Grade 12
Essential Mathematics
Achievement Test

Student Booklet

June 2019

Manitoba

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Student Booklet. June 2019

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Available in alternate formats upon request.

Grade 12 Essential Mathematics Achievement Test
Student Booklet (June 2019)

DESCRIPTION

Time Required to Complete the Test: 2 hours

Additional Time Allowed: 30 minutes

This test consists of six parts: **Total Possible Marks: 72**

Learning Unit	Suggested Time to Complete	Marks
Vehicle Finance	15–20 minutes	17
Precision Measurement	10–15 minutes	8
Probability	10–15 minutes	10
Home Finance	15–20 minutes	14
Geometry and Trigonometry	15–20 minutes	14
Statistics	10–15 minutes	9

Please turn off your cell phone and all other such devices.

DIRECTIONS

- Show all your work.
- Use your *Formula Sheet* and your study sheet.
- Use a scientific calculator. Graphing calculators are not permitted.
- Show **complete answers** in the space(s) provided in this booklet.
- Provide explanations and justifications.
- Use a well-organized method to communicate your answer.
- Let the mark values for each question guide you in answering the question.
- Express answers in decimal and percentage form to at least **two decimal places** when rounding, unless otherwise indicated.

  Example: $\frac{15}{29} = 0.52$ or 51.72%

Remember

- Include units in your final answer.
- Some answers are to be given as decimal values. Rounding too early in your solution may result in an inaccurate final answer for which full marks will not be given.

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/illustrate	a reasonably neat picture or diagram (not necessarily to scale) that clearly shows or explains an idea, concept, or method
calculate	a mathematical formula, an algebraic equation, or a numerical calculation to solve a problem
determine	a verification or confirmation by count, observation, formula, pattern, use of a table, etc.

PLEASE WAIT UNTIL INSTRUCTED TO TURN THE PAGE.

Vehicle Finance

Question 1

2 marks 101

Marjorie borrows $18 000 to finance the purchase of a car. She makes monthly car payments of $325 for 6 years.

Calculate the total finance charge (interest) she will pay for the loan. (2 marks)

Question 2

3 marks 102 103

Maria is buying a new vehicle. After making a down payment to the dealership, Maria finances the remaining balance through her bank. The table below shows the details of the purchase.

Vehicle price	$29 000
Down payment	$8000
Total tax	$3770
Finance charge (interest)	$2386
Term	48 months

A) Calculate the total amount that will be paid to the bank. (2 marks)

B) Calculate Maria's monthly payment. (1 mark)

Question 3

1 mark 104

Explain one advantage of financing the purchase of a new car rather than leasing it.

Question 4

3 marks 105

Luc purchases a used vehicle privately. The vehicle costs $12 000 and has a book value of $10 000. He also pays $50 for a safety inspection.

Calculate the total amount Luc will pay for the vehicle, after taxes. (3 marks)

Question 5

1 mark 106

State one factor that affects your car insurance premium.

Question 6

2 marks 107

You decide to buy the car you have been leasing for the past 3 years. The car had a sticker price of $32 000, before taxes. The residual value is 40% of the sticker price.

Calculate the residual value of the car, after taxes. (2 marks)

Question 7

3 marks 108

Juanita buys a new compact car. She is responsible for the following operating costs.

Operating Costs	
Cost per kilometre	$0.126/km
Monthly car payment	$350

Juanita drives 15 000 km per year.

Calculate the annual operating costs of the car, before taxes. (3 marks)

Question 8

2 marks 109

Jafar owns a truck and a hybrid car. The fuel economy of the truck is 9.4 L/100 km. The fuel economy of the car is 3.5 L/100 km. Jafar drove his truck 17 000 km last year.

Calculate how much less fuel he would have used if he had driven his hybrid car instead of his truck. (2 marks)

Precision Measurement

Question 9

2 marks 110

Colette is mixing iced tea in the jug shown below.

State the amount of iced tea in the jug in the form: measurement ± uncertainty
(2 marks)

Question 10

1 mark 111

Pierre is a competitive swimmer. He finished a race with a time of 28.17 seconds.

State the precision of the measurement.

Question 11

1 mark 112

Kenneth wants to build a shelf with a width of $59 \text{ cm} \pm 0.02 \text{ cm}$.

State the maximum acceptable width of the shelf.

Question 12

1 mark 113

Choose the letter that best completes the statement below.

The range of acceptable measurements refers to:

A) the maximum

B) the minimum

C) the precision

D) the tolerance

Answer: _____

Question 13

1 mark 114

The uncertainty of a scale is 0.25 g.

State the precision of the scale.

Question 14

2 marks 115

The uncertainty for the speedometer of a vehicle is 5% of the speedometer's reading.

Calculate the minimum speed a vehicle could be travelling if its speedometer reads 60 km/h.
(2 marks)

Probability

Question 15

4 marks 116 117

Colin has a painting company. He advertises by delivering brochures. Each brochure costs him $2.50 to print. He finds that 1 out of 50 brochures results in a painting job where he earns $100.

A) Calculate the expected value of each brochure. (3 marks)

B) Justify whether Colin should continue to deliver brochures based on your answer in Part A. (1 mark)

Question 16

2 marks 118 119

The odds **against** breaking your pencil lead are $323 : 7$.

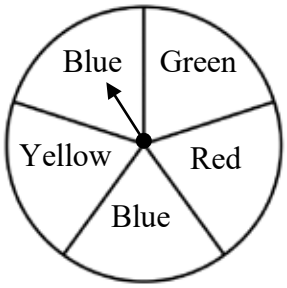
A) State the odds in favour of breaking your pencil lead. (1 mark)

B) State the probability of breaking your pencil lead. (1 mark)

Question 17

1 mark 120

Arielle spins the following spinner. The spinner is divided into equal sections.

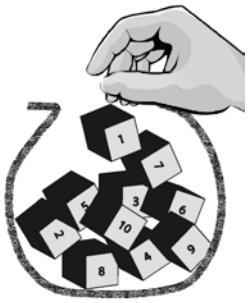


State the probability of the spinner landing on blue.

Question 18

2 marks 121 122

Wooden blocks numbered 1 through 10 are placed in a bag. The blocks are all the same size and shape. Your teacher pulls out one block, records the number, and puts the block back in the bag. She repeats this process nine more times.



Her results are recorded below.

10 6 5 6 4 10 4 5 8 4

A) A student states that the experimental probability and the theoretical probability of pulling Block 4 are the same.

Explain why he is incorrect. (1 mark)

B) State which block has the same experimental and theoretical probability of being pulled. (1 mark)

Question 19

1 mark 123

Emmanuel has two cubes with faces numbered 1 through 6; one red and one blue. The two cubes are rolled.

The chart below shows the numbers on each cube and the possible sums.

		Blue Cube					
		1	2	3	4	5	6
Red Cube	1	2	3	4	5	6	7
	2	3	4	5	6	7	8
	3	4	5	6	7	8	9
	4	5	6	7	8	9	10
	5	6	7	8	9	10	11
	6	7	8	9	10	11	12

State the probability of the two cubes having a sum greater than 8.

Home Finance

Question 20

4 marks 124 125

Mr. Reid wants to buy a house for $260 000. His monthly mortgage payment would be $1524. The property taxes are $2220 annually, and the heating costs are $195 monthly. Mr. Reid's gross monthly income is $5125.

A) Calculate Mr. Reid's Gross Debt Service Ratio as a percent. (3 marks)

B) Explain whether Mr. Reid will be approved for the mortgage. (1 mark)

Question 21

2 marks 126 127

Describe the purpose of the following one-time costs that are associated with buying a house.

A) Lawyer Fees (1 mark)

B) Home Inspection (1 mark)

Question 22

1 mark 128

Myra owns a house. Even though her old furnace works, Myra replaces it with a new, more efficient furnace.

Justify why Myra made this decision.

Question 23

1 mark 129

Adelynn is purchasing a home insurance policy for her house.

Justify why she should choose a comprehensive policy rather than a standard policy.

Question 24

3 marks 130 131

Rypin has just purchased a house. He has a mortgage with an interest rate of 3.5% and an opening balance of $98 000.

A) Calculate the interest on his first monthly mortgage payment. (2 marks)

B) Rypin's monthly mortgage payment is $875.90.

Calculate how much of his first month's payment will go towards the unpaid balance. (1 mark)

Question 25

2 marks 132

Jasmine bought a house for $225 000. She already knows that for the first $200 000, the land transfer tax will cost $1650.

Calculate the total land transfer tax. (2 marks)

Land Transfer Tax Table	
Value of Property	**Rate**
On the first $30 000	0%
On the next $60 000 (i.e., $30 001 to $90 000)	0.5%
On the next $60 000 (i.e., $90 001 to $150 000)	1.0%
On the next $50 000 (i.e., $150 001 to $200 000)	1.5%
On amounts in excess of $200 000	2.0%

Question 26

1 mark 133

Choose the letter that best completes the statement below.

The item that is **not** an ongoing home maintenance task is:

A) checking for leaky faucets

B) ensuring that the furnace is functioning

C) replacing a shattered window

D) checking hot water tank for leaks

Answer: _____

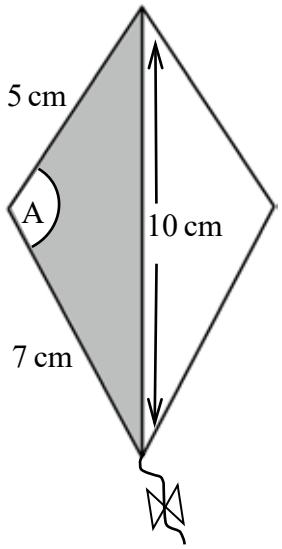
Geometry and Trigonometry

Question 27

3 marks 134

Hansel is using the following model to build nylon kites.

Calculate the measure of $\angle A$. (3 marks)



Question 28

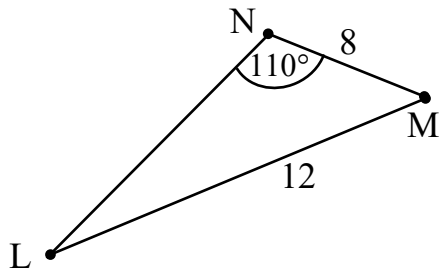
1 mark 135

Explain why a kite is not a regular polygon.

Question 29

3 marks 136

Given the following diagram:

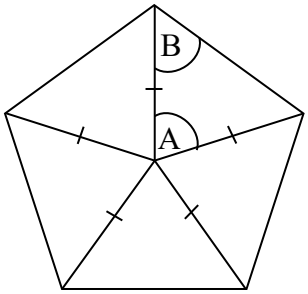


Calculate the measure of $\angle L$. (3 marks)

Question 30

2 marks 137 138

Sherry is building a recycling station with 5 bins. The top view of the recycling station shows how each bin is an isosceles triangle and that together they form a regular pentagon.



A) Calculate the measure of $\angle$A. (1 mark)

B) Calculate the measure of $\angle$B. (1 mark)

Question 31

1 mark 139

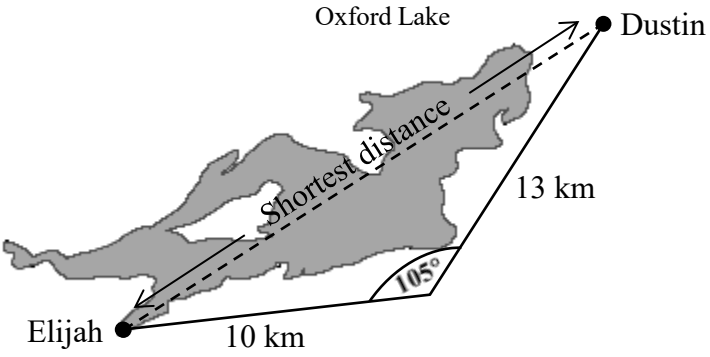
Explain why a triangle cannot have two obtuse angles.

Question 32

3 marks 140

Elijah and Dustin live across Oxford Lake from each other.

Calculate the shortest distance that Dustin must travel by snowmobile to visit his friend in winter. (3 marks)



Question 33

1 mark 141

Identify the statement that best describes a property of a rectangle.

A) The diagonals of a rectangle are congruent.

B) A rectangle has only one pair of parallel sides.

C) The diagonals of a rectangle bisect the interior angles.

D) The diagonals of a rectangle meet at right angles.

Answer: _____

Statistics

Question 34

2 marks 142 143

Hayden is a competitive diver. On his first dive, Hayden receives the following scores from the judges:

6.5 6.5 6.5 6.0 7.0 6.5 9.5

A) Calculate the trimmed mean by removing the highest and lowest scores. (1 mark)

B) Explain the effect of removing the highest and lowest diving scores on Hayden's mean score. (1 mark)

Question 35

2 marks 144

In gymnastic competitions, a maximum of 10 points can be awarded per category.

The table below shows Alice's results.

Category	Weight	Points
Execution	80%	9.8
Difficulty	20%	8.3
Overall Score		

Calculate Alice's overall score using a weighted mean. (2 marks)

Question 36

2 marks 145

The table below lists the daily earnings of a waiter.

$50	$55	$55	$56	$59
$60	$60	$66	$75	$85
$90	$95	$140	$140	$145

Calculate the percentile rank for a daily earning of $85. (2 marks)

Question 37

3 marks 146

The table below shows the total amount spent on groceries during a 12-week period.

$72	$126	$84	$113
$113	$142	$126	$126
$97	$111	$108	$95

Calculate the mean, median, and mode for these amounts. (3 marks)

Mean: _____

Median: _____

Mode: _____

Formula Sheet: Essential Mathematics

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

Additional formulas on next page. →

Tax Rates					
Provincial	Provincial Sales Tax (PST)	8%	Federal	Goods and Services Tax (GST)	5%

Taxes on Vehicle Purchases		
	PST	**GST**
Buying New	PST	GST
Buying Used from a Dealership	PST	GST
Buying Used Privately	PST calculated on greater of book value or purchase price	No GST
Safety	No PST	GST
Materials and Labour	PST	GST
Lien Search	No PST	No GST

Taxes on Home Insurance		
	PST	**GST**
Homeowner's/Tenant's Insurance	PST	No GST