Grade 12
Essential Mathematics
Achievement Test

Student Booklet

June 2014

Manitoba

Manitoba Education and Advanced Learning Cataloguing in Publication Data

Grade 12 essential mathematics achievement test.
Student Booklet. June 2014 [electronic resource]

ISBN: 978-0-7711-5546-8

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 (June 2014)

DESCRIPTION

Total Possible Marks: 80 **Maximum Time: 120 minutes**

This test consists of six parts:

Learning Unit	Suggested Time to Complete	Marks
Home Finance	15–20 minutes	17
Vehicle Finance	20–25 minutes	16
Precision Measurement	15–20 minutes	10
Probability	10–15 minutes	10
Geometry and Trigonometry	15–20 minutes	17
Statistics	15–20 minutes	10

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. A new homeowner has the following costs:

Monthly heating cost	$150
Mortgage	$925
Land transfer tax	$250
Home insurance	$1000
Property tax adjustment	$200
Property tax	$1200

Identify a one-time (or additional) cost from the above list.

4 Marks

102

2. Complete the following amortization table by filling in the empty boxes.

Date	Payment	Interest	Principal	Unpaid Balance
April 15	$789.00	$500.00	$289.00	$149 711.00
May 15	$789.00	$499.04		$149 421.04
June 15		$498.07	$290.93	
July 15	$789.00		$291.90	$148 838.21

4 Marks

3. The monthly heating payment for a home is $250.

103

A) State the homeowner's heating costs for 5 years. (1 mark)

104

B) If the homeowner installs new windows, it will reduce the heating costs by 30%. Calculate the homeowner's expected heating costs for 5 years if new windows are installed. (2 marks)

105

C) The total cost for the windows is $12 000. Explain whether replacing the windows is a good financial decision. (1 mark)

2 Marks

106

4. A couple has chosen a house to purchase. The bank calculates the couple's Gross Debt Service Ratio (GDSR) to be 40%. State two ways the couple could decrease their GDSR.

2 Marks

107

5. Homeowners pay a Land Transfer Tax when purchasing a property. This tax is calculated as follows:

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%

Calculate the Land Transfer Tax due on a property valued at $90 000.

4 Marks

108

6. State two benefits of owning a house and two benefits of renting a property assuming the monthly payments are the same.

Benefit of owning a house	Benefit of renting a property
1.	1.
2.	2.

Vehicle Finance

4 Marks

7. John wants to lease a vehicle for 3 years. The monthly lease payment is $650. A down payment of $5000 is required. All taxes are included in the payments.

109

A) Calculate the total cost of the lease. (2 marks)

110

B) John decides to purchase the vehicle at the end of the lease. The initial value of the vehicle was $45 000 including taxes. Its residual value after 3 years is 45%. Calculate the total amount he will pay for the vehicle. (2 marks)

2 Marks

111

8. Describe one benefit of buying a new vehicle and one benefit of buying a used vehicle.

Benefit of buying a new vehicle	Benefit of buying a used vehicle

2 Marks

112

9. The odometer reads 15 924 km before Seth leaves for a trip. After using 73.2 L of fuel, the odometer reads 16 519 km. Determine the fuel efficiency of his vehicle in L/100 km.

4 Marks

113

10. Brian bought a car valued at $28 600. It depreciates at 20% per year. Complete the table to find the value of the vehicle after 2 years.

Year	Vehicle Value	Depreciation Amount	Year-end Value of Vehicle
1	$28 600		
2			

3 Marks

11. Joe borrows $16 750 at 7% over 5 years to purchase a car.

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
6.25	86.18	44.43	30.54	23.60	19.45
6.50	86.30	44.55	30.65	23.71	19.57
6.75	86.41	44.66	30.76	23.83	19.68
7.00	86.53	44.77	30.88	23.95	19.80
7.25	86.64	44.89	30.99	24.06	19.92
7.50	86.76	45.00	31.11	24.18	20.04
7.75	86.87	45.11	31.22	24.30	20.16
8.00	86.99	45.23	31.34	24.41	20.28

114

A) Calculate his monthly payment. (2 marks)

115

B) State the amount of interest paid in the first month. (1 mark)

1 Mark

116

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

When insuring a vehicle in Manitoba, the factor that affects your premium is:

a) your education
b) where you live
c) your gender
d) the insurance agent you purchase from
e) your age

Answer: _____

Precision Measurement

2 Marks

117

13. State a measurement situation where a degree of precision would be required. Justify your answer.

2 Marks

118

14. Dave wants to install three new cupboards in his bathroom. Each cupboard is 40 cm wide. He measured the space to be 120 cm wide. Explain why the cupboards may not fit using one of the following concepts: accuracy, tolerance, or uncertainty.

2 Marks

119

15. A manufacturer creates ball bearings with diameters that have nominal values of 5 cm and tolerances of 0.02 cm. State the minimum and maximum diameter of a ball bearing if the nominal value is the midpoint of the tolerance range.

Minimum: _____

Maximum: _____

2 Marks

120

16. Given the following diagram of a measuring device:

State the precision and uncertainty of the measuring device:

Precision: _____

Uncertainty: _____

2 Marks

121

17. Tolerance is often used in construction, commercial, industrial, or artistic applications.

    Demonstrate one use of tolerance in the real world by performing the following two steps:

    - State a specific example where tolerance is used.
    - Support your example with a written explanation of how tolerance is used.

Probability

2 Marks

18. The first day of the month falls on a Sunday 48 times in 28 years.

122

A) State the probability of the first day of any given month falling on a Sunday. (1 mark)

123

B) State the odds in favour of this happening. (1 mark)

2 Marks

19. The probability of an eagle returning to the same nest year after year is $\frac{7}{8}$.

124

A) State this probability as a decimal. (1 mark)

125

B) State the probability of the eagle **not** returning to the same nest. (1 mark)

2 Marks

126

20. The Cook Construction Company is bidding on a $200 000 contract to apply gravel on the roads in the Rural Municipality of Timber Valley. It costs the company $5250 to draft the bid. This company has a 10% chance of winning the contract.

    Calculate the expected value of the Cook Construction Company's bid.

1 Mark

127

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

Probability compares the number of favourable outcomes to

a) the likelihood of it not occurring
b) the total number of outcomes
c) the number of unfavourable outcomes
d) the likelihood of it occurring

Answer: _____

1 Mark

128

22. The odds against hitting a moose on the highway are $193 : 7$. State the probability of hitting a moose.

2 Marks

129

23. Eagle Motors has determined that the theoretical probability of a vehicle breaking down is 0.001. In a sample of 5000 vehicles, 100 have broken down.

A) State the experimental probability of an Eagle Motors vehicle breaking down. (1 mark)

130

B) State the number of vehicles, from the 5000 sampled, that can be expected to break down based on the theoretical probability. (1 mark)

Geometry and Trigonometry

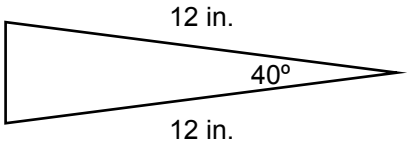
2 Marks

131

24. A triangle has sides of 12 cm, 14 cm, and 16 cm. Justify whether the triangle has two congruent angles.

3 Marks

25. Johnny needs a wedge that will raise his bookshelf at least 4 inches.



132

A) Calculate the length of the third side of the wedge. (2 marks)

133

B) Explain whether the wedge shown above will work for Johnny. (1 mark)

3 Marks

26. The Cosine Law is often used in construction, commercial, industrial, or artistic applications.

134

A) Demonstrate one use of the Cosine Law in the real world by performing the following two steps: (2 marks)

- State a specific example where Cosine Law is used.
- Support your example with a written explanation of how Cosine Law is used.

135

B) Sketch a reasonably neat picture or diagram (not necessarily to scale) that supports your example in Part A. (1 mark)

1 Mark

136

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

If all sides of a 4-sided polygon are equal, then:

a) The adjacent angles are equal.
b) The quadrilateral is a square.
c) The diagonals intersect at 90º.
d) The diagonals do not bisect the interior angles of the quadrilateral.

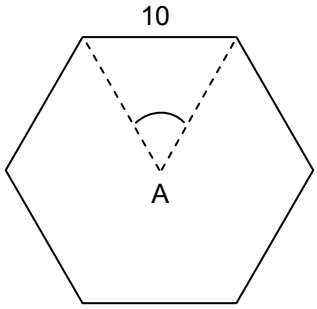
Answer: _____

2 Marks

28. A regular hexagon has a side length of 10 metres.

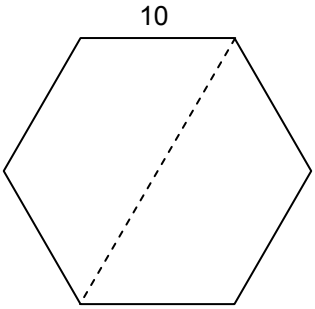
137

A) State the measure of angle A, the central angle, in degrees. (1 mark)



138

B) State the measure of the given diagonal in metres. (1 mark)



3 Marks

29. Polygons are often used in construction, commercial, industrial, or artistic applications.

139

A) Demonstrate one use of the various properties of polygons in the real world by performing the following two steps: (2 marks)

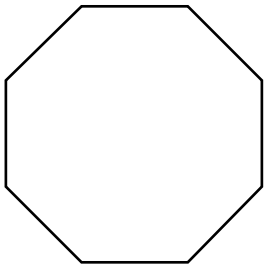
- State a specific example where the various properties of polygons are used.
- Support your example with a written explanation of how the various properties of polygons are used.

140

B) Sketch a reasonably neat picture or diagram (not necessarily to scale) that supports your example in Part A. (1 mark)

3 Marks

30. Given the following regular polygon:



141

A) Calculate the sum of the interior angles in the polygon. (2 marks)

142

B) State the measure of each interior angle in the polygon. (1 mark)

Statistics

4 Marks

31. The scores for a unit test in mathematics are listed below.

30	45	45	55	65	70	70	70	75	80	95

143

A) State the median: (1 mark)

Median: _____

144

B) The teacher decides not to count the lowest mark. State whether each of the following will increase, decrease, or have no change. (3 marks)

Mode: _____

Median: _____

Mean: _____

3 Marks

145

32. On a course outline, the teacher has indicated that the course work is worth 70% of the final mark and the exam is worth 30% of the final mark.

    Calculate the final mark of a student who has achieved 67% on the course work and 82% on the final exam.

3 Marks

33. In a university class of 230 students, Kegan achieved 92% on the final exam. There were 23 students who scored lower than Kegan.

146

A) Calculate Kegan's percentile rank. (2 marks)

147

B) The university will only give an award to the top 10% of students. Explain whether Kegan will get an award. (1 mark)

Formula Sheet: Essential Mathematics

Name of Formula	Details	Formula
Percentile Rank (P)	b = number of raw scores below the given score n = total number of raw scores	$P = \frac{b}{n} \times 100$
Simple Interest (I)	P = principal r = annual interest rate t = time in years	$I = Prt$
Gross Debt Service Ratio ($GDSR$)		$GDSR = \frac{\text{Monthly Mortgage Payment} + \text{Monthly Property Taxes} + \text{Monthly Heating Costs}}{\text{Gross Monthly Income}} \times 100$
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	$C = \frac{360°}{n}$

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%