

Grade 12
Essential Mathematics
Achievement Test

Student Booklet

January 2014

Manitoba Education and Advanced Learning Cataloguing in Publication Data

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

ISBN: 978-0-7711-5538-3

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

Permission is hereby given to reproduce this document for non-profit educational purposes provided the source is cited.

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 (January 2014)

DESCRIPTION

Total Possible Marks: 83

Maximum Time: 120 minutes

This test consists of six parts:

Learning Unit	Suggested Time to Complete	Marks
Home Finance	15–20 minutes	18
Probability	10–15 minutes	14
Vehicle Finance	20–25 minutes	18
Geometry and Trigonometry	15–20 minutes	15
Precision Measurement	15–20 minutes	8
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

4 Marks

1. Carrie is thinking of purchasing a house. The monthly mortgage payment, heating cost, and property tax would be \$836.25, \$150, and \$135, respectively. Carrie has a gross monthly income of \$2800.

101

A) Determine Carrie's Gross Debt Service Ratio (GDSR). (3 marks)

102

B) Explain whether Carrie can afford to purchase this house. (1 mark)

2. Determine the monthly payment for a mortgage of \$235 000 at an interest rate of 4% for a period of 25 years.

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

3. State two (2) examples of emergency home repair costs.

4. Calculate the total cost of insurance for a house valued at \$250 000 with comprehensive insurance in Area 3 and a \$500 deductible.

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%

5. A property has a portioned assessment of \$120 000 and has 60 feet of frontage. The municipal mill rate is 13.01 mills. There is a special lighting levy of \$3.50 per foot of frontage. Education taxes are \$1903.20 and there is a Provincial Property Tax Credit of \$750. Calculate the total taxes due for this property.

All calculations and answers must appear on **this page**. The *Statement and Demand for Taxes* on the facing page is provided for rough work only.

STATEMENT AND DEMAND FOR TAXES

PROPERTY DESCRIPTION							<ul style="list-style-type: none"> ERRORS AND OMISSIONS EXCEPTED ALL LAND IN ARREARS FOR MORE THAN ONE YEAR SHALL BE SOLD FOR TAXES ALL CHEQUES MADE IN CANADIAN FUNDS BANK RECEIPT CONSTITUTES OFFICIAL RECEIPT RETAIN COPY FOR INCOME TAX PURPOSES
ROLL NUMBER	WARD	Lot/Section	Blk/Twp.	Plan/Range	Frontage/Area	Dwell. Units	
Civic Address.							
Title or Deed No..	Current Assessment Land	Buildings	Status Code	Total Assessment	Prop. Class	Portion %	
ASSESSMENT SUBJECT TO LOCAL IMPROVEMENT LEVY.							

MUNICIPAL TAXES	Description	Total Port Assessment	Mill Rate	Levy		
	General Municipal.					
	By-Law No..	Term.	Type.	Frontage Levy.	Mill Rate.	Levy.

EDUCATIONAL TAXES	Description	Total Port Assessment	Mill Rate	Levy
	Provincial Education 1 Provincial Education 2 School Division Tax.			

PROVINCIAL TAX CREDITS	Assessment	Levy
	(See Manitoba Enclosure for Additional Information). Manitoba Resident Homeowner Tax Assistance.	

TOTAL TAXES DUE							
Municipal Tax.	Education Tax.	Total Taxes.	Prov. Credits.	Net Taxes.	Arrears/Credits.	Added Taxes.	Taxes Due.

**No marks awarded for work done on this page.
Provide your answers on page 6.**

6. Dan would like to move out of his parents' house. He can afford \$700 per month, either for a monthly rent payment or for a monthly mortgage payment. State two (2) reasons why he should rent, rather than purchase, a place to live such as an apartment or a house.

Probability

2 Marks

108

7. State the probability of “two out of five” as a decimal number and as a percent.

decimal number: _____

percent: _____

4 Marks

8. The probability that John will get a construction contract is 0.33. It will cost him \$25 000 to prepare his bid and, if he gets the contract, it will be worth \$100 000.

109

A) Determine his expected value. (3 marks)

B) Justify whether he should bid on the job, based on your answer in Part A. (1 mark)

110

9. Explain the difference between odds and probability.

2 Marks

10. The City of Selkirk is planning a Fun Day.

112

- A) The probability of it raining on Fun Day is 3 out of 24. State the odds that it will **not** rain on Fun Day. (1 mark)

113

- B) The odds for winning a prize at Fun Day are 2:1. State the probability of winning a prize. (1 mark)

3 Marks

11. Erwin is a farmer in rural Manitoba. There is an equal probability that a farmer in Erwin's area will plant one of two crops: wheat or canola. Erwin surveys 10 farmers in the area and finds out that 7 of them plan to plant wheat.

114

A) State the theoretical probability that a surveyed farmer will plant wheat. (1 mark)

115

B) State the experimental probability that a surveyed farmer will plant canola. (1 mark)

116

C) Explain why Erwin might decide to plant canola even though most farmers in the area are planning to plant wheat. (1 mark)

1 Mark

117

12. A fair six-sided cube numbered from 1 to 6 is rolled. State the probability that a 4 or less (1, 2, 3, or 4) will be rolled.

Vehicle Finance

3 Marks

118

13. Tom decides to buy a new car in Manitoba for \$32 400. He adds a tow package to the car for \$3000. The freight is \$650. The dealership gives him \$12 000 for his old car.

Calculate the cost, including taxes, of purchasing the new vehicle.

4 Marks

14. Mary borrows \$18 500 from her bank to purchase a car. The bank offers her an interest rate of 6.75% for 4 years.

**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
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

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

119

- B) Calculate the total amount of interest paid over the life of the loan. (2 marks)

120

2 Marks

121

15. Dallas needs a vehicle to get to work. He has decided which vehicle he wants. State two (2) advantages of buying the vehicle, rather than leasing it.

2 Marks

122

16. Tom's vehicle uses 12.8 L of fuel for every 100 km driven. The cost of fuel is \$1.20/Litre. Calculate the cost of fuel for Tom to drive 3000 km.

17. Robert took his vehicle in for servicing at a Manitoba dealership. The dealership charged \$90 per hour for labour. The servicing took 1.5 hours to complete. Two (2) windshield wipers were replaced at a cost of \$12 each. Four (4) winter tires were put on at a cost of \$120 each. Calculate the total cost, including tax, of the servicing.

2 Marks

124

18. State two (2) factors that determine the cost of vehicle insurance in Manitoba.

1 Mark

125

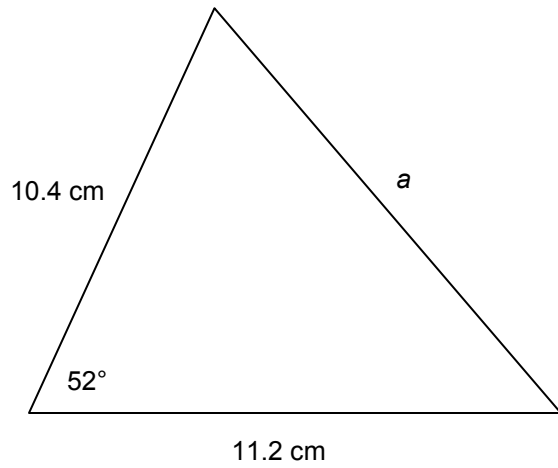
19. Tammy drives her car 20 kilometres to work each day. State the type of insurance policy Tammy will need for proper coverage.

Geometry and Trigonometry

2 Marks

126

20. Given the triangle below, calculate the length of side a in centimetres.



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

127

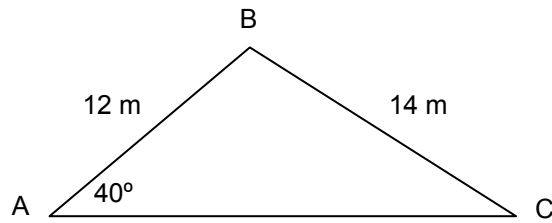
A) Demonstrate one use of the Sine Law in the real world by performing the following two steps: (2 marks)

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

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

128

22. Given the triangle below, calculate the measure of angle C, in degrees.



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

130

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

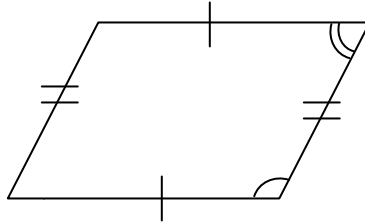
- State a specific example where the various properties of polygons are used.
- Support your example with a written explanation of how the various properties of polygons are used.

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

131

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

Refer to the following diagram. It is true that:



- a) the diagonals are equal
- b) the consecutive angles are equal
- c) the diagonals are perpendicular
- d) the opposite angles are equal

Answer: _____

25. Determine (by illustration or calculation) the total number of diagonals in a regular six-sided polygon.

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

An isosceles triangle must have

- a) a right angle
- b) two sides of the same length
- c) all angles with different measures
- d) all acute angles

Answer: _____

27. A coin is in the shape of a regular polygon with 11 sides. State the measure of a central angle in degrees.



Precision Measurement

1 Mark

136

28. Explain why a timer for a 100 m race would need to be more precise than a timer for a 10 km run.

1 Mark

137

29. The length of a school's garden is measured using a stick that has been cut to 1 metre in length. State the uncertainty in the measurements made using the stick.

30. Describe a measurement situation and explain why a certain degree of accuracy would be required.

2 Marks

31. A company manufactures cylinders that must have a mass of 4.82 kg, within a tolerance of 0.24 kg.

139

A) State the minimum mass. (1 mark)

140

B) State the maximum mass. (1 mark)

2 Marks

141

32. Explain why the concept of tolerance would be important when installing kitchen cabinets.

Statistics

2 Marks

33. The data below shows the amount of snow that fell during a 7-day period in Springfield, Manitoba.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
2 cm	0 cm	1 cm	12 cm	4 cm	0 cm	3 cm

- A) State the median daily snowfall for the period. (1 mark)

142

- B) State the mode of daily snowfall for the period. (1 mark)

143

3 Marks

34. Mrs. Themark's class of 10 students had the following results (as percents) on a recent unit test:

10	65	75	82	90
57	67	78	83	91

- A) Mrs. Themark wants to determine the class average by calculating the trimmed mean, by removing the highest and lowest result. Calculate the trimmed mean. (2 marks)

144

- B) Explain why the mark of 10% could be considered an outlier. (1 mark)

145

35. A student scored in the 99th percentile of her class, yet was unhappy with her test mark. Explain how she could be unhappy with this result.

3 Marks

36. Fifty (50) members of a football team are weighed. Thomas weighs 165 pounds. Four (4) players weigh less than Thomas.

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

147

B) Explain how Thomas's weight compares to the weight of the other team members. (1 mark)

148

Formula Sheet: Essential Mathematics

Name of Formula	Details	Formula
Percentile Rank (<i>P</i>)	<i>b</i> = number of raw scores below the given score <i>n</i> = total number of raw scores	$P = \frac{b}{n} \times 100$
Simple Interest (<i>I</i>)	<i>P</i> = principal <i>r</i> = annual interest rate <i>t</i> = time in years	$I = Prt$
Gross Debt Service Ratio (<i>GDSR</i>)		$GDSR = \frac{\text{Monthly Mortgage Payment} + \text{Monthly Property Taxes} + \text{Monthly Heating Costs}}{\text{Gross Monthly Income}} \times 100$
Expected Value (<i>EV</i>)	<i>P</i> = probability	$EV = P(\text{win}) \times \$\text{gain} - P(\text{lose}) \times \loss
Sum of Interior Angles of Polygons (<i>S</i>)	<i>n</i> = number of sides	$S = 180^\circ (n - 2)$
Central Angle of Regular Polygons (<i>C</i>)	<i>n</i> = number of sides	$C = \frac{360^\circ}{n}$

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%
---	--

