

Grade 12
Essential Mathematics
Achievement Test

Student Booklet

January 2016

Manitoba Education and Advanced Learning Cataloguing in Publication Data

Grade 12 essential mathematics achievement test.
Student Booklet. January 2016

This resource is available in print and electronic formats

ISBN: 978-0-7711-6178-0 (print)

ISBN: 978-0-7711-6179-7 (pdf)

1. Educational tests and measurements—Manitoba.
 2. Mathematical ability—Testing.
 3. Mathematics—Examinations, questions, etc.
 4. Mathematics—Study and teaching (Secondary)—Manitoba.
- I. Manitoba. Manitoba Education and Advanced Learning.
510.76

Manitoba Education and Advanced Learning
School Programs Division
Winnipeg, Manitoba, Canada

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This resource will also be available on the Manitoba Education and Advanced Learning website at www.edu.gov.mb.ca/k12/assess/archives/index.html.

Websites are subject to change without notice.

Disponible en français.

Available in alternate formats upon request.

Grade 12 Essential Mathematics Achievement Test Student Booklet (January 2016)

DESCRIPTION

Total Possible Marks: 77

Maximum Time: 120 minutes

This test consists of six parts:

Learning Unit	Suggested Time to Complete	Marks
Home Finance	15–20 minutes	16
Probability	10–15 minutes	11
Vehicle Finance	20–25 minutes	18
Geometry and Trigonometry	15–20 minutes	15
Precision Measurement	15–20 minutes	8
Statistics	15–20 minutes	9

GENERAL DIRECTIONS

- ◆ You may use the *Formula Sheet: Essential Mathematics* found at the end of this booklet and your study sheet.
- ◆ Use of a scientific calculator and ruler may be necessary. Graphing calculators are not permitted.
- ◆ Read all instructions on the test carefully.
- ◆ **If you need more space to answer a question, extra pages may be provided by your teacher. Write your booklet ID number and question number on any extra page(s) used and staple the additional page(s) into the booklet where your answer begins.**

At this point, please turn off your cell
phone and all other such devices.

Remember to

- ◆ show all your work in this booklet
- ◆ use your *Formula Sheet*
- ◆ use your study sheet
- ◆ use a scientific (non-graphing) calculator
- ◆ use a ruler

DIRECTIONS

- ◆ Show **complete answers** in the space(s) provided in this booklet.
- ◆ Let the mark values for each question guide you in answering the question.
- ◆ Show all your work.
- ◆ Be sure to include units in your final answer.
- ◆ Use your *Formula Sheet* and your study sheet.
- ◆ Provide explanations and justifications.
- ◆ Use a well-organized method to communicate your answer.

Directing Words

Some questions may include directing words such as *explain*, *state*, and *calculate*. These words are explained below.

The word	The question is asking for...
identify/choose	the appropriate answer(s) from a given list of choices
state	a word, sentence, or number, without an explanation
describe/explain	words or symbols, diagrams, charts or graphs, or other methods that clearly show what you are thinking
justify/support	an explanation, information, or evidence that shows why your method, idea, or answer is correct
sketch	a reasonably neat picture or diagram (not necessarily to scale) that shows or explains an idea, concept, or method
calculate/determine	a mathematical formula, an algebraic equation, or a numerical calculation to solve a problem



PLEASE WAIT UNTIL THE TEACHER TELLS YOU TO TURN THE PAGE.

Home Finance

4 Marks

1. David is planning on purchasing a house. The monthly mortgage payment will be \$925 and the monthly heating costs will be \$235. The annual property taxes will be \$3180.

- A) Calculate David's Gross Debt Service Ratio (GDSR) if his gross monthly income is \$3958. (3 marks)

101

- B) Explain whether David will be approved for the home mortgage. (1 mark)

102

2 Marks

103

2. A homeowner wants to purchase comprehensive insurance with a \$200 deductible. Her house is valued at \$195 000 and is located in Area 2. Calculate the total cost of her insurance.

Use the *Manitoba Homeowner's Insurance Rates* table on the facing page.

Manitoba Homeowner's Insurance Rates

Manitoba Homeowner's Insurance Rates (\$500 deductible)								
	Winnipeg		Area 2		Area 3		Area 4	
Amount	Standard	Comprehensive	Standard	Comprehensive	Standard	Comprehensive	Standard	Comprehensive
\$ 50 000	195	214	147	161	196	216	261	287
\$ 55 000	216	238	160	176	217	239	289	318
\$ 60 000	237	260	173	190	237	261	315	347
\$ 65 000	252	277	187	205	255	281	339	373
\$ 70 000	266	303	200	220	270	297	359	395
\$ 75 000	294	314	210	231	285	314	379	417
\$ 80 000	310	323	221	243	302	332	402	462
\$ 85 000	318	333	226	249	313	344	416	458
\$ 90 000	324	349	231	254	324	356	431	474
\$ 95 000	348	370	244	268	345	380	459	505
\$100 000	364	393	260	286	361	397	480	528
\$105 000	390	417	278	306	378	416	503	553
\$110 000	402	441	293	322	393	432	523	575
\$115 000	418	464	299	329	409	450	544	598
\$120 000	436	487	309	340	424	466	564	620
\$125 000	451	510	319	351	444	488	591	650
\$130 000	472	543	339	373	466	513	620	682
\$135 000	498	557	345	380	477	525	634	697
\$140 000	523	580	358	394	496	546	660	726
\$145 000	538	596	375	413	508	559	676	744
\$150 000	550	604	385	424	520	572	692	761
\$155 000	557	613	398	438	551	606	733	806
\$160 000	565	622	413	454	569	626	757	833
\$165 000	572	629	425	468	589	648	783	861
\$170 000	590	647	441	485	609	670	810	891
\$175 000	607	668	451	496	624	686	830	913
\$180 000	620	686	466	513	648	713	862	948
\$185 000	636	702	478	526	667	734	887	976
\$190 000	652	717	492	541	705	776	938	1032
\$195 000	678	742	504	554	720	792	958	1054
\$200 000	692	771	519	571	726	799	966	1063
Additional amounts per \$1000 coverage	Add: \$3.15	Add: \$3.50	Add: \$2.75	Add: \$3.03	Add: \$3.55	Add: \$3.91	Add: \$4.72	Add: \$5.19

\$200 deductible—Increase premium by 10%

3. A couple has purchased a house in Brandon for their son to live in while he attends university. State 2 on-going expenses related to home ownership.

1. _____

2. _____

4. Sherry will need a \$245 000 mortgage to purchase a house.

Amortization Period of Mortgage Loan When Paid Monthly					
(Blended payment of principal and interest per \$1000 of loan)					
Interest Rate	5 years	10 years	15 years	20 years	25 years
4.00%	\$18.40	\$10.11	\$7.38	\$6.04	\$5.26
4.25%	18.51	10.23	7.50	6.17	5.40
4.50%	18.62	10.34	7.63	6.30	5.53
4.75%	18.74	10.46	7.75	6.44	5.67
5.00%	18.85	10.58	7.88	6.57	5.82
5.25%	18.96	10.70	8.01	6.71	5.96
5.50%	19.07	10.82	8.14	6.84	6.10
5.75%	19.19	10.94	8.27	6.98	6.25
6.00%	19.30	11.07	8.40	7.12	6.40
6.25%	19.41	11.19	8.53	7.26	6.55
6.50%	19.53	11.31	8.66	7.41	6.70
6.75%	19.64	11.43	8.80	7.55	6.85
7.00%	19.75	11.56	8.93	7.70	7.00
7.25%	19.87	11.68	9.07	7.84	7.16
7.50%	19.98	11.81	9.21	7.99	7.32
7.75%	20.10	11.94	9.34	8.13	7.47
8.00%	20.21	12.06	9.48	8.28	7.63

- A) Determine her monthly mortgage payment if she gets an interest rate of 5.25% and amortizes the mortgage over 20 years. (2 marks)

105

- B) Calculate the total interest paid over the 20-year mortgage. (2 marks)

106

5. State 2 costs related to preventative home maintenance.

1. _____

2. _____

2 Marks

108

6. A house and land have an assessed value of \$225 000. The portion percentage is 45%. The municipality has a tax rate of 32 mills. Calculate the general municipal tax.

Probability

1 Mark

109

7. Emerito has to write a math quiz at the end of every week. Each quiz is out of 10 marks. His marks on the last 6 weeks' quizzes were as follows:

4	7	8	6	8	7
---	---	---	---	---	---

State the probability that a randomly chosen quiz has a mark of 70% or more.

8. State 63% as a fraction and as a decimal.

Fraction: _____

Decimal: _____

4 Marks

9. A company wishes to advertise a new type of breakfast cereal by sending out small samples through the mail to potential customers. There is a 7% chance that a potential customer will like the cereal and buy a full box for \$6.00.

A) Calculate the expected value for the company if the samples cost \$0.40 each to produce and distribute. (3 marks)

111

B) Justify whether the company should try this form of advertising based on your answer in Part A. (1 mark)

112

10. State the probability of a baseball player hitting a ball given that the odds for this event are 1 : 4.

11. Ten cards, numbered 1 to 10, are placed in a bag. A student pulls a card from the bag, records the number, and puts the card back in the bag. The student repeats this process 9 more times. The table below shows the results.

3	6	8	4	4	1	10	6	2	5
---	---	---	---	---	---	----	---	---	---

114

- A) State the experimental probability of a student pulling out a card with a number greater than 7. (1 mark)

115

- B) State the theoretical probability of a student pulling out a card with a number greater than 7. (1 mark)

12. Choose the letter that best completes the statement below.

The probability of a tadpole surviving to become an adult frog is 90%. The odds **against** this happening are:

- a) 1 : 9
- b) 9 : 1
- c) 1 : 10
- d) 10 : 1

Answer: _____

Vehicle Finance

4 Marks

117

13. State 2 advantages and 2 disadvantages of buying a used car rather than buying a similar new car.

Advantages	Disadvantages
1.	1.
2.	2.

2 Marks

118

14. Mark wants to buy a new truck worth \$25 500. The dealership offers him a trade-in value of \$3500 for his used car. Calculate the purchase price of the new truck after taxes.

1 Mark

119

15. State 1 way to decrease the total amount paid to finance the car you have decided to buy.

16. Nancy is purchasing a new vehicle for \$26 500 after taxes at 4.5% for 5 years.

Monthly Vehicle Loan Payments per \$1000 borrowed					
Interest Rate (%)	Years to Repay Loan				
	1	2	3	4	5
4.00	85.15	43.42	29.52	22.58	18.42
4.25	85.26	43.54	29.64	22.69	18.53
4.50	85.38	43.65	29.75	22.80	18.64
4.75	85.49	43.76	29.86	22.92	18.76
5.00	85.61	43.87	29.97	23.03	18.87
5.25	85.72	43.98	30.08	23.14	18.99
5.50	85.84	44.10	30.20	23.26	19.10
5.75	85.95	44.21	30.31	23.37	19.22
6.00	86.07	44.32	30.42	23.49	19.33

A) Calculate Nancy's monthly payment. (2 marks)

120

B) At another financial institution Nancy is offered a loan with a monthly payment of \$400 for 7 years. Justify which option Nancy should choose. (1 mark)

121

3 Marks

17. On average, the fuel economy of Jasmine's vehicle is 8.5 L/100 km. In the past month, Jasmine has travelled a total of 2800 km.

A) Calculate the total litres of gas Jasmine's vehicle used for the month based on the average fuel economy. (2 marks)

122

B) State the total cost of fuel used if it costs \$1.23 per litre. (1 mark)

123

18. Choose the letter that best completes the statement below.

When insuring a vehicle in Manitoba, the factor that does **not** affect your premium is:

- a) your driving record
- b) your gender
- c) the type of vehicle
- d) the use of vehicle

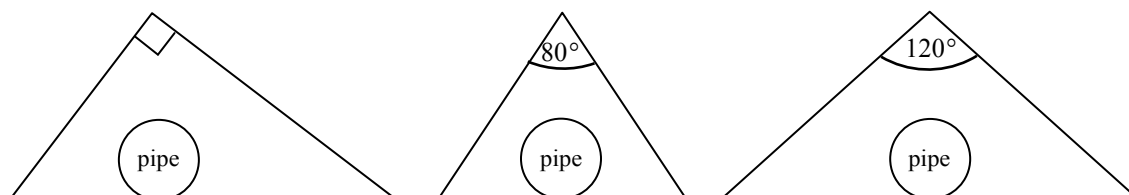
Answer: _____

19. Bryan's 20-year-old vehicle has broken down. He therefore pushes it into a repair shop in Manitoba. His car needs to have the radiator (\$500) and timing belt (\$450) replaced. The labour cost is \$120 per hour and it takes 4 hours to repair his vehicle. Calculate how much it costs to have his vehicle repaired after taxes.

Geometry and Trigonometry

2 Marks

20. Martha is building a triangular ramp over a drainage pipe. She is considering the following designs:



126

- A) Choose the letter that best completes the statement below. (1 mark)

The type of triangular ramp that allows a wheelbarrow to be pushed smoothly over the pipe with the least amount of effort from either side is:

- a) acute
- b) equilateral
- c) obtuse
- d) right

Answer: _____

127

- B) Justify why this type of triangle should be used for the ramp, making reference to the base angles. (1 mark)

21. A manufacturer of solar panels states that panels should be installed at a 70° angle with the horizontal base of the roof. Calculate the length of the roof as identified in the diagram.

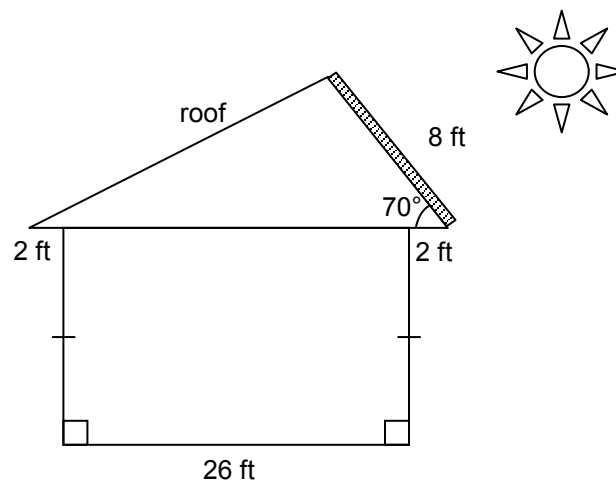
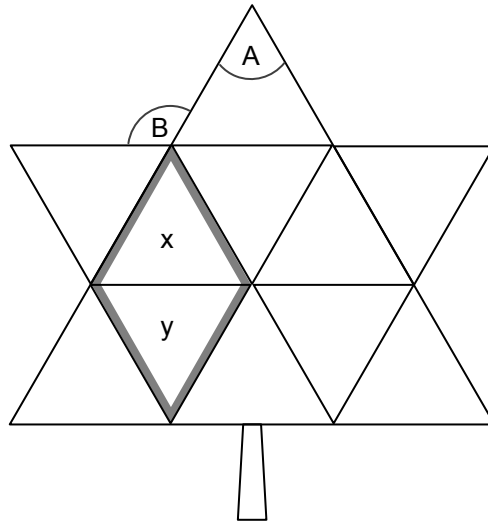


Diagram is not to scale

22. Canada's Centennial Maple Leaf is made up of 11 equilateral triangles.



A) State the measure of angle A. (1 mark)

129

B) State the measure of angle B. (1 mark)

130

C) State the type of quadrilateral created by combining triangles x and y. (1 mark)

131

2 Marks

132

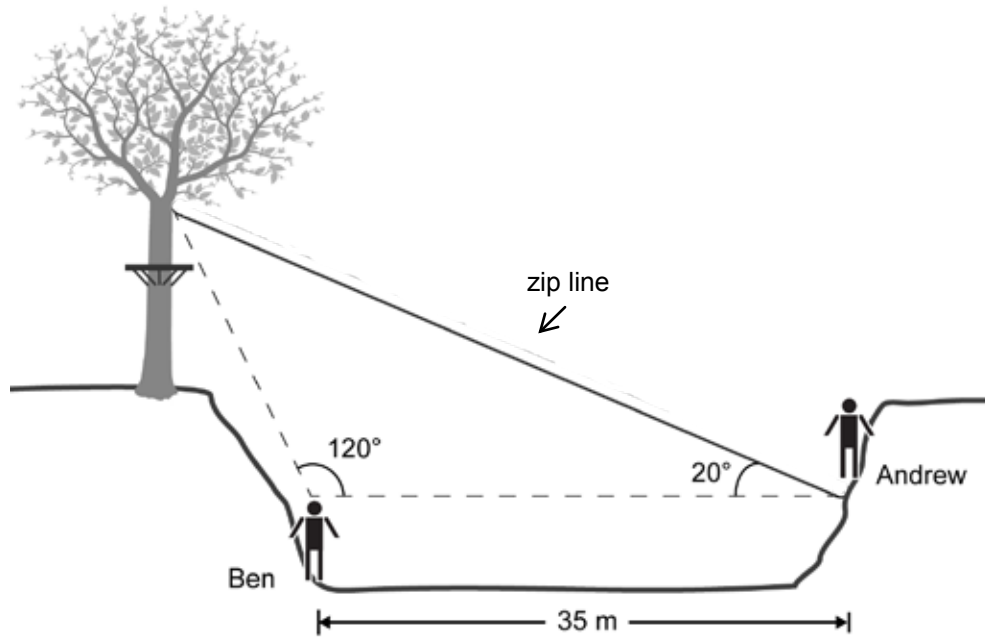
23. Squares and parallelograms are geometric figures. Using properties of polygons:

A) Explain why a square is a parallelogram. (1 mark)

133

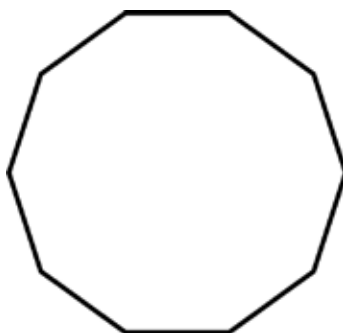
B) Explain why a parallelogram is not always a square. (1 mark)

24. Andrew and Ben are building a zip line across a ravine.



Calculate the length of the zip line.

25. Consider a regular decagon.



A) State the sum of all interior angles. (1 mark)

135

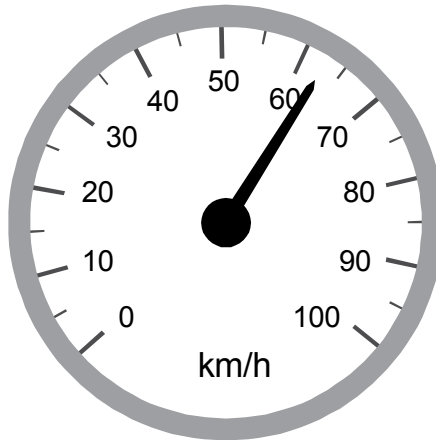
B) State the measure of an interior angle for the regular decagon. (1 mark)

136

Precision Measurement

2 Marks

26. Refer to the following diagram of a speedometer.



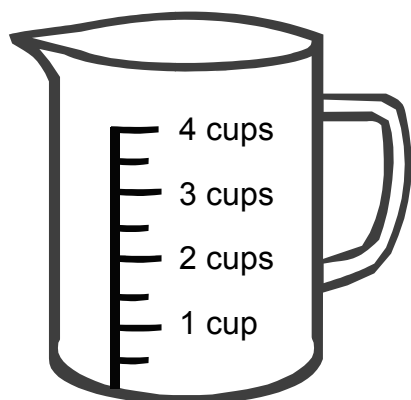
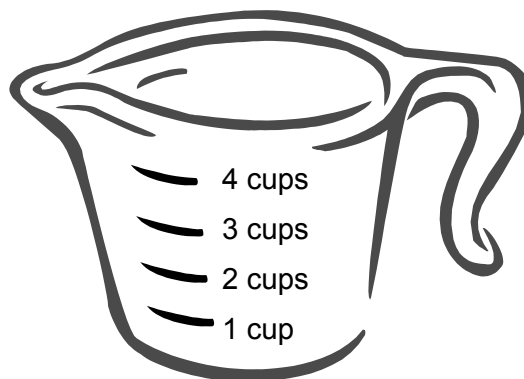
A) State the precision of the speedometer. (1 mark)

137

B) State the uncertainty of the speedometer. (1 mark)

138

27. Johnny needs to measure $1\frac{3}{4}$ cups of water to make bread. Justify which of the following measuring cups is more precise.

**A****B**

2 Marks

28. Jill buys a roll of wallpaper. She uses a measuring device with a precision of 1 cm to measure and cut a 95 cm piece.

A) State the maximum length of the cut piece of wallpaper. (1 mark)

140

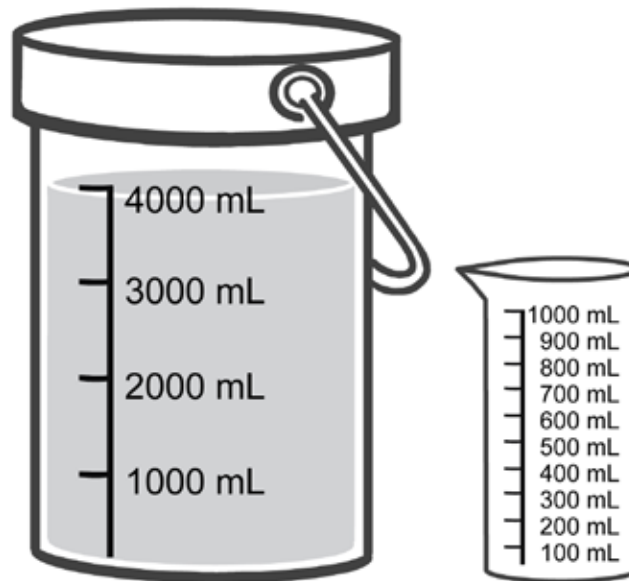
B) State the minimum length of the cut piece of wallpaper. (1 mark)

141

29. Colin has a bucket, marked in 1000 mL increments, that he fills with 4000 mL of liquid fertilizer. He wants to remove 300 mL of the liquid fertilizer. He uses a 1000 mL container marked in 100 mL increments.

Calculate the remaining amount of mixture that will be in the bucket in the format:

measurement \pm uncertainty



30. Ralph is painting his living room with a custom colour that was created at the paint store by mixing colours. He did not buy enough paint and needs to buy more.

Explain why a degree of accuracy is needed when mixing additional paint to match his original colour.

Statistics

3 Marks

31. DBG Manufacturing has 50 employees. The following table shows employee salaries:

Position	Number of Employees	Salary
President	1	\$700 000
Managers	3	\$100 000
Sales Staff	30	\$50 000
Administration	4	\$40 000
Maintenance	5	\$37 000
Secretaries	7	\$35 000

A) State the mode of the salaries. (1 mark)

144

B) State which measure of central tendency is most affected by removing the president's salary. Justify your answer. (2 marks)

145

1 Mark

146

32. Connor scored 18/20 on a math test. His mark put him in the 15th percentile. Justify what his percentile rank indicates about the math test.

2 Marks

147

33. Ryan has just finished writing a statistics test. There are 40 students in his class and 30 students scored less than Ryan. Calculate Ryan's percentile rank.

34. Juanita took a Physics course. The following table shows the marks she earned for a project and the weight for each category:

Category	Mark (%)	Weight (%)
Theories	90	40
Communication	60	10
Calculations	70	50

- A) Calculate Juanita's final mark for the project using a weighted mean. (2 marks)

148

- B) If Juanita wanted to improve her overall grade, state in which category she should focus her efforts. Justify your answer. (1 mark)

149

Formula Sheet: Essential Mathematics

Name of Formula	Details	Formula
Percentile Rank (<i>PR</i>)	<i>b</i> = number of raw scores below the given score <i>n</i> = total number of raw scores	$PR = \frac{b}{n} \times 100$
Simple Interest (<i>I</i>)	<i>P</i> = principal <i>r</i> = annual interest rate <i>t</i> = time in years	$I = Prt$
Gross Debt Service Ratio (<i>GDSR</i>)		$GDSR = \frac{\text{Monthly mortgage payment} + \text{Monthly property taxes} + \text{Monthly heating costs}}{\text{Gross monthly income}} \times 100$
Fuel Economy in L/100 km (<i>FE</i>)		$FE = \frac{\text{Fuel used in litres}}{\text{Distance in km}} \times 100$
Expected Value (<i>EV</i>)	<i>P</i> = probability	$EV = P(\text{win}) \times \$\text{gain} - P(\text{lose}) \times \loss
Sum of Interior Angles of Polygons (<i>S</i>)	<i>n</i> = number of sides	$S = 180^\circ(n - 2)$
Central Angle of Regular Polygons (<i>C</i>)	<i>n</i> = number of sides	$C = \frac{360^\circ}{n}$
Number of Diagonals in a Polygon (<i>D</i>)	<i>n</i> = number of sides	$D = \frac{n(n - 3)}{2}$

Trigonometric Laws

Sine Law	$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$	Cosine Law	$a^2 = b^2 + c^2 - 2bc \cos A$
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Tax Rates

Federal	Goods and Services Tax (GST)	5%	Provincial	Provincial Sales Tax (PST)	8%
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	Taxes on Vehicle Purchases	
	PST	GST
Buying New	PST	GST
Buying Used from Dealership	PST	GST
Buying Used (Private)	PST calculates on greater of book value or purchased price	No GST
Safety	No PST	GST
Materials and Labour	PST	GST
Lien Search	No PST	No GST

