Grade 12
Essential Mathematics
Achievement Test

Student Booklet

June 2016

Manitoba

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Student Booklet. June 2016

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After the administration of this test, print copies of this resource will be available for purchase from the Manitoba Learning Resource Centre (formerly the Manitoba Text Book Bureau). Order online at www.mtbb.mb.ca.

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.

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Disponible en français.

Available in alternate formats upon request.

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

DESCRIPTION

Total Possible Marks: 76 **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	15–20 minutes	16
Geometry and Trigonometry	15–20 minutes	14
Precision Measurement	10–15 minutes	8
Statistics	10–15 minutes	11

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

1 Mark

101

1. Jin is purchasing his first house. State 1 additional (one-time) cost to consider when purchasing his house.

2 Marks

102

2. Identify the 2 advantages of renting a house compared to buying a house from the list below:

- building equity
- lower initial (up front) costs
- ability to renovate
- move/leave whenever you want without penalty
- insurance is cheaper
- not responsible for any damages

Note: Place one response per line.

Advantage 1: _____

Advantage 2: _____

4 Marks

3. David took out a mortgage of $259 000 for a new house. He has arranged financing for 4% over 20 years.

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

103

A) Calculate the monthly mortgage payment. (2 marks)

104

B) Calculate the interest on the first month's payment. (2 marks)

4 Marks

105

4. Yuri wants to purchase homeowner's insurance for his house valued at $230 000 which is located in Area 4. He wants a standard policy with a $500 deductible. Calculate the total cost of the homeowner's 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%

4 Marks

5. Marcía earns $52 500 annually and wants to buy a new house. Her monthly mortgage payments will be $725, the monthly property taxes will be $262.50, and the monthly heating costs will be $215.

106

A) Calculate Marcía's Gross Debt Service Ratio (GDSR). (3 marks)

107

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

1 Mark

108

6. State 1 energy-efficient improvement available to homeowners.

Probability

2 Marks

7. Josephine has placed 3 white, 5 blue, and 6 purple marbles in a bag.

109

A) State the probability of randomly selecting a purple marble from the bag. (1 mark)

110

B) A purple marble is pulled out of the bag and not replaced. State the probability of randomly selecting another purple marble from the bag. (1 mark)

1 Mark

111

8. State the odds in favour of a tidal wave occurring given that the probability for this event is 3 out of 147.

4 Marks

9. A game at a summer carnival costs $2 to play. The prize at this game is a stuffed animal valued at $10. The probability of winning the game is 27%.

112

A) Calculate the expected value (EV) for the game from the player's perspective. (3 marks)

113

B) Justify whether the **owner** of the game should continue offering it at the carnival based on your answer in Part A. (1 mark)

2 Marks

114

10. State the probability of "13 out of 50" as a decimal and a percent.

Decimal: _____

Percent: _____

1 Mark

115

11. A group of 30 students were given 4 choices and asked to choose their favourite colour. The results were as follows:

Red	Blue	Yellow	Green
9	12	6	3

The teacher states "If I choose a student at random, there is a 25% probability that their favourite colour is green."

The teacher's claim is an example of theoretical probability. Justify the teacher's claim.

1 Mark

116

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

Sharon would like to borrow a specific book from the local library. The odds **against** the book being available are $1:99$. The probability of the book being available is:

a) $\frac{2}{98}$

b) $\frac{99}{1}$

c) $\frac{1}{100}$

d) $\frac{99}{100}$

Answer: _____

Vehicle Finance

2 Marks

117

13. Omar buys a new car with a base price of $21 800 and purchases the following options:

    Navigation system: $1000
    Sound system: $800

    Calculate the cost, after taxes, of purchasing the new vehicle if he receives $3000 for his trade-in.

1 Mark

118

14. State 1 disadvantage of buying a used vehicle.

2 Marks

119

15. Michel is purchasing a new vehicle. The price of the vehicle is $30 000 and it will depreciate 20% in the first year.

    Calculate the value of the vehicle after the first year.

2 Marks

120

16. Manhatten is considering leasing a vehicle for her courier company. State 2 reasons why she **should not** lease a vehicle.

    Note: Place one response per line.

    Reason 1:_____

    Reason 2:_____

3 Marks

17. The fuel economy of Gina's vehicle is 7 L/100 km. She is planning to drive her vehicle from Winnipeg to Toronto, a distance of 2230 kilometres.

121

A) Determine the total amount of fuel in litres required for the trip. (2 marks)

122

B) Determine the cost of the trip if the fuel price is $1.30/L. (1 mark)

4 Marks

18. Alicia is purchasing a new vehicle for $24 000, after taxes. She is financing the vehicle for 4% over 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

123

A) Calculate Alicia's monthly vehicle payment. (2 marks)

124

B) Calculate the total amount of interest she will pay over the 5 years. (2 marks)

2 Marks

19. Julie is moving from rural Manitoba to Winnipeg for her job. Her insurance broker told her that it will now be more expensive to insure her car.

125

A) State why Julie's premiums will increase. (1 mark)

126

B) Julie retires from her job and wants to continue driving her car. State what she can do to decrease her premiums. (1 mark)

Geometry and Trigonometry

2 Marks

20. Pedro is building a triangular roof for a house. He would like to build it as steep as possible so snow does not accumulate on the roof.

127

A) State whether Pedro's roof should be an equilateral or isosceles triangle. (1 mark)

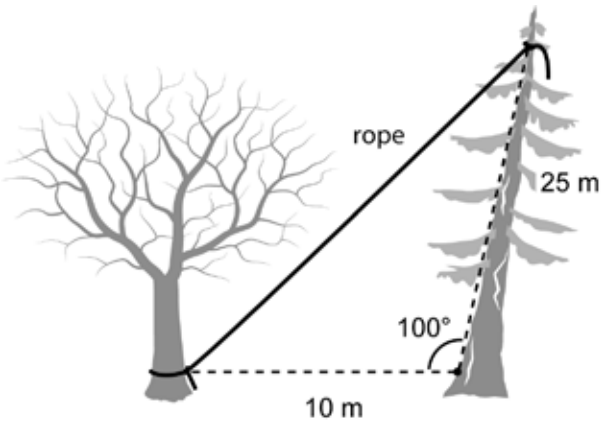
128

B) Justify your answer from Part A. (1 mark)

2 Marks

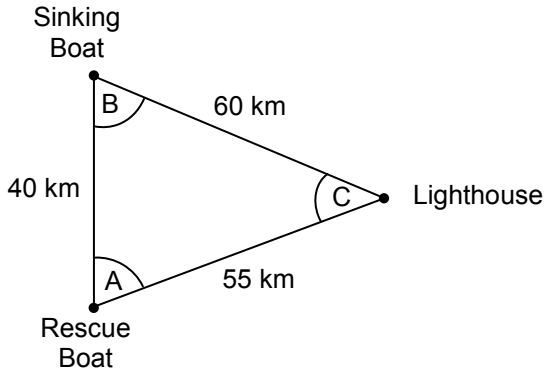
129

21. A gardener has been hired to stabilize a spruce tree that was damaged in a wind storm. The gardener decides to attach a rope from 25 metres up the spruce tree to the base of another tree 10 metres away. Calculate the length of the rope between the 2 trees, as shown in the diagram (excluding the knots).



2 Marks

22. Given the following situation:



130

A) Identify the formula that would be most appropriate to solve for angle A. (1 mark)

a) $\cos A = \frac{\text{adj}}{\text{hyp}}$

b) $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

c) $\frac{\sin A}{a} = \frac{\sin B}{b}$

d) $\sin A = \frac{\text{opp}}{\text{hyp}}$

Answer: _____

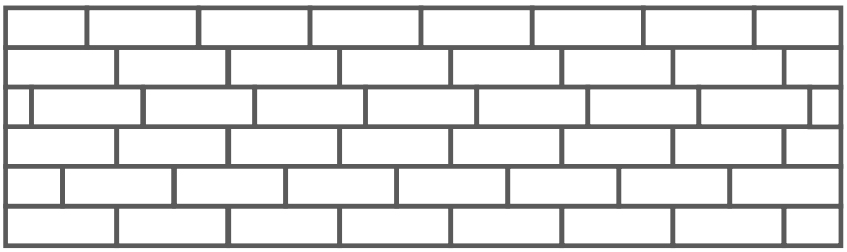
131

B) Justify your choice from Part A. (1 mark)

2 Marks

132

23. Bob is building a brick wall using rectangular bricks.



State 2 properties of polygons that allow for a rectangular wall to be completed using the bricks.

Note: Place one response per line.

Property 1: _____

Property 2: _____

2 Marks

24. Consider a regular polygon with 17 sides.

133

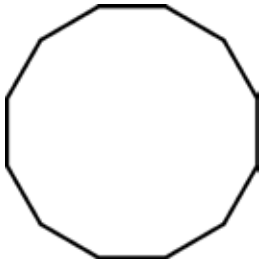
A) State the number of diagonals in this polygon. (1 mark)

134

B) State the central angle of this polygon. (1 mark)

2 Marks

25. A regular dodecagon is a 12-sided figure.



Dodecagon

135

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

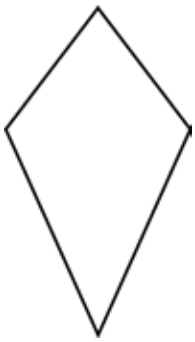
136

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

2 Marks

137

26. A kite is a type of polygon. State 2 properties of this polygon.



Note: Place one response per line.

Property 1: _____

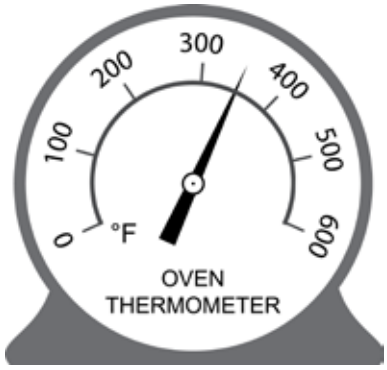
Property 2: _____

Precision Measurement

2 Marks

138

27. State the precision and uncertainty of the oven thermometer shown below.



Precision: _____

Uncertainty: _____

1 Mark

139

28. A student measured a piece of rope using 5 different measuring tapes with the same precision. He recorded the following measurements:

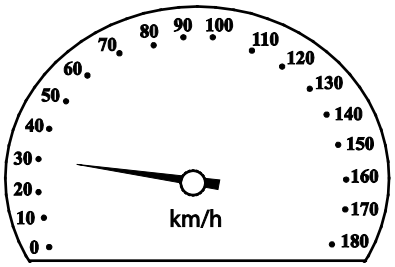
5.34 m	5.32 m	5.37 m	5.34 m	5.38 m

State the precision of the measuring tapes.

1 Mark

140

29. The speed limit in a school zone is 30 km/h. Evan's speedometer reads 30 km/h. Explain why Evan may be pulled over for exceeding the speed limit using one of the following concepts: accuracy, tolerance, uncertainty, or precision.



2 Marks

30. A company makes sticks for frozen fruit snacks with a measurement of $15.5\text{ cm}\ ^{+0}_{-0.2\text{ cm}}$.

141

A) State the maximum length. (1 mark)

142

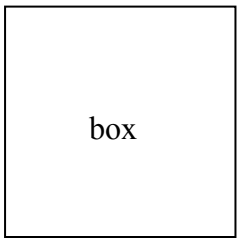
B) State the minimum length. (1 mark)

2 Marks

143

31. Rajiv places 4 boxes side by side. Each box is built to measure $12" \pm \frac{1}{32}"$ in width.

Calculate the combined width of the boxes in the format: **measurement $\pm$ uncertainty**



$12" \pm \frac{1}{32}"$

Statistics

2 Marks

144

32. Nikolai received a test score of 84%. He was told he scored in the 95th percentile.

A) Explain what his test score indicates. (1 mark)

145

B) Explain what his percentile rank indicates. (1 mark)

2 Marks

146

33. Athena is trying to calculate her final mark on her test. The table below shows the percent she received and the weightings for each category.

Category	% correct	Weight
Multiple choice	87%	50%
Short answer	61%	20%
Long answer	68%	30%

Calculate Athena's final mark using a weighted mean.

3 Marks

147

34. The following set of data represents the number of homeruns hit by 9 players on a baseball team:

62	14	25	7	48	31	14	47	4

State the mean, median, and mode.

Mean: _____

Median: _____

Mode: _____

3 Marks

35. Jimbo has the following marks on his tests:

41%	78%	84%	69%	75%

148

A) Explain why he might ask that his test mark be calculated using a trimmed mean. (1 mark)

149

B) Calculate his trimmed mean if the teacher agrees and trims his highest and lowest test marks. (2 marks)

1 Mark

150

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

The measure of central tendency that is most affected by outliers is:

a) mode
b) mean
c) median
d) trimmed mean

Answer: _____

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 ($GDSR$)		$GDSR = \frac{\text{Monthly mortgage payment} + \text{Monthly property taxes} + \text{Monthly heating costs}}{\text{Gross monthly income}} \times 100$
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 $a^2 = b^2 + c^2 - 2bc \cos A$

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

	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