Grade 12
Essential Mathematics
Achievement Test

Student Booklet

June 2013

Manitoba

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Available in alternate formats upon request.

Grade 12 Essential Mathematics Achievement Test
Student Booklet (June 2013)

DESCRIPTION

Total Possible Marks: 78 **Maximum Time: 120 minutes**

This test consists of six parts:

Learning Unit	Suggested Time to Complete	Marks
Vehicle Finance	20–25 minutes	16
Geometry and Trigonometry	15–20 minutes	15
Statistics	15–20 minutes	10
Home Finance	15–20 minutes	14
Precision Measurement	15–20 minutes	10
Probability	10–15 minutes	13

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

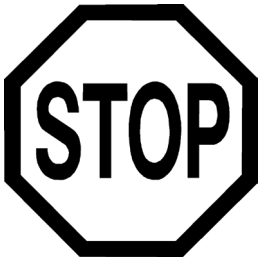
DIRECTIONS

- 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, illustrate,* and *calculate.* These words are explained below.

The Word	The question is asking for…
identify/list/name/state	a label or title of an item, concept, or method
defend/justify/support	an explanation, information, or evidence that shows why your method, idea, or answer is good
describe/explain/express	words or symbols, diagrams, a chart or graph, or other methods that **clearly show** what you mean or what you are thinking
illustrate/sketch	a reasonably neat picture or diagram (not necessarily to scale) that shows or explains an idea or method
draw	a diagram to scale or graph that shows or explains an idea or method
calculate/convert/determine/find	a mathematical formula, an algebraic equation, or a numerical calculation to solve a problem
plot	placement of a point or points on a graph



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

Vehicle Finance

2 Marks

101

1. You are purchasing a vehicle. The bank will lend you $16 500, repayable over 3 years at an interest rate of 4.25%. Calculate the monthly payment.

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

2 Marks

102

2. Tom wishes to buy a new car in Manitoba for $18 000. The car dealership has agreed to accept Tom's old car with a trade-in value of $2000. Calculate the total cost including taxes to buy the new car.

2 Marks

103

3. Describe one (1) advantage and one (1) disadvantage of purchasing a new car instead of leasing one.

Advantage of purchasing	**Disadvantage of purchasing**

5 Marks

4. You are leasing a vehicle. The monthly lease payment is $299 plus taxes for 36 months. The lease requires a $4500 down payment.

104

A) Calculate the total amount paid over 36 months. (3 marks)

105

B) You choose to purchase the vehicle at the end of the lease for the residual value (75% of the original value). The original cost of the vehicle was $34 000 plus taxes. Calculate the total amount paid for the vehicle. (2 marks)

3 Marks

106

5. Phillip buys a used car for $1500. The price of a safety inspection on the car was $40. When registering the car, Phillip is told that the book value of the car is $3700. Calculate the total cost of purchasing the car.

2 Marks

107

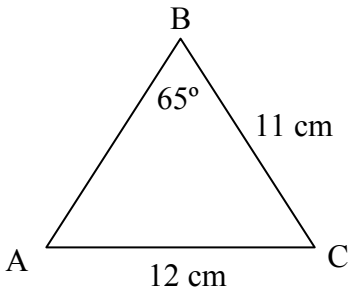
6. Nancy is going on a 1300 km car trip. Her car's fuel efficiency is 8 L/100 km. The average price for fuel on her trip is estimated to be $1.20 per litre. Calculate the cost of fuel for her trip.

Geometry and Trigonometry

2 Marks

108

7. In triangle ABC, the length of side AC is 12 cm, the length of side BC is 11 cm, and the measure of angle B is 65º. Use the Sine Law to calculate the measure of angle A in degrees.



3 Marks

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

109

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, or with other information or evidence, of how Cosine Law is used.

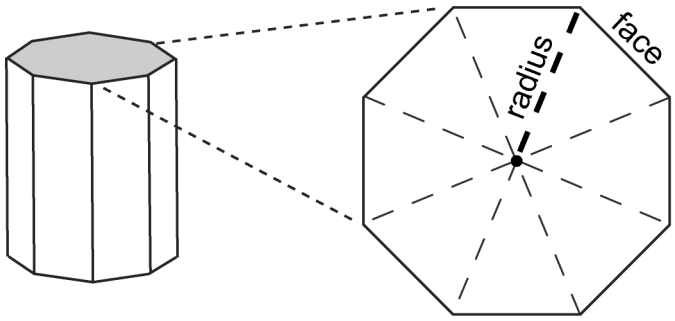
110

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

3 Marks

111

9. A building foundation has 8-sided regular polygon piles. Each pile has a radius of 12 inches. Determine the width of a face of the polygon.



3 Marks

10. A given quadrilateral has the following properties:

- the opposite sides have equal length
- the measures of consecutive (or adjacent) angles are not equal

112

A) Draw the quadrilateral with these properties. (2 marks)

113

B) State the name of this quadrilateral. (1 mark)

1 Mark

114

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

A given quadrilateral has four sides of equal length. The quadrilaterals with this property are

a) all parallelograms
b) all trapezoids
c) all regular pentagons
d) all trapezoids and all rhombuses
e) all rhombuses

Answer: _____

3 Marks

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

115

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, or with other information or evidence, of how the various properties of polygons are used.

116

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

Statistics

1 Mark

117

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

Outliers are removed from a data set before calculating the measure of central tendency. This measure is called the

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

Answer: _____

2 Marks

14. You are given the following set of data:

10	3	10	4	5
2	9	9	2	7
7	3	8	8	3

118

A) Express the mode. (1 mark)

Answer: _____

119

B) Express the median. (1 mark)

Answer: _____

2 Marks

120

15. A research company conducted a survey on the music preferences of two groups of people. People in Group A enjoyed 1 out of the 5 songs. People in Group B enjoyed 3 out of the 5 songs.

    Explain why the research company may use a weighted mean to determine the overall enjoyment of the music.

2 Marks

121

16. A class of 20 students had a mean of 8 out of 10 on a recent quiz. The teacher added up all of the marks and got 160 out of 200 marks for the class. The teacher decides to use a trimmed mean, and drops two marks: a “2” and a “10”. Calculate the trimmed mean for the class.

3 Marks

17. On a recent math test, Hannah received a better mark than 16 other students in the class. There are 25 students in the class.

122

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

123

B) Explain whether Hannah passed the test. (1 mark)

Home Finance

2 Marks

124

18. State two (2) reasons why a homeowner would spend money on preventative maintenance.

2 Marks

125

19. Homeowners must 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 $80 000.

4 Marks

126

20. State four (4) ongoing or daily expenses of maintaining a house. Choose from the list of expenses below.

Lawyer's fees	Down payment	Mortgage payment
Utilities	Yard care	Interest adjustment
Property tax	Movers	Insurance

1. _____

2. _____

3. _____

4. _____

2 Marks

127

21. A couple owns an older house and they would like to reduce their expenses. State two (2) things they could do to reduce their monthly heating costs.

2 Marks

128

22. Calculate the monthly payment for a mortgage of $120 000, amortized over 15 years at a rate of 4% interest per year.

Amortization Period of Mortgage Loan When Paid Monthly

Amortization Period of Mortgage Loan (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

2 Marks

129

23. A portion of Joe's monthly mortgage payment goes towards interest. Joe wonders how much interest he will pay over the life of the mortgage.

    Explain how Joe can calculate this amount.

Precision Measurement

2 Marks

130

24. A metre stick is divided into 100 centimetres. Express the precision and uncertainty for the metre stick.

Precision: _____

Uncertainty: _____

2 Marks

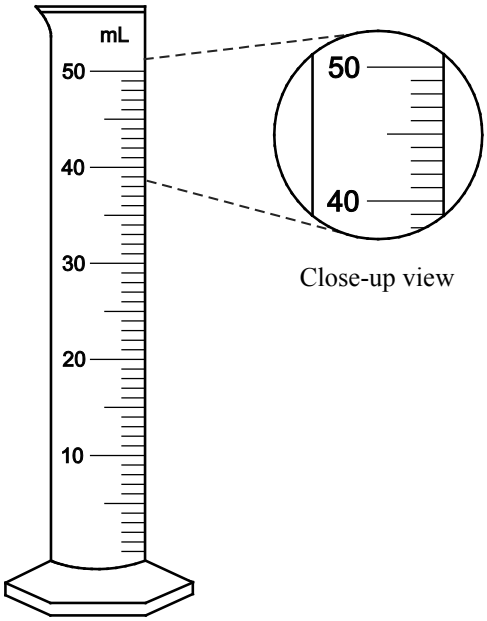
131

25. Gold is trading at $1 300 per ounce. Explain why a jeweller would want to be very accurate when weighing gold to make a ring.

2 Marks

132

26. A graduated cylinder is a measuring device used for liquids. Express the precision and uncertainty for the given graduated cylinder.



Close-up view

Graduated cylinder

Precision: _____

Uncertainty: _____

2 Marks

133

27. A steel manufacturer creates an item that must be 5 cm across with a tolerance of 0.2 cm (± 0.1 cm). The manufacturer writes the measurements of the item in the form:

$$a^{0}_{b}$$

Express the values of a and b.

a: _____

b: _____

2 Marks

134

28. 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, or with other information or evidence, of how tolerance is used.

Probability

2 Marks

29. A fair coin is tossed four (4) times and the results are: heads, heads, heads, tails.

135

A) Express the probability of the coin landing on "heads" the next time it is tossed. (1 mark)

136

B) Explain your answer in Part A. (1 mark)

3 Marks

137

30. In a book, 17 out of 68 pages contain an image. Express the probability, in the form of a fraction, a decimal, and a percent, that a randomly selected page will contain an image.

Fraction: _____

Decimal: _____

Percent: _____

3 Marks

31. Sandy pays $5 to play a game. The probability of winning is 60%. She will receive $10 if she wins.

138

A) Determine the expected value for this game. (2 marks)

139

B) Explain whether Sandy should play this game, based on your answer in Part A. (1 mark)

1 Mark

140

32. Describe a situation that would have favourable odds of 5 : 2.

3 Marks

33. John has a six-sided cube and each face is labelled with a different number: 1, 2, 3, 4, 5, and 6.

He tosses the cube and sees the following results: 6, 4, 6, 6, 1, 6.

141

A) Assume that the cube is fair. Express the theoretical probability of tossing the cube and it showing a 6. (1 mark)

142

B) Express the experimental probability of tossing the cube and it showing a 6. (1 mark)

143

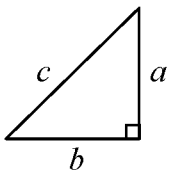
C) Explain whether you think this is a "fair cube". (1 mark)

1 Mark

144

34. Express the probability of there being an October snowstorm somewhere in Manitoba if the odds for this occurrence are 3 to 1.

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	$P = \left(\frac{B}{n}\right) \times 100$
Simple Interest (I)	P = principal r = annual interest rate t = time in years	$I = Prt$
Gross Debt Service Ratio (GDSR)		$GDSR = \frac{\text{Monthly Mortgage Payment} + \text{Monthly Heating Cost} + \text{Monthly Property Taxes}}{\text{Gross Monthly Income}} \times 100$
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	$C = \frac{360°}{n}$
Pythagorean Theorem for Right Triangles		$c^2 = a^2 + b^2$

Trigonometric Functions		
$\sin\theta = \frac{\text{opposite side}}{\text{hypotenuse}}$	$\cos\theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$	$\tan\theta = \frac{\text{opposite side}}{\text{adjacent side}}$
Sine Law $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$	Cosine Law $a^2 = b^2 + c^2 - 2bc\cos A$	