Grade 12
Essential Mathematics
Achievement Test

Student Booklet

January 2013

Manitoba

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Available in alternate formats upon request.

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

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	16
Probability	10–15 minutes	12
Vehicle Finance	20–25 minutes	20
Geometry and Trigonometry	15–20 minutes	14
Precision Measurement	15–20 minutes	10
Statistics	15–20 minutes	11

GENERAL DIRECTIONS

- You may use the *Formula Sheet: Essential Mathematics* found at the end of this Student 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

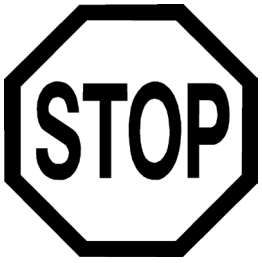
DIRECTIONS

- 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.

Home Finance

4 Marks

1. List two (2) types of additional or one-time costs to consider when initially purchasing a home. Do not include the down payment or mortgage payment. Explain these costs. 101

Additional Costs	**Explanations**
1.	1.
2.	2.

4 Marks

2. Jared is moving away from home and must decide where to live. There are various benefits to owning a house or renting a property.

   State two (2) benefits of owning a house and two (2) benefits of renting a property. You may choose from the following list: 102

   – equity
   – no maintenance costs
   – lower insurance cost
   – easier to renovate
   – no property taxes
   – acts as an investment

Benefits of owning a house	**Benefits of renting a property**
1.	1.
2.	2.

2 Marks

3. Describe two (2) ways people can decrease their Gross Debt Service Ratio (GDSR). 103

2 Marks

4. A couple purchased a house in Winnipeg valued at $175 000. The couple also plans on buying comprehensive homeowner's insurance. Calculate the cost of insuring this house if the purchasers choose a policy with a $200 deductible. 104

   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. Juan's property has a total assessed value of $150 000. The portioned percentage on his property is 45%.

   A) Calculate the portioned assessment of the property. (1 mark) 105

   B) The municipal tax rate is 12.5 mills. The amount of school division tax due is $1 451.25. The provincial tax credit this year is $775. Calculate Juan's total property tax bill for this year. (3 marks) 106

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

STATEMENT AND DEMAND FOR TAXES

PROPERTY DESCRIPTION						
ROLL NUMBER	WARD	Lot/Section	Blk/Twp	Plan/Range	Frontage/Area	Dwell. Units
Civic Address						

Title or Deed No.	Current Assessment Land	Current Assessment Buildings	Status Code	Total Assessment	Prop. Class	Portion %	Total Port Assessment

- 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

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

(See Manitoba Enclosure for Additional Information)	Assessment	Levy
	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 p. 6.

Probability

2 Marks

6. You are given the data set: 1, 2, 3, 4, 5.

   A) Express the probability of the number 2 being randomly selected from the set. (1 mark) 107

   B) Express the probability of **not** selecting the number 5 from the set. (1 mark) 108

1 Mark

7. The probability of an event occurring is 3 out of 5. Express this probability as a decimal or percent. 109

2 Marks

8. Explain what it means if an event, such as a game or a business contract, has an expected value of 0. 110

1 Mark

9. On a quiz out of 10 marks, the scores of several students were: 3, 4, 6, 7, 7, 8, and 10. 111
Express the odds that a randomly selected student scored greater than 50% on the quiz.

1 Mark

10. The odds **against** an event occurring are $1:5$. Express the probability **for** the event occurring. 112

3 Marks

11. A company knows that 1 out of every 100 vacuums sold will be defective in some way. A store sells 100 of these vacuums and 10 people return them because they are defective.

A) Express the **experimental** probability of buying a defective vacuum. (1 mark) 113

B) Explain the difference between "theoretical probability" and "experimental probability". (2 marks) 114

2 Marks

12. A manufacturing plant is concerned with controlling the quality of its products. It was determined that the probability of producing a defective product is 1%.

    An employee takes two products from the plant and finds that one of them is defective. The employee is worried that 50% of the products are defective. Explain whether this employee is justified in being worried by these results. 115

Vehicle Finance

2 Marks

13. Sally recently graduated from college and has started working at her first job. She has decided to lease a car. State one reason why leasing may be a good choice for Sally. Justify your reason. 116

5 Marks

14. Lindsay takes her car to a Manitoba car dealership for servicing. The dealership charges $95 per hour for labour. The following items were replaced: four (4) spark plugs for $2.25 each, one (1) air filter for $12.50 and one (1) headlight for $30. The job took 1.25 hours to complete. 117

    Calculate the total cost of repairs including taxes.

4 Marks

15. Maryann borrows $12 500 from her bank to purchase a car. The bank offers her a rate of 6.75% per year for 5 years.

Monthly Vehicle Loan Payments
per $1 000 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

A) Calculate the monthly payment. (2 marks) 118

B) Calculate the total amount of interest paid over the life of the car loan. (2 marks) 119

3 Marks

16. Drew has recently purchased a vehicle for $17 100. He borrowed $15 000 at 6.25% interest for 5 years. Complete the amortization table below. 120

Month	Monthly Payment	Interest	Principal	Unpaid Balance
				$15 000.00
1	$291.75	$78.13	$213.62	$14 786.38
2	$291.75	$77.01	$214.74	
3	$291.75			$14 355.78

1 Mark

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

When purchasing car insurance, a deductible is:

a) the amount you pay every year for the insurance.
b) a one-time lump sum you pay the insurance company when you first buy the car.
c) the amount of the insurance claim you must pay when at fault for an accident.
d) the amount you pay for extra coverage against damage to another person or their property.

Answer: _____ 121

4 Marks

18. State and explain two (2) factors that may increase a car insurance premium in Manitoba. 122

Factors	**Explanations**
1.	1.
2.	2.

1 Mark

19. Explain why a car insurance policy with a $200 deductible will cost more than a similar policy with a $500 deductible. 123

Geometry and Trigonometry

3 Marks

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

A) Demonstrate one use of the Sine Law in the real world by performing the following two steps: (2 marks) 124

- State a specific example where Sine Law is used.
- Support your example with a written explanation, or with other information or evidence, of how Sine Law is used.

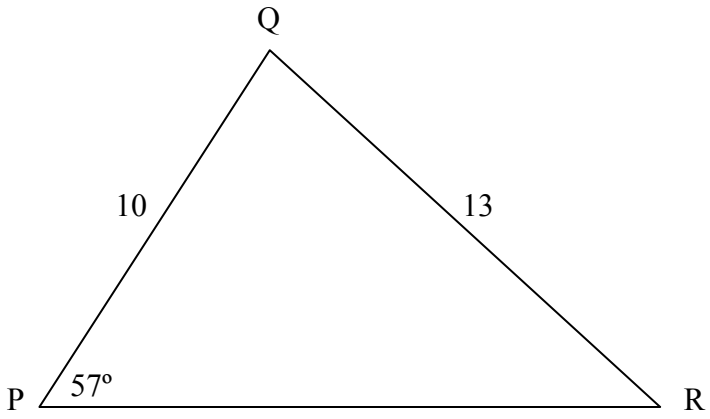
B) Sketch a reasonably neat picture or diagram (not necessarily to scale) that supports your example in Part A. (1 mark) 125

2 Marks

21. In triangle ABC, the length of side AB is 14 cm and the length of side AC is 18 cm. The measure of angle A is 31º. Calculate the length of side BC in cm. 126

2 Marks

22. Given triangle PQR:



Determine the measure of angle R in degrees. 127

2 Marks

23. The sum of the interior angles of a polygon is 900^{o}. Determine the number of sides of the polygon. 128

2 Marks

24. State two (2) properties that would prove a quadrilateral is a parallelogram. 129

3 Marks

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

A) Demonstrate one use of the various properties of polygons in the real world by performing the following two steps: (2 marks) 130

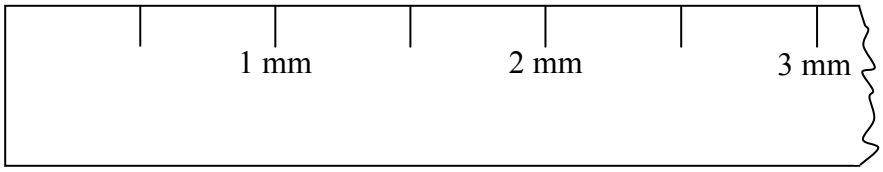
- State a specific example where the various properties of polygons are used.
- Support your example with a written explanation, or with other information or evidence, of how the various properties of polygons are used.

B) Sketch a reasonably neat picture or diagram (not necessarily to scale) that supports your example in Part A. (1 mark) 131

Precision Measurement

2 Marks

26. Given the measuring device below, express its precision and uncertainty in mm. 132



Precision: _____

Uncertainty: _____

2 Marks

27. Explain why you cannot rely on a measuring device to determine the exact length of an object. 133

2 Marks

28. A manufacturer drills a hole into a board. An employee measures the diameter of the hole to be 4.37 mm. She knows that the device used to measure the hole has an uncertainty of 0.02 mm. Express the minimum and maximum diameters of the hole in mm. 134

Minimum Diameter: _____

Maximum Diameter: _____

2 Marks

29. An engineering drawing states that a certain part has the following length: 135

$$\begin{matrix}4.2\\4.0\end{matrix}\ \text{mm}$$

Express the nominal value and tolerance for this part, in mm.

Nominal value: _____

Tolerance: _____

2 Marks

30. Tolerance is often used in construction, commercial, industrial, or artistic applications. 136

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.

Statistics

2 Marks

31. You are given the following set of marks from a recent quiz:

7	4.5	2.5	8.5	4	7	4.5	9.5	6.5

Express the mean and median for this set of marks. 137

Mean: _____

Median: _____

2 Marks

32. Explain why a student might request that her course mark be calculated using a "trimmed mean" method. 138

4 Marks

33. Jim had the following results during his recent mathematics course:

Term: 400 out of a possible 500 marks
Final Exam: 30 out of a possible 50 marks

A) Calculate Jim's final mark if the teacher weights the term and final exam marks equally. (2 marks) 139

B) Calculate Jim's final mark if the teacher gives an 80% weight to the term and a 20% weight to the final exam. (2 marks) 140

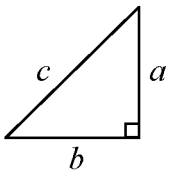
3 Marks

34. The following measurements represent the weights (in pounds) of players on a football team:

Players' Weights (in pounds)			
225	250	270	295
225	250	280	300
230	250	285	315
245	265	295	320

Calculate the percentile rank of a player that weighs 250 pounds. 141

Formula Sheet: Essential Mathematics

Name of Formula	Details	Formula
Percentile Rank (P)	B = number of raw scores below the given score E = number of raw scores equal to the given score, including the given score n = total number of raw scores	$P = \left(\frac{B + 0.5E}{n}\right) \times 100$
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 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 $a^2 = b^2 + c^2 - 2bc\cos A$