Grade 12 Essential Mathematics Achievement Test

Student Booklet

January 2015



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Disponible en français.

Available in alternate formats upon request.

Grade 12 Essential Mathematics Achievement Test Student Booklet (January 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	15
Probability	10–15 minutes	11
Vehicle Finance	20–25 minutes	17
Geometry and Trigonometry	15–20 minutes	14
Precision Measurement	15–20 minutes	10
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

101

- 1. Chris buys a house in Carman for \$225 000. The bank offers him a mortgage interest rate of 4.75% amortized over 25 years.
 - A) Chris makes a 10% down payment. Calculate the amount that Chris needs to borrow from the bank for his mortgage. (2 marks)

B) Calculate the monthly mortgage payment. (2 marks)

Amortization Period of Mortgage Loan When Paid Monthly (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	

103

2. State two factors that may increase or decrease a homeowner's insurance premium.

Upgrade	Description
1.	
2.	

3. Describe 2 energy-efficient upgrades that are available to homeowners.

4. A home has a portioned assessment of \$160 000 and a frontage of 50 feet. The municipal tax rate is 23.01 mills. The education taxes are \$1171.20. Local sewer improvements are assessed at \$6 per foot. Calculate the total taxes due if the provincial property tax credit is \$750.

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

STATEMENT AND DEMAND FOR TAXES

ROLL NUMBER V Civic Address Title or Deed No. La	WARD. Lot/S Current Assess and B	sment uildings	Blk/Twp Status Code	Total Assessm	n/Range Pr	Frontage//	Area	Dwell. Units	ALL LAND I FOR MORE SHALL BE S ALL CHEQU CANADIAN	N ARREARS THAN ONE YEAR OLD FOR TAXES IES MADE IN
Civic Address Title or Deed No. La	Current Assess and B	sment uildings	Status Code	Total Assessm	Pr				• ALL CHEQU	OLD FOR TAXES
Title or Deed No La	Current Assess Land B	sment uildings	Status Code	Total Assessm	Pr	on Port	- 1			FUNDS
						ass. %	on	Total Port Assessment	BANK RECE OFFICIAL R RETAIN CO TAX PURPO	EIPT CONSTITUTES ECEIPT PY FOR INCOME DSES
									ASSI SUBJEC IMPR	ESSMENT T TO LOCAL OVEMENT _EVY.
		[
			Des	scription		As	otal P sessr	ort nent	Mill Rate	Levy
MUNICIE	PAL	General Municipal								
TAXES	TAXES		No. Te	erm.	Туре	Fror	tage	Levy	Mill Rate	Levy
EDUCATIO	ONAL	Desc		scription Total Port Assessment		ort nent	Mill Rate	Levy		
TAXES	S	Provincia Provincia School D	Provincial Education 1 Provincial Education 2 School Division Tax							
		(See Mar	nitoba			Asse	ssme	ent		Levy
TAX CRE		Enclosure Additiona Informatio	Additional Manitoba Resident Homeowner Tax Information)			Assistance.				
			тот	AL TAX	ES DUE					
Municipal Tax. Ec	Education Tax	Total Ta	ixes l	Prov. Cred	its. N	let Taxes	Arr	ears/Credits	Added Taxes	Taxes Due

No marks awarded for work done on this page. Provide your answers on p. 4.

1 Mark

106

5. Explain why the insurance premium would be lower for tenant's insurance rather than homeowner's insurance for the same property.

6. Explain three types of additional (one-time) costs to consider when initially purchasing a home. Do not include the down payment or mortgage payment.

Additional Cost	Explanation
1.	
2.	
3.	

Probability

2 Marks

108

7. The probability of Billy scoring a basket is 6 out of 8. State Billy's success rate as a fraction and as a percent.

Fraction:

Percent:

109

- 8. Jonas is experimenting with pulling blocks out of a bag. There is an equal number of red blocks, yellow blocks, and blue blocks.
 - A) State the theoretical probability of pulling out a yellow block. (1 mark)

110

B) After repeating the experiment several times, Jonas pulled a red block 7 times, a yellow block 3 times, and a blue block 2 times. State the experimental probability of pulling a yellow block. (1 mark)

111

9. It would cost \$1000 for a contractor to bid on a construction project. There is a one in four chance that she will win the contract. If she is awarded the contract she will be paid \$3000 for the work.

A) Calculate the expected value. (3 marks)

B) Justify whether she should bid on the contract based on the expected value calculated in Part A. (1 mark)

1 Mark

113

10. The weather forecast states that there is a 30% probability of rain for tomorrow. State the odds **against** it raining tomorrow.

114

115

11. The manager of a clothing company collects the following sales data for the winter season.

T-shirt colours	Red	Yellow	Green	Blue
Number purchased	111	140	204	145

A) State the probability that a customer purchased a green T-shirt based on the sales data presented above. (1 mark)

B) The manager of the store needs to order 9000 T-shirts for next year. State how many green T-shirts the manager should order based on the above sales data. (1 mark)

Vehicle Finance

2 Marks

116

12. Tyson has a job that requires a vehicle for out-of-town travel. On average, he drives at least 3000 km per month. State one advantage and one disadvantage of leasing a vehicle.

13. Shannon lives in Manitoba and is going to buy her neighbour's car for \$6500. The neighbour is paying for the safety inspection and the lien search. The book value for the car is \$8000. Calculate the total cost to purchase the car after taxes.

118

- 14. Bonnie wishes to buy a new vehicle from a Manitoba dealership for \$16 200 before taxes. She has \$5000 saved for a down payment.
 - A) Calculate the amount Bonnie needs to borrow to purchase the vehicle. (2 marks)

B) Bonnie can get a loan for 4 years at 5.5%. Calculate the amount of interest in the first month's payment. (2 marks)

120

15. A car travels 2400 km and consumes 200 L of fuel. Calculate the fuel economy in L/100 km for the car.

121

- 16. Frank has been leasing his pickup truck for the last 3 years. He has made a total of \$16 028 in payments; which included a down payment of \$3500.

Calculate Frank's monthly lease payments.

1 Mark

122

17. Sam has been involved in a car accident. Explain if this will affect the cost of his Manitoba vehicle insurance.

123

18. A brand new car costs \$26 800 after taxes. It will depreciate 15% in the first year. Calculate the value of the car after the first year.

19. Sylvie takes her car in for a seasonal maintenance checkup at a Manitoba dealership. In addition to the basic \$60 fee, Sylvie gets an oil change for \$50, and a new set of brake pads for \$80. The mechanic spends 1.5 hours working on the vehicle at a rate of \$90 per hour.

Calculate Sylvie's total bill, after taxes.

Geometry and Trigonometry

2 Marks

125

20. Determine the number of diagonals in a regular octagon.

Number of diagonals:_____

21. Sally spots an airplane in the sky flying away from her at an angle of elevation of 32°. At the same time, Tom who is 6.3 km away from Sally sees the same airplane flying towards him at an angle of elevation of 15°.



Calculate how far the plane is from Tom.

127

128

- 22. The Cosine Law is often used in construction, commercial, industrial, or artistic applications.
 - A) Sketch a labelled picture or diagram (not necessarily to scale) that demonstrates where the Cosine Law can be used in the real world. (1 mark)

B) Support your diagram with an explanation of how the Cosine Law was used. (1 mark)

129

23. Given a regular hexagon with centre C:



A) Determine the measure of the central angle of the hexagon. (1 mark)

B) Determine the length of side *a*. Justify your response. (2 marks)

- 131
- 24. 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)

132

25. Looking at his chocolate bar from a top view, Brian states that it looks like a rectangle. State two properties of Brian's chocolate bar that make it a rectangle.

Precision Measurement

2 Marks

133

26. State an example from the construction, commercial, industrial, or artistic industries where a certain degree of tolerance is required. Support your example with an explanation of how tolerance was required.

- 134
- 27. An odometer is used to measure the distance a car travels. The trip odometer reads 947.2 km. State the precision and uncertainty of the odometer.

Precision:

Uncertainty:

135

28. A metre stick is left outside in the sun and it expands. Explain how this will affect the stick's accuracy and precision.

Accuracy:

Precision:

29. The width of a door frame has a nominal value of 36 inches (which is halfway between the minimum and maximum value). The tolerance is 0.5 inches. State the minimum and maximum values of the width of the door frame.

Maximum:

Minimum:

137

30. A welding company has determined that the desired length of a steel arm is 12 cm ± 2.5 cm. The tolerance is given in the form *nominal value*^{+tolerance}₋₀. State the nominal value and tolerance.

nominal value:_____

tolerance:

Statistics

2 Marks

138

31. Given the following scores from a Grade 12 Biology class:

61	80	87	54
40	86	61	68
54	72	54	87

A) State the mean. (1 mark)

B) State the mode. (1 mark)

32. Three hundred (300) students wrote a math exam. Craig scored 78% on his math exam. Calculate Craig's percentile ranking, if 204 students received a lower score than him.

- 33. Jody and Carol play on two different basketball teams. They were both ranked for points scored on their teams.
 - Jody ranks in the 90th percentile on her team.
 - Carol ranks in the 75th percentile on her team.

Explain whether it can be determined which player scored more points.

1 Mark

142

34. Tatiana is enrolled in a law class. The following table shows the average marks she earned and the weight for each category.

Category	Average Mark	Weight
Assignments	90	10%
Tests	65	60%
Final Exam	60	30%

Using a weighted mean, calculate Tatiana's final mark in the course.

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29	61	87	64
53	90	82	46
70	78	76	73

35. Calculate the trimmed mean by eliminating the highest and the lowest number for the following set of data.

Formula Shee	t: Essential	Mathematics
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Name of Formula	Details	Formula
Percentile Rank (PR)	b = number of raw scores below the given score n = total number of raw scores	$PR = \frac{b}{n} \times 100$
Simple Interest (<i>I</i>)	P = principal r = annual interest rate t = time in years	I = Prt
Gross Debt Service Ratio (GDSR)		$GDSR = \frac{\begin{array}{c} \text{Monthly Monthly Monthly} \\ \text{mortgage + property + heating} \\ \text{gayment taxes costs} \\ \text{Gross monthly income} \times 100 \end{array}$
Fuel Economy in L/100 km (FE)		$FE = \frac{\text{Fuel used in litres}}{\text{Distance in km}} \times 100$
Expected Value (EV)	P = probability	$EV = P(win) \times $ \$gain - $P(lose) \times $ \$loss
Sum of Interior Angles of Polygons (S)	n = number of sides	$S = 180^{\circ}(n-2)$
Central Angle of Regular Polygons (C)	n = number of sides	$C = \frac{360^{\circ}}{n}$
Number of Diagonals in a Polygon (D)	n = number of sides	$D = \frac{n(n-3)}{2}$

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%		