

Grade 12  
Essential Mathematics  
Achievement Test

# **Student Booklet**

January 2018

Manitoba Education and Training Cataloguing in Publication Data

Grade 12 essential mathematics achievement test.  
Student Booklet. January 2018

This resource is available in print and electronic formats.

ISBN: 978-0-7711-7619-7 (print)

ISBN: 978-0-7711-7620-3 (pdf)

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 Training.  
510.76

Manitoba Education and Training  
Winnipeg, Manitoba, Canada

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**Grade 12 Essential Mathematics Achievement Test  
Student Booklet (January 2018)**

**DESCRIPTION**

**Total Possible Marks: 73**

**Maximum Time: 120 minutes**

**This test consists of six parts:**

<b>Learning Unit</b>	<b>Suggested Time to Complete</b>	<b>Marks</b>
Home Finance	15–20 minutes	12
Probability	10–15 minutes	12
Vehicle Finance	15–20 minutes	16
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.

<b>The word</b>	<b>The question is asking for...</b>
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/determine	a mathematical formula, an algebraic equation, or a numerical calculation to solve a problem



**PLEASE WAIT UNTIL INSTRUCTED TO TURN THE PAGE.**



# Home Finance

## Question 1

1 mark 101

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Cia bought a house for \$298 500. She made the minimum down payment of 5%.

Calculate the amount of Cia's down payment.

## Question 2

1 mark 102

Blair plans to buy a house. He is considering the following 2 similar houses.

	<b>House A</b>	<b>House B</b>
<b>Cost</b>	\$250 000	\$240 000
<b>Furnace</b>	New furnace (high efficiency)	Used furnace (needs replacing in 5 years at a cost of \$10 000)

Justify which house Blair should buy with reference to the heating costs over time.

### Question 3

2 marks 103

Mamadou's house insurance policy has a deductible of \$1000. The annual premium is \$1500. If no claim is made during the year, he receives a 10% discount on the premium the following year.

Calculate the total amount paid over the 2 year period, before taxes.

<b>Summary</b>	
Year 1	no claim made
Year 2	claim made

## Question 4

3 marks 104

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A property has a portioned assessment of \$198 000. The municipal tax rate is 18.2 mills. Education taxes are \$1960. The property has a frontage of 45 feet. There is a local improvement levy of \$9.42 per foot for lane paving.

Calculate the total taxes due if the provincial tax credit is \$700.

## Question 5

1 mark 105

---

Explain why a bank usually limits the Gross Debt Service Ratio (GDSR) to 32% when determining if a homebuyer will be approved for a mortgage.

## Question 6

3 marks

106  
107  
108

Darcy and Marco have qualified for a \$300 000 mortgage with two payment options.

Option 1 is a 4.5% loan for 25 years with a monthly rate of \$5.50 per thousand borrowed.

Option 2 is a 6.5% loan for 20 years during which they would have paid a total of \$482 400.

A) Calculate the monthly mortgage payment for Option 1. (1 mark)

B) Calculate the total amount paid over the 25 years in Option 1. (1 mark)

C) Justify why Darcy and Marco might choose Option 1 instead of Option 2. (1 mark)

## Question 7

1 mark 109

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Preventative home maintenance can help a homeowner avoid expensive emergency repairs.

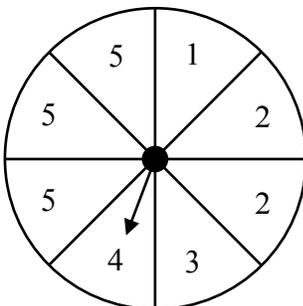
Describe 1 preventative maintenance task that you can do to ensure the roof of your house remains in good condition.

# Probability

## Question 8

2 marks  $\begin{matrix} 110 \\ 111 \end{matrix}$

Given the following spinner:



A) State the probability, in fraction form, of the spinner landing on 4. (1 mark)

B) State the probability, as a percent, of the spinner landing on a number less than 4. (1 mark)

## Question 9

1 mark 112

A company states that the theoretical probability of manufacturing a defective calculator is 1.3%. Natalie samples 200 calculators and finds that 4% of them are defective. She immediately takes a second sample of 1000 calculators and finds that 1.8% of them are defective.

**Natalie's Results**

	<b>Sample Size</b>	<b>Percent Defective</b>
Sample 1	200	4%
Sample 2	1000	1.8%

Explain why her second sample is closer to the theoretical probability than her first.

## Question 10

1 mark 113

---

The probability of being selected as a jury member is 0.07.

Calculate the probability, in decimal form, of **not** being selected.

## Question 11

1 mark 114

---

State the odds **against** a soccer game ending in a tie score if the probability of a tie is  $\frac{9}{225}$ .

## Question 12

1 mark 115

---

The probability of having green eyes is 3 out of 25.

Calculate the expected number of people who have green eyes in a group of 150 people.

## Question 13

3 marks 116

“Pick the Marble” is a game that involves picking one marble out of a bag. In the bag, 32% of the marbles are red, 4% are green, and 64% are blue. It costs \$2 to play, and the prizes are listed in the table below.

**Pick the Marble**

<b>Colour</b>	<b>Probability of Winning</b>	<b>Prizes</b>
Red	32%	Stuffed animal valued at \$10
Green	4%	Stuffed animal valued at \$15
Blue	64%	Nothing

Calculate the expected value for the game.

## Question 14

3 marks

117  
118  
119

---

Each letter of the word **MULTIPLICATION** is written on a different card. The cards are shuffled and placed face down on a table. One card is selected and then replaced.

A) State the probability of selecting a card with the letter L or P. (1 mark)

B) State the odds in favour of selecting a card with the letter A. (1 mark)

C) State the odds **against** selecting a card with a vowel (A, E, I, O, U). (1 mark)

# Vehicle Finance

## Question 15

2 marks 120

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Shania wants to know how much tax she will pay on a new vehicle if she buys a \$17 000 vehicle and trades in her current vehicle valued at \$4000.

Calculate the **amount of tax** she will pay for this new vehicle.

## Question 16

2 marks 121

---

Describe 2 advantages of leasing a car rather than financing the purchase of a similar new car.

Place one response per line.

1. \_\_\_\_\_

2. \_\_\_\_\_

## Question 17

3 marks

122  
123  
124

Jean is financing the purchase of a new vehicle. She has saved money for the down payment. The table below shows the details of the purchase.

Price of new vehicle	\$26 000
Trade-in value of current vehicle	\$2000
Tax	\$3120
Down payment	\$3000
Monthly payment	\$544.39
Term	48 months

A) Calculate the total amount borrowed. (1 mark)

B) Calculate the total monthly payments paid over the term of the loan. (1 mark)

C) Calculate the finance charge (interest). (1 mark)

## Question 18

2 marks 125

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Hugo is going to lease a car. He will pay \$384.20 per month, after taxes, for 36 months. He will make a down payment of \$1500.

Calculate the total cost paid by Hugo at the end of the 36-month lease.

## Question 19

2 marks 126

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Describe 2 factors, other than the make, model, and year of the vehicle, that can affect the cost of your car insurance.

Place one response per line.

1. \_\_\_\_\_

2. \_\_\_\_\_

**Question 20**2 marks 127  
128

José and Shurjeel went on a road trip and recorded the following information:

	<b>Distance Driven</b>	<b>Amount of Gas Used</b>	<b>Cost</b>
Monday	1200 km	45 L	\$49.50
Tuesday	800 km	38 L	\$19.00
Wednesday	1400 km	47 L	\$34.00
Total	3400 km	130 L	\$102.50

A) Calculate the fuel economy for the trip in L/100 km. (1 mark)

B) Calculate the cost of gas per litre for the trip. (1 mark)

**Question 21**

3 marks 129

Alise is taking her car in for servicing. She needs the oil changed and an air filter replaced. The cost of labour is \$95 per hour. The following table shows the details of the servicing.

<b>Parts</b>	<b>Cost of Parts</b>	<b>Labour Hours Required</b>
Oil and filters	\$50	0.5

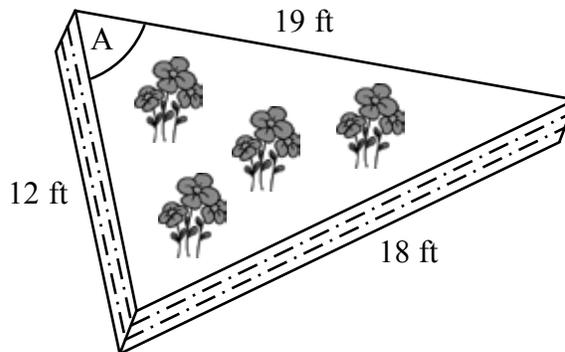
Calculate the total cost Alise will pay after taxes.

# Geometry and Trigonometry

## Question 22

3 marks 130

George needs to build walls to support his garden. The dimensions of the garden are indicated below.

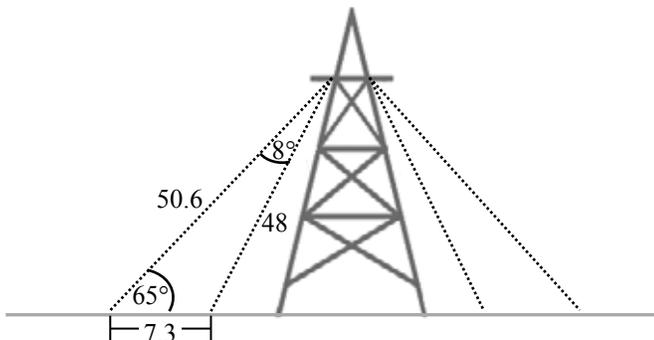


Determine the measure of angle A in George's garden.

## Question 23

1 mark 131

Given the following diagram of a tower with supporting wires:



Identify which of the following is true.

A)  $\frac{\sin 8^\circ}{48} = \frac{\sin 65^\circ}{50.6}$

B)  $\frac{\sin 8^\circ}{50.6} = \frac{\sin 65^\circ}{48}$

C)  $50.6^2 = 7.3^2 + 48^2 - [(2)(7.3)(48)\cos 8^\circ]$

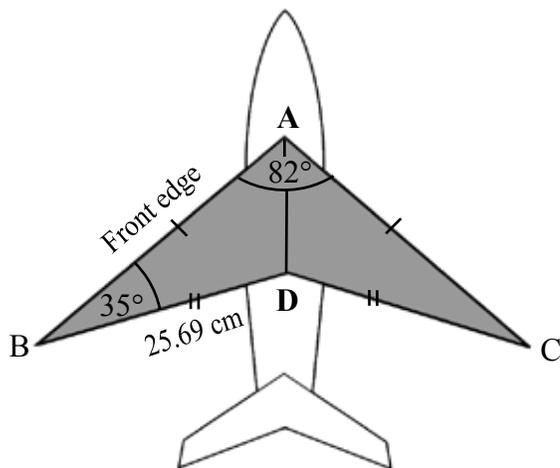
D)  $7.3^2 = 48^2 + 50.6^2 - [(2)(48)(50.6)\cos 8^\circ]$

**Answer:** \_\_\_\_\_

## Question 24

4 marks 132

Margo is building a model airplane. The measure of  $\angle BAC$  is  $82^\circ$ ,  $\overline{BD}$  is 25.69 cm and  $\angle ABD$  is  $35^\circ$ .

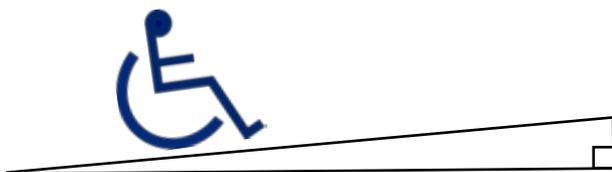


Calculate the length of the front edge of the wing  $\overline{AB}$ .

## Question 25

1 mark 133

The wheelchair ramp illustrated below forms a triangle.



Identify which of the following terms describes this triangle.

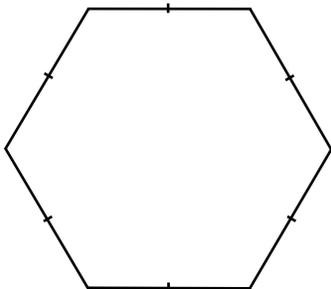
- A) equilateral triangle
- B) isosceles triangle
- C) obtuse triangle
- D) right triangle

**Answer:** \_\_\_\_\_

## Question 26

2 marks 134

Given the following regular polygon:



Calculate or illustrate the total number of diagonals that can be drawn.  
If illustrating, clearly state the total number of diagonals.

## Question 27

1 mark 135

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Justify why the following statement is false.

“If a quadrilateral has one pair of parallel sides and one pair of congruent sides, then the quadrilateral must be a parallelogram.”

**Question 28**

2 marks 136

Calculate how many sides a regular polygon has if the sum of the interior angles is  $1980^\circ$ .

# Precision Measurement

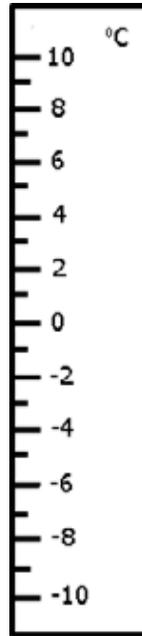
## Question 29

1 mark 137

Explain which of the following thermometers is more precise.



Thermometer A



Thermometer B

## Question 30

1 mark 138

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Choose the letter that best completes the sentence below.

How close a measurement is to the true value refers to:

- A) tolerance
- B) accuracy
- C) precision
- D) uncertainty

**Answer:** \_\_\_\_\_

## Question 31

1 mark 139

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Jordana is having a ring made by a jeweller. Her ring is to weigh 4.86 grams.

Calculate the uncertainty of the weight of her ring.

Do not round your final answer.

## Question 32

1 mark 140

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Jonalee is a veterinarian. Her thermometer indicated a dog's temperature to be  $38.6^{\circ}\text{C}$ .

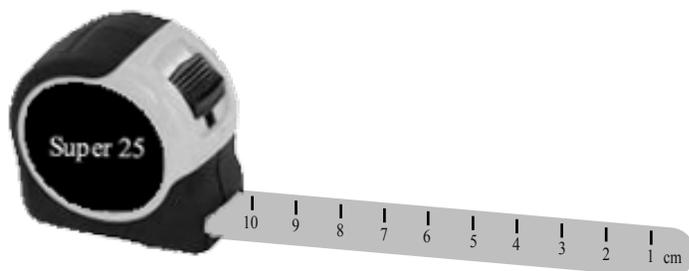
State the precision of the thermometer she used.

Do not round your final answer.

### Question 33

1 mark 141

Mario is installing a subfloor using sheets of plywood. He measures a sheet of plywood to be 225 cm long using the tape measure shown below.



Calculate the minimum possible length of the sheet of plywood.

Do not round your final answer.

## Question 34

1 mark 142

Choose the letter that best completes the sentence below.

The tolerance expression that allows for a maximum value greater than 16.5 cm is:

A)  $16.5 \text{ cm} \begin{matrix} +0.5 \text{ cm} \\ 0 \end{matrix}$

B)  $\begin{matrix} 16.5 \text{ cm} \\ 15.5 \text{ cm} \end{matrix}$

C)  $16 \text{ cm} \pm 0.5 \text{ cm}$

D)  $16.5 \text{ cm} \begin{matrix} 0 \\ -1 \text{ cm} \end{matrix}$

**Answer:** \_\_\_\_\_

## Question 35

1 mark 143

Oumar is cutting lenses for a pair of glasses. In order for the lenses to fit into the frame, the lenses need to have a minimum thickness of 1.896 mm and a maximum thickness of 2.022 mm.

State the measurement in the form:

maximum value  $\begin{matrix} +0 \\ -\text{tolerance} \end{matrix}$

Do not round your final answer.

## Question 36

2 marks 144

---

An iron needs to be heated to a temperature between  $230^{\circ}\text{F}$  and  $280^{\circ}\text{F}$ .

State the measurement in the form:

$$\text{nominal value} \pm \frac{1}{2}(\text{tolerance})$$

Do not round your final answer.

# Statistics

## Question 37

1 mark 145

---

Marc must write an entrance exam to enter university. He must receive a minimum grade of 75% to be accepted.

Last year his mark was in the 70th percentile. He was not accepted. This year his mark is in the 80th percentile.

Justify why it cannot be determined if Marc will be accepted into university this year.

### Question 38

2 marks 146

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Financial institutions use credit scores to decide whether people qualify for a loan.

Below is a list of credit scores for people applying for a bank loan.

620	655	706	722	722
768	775	778	780	784
784	800	803	816	824
824	831	840	849	852

Calculate the percentile rank for a credit score of 800.

**Question 39**

2 marks 147

Réjean entered one of his paintings in the provincial art show. The table below shows the points he received and the weight of each category.

<b>Category</b>	<b>Points Received (out of 100)</b>	<b>Weight</b>
Originality	92	35%
Design	87	40%
Colour	77	25%

Calculate the final score on Réjean's painting using a weighted mean.

**Question 40**

1 mark 148

A store sells shoes with sizes ranging from 7 to 12. The following table shows sales for the last month.

Size	Quantity Sold
7	5
8	20
9	25
10	43
11	5
12	2

Choose the letter that best completes the sentence below.

The measure of central tendency that represents the most popular shoe size is:

- A) mean
- B) median
- C) mode
- D) weighted mean

**Answer:** \_\_\_\_\_



**Question 42**

2 marks 151

Sidi works as a sales clerk at Cycle Sports. During the first 12 days of the month, the store sold the following numbers of bikes:

16	32	27	19
19	23	19	32
25	20	35	33

Calculate the median and the mode of this data.

Median: \_\_\_\_\_ bikes

Mode: \_\_\_\_\_ bikes

## Formula Sheet: Essential Mathematics

Name of Formula	Details	Formula
Percentile Rank ( <i>PR</i> )	<i>b</i> = number of raw scores below the given score <i>n</i> = total number of raw scores	$PR = \frac{b}{n} \times 100$
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> )		$GDSR = \frac{\left( \begin{array}{l} \text{Monthly mortgage} \\ \text{+ property taxes} \\ \text{+ heating costs} \end{array} \right)}{\text{Gross monthly income}}$
Fuel Economy in L/100 km ( <i>FE</i> )		$FE = \frac{\text{Fuel used in litres}}{\text{Distance in km}} \times 100$
Expected Value ( <i>EV</i> )	<i>P</i> = probability	$EV = P(\text{win}) \times \$\text{gain} - P(\text{lose}) \times \$\text{loss}$
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	$C = \frac{360^\circ}{n}$
Number of Diagonals in a Polygon ( <i>D</i> )	<i>n</i> = number of sides	$D = \frac{n(n - 3)}{2}$
<b>Trigonometric Laws</b>		
Sine Law	$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$	Cosine Law $a^2 = b^2 + c^2 - (2bc \cos A)$ $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$
<b>Tax Rates</b>		
Federal	Goods and Services Tax (GST) 5%	Provincial Provincial Sales Tax (PST) 8%

continue

<b>Taxes on Vehicle Purchases</b>		
	<b>PST</b>	<b>GST</b>
Buying New	PST	GST
Buying Used from a Dealership	PST	GST
Buying Used (Private Sale)	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
<b>Taxes on Home Insurance</b>		
	<b>PST</b>	<b>GST</b>
Homeowner's/Tenant's Insurance	PST	No GST