Grade 12
Essential Mathematics
Achievement Test

Student Booklet

June 2018

Manitoba

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Student Booklet. June 2018

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Grade 12 Essential Mathematics Achievement Test
Student Booklet (June 2018)

DESCRIPTION

Total Possible Marks: 78 **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	10
Vehicle Finance	15–20 minutes	19
Geometry and Trigonometry	15–20 minutes	14
Precision Measurement	10–15 minutes	9
Statistics	10–15 minutes	10

Please turn off your cell phone and all other such devices.

DIRECTIONS

- Show all your work.
- Use your *Formula Sheet* and your study sheet.
- Use a scientific calculator. Graphing calculators are not permitted.
- Show **complete answers** in the space(s) provided in this booklet.
- Provide explanations and justifications.
- Use a well-organized method to communicate your answer.
- Let the mark values for each question guide you in answering the question.
- Express answers in decimal and percentage form to **two decimal places** when rounding, unless otherwise indicated.

  Example: $\frac{15}{29} = 0.52$ or 51.72%

Remember

- Include units in your final answer.
- Some answers are to be given as decimal values. Rounding too early in your solution may result in an inaccurate final answer for which full marks will not be given.

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/illustrate	a reasonably neat picture or diagram (not necessarily to scale) that clearly shows or explains an idea, concept, or method
calculate	a mathematical formula, an algebraic equation, or a numerical calculation to solve a problem
determine	a verification or confirmation by count, observation, formula, pattern, use of a table, etc.

PLEASE WAIT UNTIL INSTRUCTED TO TURN THE PAGE.

Home Finance

Question 1

3 marks

101
102
103

Satram's home has an assessed value of $430 000.

A) Calculate the total portioned assessment for the property if the portioned percentage is 45%. (1 mark)

B) The mill rate for the Municipal tax is 24 mills on the portioned assessment.

Calculate the Municipal tax. (1 mark)

C) In addition to the Municipal tax, there is an Education tax of $3870 and a provincial tax credit of $700.

Calculate the total amount of property tax to be paid. (1 mark)

Question 2

3 marks 104

George is considering purchasing a home. He earns a gross income of $44 400 annually. The monthly heating costs are $140, the monthly property taxes are $200, and the monthly mortgage payment is $940.

Calculate George's Gross Debt Service Ratio (GDSR).

Question 3

2 marks 105 106

Sam is moving out. She must pick between the following two options:

Option	Size	Cost per month
House purchase	1200 square feet	$1400 mortgage payment
Apartment rental	1200 square feet	$1400 rent

A) Explain one possible advantage of purchasing the house. (1 mark)

B) Explain one possible advantage of renting the apartment. (1 mark)

Question 4

4 marks

107
108
109

Jing-Wei is purchasing a home for $310 000 and will make a down payment of 5%. She will finance the mortgage over 25 years.

A) Calculate the amount borrowed for the mortgage. (1 mark)

B) Calculate the monthly mortgage payment if it costs $5.26 per month for each $1000 borrowed. (1 mark)

C) Calculate the cost of financing (interest) paid on the 25-year mortgage. (2 marks)

Question 5

1 mark 110

Choose which one of the following costs is an ongoing home ownership cost.

A) moving expenses

B) lawyer fees

C) land transfer tax

D) property tax

Answer: _____

Question 6

2 marks 111 112

Steve is purchasing a property valued at $230 000. As shown in the chart, he has found that for the first $150 000, the land transfer tax will total $900. The land transfer tax is calculated as follows:

Land Transfer Tax Table		
Value of Property	**Rate (%)**	**Tax Amount ($)**
On the first $30 000	0%	$0
On the next $60 000 (i.e., $30 001 to $90 000)	0.5%	$300
On the next $60 000 (i.e., $90 001 to $150 000)	1.0%	$600
On the next $50 000 (i.e., $150 001 to $200 000)	1.5%	
On amounts in excess of $200 000	2.0%	

A) Calculate the land transfer tax due on the next $50 000. (1 mark)

B) Calculate the land transfer tax due on the amounts in excess of $200 000. (1 mark)

Question 7

1 mark 113

Sven owns a home. Sven did not move, but in 2017 his house insurance premiums were $100 less than his 2016 premiums.

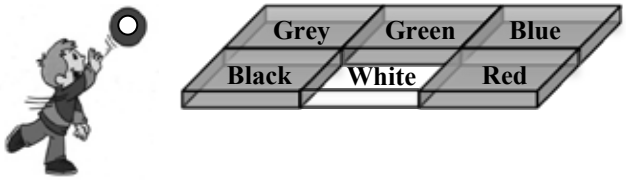
Describe one possible reason why Sven's premiums were lower in 2017.

Probability

Question 8

2 marks 114 115

A ring is tossed into one of six boxes. With each toss, there is an equal chance for the ring to land in any one of the boxes.



A ring is tossed 100 times with the following results:

Box	Number of times
White	22
Not White	78

A) State the theoretical probability of tossing a ring into the white box. (1 mark)

B) State the experimental probability of the ring **not** landing in the white box. (1 mark)

Question 9

1 mark 116

The probability of being born with one extra finger or toe is approximately 1 out of 500.

Calculate the probability as a percent.

Question 10

3 marks 117

Stephanie offers horse drawn carriage tours. It costs her $30 per day for feed and care of the horses. Each day she will operate either a premium tour, a standard tour, or no tour at all.

The table below shows the fee for each tour and the probability it will occur each day.

Tour	Fee for the Tour	Probability
Premium	$100	10%
Standard	$50	50%
No tour	$0	40%

Calculate Stephanie's daily expected value.

Question 11

1 mark 118

In many soccer leagues, the odds in favour of scoring on a penalty kick are 7 to 3.

State the probability, in fraction form, of **not** scoring on a penalty kick.

Question 12

2 marks 119

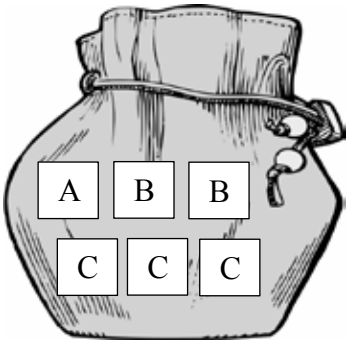
Jose cuts down 60 trees per month. Each time he cuts down a tree, there is a 1% probability that he will need to repair his chainsaw.

Calculate how many times Jose should expect to repair his chainsaw in one year.

Question 13

1 mark 120

A bag contains the following tiles:



David removes one [B] tile from the bag and does not return it. He then randomly removes a second tile.

State the odds in favour of this second tile being [C].

Vehicle Finance

Question 14

1 mark 121

Choose the letter that best completes the statement below.

One cost Akaps would pay when purchasing a new car that he would **not** have to pay when purchasing a used car privately is:

A) book value

B) GST

C) PST

D) insurance

Answer: _____

Question 15

4 marks

122
123
124

Melanie purchased a van for $8000, after taxes. She made a down payment of $1500 and is financing the remaining balance.

A) Calculate the total amount Melanie will finance. (1 mark)

B) The bank offers Melanie an annual interest rate of 7% over 5 years to finance the van.

Calculate the amount of interest Melanie will pay on her first month's payment. (2 marks)

C) State one way Melanie could reduce the monthly payment for her van. (1 mark)

Question 16

2 marks 125

Maya is purchasing a used car from a dealership for $3500, before taxes. The trade-in value of her old vehicle is $500.

Calculate the total amount Maya will pay for the car, after taxes.

Question 17

1 mark 126

Henry is a long-distance delivery driver in Manitoba who needs a new vehicle. He often drives on gravel roads that damage his car.

Explain one reason why Henry should purchase a new vehicle instead of leasing one.

Question 18

2 marks 127

The distance from The Pas to Calgary is 1174 km. Lloyd's scooter has a fuel economy of 1.9 L/100 km.

Calculate the amount of fuel used if Lloyd drives his scooter from The Pas to Calgary.

Question 19

2 marks 128

Shawna is at an insurance agency to renew her car insurance policy.

Describe two changes she could make to lower the total cost of her insurance.

Place one response per line.

1. _____

2. _____

Question 20

3 marks 129 130

Serge needs to pay for the following repairs on his vehicle:

Item	Cost of Parts	Labour Time Required
Muffler	$207	0.5 hour
Transmission	$600	2.5 hours

A) Calculate the total labour cost, before taxes, if the service center charges $110/hour. (1 mark)

B) Calculate the total amount Serge will pay to the service centre, after taxes. (2 marks)

Question 21

2 marks 131 132

Chris purchases a snowmobile for $11 500. The snowmobile depreciates at a rate of 15% per year.

A) Calculate the amount of depreciation in the first year. (1 mark)

B) Calculate the value of the snowmobile at the end of the first year. (1 mark)

Question 22

2 marks 133

Odette is purchasing a used vehicle privately. She has some additional costs to pay: $40 for a safety inspection and $15 for a lien search.

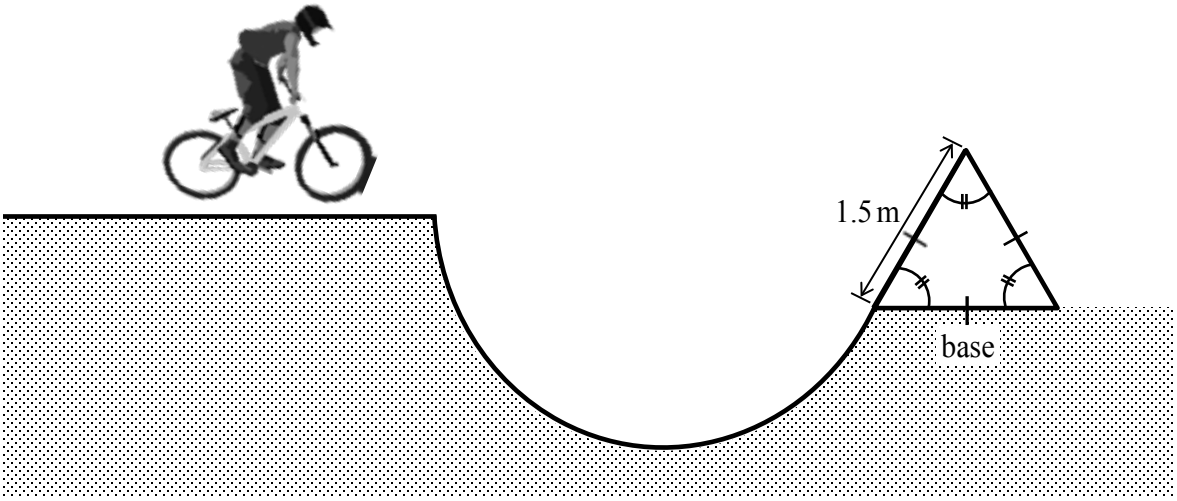
Calculate the total for these additional costs, after taxes.

Geometry and Trigonometry

Question 23

2 marks 134 135

An extreme bike rider has constructed a ramp with a 1.5 m long take off as shown below.



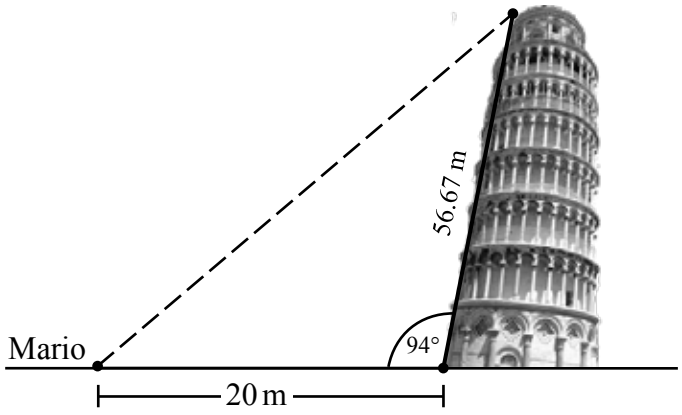
A) State the type of triangle used for the ramp. (1 mark)

B) State the measure of one of the ramp's base angles. (1 mark)

Question 24

3 marks 136

Mario is taking a photo of the Leaning Tower of Pisa from 20 m away. The Leaning Tower of Pisa is on an angle of $4°$ from vertical. The tower is 56.67 m tall.

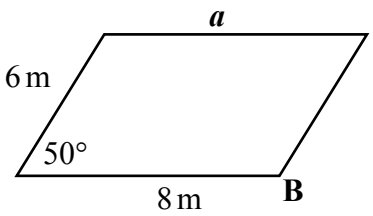


Calculate the distance from Mario to the top of the tower.

Question 25

2 marks 137

State the length of side ***a*** and the measure of angle **B** for the parallelogram below.



Place one response per line.

length of side *a*: _____

measure of ∠B: _____

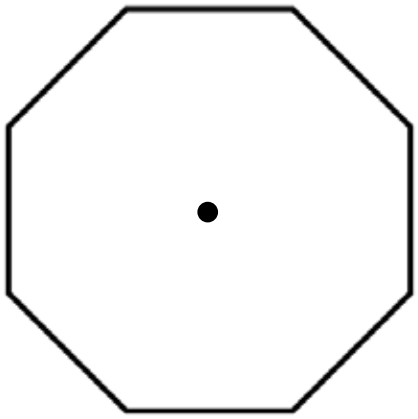
Question 26

3 marks

138
139
140

Juanita is building a table in the shape of a regular octagon.

A) Sketch and label one of the central angles. (1 mark)



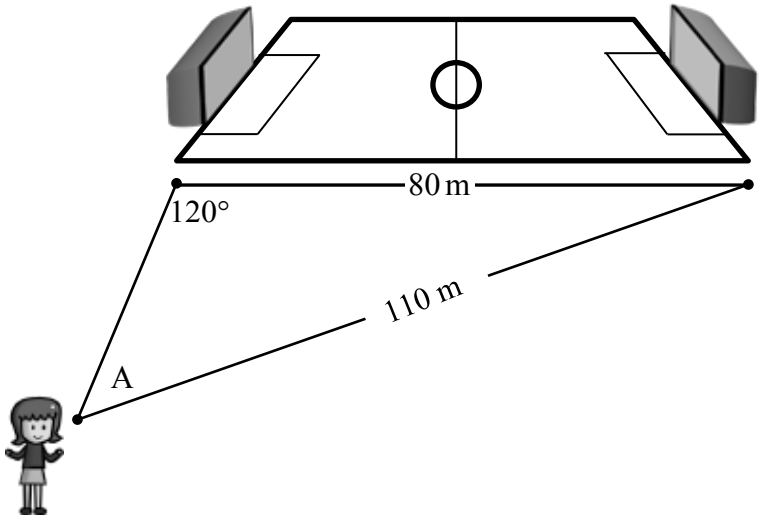
B) Calculate the measure of one of the central angles. (1 mark)

C) Calculate the measure of one of the interior angles. (1 mark)

Question 27

3 marks 141

Maria is watching a soccer match. The following sketch is the view from her seat.

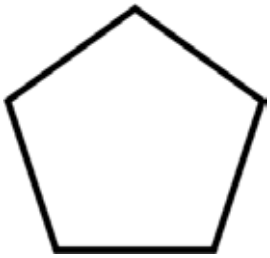


Calculate the measure of angle A.

Question 28

1 mark 142

Choose which one of the following equations could be used to find the number of diagonals in a pentagon.



A) $D = \frac{5(3-5)}{2}$

B) $D = \frac{6(6-3)}{2}$

C) $D = \frac{5(3)}{2}$

D) $D = \frac{5(2)}{2}$

Answer: _____

Precision Measurement

Question 29

1 mark 143

Given the following measurement:

$$2.5 \text{ mL} \begin{matrix} +0.3 \text{ mL} \\ -0 \end{matrix}$$

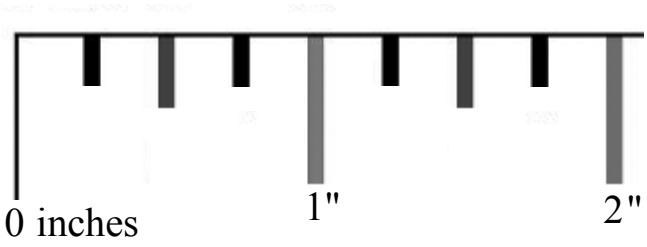
State the minimum value.

Do not round the final answer.

Question 30

1 mark 144

Given the following enlarged diagram of a ruler:



State the precision of the ruler.

Do not round the final answer.

Question 31

1 mark 145

A door manufacturer states that the measurement of a door is:

$$32" \begin{array}{l} +0 \\ -\frac{1}{2} \end{array}"$$

State the nominal value of the door.

Do not round the final answer.

Question 32

1 mark 146

A baker fills a 250 mL measuring cup with sugar.

The true amount of sugar in the measuring cup is 225 mL.

Explain what could have affected the accuracy of the measuring cup.

Question 33

1 mark 147

Joel is cutting a new pair of insoles for his shoes. The true length of the shoes is 25 cm.

Choose which measurement Joel should use so the insoles will fit the shoes the best (not too large or too small).

A) 23.5 ± 1.5 cm

B) 24.0 ± 1.0 cm

C) 24.5 ± 0.5 cm

D) 25.0 ± 1.2 cm

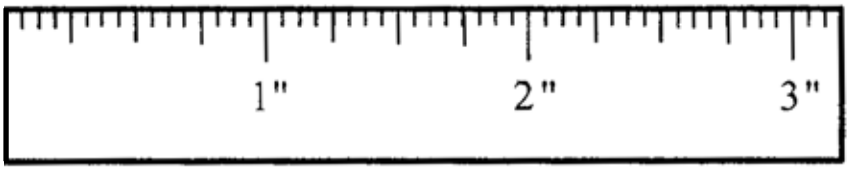
Answer: _____

Question 34

1 mark 148

A spark plug in a car needs a gap precise to $\frac{1}{100}$ of an inch.

Explain why you should not use the ruler below to measure the gap. (Diagram is enlarged.)



Question 35

2 marks 149

A welder is joining three pieces of pipe end to end. She measures them using a measuring tape precise to 0.1 cm. The three pieces of pipe are shown below.

5.4 cm 60.3 cm 30.1 cm

Calculate the combined length of the three pipes in the form measurement ± uncertainty.

Do not round the final answer.

Question 36

1 mark 150

An employee doing quality control at a screw factory uses the following measurements to check the diameter of the screws.

$$7.85 \text{ mm} \begin{matrix} +0.12 \text{ mm} \\ -0.06 \text{ mm} \end{matrix}$$

State the tolerance of the measurement.

Do not round the final answer.

Statistics

Question 37

2 marks 151

A school group went on a weekend ice fishing trip. The following table shows how many fish each student caught and released:

Name	Number of Fish Caught and Released
Jin	45
Sue	16
Dave	13
Tyson	40
Bob	39
Alexa	13

Calculate Sue's percentile rank.

Question 38

2 marks 152 153

A group of 20 students fundraised a total of $3000 for a local charity.

A) Calculate the mean amount of money fundraised by each student. (1 mark)

B) The median amount raised by the group is $120.

Explain why eliminating the highest and the lowest amounts fundraised will not affect the median amount. (1 mark)

Question 39

2 marks 154

A golf course located near a shopping center may be expanded. A survey is conducted at two locations to determine the percentage of people in favour of the expansion. The table below shows the results of the survey.

Survey Location	Percentage in Favour	Weight
Golf Course	95%	20%
Shopping Centre	35%	80%

Calculate the weighted mean of the percentage in favour of the expansion of the golf course.

Question 40

2 marks 155

The following table shows the amount of bushels per ton of various crops grown in Manitoba.

Crop	Bushels per Ton
Barley	45.93
Corn	39.37
Oats	68.89
Soya beans	36.74
Wheat	36.74
Sunflower	73.49
Canola	44.09

Calculate the trimmed mean (bushels per ton) of the various crops by eliminating the two highest and the two lowest values.

Question 41

1 mark 156

In a math class, David received the median score on his math test. Phil's score was at the 75th percentile. No students received the same score.

State the approximate percentage of students who received a score between David's and Phil's.

Question 42

1 mark 157

Choose the letter that best completes the statement below.

Removing a low outlier:

A) decreases the mean

B) increases the mean

C) has no effect on the mean

D) decreases the median

Answer: _____

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	$PR = \frac{b}{n} \times 100$
Simple Interest (I)	P = principal r = annual interest rate t = time in years	$I = Prt$
Gross Debt Service Ratio ($GDSR$)		$GDSR = \frac{\left(\begin{array}{c}\text{Monthly}\\ \text{mortgage}\\ \text{payment}\end{array} + \begin{array}{c}\text{Monthly}\\ \text{property}\\ \text{taxes}\end{array} + \begin{array}{c}\text{Monthly}\\ \text{heating}\\ \text{costs}\end{array}\right)}{\text{Gross monthly income}}$
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	$EV = P(\text{win}) \times \$\text{gain} - P(\text{lose}) \times \$\text{loss}$
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	$C = \frac{360°}{n}$
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	$a^2 = b^2 + c^2 - (2bc\cos A)$ $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

Tax Rates					
Federal	Goods and Services Tax (GST)	5%	Provincial	Provincial Sales Tax (PST)	8%

continued →

Taxes on Vehicle Purchases		
	PST	**GST**
Buying New	PST	GST
Buying Used from a Dealership	PST	GST
Buying Used Privately	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
Taxes on Home Insurance		
	PST	**GST**
Homeowner's/Tenant's Insurance	PST	No GST