Grade 12
Essential Mathematics
Achievement Test

Student Booklet

June 2015

Manitoba

After the administration of this test, print copies of this resource will be available for purchase from 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>.

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 2015)

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	14
Probability	10–15 minutes	12
Vehicle Finance	20–25 minutes	20
Geometry and Trigonometry	15–20 minutes	13
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. Lorenzo wants to buy a house. His monthly property taxes will be $125, his monthly heating costs will be $160, and his monthly mortgage payment will be $1216. He has a gross income of $38 400 per year.

    101

    A) Calculate his Gross Debt Service Ratio (GDSR) as a percent. (3 marks)

    102

    B) Explain if his loan application will be approved based on the GDSR calculated in Part A. (1 mark)

2. State 2 ways to reduce the interest paid over the life of a mortgage.

3. Betty bought a house for $185 000. She already knows that for the first $150 000 the land transfer tax will cost $900. Calculate the total land transfer tax.

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%

4. Linnea buys a house. Two (2) of her daily (on-going) expenses are heating costs and mortgage payments. State another 2 daily (on-going) house expenses.

Expenses
1.
2.

5.   Homeowners are responsible for preventative maintenance and emergency repairs on the roof of a house.

106
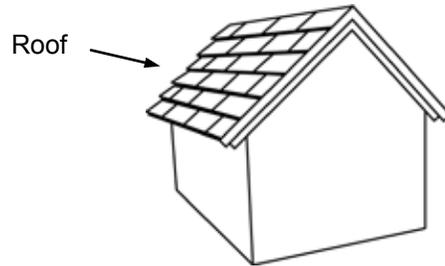
A)   Describe an example of preventative maintenance that should be done to the roof of a house. (1 mark)

107

B)   Describe an example of an emergency repair that would need to be done to the roof of a house. (1 mark)

6. Sacha recently purchased a new house with a 20-year mortgage of $174 000. Her monthly mortgage payment is $1096.20.

108

A) State the total amount that Sacha will have repaid to the bank at the end of the mortgage. (1 mark)

109

B) State the total amount of money paid in interest to the bank over the life of the mortgage. (1 mark)

Probability

2 Marks

7. There are 12 red and 28 blue marbles placed in a box.

A) State the probability of randomly selecting a red marble. (1 mark)

B) State the odds **against** choosing a red marble. (1 mark)

8. State the probability of randomly choosing the letter "B" from the letters in the word "probability."

P R O B A B I L I T Y

9. Howard spends $1.55 on each food sample he gives away at his restaurant. There is an 8% chance that after tasting the sample, the customer will order the new menu item. Howard earns $20 for every new menu item he sells.

113

A) Determine the expected value of the food sample. (3 marks)

114

B) Justify whether Howard should be offering the food samples based on the expected value. (1 mark)

10. Random testing of golf balls shows that 100 out of every 5000 are defective.

A) State the odds in favour of a golf ball being defective. (1 mark)

B) State the probability of a golf ball **not** being defective. (1 mark)

C) A company produces 80 000 golf balls. State the expected number of defective golf balls. (1 mark)

11. The Teddy Bear Factory hosts birthday parties where children can build their own teddy bears. They offer 4 different party packages that are equally likely to be chosen. Their sales during the last month were as follows:

Red package: 18
Blue package: 34
Green package: 16
Yellow package: 12

118

A) The Smith family would like to book a party. State the experimental probability that the Smith family will choose the yellow package. (1 mark)

119

B) State the theoretical probability that the Smith family will choose the yellow package. (1 mark)

Vehicle Finance

2 Marks

12. Describe 2 disadvantages of leasing a new car.

13. Carter is purchasing a new vehicle for $27 800, after taxes. He makes a down payment of $3000. The bank offers financing for 5 years at a rate of 6.25%.

Monthly Vehicle Loan Payments per $1000 borrowed					
Interest Rate (%)	Years to Repay Loan				
	1	2	3	4	5
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

121

A) Calculate the monthly payment. (3 marks)

122

B) Calculate the total paid for the vehicle by the end of the 5-year term. (1 mark)

14. A previously leased vehicle with an original value of $18 300 is for sale at a Manitoba dealership. The residual value is 58%. Calculate the total cost to buy the vehicle, after taxes.

15. Paige is planning to go on a 3000 km road trip. She owns a truck and a car. The truck uses 8.5 L of fuel per 100 km. The car uses 6 L of fuel per 100 km.

124

A) State which vehicle Paige should use if she wants to get the best fuel economy. (1 mark)

125

B) State the number of litres used during the trip by the vehicle selected in Part A. (1 mark)

126

C) State the total cost of fuel for the trip if gas costs $1.23/L. (1 mark)

16. Desarae is purchasing a vehicle in Manitoba through a private sale for $12 000. A lien search was done for $18. The book value of the vehicle is listed as $13 500. Desarae has a safety check performed for $40. Calculate the total cost of purchasing the vehicle after taxes using the table below.

	Taxes on Vehicle Purchases	
	PST	GST
Buying New	PST	GST
Buying Used from Dealership	PST calculated on greater of book value or purchase price	GST
Buying Used (Private)	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

17. Bill had his vehicle's exhaust system repaired at a Manitoba dealership. Labour charges were $110 per hour. The cost of the exhaust system parts were: converter $350, muffler $120, and exhaust pipe $80. The job required 1.5 hours of labour to complete.

Calculate the total cost of the repairs, after taxes.

18. State 2 factors that affect the cost of vehicle insurance premiums other than driving record, traffic tickets, and at-fault accidents.

19. A car collector owns a vehicle worth $37 500. The vehicle depreciates 20% per year. Calculate the value of the vehicle after the first year.

Geometry and Trigonometry

2 Marks

20. A construction company needs to calculate the length of support wires required to install an antenna on a roof. Calculate the length of the shorter support wire.

Antenna

Longer support wire

Shorter support wire

20 ft

50°

10 ft

Roof
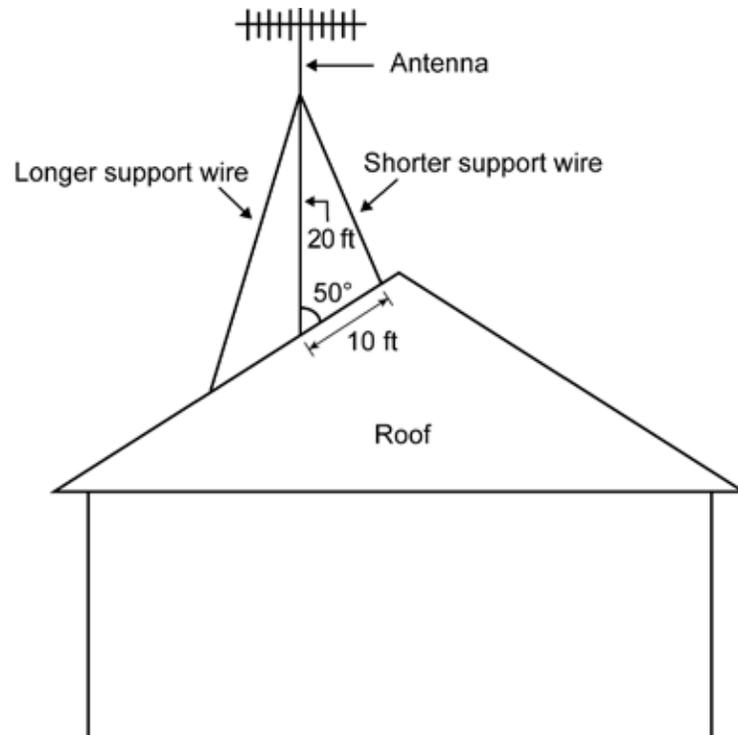
21. The Sine Law is often used in construction, commercial, industrial, or artistic applications.

132

   A) Sketch a labelled picture or diagram (not necessarily to scale) that demonstrates where
       the Sine Law can be used in the real world. (1 mark)

133

   B) Explain how the Sine Law was used in your diagram. (1 mark)

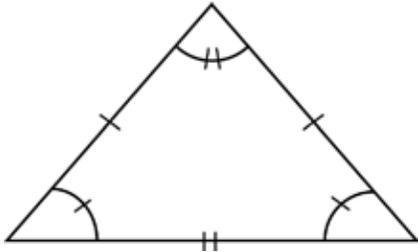22. A regular polygon has central angles of 45°.

134

   A) State the number of sides for this polygon. (1 mark)

135

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

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

    The following triangle is:

    a) scalene
    b) equilateral
    c) isosceles
    d) right


    Answer: _____

24. Sketch a rhombus and label **all** of the congruent parts.

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

- Sketch a picture or diagram that demonstrates how properties of polygons are used in the real world. (1 mark)
- Support your diagram with an explanation of how the properties were used. (1 mark)

26. A building is on the side of a hill. Calculate the length of shadow (x) the building will cast on the ground.
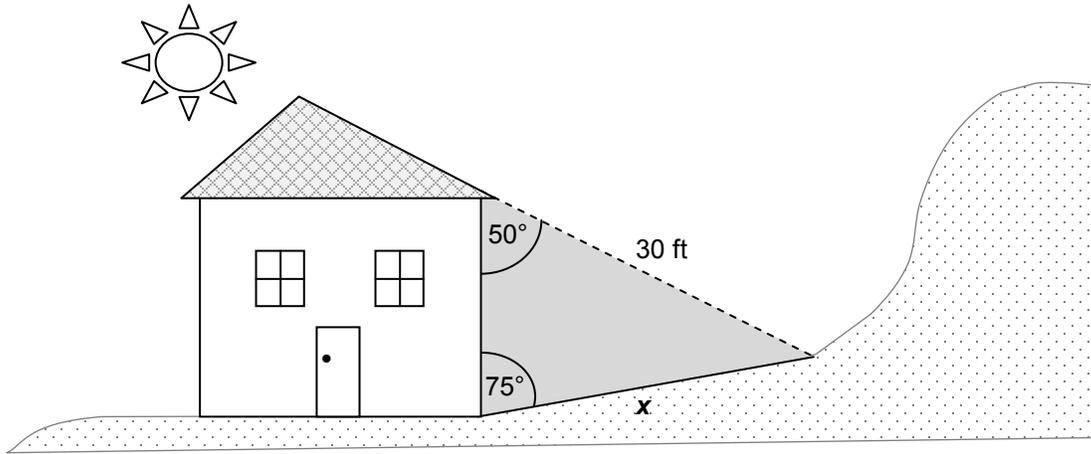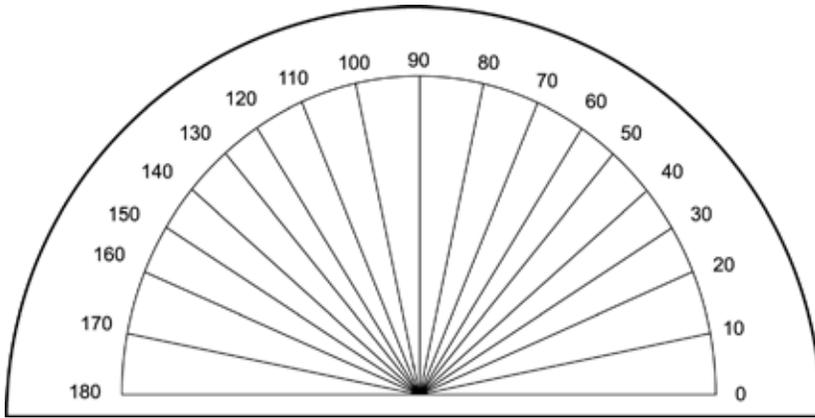
Precision Measurement

27. Cailyn works as a production engineer. She is working with a machine part that has a tolerance of 0.04 mm and a nominal value of 0.50 mm which is halfway between the maximum and minimum values. State the maximum and minimum values of the machine part.

Maximum: _____

Minimum: _____

28. State the precision and uncertainty of the protractor.

Precision: _____

Uncertainty: _____

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

- State a specific example where tolerance is used. (1 mark)
- Support your example with an explanation of how tolerance was required. (1 mark)

30. Chris owns a candy factory that specializes in making chocolate candies. Explain why Chris needs to be very accurate when measuring his ingredients.

31. The maximum amount of stuffing that can fit in a pillow is 1500 grams. The tolerance is 100 grams. State the nominal value (which is halfway between the minimum and maximum values).

Statistics

2 Marks

32. Nicole is calculating her final mark in an Essential Mathematics course. Her projects are worth 45%, her tests are worth 35%, and her final exam is worth 20%.

    Nicole earned

    40% on her projects
    60% on her tests
    75% on her final exam

    Calculate her final mark using a weighted mean.

33. Explain the difference between Jill receiving 80% on a test and being in the 80th percentile for the same test.

34. Using the following data:

63	47	88	91	76
41	51	74	76	83

A)   State the mean. (1 mark)

B)   State the median. (1 mark)

C)   State the mode. (1 mark)

35. The annual salaries for employees at Turnbull's manufacturing plant are:

Salary	$12 000	$29 000	$36 000	$40 000	$ 55 000	$80 000
Number of employees	10	8	7	8	5	2

Margaret, one of the employees, has an annual salary of $36 000. Calculate her percentile rank.

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	$PR = \dfrac{b}{n} \times 100$
Simple Interest (*I*)	P = principal r = annual interest rate t = time in years	$I = Prt$
Gross Debt Service Ratio (*GDSR*)		$GDSR = \dfrac{\text{Monthly mortgage payment} + \text{Monthly property taxes} + \text{Monthly heating costs}}{\text{Gross monthly income}} \times 100$
Fuel Economy in L/100 km (*FE*)		$FE = \dfrac{\text{Fuel used in litres}}{\text{Distance in km}} \times 100$
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	$C = \dfrac{360°}{n}$
Number of Diagonals in a Polygon (*D*)	n = number of sides	$D = \dfrac{n(n-3)}{2}$

Trigonometric Laws

Sine Law	$\dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$	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%