \div \left(\frac{3x+1}{x-3}\right)$ f) $\frac{3}{\left(\frac{2}{x}\right)}$ g) $\frac{\left(\frac{2x+6}{x+1}\right)}{\left(\frac{x+3}{x^2-1}\right)}$ h) $\frac{\left(\frac{1}{x}+3\right)}{\left(\frac{1}{x}-3\right)}$

# Mathematics 10

## 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
<i>(continued)</i>	P1–8. Find and verify the solutions of rational equations. (PR28) [CN, PS]	8.1 Solve for $x$ , checking for any nonpermissible values. a) $\frac{2}{x} = -3$ b) $\frac{4}{x} + \frac{3}{2x} = \frac{11}{4}$ c) $\frac{5}{x-1} - \frac{2}{x+1} = 2$ d) $\frac{2x+1}{x+3} - \frac{x-2}{x+1} = 5$ e) $\frac{3}{x^2-25} + \frac{2}{x+5} = \frac{4}{x-5}$ f) $\frac{4}{x-5} + 6 = \frac{4}{x-5}$ 8.2 The average speed of an airplane is five times as fast as the average speed of a passenger train. To travel 400 km, the train requires 4 hours more than the airplane. Find the average speeds of the train and the airplane.

**Strand: Patterns and Relations (Relations and Functions)**

*Students will:*

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

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

General Outcomes	Specific Outcomes	Illustrative Examples																								
<p>Examine the nature of relations with an emphasis on functions.</p>	<p>C1–9. (PR47) Plot linear and nonlinear data, using appropriate scales. [C, V]</p>	<p>9.1 The mass of a beaker is recorded when the beaker contains varying volumes of ethanol. The results of the experiment are recorded in the table below.</p> <table border="1"> <thead> <tr> <th>Volume of Ethanol (mL)</th> <th>Mass of Beaker and Liquid (g)</th> </tr> </thead> <tbody> <tr><td>0</td><td>90</td></tr> <tr><td>50</td><td>129</td></tr> <tr><td>100</td><td>168</td></tr> <tr><td>150</td><td>207</td></tr> <tr><td>200</td><td>246</td></tr> </tbody> </table> <p>Measurements may be assumed correct to the nearest mL and to the nearest g.</p> <p>Plot this data on a scatterplot, using appropriate scales, and answer the following questions.</p> <ol style="list-style-type: none"> <li>Assuming that this pattern continues, determine the mass of the beaker and liquid when 250 mL of ethanol is present.</li> <li>When a volume of 200 mL of ethanol is in the beaker, determine the mass of the ethanol alone.</li> <li>The density of a liquid is defined as the mass of 1 mL of the liquid. Determine the density of the ethanol.</li> </ol> <p>9.2 Nannook’s Pizza uses the following price structure.</p> <table border="1"> <thead> <tr> <th>Diameter (inches)</th> <th>Cost (\$)</th> </tr> </thead> <tbody> <tr><td>8</td><td>6.50</td></tr> <tr><td>10</td><td>10.20</td></tr> <tr><td>12</td><td>14.65</td></tr> <tr><td>14</td><td>19.90</td></tr> <tr><td>16</td><td>26.00</td></tr> </tbody> </table> <p>Plot this data on a scatterplot, using appropriate scales, and describe the pattern.</p>	Volume of Ethanol (mL)	Mass of Beaker and Liquid (g)	0	90	50	129	100	168	150	207	200	246	Diameter (inches)	Cost (\$)	8	6.50	10	10.20	12	14.65	14	19.90	16	26.00
Volume of Ethanol (mL)	Mass of Beaker and Liquid (g)																									
0	90																									
50	129																									
100	168																									
150	207																									
200	246																									
Diameter (inches)	Cost (\$)																									
8	6.50																									
10	10.20																									
12	14.65																									
14	19.90																									
16	26.00																									

# Mathematics 10

## 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

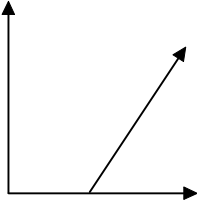
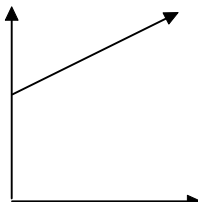
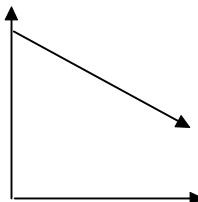
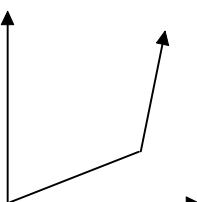
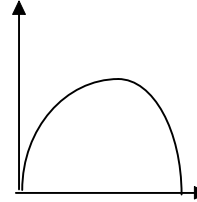
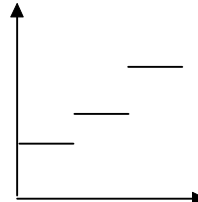
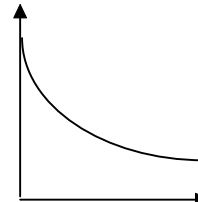
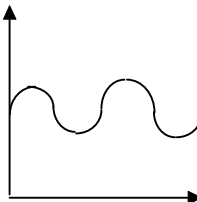
Mental Mathematics

[PS] Problem Solving

[R] Reasoning

[T] Technology

[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
<p>Examine the nature of relations with an emphasis on functions.</p> <p><i>(continued)</i></p>	<p>C2-1. Represent data, using function models. (PR48) [CN, PS, V]</p>	<p>1.1 Sketch graphs to illustrate the following situations. If sufficient information is given, represent the situation by a suitable equation. Sketch and, if possible, represent by an equation:</p> <ol style="list-style-type: none"> <li>the area of a circle as a function of its radius</li> <li>the cost of mailing a letter as a function of the mass of the letter</li> <li>the cost of renting a car for one day as a function of the kilometres driven</li> <li>the population of Canada as a function of the year</li> <li>the length of daylight as a function of the date.</li> </ol> <p>1.2 For each of the following graphs, describe a practical situation that could be represented by the graph. In describing the situation, state the meanings of any intercepts, slopes, maxima and/or minima.</p> <div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="text-align: center;"></div> <div style="text-align: center;"></div> <div style="text-align: center;"></div> <div style="text-align: center;"></div> <div style="text-align: center;"></div> <div style="text-align: center;"></div> <div style="text-align: center;"></div> <div style="text-align: center;"></div> </div>

# Mathematics 10

## 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

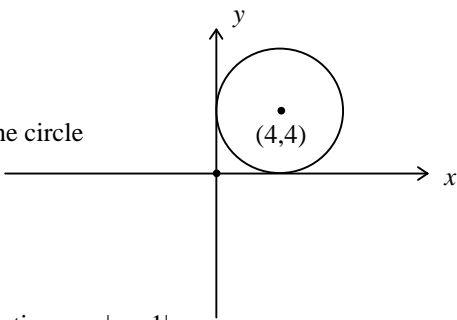
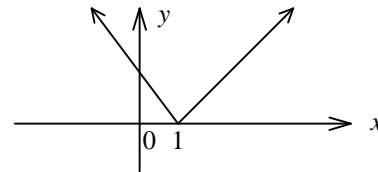
Mental Mathematics

[PS] Problem Solving

[R] Reasoning

[T] Technology

[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples
<p><i>(continued)</i></p>	<p>C2-2. Use a graphing tool to draw the graph of a function from its equation. [C, T, V]</p> <p>C2-3. Describe a function in terms of:  <ul style="list-style-type: none"> <li>• ordered pairs</li> <li>• a rule, in word or equation form</li> <li>• a graph.</li> </ul> [C, CN, V]</p> <p>C2-4. Use function notation to evaluate and represent functions. [C, PS]</p> <p>C2-5. Determine the domain and range of a relation from its graph. [PS, V]</p>	<p>2.1 Graph the function <math>y = x + 1</math>, using a graphing tool.</p> <p>2.2 Graph the function <math>y = x^2 + 100</math>, using a graphing tool. Explain the process used, so that the graph appears on the screen.</p> <p>3.1 Describe the parking charges at a parkade in terms of ordered pairs, a rule and a graph.</p> <p>4.1 If <math>f(x) = x^2 - 5x + 3</math>, find <math>f(2)</math>. What is an ordered pair describing the point on the graph having a y-coordinate of <math>f(2)</math>?</p> <p>4.2 If <math>f(x) = 3x^2 - 6x + 5</math>, find <math>f(\sqrt{3})</math>, <math>f(2x)</math> and <math>f(3t + 2)</math>.</p> <p>5.1 If the coordinate axes touch the circle, what is the domain and range of the circle shown in the graph to the right?</p> <p>5.2 Determine, from its graph shown below, the domain and range of the function <math>y =  x - 1 </math>.</p> <div style="text-align: right; margin-top: 20px;">  </div> <div style="text-align: center; margin-top: 20px;">  </div>

# Mathematics 10

## 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
<i>(continued)</i>	<p>C2–6. (PR53) Determine the following characteristics of the graph of a linear function, given its equation:</p> <ul style="list-style-type: none"> <li>• intercepts</li> <li>• slope</li> <li>• domain</li> <li>• range.</li> </ul> <p>[PS, V]</p>	<p>6.1 A tanker truck drives on a weigh scale and then is filled with crude oil. The mass <math>M</math>, measured in kilograms, of the truck and the volume <math>V</math>, measured in barrels, of crude oil are related by the formula:</p> $M = 14\,000 + 180V; V \leq 500.$ <ol style="list-style-type: none"> <li>Draw the graph with <math>V</math> on the horizontal axis and <math>M</math> on the vertical axis.</li> <li>The tank has a maximum capacity of 500 barrels. What is the mass of the truck when it contains 500 barrels of oil?</li> <li>What is the mass of the empty truck? Where is this value found on the graph?</li> <li>Find the slope, and give an interpretation for it.</li> <li>Give the domain for this problem.</li> <li>Express the range in words.</li> </ol> <p>6.2 Graph each of the following equations; and indicate intercepts, slope, domain and range.</p> <ol style="list-style-type: none"> <li><math>y = 2x; x = (0, 1, 2, 3, 4, 5, 6)</math></li> <li><math>y = -\frac{1}{3}x; x = \text{a real number}</math></li> <li><math>y = 3</math></li> <li><math>x = 3</math></li> <li><math>y = \frac{1}{3}x + 5; x = \text{a real number}</math></li> <li><math>y = mx + b; x = \text{a real number}</math></li> </ol>

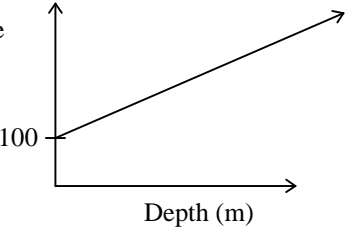
Mathematics 10

Strand: Patterns and Relations (Relations and Functions)

Students will:

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

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

General Outcomes	Specific Outcomes	Illustrative Examples										
<p>Represent data, using linear function models.</p> <p style="text-align: right;"><i>(continued)</i></p>	<p>C2-7. (PR56) Use direct variation and arithmetic sequences as applications of linear functions. [CN, PS, V]</p> <p style="text-align: right;"><i>(continued)</i></p>	<p>7.1 A hydrologist studied the relationship between the pressure on an object and its depth of submersion in a liquid. The following graph was sketched. Draw conclusions based upon the sketch.</p> <div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 20px;"> <p>Pressure (kPa)</p> <p>100</p> </div>  </div> <p>7.2 Simple interest varies directly with the amount borrowed.</p> <p>a) If the interest is \$5 for \$100 borrowed, what would the interest be for \$325 borrowed?</p> <p>b) Graph the relation, and write the equation of the graph.</p> <p>7.3 A jet ski rental operation at Lake Okanagan charges a fixed insurance premium, plus an hourly rate. The total cost for two hours is \$50 and for five hours is \$110.</p> <p>a) Graph the relation.</p> <p>b) Determine the fixed insurance premium and the hourly rate to rent the jet ski.</p> <p>7.4 With new equipment coming on line, a soft drink manufacturer has been increasing its production each day according to the following table. Assume a maximum daily output of 25 000 cans.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Day</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>Units</td> <td>4000</td> <td>4200</td> <td>4400</td> <td>4600</td> </tr> </table> <p>a) Graph the relation. Hint: this is a discrete case.</p> <p>b) On what day will they be able to produce 20 000 cans, if this trend continues?</p>	Day	1	2	3	4	Units	4000	4200	4400	4600
Day	1	2	3	4								
Units	4000	4200	4400	4600								

# Mathematics 10

## 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

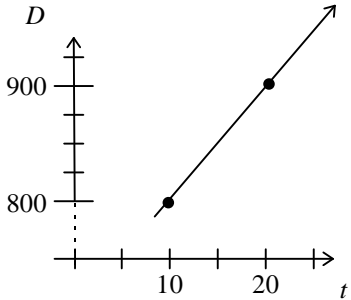
Mental Mathematics

[PS] Problem Solving

[R] Reasoning

[T] Technology

[V] Visualization

General Outcomes	Specific Outcomes	Illustrative Examples										
<i>(continued)</i>	<i>(continued)</i>	<p>7.5 Given the distance–time graph shown, answer the following questions.</p>  <ol style="list-style-type: none"> <li>If <math>D = 850</math>, what is <math>t</math>?</li> <li>If <math>t = 25</math>, what is <math>D</math>?</li> <li>If <math>D = 1500</math>, what is <math>t</math>?</li> <li>Write the equation of the function.</li> <li>Verify the accuracy of your estimates in a), b) and c), using the equation of the function.</li> </ol> <p>7.6 Given the data in the table, predict the fuel consumption for the following engines:</p> <ol style="list-style-type: none"> <li>2.5 L</li> <li>5.0 L.</li> </ol> <table border="1"> <thead> <tr> <th>Engine Size (L)</th> <th>Consumption ( L/100 km)</th> </tr> </thead> <tbody> <tr> <td>2.2</td> <td>6.4</td> </tr> <tr> <td>3.0</td> <td>7.5</td> </tr> <tr> <td>3.8</td> <td>8.1</td> </tr> <tr> <td>4.1</td> <td>8.6</td> </tr> </tbody> </table> <p>7.7 A video game operator gives all her change in quarters. From a \$20 bill, she gives 56 quarters change for a \$6 purchase. She gives 8 quarters change from a \$20 bill for an \$18 purchase.</p> <ol style="list-style-type: none"> <li>Graph the number of quarters given as change <math>N</math> on the vertical axis and the amount of the purchase <math>P</math> on the horizontal axis. Assume that a \$20 bill was given.</li> <li>What is the domain and range of the function?</li> <li>How does the graph change, if a \$10 bill is used?</li> </ol>	Engine Size (L)	Consumption ( L/100 km)	2.2	6.4	3.0	7.5	3.8	8.1	4.1	8.6
Engine Size (L)	Consumption ( L/100 km)											
2.2	6.4											
3.0	7.5											
3.8	8.1											
4.1	8.6											

## Mathematics 10

### 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
<p>Demonstrate an understanding of scale factors, and their interrelationship with the dimensions of similar shapes and objects.</p>	<p>C3-1. (SS1) Calculate the volume and surface area of a sphere, using formulas that are provided. [CN, PS, V]</p> <p>C3-2. (SS2) Determine the relationships among linear scale factors, areas, the surface areas and the volumes of similar figures and objects. [CN, PS, R, V]</p>	<p>1.1 Calculate the volume and surface area of a beach ball of radius 15 cm.</p> <p>1.2 A hot air balloon has a spherical shape and a diameter of 4 m. If 30 additional cubic metres of air are pumped into the balloon, what will be the new values for the diameter, volume and surface area?</p> <p>2.1 The area of a region in a plane is <math>10 \text{ cm}^2</math>. By what factor must each of the dimensions of this region be multiplied to increase the area by <math>20 \text{ cm}^2</math>?</p> <p>2.2 A model train is built to a scale of 1:50. If the length of the model engine is 20 cm and the area of sheet metal used to cover the outside surface of the model is <math>180 \text{ cm}^2</math>, what is the actual length of the engine and the actual area of the sheeting used to cover the engine? If the volume displaced by the model engine is <math>126 \text{ cm}^3</math>, what is the volume displaced by the real engine, in <math>\text{m}^3</math>?</p> <p>2.3 It is improbable that a giant human, 6 m in height (three or four times normal human height), could exist. Which biological systems are most likely to break down? Explain your answer.</p>

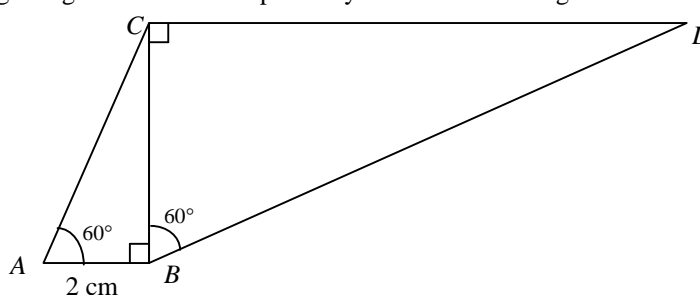
# Mathematics 10

## 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<br>Mental Mathematics | [T] Technology       |
|  | [V] Visualization    |

General Outcomes	Specific Outcomes	Illustrative Examples
<p>Solve problems involving triangles, including those found in 3-D and 2-D applications.</p> <p style="text-align: right;"><i>(continued)</i></p>	<p>C3–3. Solve problems involving two right triangles. [CN, PS, V]</p> <p>C3–4. Extend the concepts of sine and cosine for angles from <math>0^\circ</math> to <math>180^\circ</math>. [R, T, V]</p> <p style="text-align: right;"><i>(continued)</i></p>	<p>3.1 From the top of a 100 m fire tower, a fire ranger observes two fires, one at an angle of depression of <math>5^\circ</math> and the other at an angle of depression of <math>2^\circ</math>. Assuming that the fires and the tower are in a straight line, determine the distance between the fires for the following:</p> <ol style="list-style-type: none"> <li>when the fires are on the same side of the tower</li> <li>when the fires are on opposite sides of the tower.</li> </ol> <p>3.2 The triangles <math>ABC</math> and <math>BCD</math> have right angles at <math>B</math> and <math>C</math> respectively. Calculate the length of side <math>CD</math>, and state the ratio of length <math>BD</math> to length <math>AC</math>.</p> <div style="text-align: center;">  </div> <p>3.3 Canada's highest waterfall is Della Falls on Vancouver Island. An observer standing at the same level as the base of the falls views the top of the falls at an angle of elevation of <math>58^\circ</math>. When the observer moves 31 m closer to the base of the falls, the angle of elevation increases to <math>61^\circ</math>. Find the height of Della Falls.</p> <p>4.1 Find <math>\sin 130^\circ</math>.</p> <p>4.2 Use a calculator to find multiple solutions for angle <math>A</math>, if <math>\sin A = \sin 130^\circ</math>. Use trial and error to find as many solutions as possible. Summarize the pattern found in the solutions.</p>

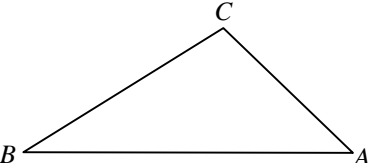
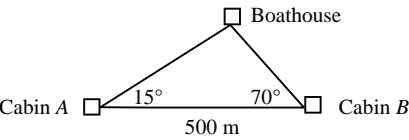
# Mathematics 10

## 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<br>Mental Mathematics | [T]  | Technology      |
|      |                                      | [V]  | Visualization   |

General Outcomes	Specific Outcomes	Illustrative Examples
<i>(continued)</i>	<i>(continued)</i>	<p>4.3 Find the value(s) for <math>A</math> (<math>0^\circ \leq A \leq 180^\circ</math>) when <math>\sin A = \frac{1}{2}</math>.            Find the value(s) for <math>A</math> (<math>0^\circ \leq A \leq 180^\circ</math>) when <math>\cos A = \frac{1}{2}</math>.            Find the value(s) for <math>A</math> (<math>0^\circ \leq A \leq 180^\circ</math>) when <math>\cos A = -\frac{1}{2}</math>.</p> <p>5.1 An electric transmission line is planned to go directly over a pond. The power line will be supported by posts at points <math>A</math> and <math>B</math>. A surveyor measures the distance from <math>B</math> to <math>C</math> as 580 m, the distance from <math>A</math> to <math>C</math> as 337 m and <math>\angle BCA</math> as <math>105.34^\circ</math>. What is the distance from post <math>A</math> to post <math>B</math>?</p> <div style="text-align: center;">  </div> <p>5.2 Two cabins are located 500 m apart on the same side of a river. Across the river from the two cabins is a boathouse. This situation is illustrated in the diagram below. Use the measurements to find the width of the river.</p> <div style="text-align: center;">  </div> <p>5.3 A farmer has a field in the shape of a triangle. From one corner, it is 530 m to the second corner and 750 m to the third corner. The angle between the lines of sight to the second and to the third corners is <math>53^\circ</math>. Find the perimeter and area of the field.</p> <p>5.4 A sailboat leaves the dock at Gibson's Landing on a bearing of <math>S57^\circ W</math>. After sailing for 8 km, the ship tacks and travels <math>S31^\circ E</math> for 5 km.</p> <ol style="list-style-type: none"> <li>How far is the sailboat from Gibson's Landing?</li> <li>What direction would it have to sail to return to the dock at Gibson's Landing?</li> </ol> <p>Bye et al., <i>Holtmath 11</i>, p. 313. Reprinted with permission.</p>

# Mathematics 10

## 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 coordinate geometry problems involving lines and line segments.</p> <p><i>(continued)</i></p>	<p>C1–10. Solve problems involving distances between points in the coordinate plane. [PS, V]</p> <p>C1–11. Solve problems involving midpoints of line segments. [PS]</p> <p>C1–12. Solve problems involving rise, run and slope of line segments. [PS, V]</p>	<p>10.1 Bob and Christine want to meet; see map below. Each block has dimensions of 120 m by 120 m. Assuming the roads are of negligible width, how far does Bob <math>B</math> have to travel to get to Christine <math>C</math>? Find two separate answers, one for a path along the roads and one for a direct path.</p> <div style="text-align: center;"> </div> <p>10.2 Plot the points <math>(-4, -2)</math> and <math>(1, 5)</math> on the coordinate plane. Describe two different ways to calculate the distance between the two points.</p> <p>10.3 Generate a method of determining the distance between any two points in the coordinate plane without having to plot the points. Justify your method.</p> <p>10.4 Program a calculator or computer to accept, as input, the coordinates of two points and to give, as output, the distance between the two points. Document the program so that someone else can use it without assistance.</p> <p>11.1 Explain to a partner the meaning of the midpoint of the line segment joining two points without using the word midpoint.</p> <p>11.2 On a map with numerical coordinates in kilometres, the village of Sundown is at <math>(6.3, 2.9)</math>, while the town of Sunup is at <math>(4.7, 13.2)</math>. It was decided to construct a water main on the direct line joining Sunup with Sundown. Each community was responsible for the cost of construction from the community to the midpoint. Find the coordinates of the midpoint and Sundown's costs, if Sundown spent \$63 475 per kilometre for construction. Determine alternative methods that could be used to solve the problem.</p> <p>12.1 If the slope of a line is 6 (<math>m = 6</math>) and the line passes through the points <math>(2, 5)</math> and <math>(1, k)</math>, what is the value of <math>k</math>?</p> <p>12.2 If two points on a line are <math>(4, 3)</math> and <math>(6, 4)</math>, find one other point on the line. Use a graphing utility to demonstrate the reasonableness of your answer.</p>

# Mathematics 10

## 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                        | [PS] | Problem Solving |
| [CN] | Connections                          | [R]  | Reasoning       |
| [E]  | Estimation and<br>Mental Mathematics | [T]  | Technology      |
|      |                                      | [V]  | Visualization   |

General Outcomes	Specific Outcomes	Illustrative Examples
<p><i>(continued)</i></p>	<p>C1–13. Determine the equation of a line, given information that uniquely determines the line. [PS, V]</p> <p>C1–14. Solve problems using slopes of: (SS23)</p> <ul style="list-style-type: none"> <li>• parallel lines</li> <li>• perpendicular lines.</li> </ul> <p>[CN, PS, V]</p>	<p>13.1 Use a graphing device to examine changes in the graph of <math>y = mx + b</math> as the values of <math>m</math> and <math>b</math> are changed. Use the results to explain why the equation <math>y = mx + b</math> is called the slope and <math>y</math>-intercept form of a linear equation.</p> <p>13.2 Write a clear explanation of the nature of the following lines: <math>x = a</math>, <math>y = b</math>, <math>x = y</math>.</p> <p>13.3 Manipulate the standard form of a straight line (<math>Ax + By + C = 0</math>) into the slope and <math>y</math>-intercept form of the same line. Determine rules that connect <math>A</math>, <math>B</math> and <math>C</math> to the slope (<math>m</math>) and to the intercepts.</p> <p>13.4 Find the equation of a line passing through the points <math>(-1, 3)</math> and <math>(4, 2)</math>.</p> <p>13.5 Given the graph of an oblique line, determine an equation for the line.</p> <p>13.6 A spring with no masses attached is 25.2 cm long. For each 1-g mass attached to the spring, the spring's length increases by 4 mm. Graph this scenario, label the axes, and find an equation for the graph.</p> <p>14.1 Graphically examine the slopes of various lines, all of which are perpendicular to the line <math>y = \frac{2}{3}x + 2</math>. Describe the slopes, and make a rule for finding the slope of a perpendicular to a given line.</p> <p>14.2 Two perpendicular lines intersect on the <math>x</math>-axis. The equation of one of the lines is <math>y = 2x - 6</math>. Find the equation of the second line.</p>

## Mathematics 10

### Strand: Statistics and Probability (Data Analysis)

*Students will:*

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

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

General Outcomes	Specific Outcomes	Illustrative Examples
<p>Implement and analyze sampling procedures, and draw appropriate inferences from the data collected.</p>	<p>C3–6. (SP1) Choose, justify and apply sampling techniques that will result in an appropriate, unbiased sample from a given population. [C, PS, R]</p> <p>C3–7. (SP2) Defend or oppose inferences and generalizations about populations, based on data from samples. [C, PS, R]</p>	<p>6.1 A toothpaste company advertises that three out of four dentists prefer their product. Analyze this statement for its completeness and its accuracy in terms of population, sample, possible sampling technique, validity and bias.</p> <p>6.2 A school cafeteria wants to introduce a new dessert. Describe how a survey could be conducted to decide which of three choices should be the new dessert.</p> <p>6.3 To predict a winner in a federal election, a magazine compiled a list of about 200 000 names from sources, such as telephone books, lists of automobile owners, club membership lists and its own subscription lists. The magazine mailed a questionnaire to everybody on the list, and 4000 returned it. The 4000 responses became the sample. Discuss the potential sources of bias.</p> <p>7.1 To determine a preference for spending \$50 in either a clothing store, an electronics shop or a restaurant, customers were surveyed one Saturday morning at the mall. Fifty-nine per cent preferred spending in a clothing store, 32% in an electronics shop and 9% in a restaurant. What generalizations can be made from these results? Does the sample adequately represent the population to be surveyed? Design a more reliable sampling method to obtain this information, and include details of the questionnaires used and the method of selecting the sample.</p> <p>7.2 Search through various forms of media to find examples of generalizations that have been made about populations, based on data from samples. Do you agree or disagree with the generalizations? Explain why.</p>

# Mathematics 10

## Strand: Statistics and Probability (Chance and Uncertainty)

Students will:

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

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

General Outcomes	Specific Outcomes	Illustrative Examples
<p>Make and analyze decisions, using expected gains and losses, based on the probabilities of simple events.</p> <p><i>(continued)</i></p>	<p>P2–6. (SP9) Connect probabilities to calculated expected gains or losses. [CN, PS, R, V]</p>	<p>6.1 A business person is preparing a proposal for a computer contract worth \$12 000. This person estimates that it would cost \$1500 to prepare the proposal, and the probability of receiving the contract is estimated to be 0.20. Find this business person’s expected gain.</p> <p>6.2 The Khan family is considering moving from Calgary to Hamilton. In Calgary, Ali earns \$46 000 and Kareema earns \$34 000. Based on the family’s research, if they move, Ali has an estimated probability of 0.85 of finding a job that pays \$53 000, and an estimated probability of 0.12 of finding a job that pays \$33 000. Otherwise he would be unemployed, receiving \$17 000. Kareema has an estimated probability of 0.65 of finding a job that pays \$62 000, and an estimated probability of 0.12 of finding a job that pays \$33 000. Otherwise she would be unemployed, receiving \$11 000. What is the expected gain in salary, if the Khans move to Hamilton?</p> <p>6.3 Sherry takes a 100-item multiple-choice examination. Each item has four possible choices. She knows 68 of the answers and guesses randomly at the other 32. Calculate her expected number of correct answers.</p>

# Mathematics 10

## Strand: Statistics and Probability (Chance and Uncertainty)

Students will:

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

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

General Outcomes	Specific Outcomes	Illustrative Examples
<p><i>(continued)</i></p>	<p>P2–7. (SP10) Solve decision-making problems involving expected values, and communicate the solutions. [C, PS, R]</p>	<p>7.1 Dave and Tony are playing toss-up with two coins. Dave wins one point, if both coins are heads or both are tails. Tony wins one point, if the two coins are different. After 100 tosses, what are the two players' expected scores? Is this a fair game?</p> <p>7.2 Joe paid \$5 to throw a pair of dice. He wins the sum of the numbers appearing on the top faces of the dice, unless a six appears on either die; then he wins nothing.</p> <p>a) Is this a fair game? b) What difference would it make if the six were changed to a one? c) Justify your answers by analyzing the sample space for this dice throw.</p> <p>7.3 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>What change in premium would be fair, if the deductible for collision were raised to \$1000?</p> <p>7.4 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>7.5 Explain why it is reasonable to insure a house against fire damage, where the probability of collecting is 0.003, but it is not reasonable for a bank, using current interest rates, to make a loan that has a 90% probability of getting repaid.</p> <p>7.6 The growing of grapes for <i>Eiswein</i> involves harvesting the grapes as late as possible in October. As each day passes, the grapes become more valuable, but there is a greater risk of a frost killing the grapes and reducing their value. For a particular year, the value of the grape juice is \$2.00/L on October 1, and the value of the juice increases by \$0.15/L per day for every day in October. The probability of a killer frost is 0.03 for any particular day in October. After a killer frost, the value of the juice is \$1.50/L. On what day does the risk of frost damage outweigh the gain from extra maturing time?</p>