Grade 12
Essential Mathematics
Achievement Test

Student Booklet

June 2025

Manitoba

Grade 12 Essential Mathematics Achievement Test
Student Booklet (June 2025)

Description

Time Required to Complete the Test: 2 hours
Additional Time Allowed: 30 minutes

This test consists of six parts:

Probability	10
Vehicle Finance	15
Precision Measurement	13
Statistics	11
Geometry and Trigonometry	12
Home Finance	14
Total Possible Marks:	**75**

Directions

- Show all your work and clearly indicate your final answer.

- Use your *Formula Sheet* and your study sheet.

- Use a well-organized method to communicate your answer.

- Let the mark values for each question guide you in answering the question.

- Include units in your final answer.

- Make sure your calculator is set to degree mode.

- Express answers in decimal and percentage form to at least **the nearest hundredth** (two decimal places) when rounding.

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

  Note: Do not round answers in the Precision Measurement unit.

- 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.

- When no tax calculation is necessary, the wording "taxes included" will be used. When you are required to add taxes, the wording "plus taxes" will be used.

- Note that all scenarios described in test questions take place in Manitoba.

Electronic communication between students through phones, email, or file sharing during the test is strictly prohibited. Please turn off your cell phone and all other such devices.

Terminology Sheet

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	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 method that clearly shows what you are thinking
justify	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.
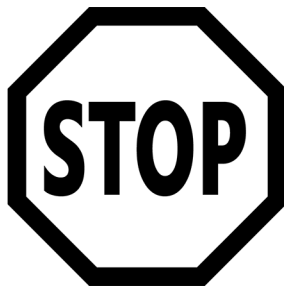
PLEASE WAIT UNTIL INSTRUCTED TO PROCEED

Probability

Question 1

A survey was conducted in a local high school. The survey found that 80% of the students play sports.

State the odds in favour of a student playing sports.

Question 2

Amy takes a loonie from her pocket and tosses it ten times. Each time it lands with the head facing up.

Explain whether Amy should use theoretical probability or experimental probability to predict the outcome of the next throw.

Question 3

2 marks

The t-shirts sold at Springfield High's school store come in three sizes: small, medium, and large.

Last year, the store sold 76 small t-shirts, 109 medium t-shirts, and 56 large t-shirts.

A) Calculate the experimental probability that a medium t-shirt was sold last year. (1 mark)

B) Calculate how many medium t-shirts should be ordered if 150 are expected to be sold this year based on last year's sales. (1 mark)

Question 4

The Retro Record company has been installing sound systems for decades. The company is bidding on a $350 000 contract. The probability of winning the contract is 4%. It costs the company $8975 to prepare the bid.

A) Calculate the expected value of the contract. (2 marks)

Show your work.

B) Justify if they should bid on this contract, based on your answer in Part A. (1 mark)

Question 5

1 mark

The odds of having red hair are 2:99.

A student calculated the probability of having red hair as follows:

$$\frac{2}{99} = 0.0202\ldots$$

Describe the student's error.

Question 6

Sheldon is playing a dart game. He throws a dart at a board and wins a prize if the dart hits an odd number. Sheldon is allowed one throw. He has the option of aiming at either Board A or Board B.

Board A

12	15	9	8
7	14	6	10
13	1	17	4
5	11	19	3

Board B

91	88	82
87	83	81
99	85	90

Justify, using probability, which board Sheldon should aim at, assuming his dart hits the board.

Show your work.

Vehicle Finance

Question 7   2.5 marks

Martin took his classic car out for a drive.

A) At the start of the trip, the odometer read 021769.1 km. At the end, the odometer read 022329.7 km. Martin's car used 90 L of gas on this trip.

   Calculate the car's fuel economy in L/100 km. (1.5 marks)

   Show your work.

B) The cost of gas is $1.629 per litre.

   Calculate the cost of gas used for this trip. (1 mark)

Question 8

Choose the letter that best completes the statement below.

Identify a factor that will affect the cost of vehicle insurance premiums.

    A) the age of the driver

    B) the make and model of the vehicle

    C) the gender of the driver

    D) the vehicle mileage

Answer: _____

Question 9

Orla would like to purchase a used vehicle privately. The price of the vehicle is $7500 and the book value is $7000. Orla pays $23.50 for a lien search.

Calculate the total amount Orla will pay for the vehicle, plus taxes.

Show your work.

Question 10

2.5 marks

Karlita purchases a vehicle from a dealership for $28 500. The vehicle loses $4275 in value during the first year.

A) Calculate the vehicle's depreciation rate during the first year, as a percent. (1 mark)

B) The vehicle's depreciation rate in the second year is 10%.

Calculate the value of the vehicle at the end of Year 2. (1.5 marks)

Show your work.

Describe one reason why pleasure insurance is less expensive than all-purpose insurance.

Katie takes her vehicle to a garage for maintenance work. Her vehicle needs a fuel pump for $134 and a new air filter for $75. There is a fee of $12 for additional materials. The garage charges $129 per hour for labour. The work takes 3 hours and 45 minutes to complete.

Calculate the total amount Katie will pay, plus taxes.

Show your work.

Question 13

Lorenzo wants to lease a truck. The dealership offers a three-year lease where Lorenzo would pay $450 a month, taxes included. A down payment of $3000 is required.

Calculate Lorenzo's total leasing costs.

Show your work.

Your friend wants to purchase a used vehicle and finds two identical vehicles priced similarly. One vehicle is at a dealership while the other is a private sale.

Justify which vehicle your friend should purchase.

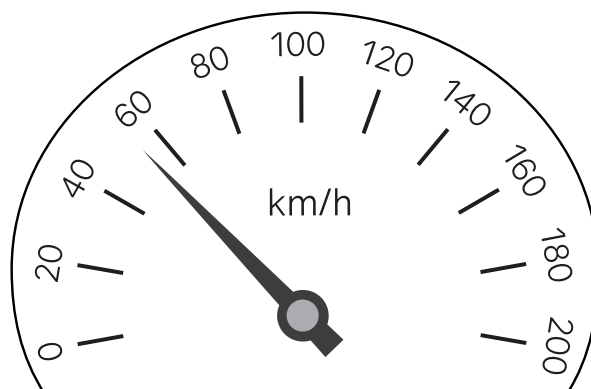# Precision Measurement

Note: Do not round answers in this unit.

Question 15

2 marks

The speedometer of a car is shown below.

A) State the precision of the speedometer. (1 mark)

B) Determine the uncertainty of the speedometer. (1 mark)

The pH for water in a fish tank must be between 7.1 and 8.1. The nominal pH is the midpoint between these two measures.

State the pH for the water in the form:

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

Question 17

Imam weighs two bags of coffee with the same scale. The mass of the first bag is 1.9 kg and the mass of the second bag is 1.2 kg.

A) Determine the uncertainty of the scale. (1 mark)

B) Determine the maximum possible mass of the two bags of coffee when combined. (2 marks)

Show your work.

Question 18   3 marks

Marley is building a bookshelf. One of the wooden pieces has a dowel that must fit into a hole in another piece of wood.

The nominal diameter, which is the midpoint between the maximum and minimum diameters, is 2.2 cm with a tolerance of 0.05 cm.
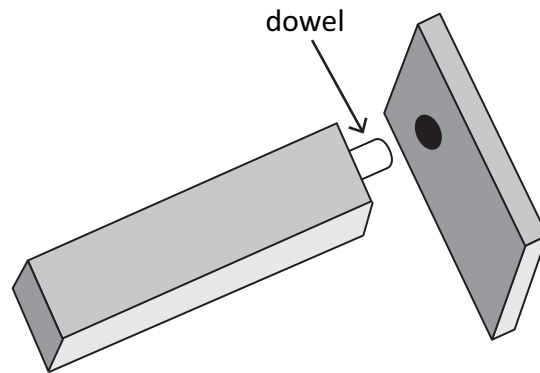
A) State the maximum and minimum diameter of the dowel. (2 marks)

Maximum: _____

Minimum: _____

B) Explain one reason why tolerance is important when considering the diameter of the dowel. (1 mark)

Question 19

3 marks

A) State the measurement 7.25 cm $\pm$ 0.03 cm in the form: minimum $-0^{+\text{tolerance}}$.
   (2 marks)

B) Explain whether the ruler shown below can be used to find the measurement in Part A.
   (1 mark)
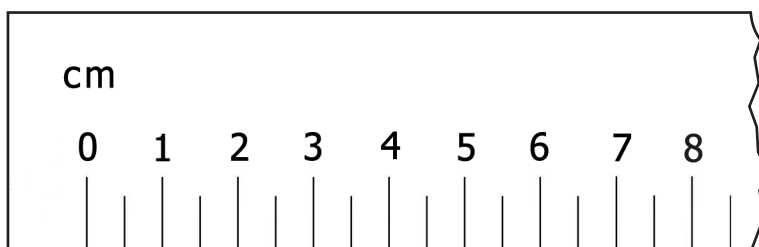
Statistics

Choose the letter that best completes the statement below.

Identify the measure of central tendency that is most affected by outliers.

    A) the mean

    B) the median

    C) the mode

    D) the trimmed mean

Answer: _____

Question 21

The average monthly overnight temperatures for Winnipeg are given in the table below.

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Average Overnight Temp. (°C)	−22	−19	−11	−2	4	11	14	12	6	0	−11	−18

A) Calculate the mean annual overnight temperature for Winnipeg. (2 marks)

Show your work.

B) The median temperature is −1°C.

Justify whether the mean or median would be a better measure to use if Tourism Manitoba wants data to attract visitors to Winnipeg. (1 mark)

Question 22

In a school division, 120 students wrote a math exam. There were 47 students who scored higher than Adam.

A student calculated Adam's percentile rank as follows:

$$PR = \frac{73}{120} \times 100$$

$$= 61st$$

Describe the student's error.

Clarinda is taking a carpentry course at a community college. Her final mark is calculated according to the categories shown below.

Course Activity	Clarinda's Mark (Out of 100)	Weight
Projects	75	50%
Tests	80	40%
Final Exam	65	10%

Calculate Clarinda's final mark by using a weighted mean.

Show your work.

Question 24

Choose the letter that best completes the statement below.

On a list of 80 numbers in ascending order, 60 is at the 75th percentile.

Identify the statement that is true.

A) 60 is the 75th number

B) 75% of the numbers are larger than 60

C) 75 numbers are below 60

D) 25% of the numbers are larger than 60

Answer: _____

Question 25

3 marks

Scott is in a figure skating competition. His scores are indicated in the table below.

	Judge A	Judge B	Judge C	Judge D	Judge E	Judge F
Score	6.8	7.8	6.8	6.7	6.6	6.9

A) State the outlier. (1 mark)

B) Calculate the trimmed mean by removing the highest and lowest scores. (2 marks)

Show your work.

Geometry and Trigonometry

Question 26

Choose the letter that best completes the statement below.

Identify the quadrilateral with diagonals that are equal length.
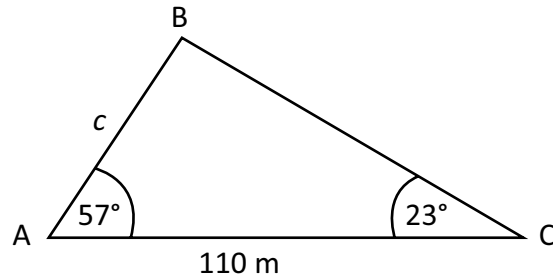
    A) a kite

    B) a rhombus

    C) a rectangle

    D) a parallelogram

Answer: _____

Calculate the length of side *c*.

Show your work.

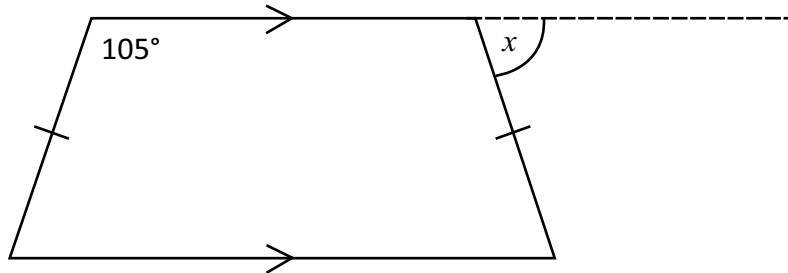Carla used a computer to draw a regular polygon with 30 sides. She claims the sum of its interior angles is 5000°.

Justify why this is not possible.

Calculate the measure of $\angle x$ in the following diagram.

Courtney makes a plant hanger for her deck. The braces are 4 inches and 6 inches long, and the anchor points for the braces are 3 inches apart, as shown below.
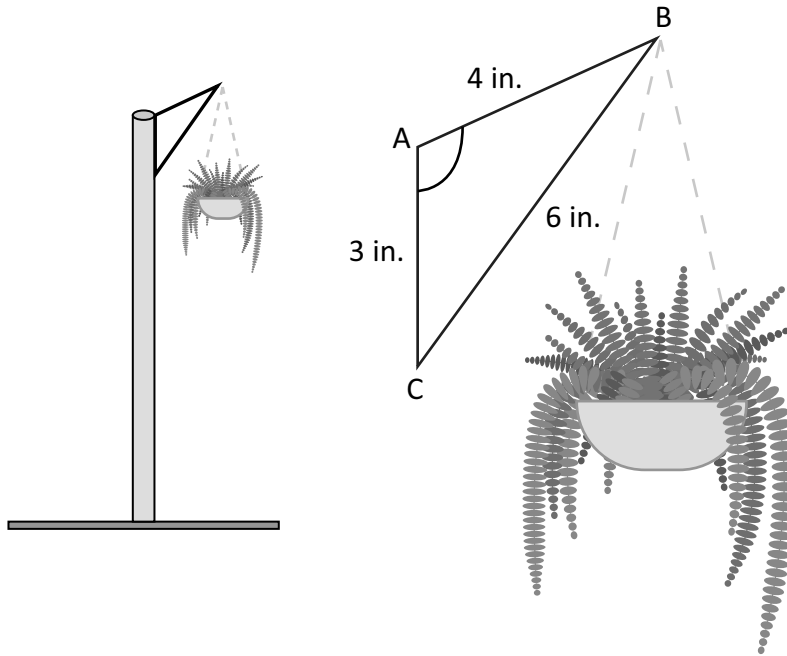
Calculate the measure of ∠A.

Show your work.

Question 31

Choose the letter that best completes the statement below.

A triangle has two congruent sides and one angle that measures 120°.

Identify the type of triangle.

    A) Acute isosceles triangle

    B) Equilateral triangle

    C) Obtuse scalene triangle

    D) Obtuse isosceles triangle

Answer: _____

Question 32

2 marks

A) Sketch and label one central angle, x, of the regular octagon shown below. (1 mark)
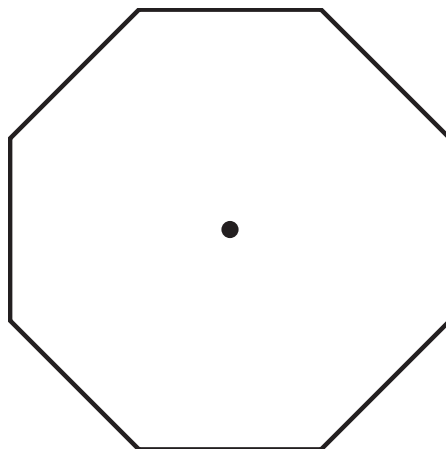
B) Calculate the measure of the central angle. (1 mark)

Wayne draws the following quadrilateral and claims that it is a parallelogram.
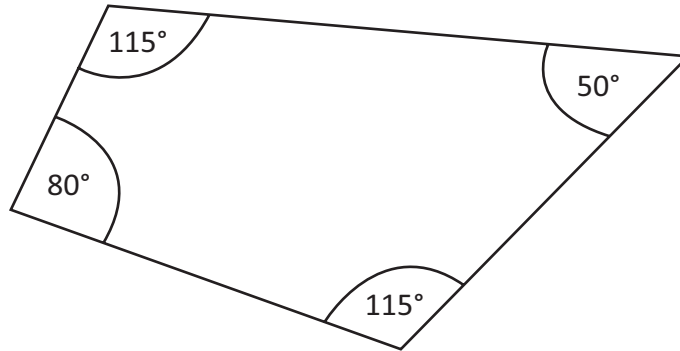
Describe one reason why he is incorrect.

Home Finance

Question 34

Myx insures a house worth $220 000 in Area 3. They choose a $200 deductible for their comprehensive coverage.

Calculate their annual insurance premium. Refer to the table on the following page.

Show your work.

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	438
$ 85 000	318	333	226	249	313	344	416	462
$ 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%

Manitoba no longer charges sales tax on home insurance premiums.

The current mill rate for property taxes in Winnipeg is 27.234 mills.

A house has a portioned assessment of $200 000.

Calculate the municipal tax collected on the house.

A couple is looking to buy a house with monthly property taxes of $394 and monthly heating costs of $207. Their gross monthly incomes are $4100 and $3275. They anticipate a monthly mortgage payment of $1362.

Calculate their Gross Debt Service Ratio.

Homeowners pay a Land Transfer Tax when purchasing a property. The tax is calculated according to the following schedule.

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

Josey is purchasing a property worth $255 000. The tax amount on the first $200 000 is $1650.

Calculate the total Land Transfer Tax that Josey has to pay.

Show your work.

Question 38

4 marks

Jackson purchased a house for $460 000. He made a down payment of $95 000 and negotiated a mortgage at an interest rate of 5.5% ammortized over 25 years. At this interest rate, he pays $6.10 per thousand dollars borrowed.

A) Calculate Jackson's monthly mortgage payment. (2 marks)

Show your work.

B) Calculate the total amount of interest Jackson will pay over the life of the mortgage. (2 marks)

Show your work.

Rajesh's house has a damaged window that causes him to pay an extra $30 per month in heating or cooling costs. It would cost him $1200 to replace the window. Rajesh is planning to sell the house and move in 5 years.

Justify whether Rajesh should replace the window.

Formula Sheet: Essential Mathematics

Name of Formula	Formula	Details
Percentile Rank (PR)	$PR = \dfrac{b}{n} \times 100$	b = number of raw scores below the given score n = total number of raw scores
Simple Interest (I)	$I = Prt$	P = principal r = annual interest rate t = time in years
Education Tax or Municipal Tax	$\text{Tax} = \text{Portioned assessment} \times \dfrac{\text{mill rate}}{1000}$	
Gross Debt Service Ratio ($GDSR$)	$GDSR = \dfrac{\left(\begin{array}{c}\text{Monthly} \quad \text{Monthly} \quad \text{Monthly} \\ \text{mortgage} + \text{property} + \text{heating} \\ \text{payment} \quad\; \text{taxes} \quad\;\; \text{costs}\end{array}\right)}{\text{Gross monthly income}}$	
Fuel Economy in L / 100 km (FE)	$\dfrac{FE}{100} = \dfrac{\text{Fuel used in litres}}{\text{Distance travelled in km}}$	
Sum of Interior Angles of Polygons (S)	$S = 180° \, (n - 2)$	n = number of sides
Measure of One Interior Angle of a Regular Polygon	$\text{Interior angle} = \dfrac{180° \, (n - 2)}{n}$	n = number of sides
Measure of One Exterior Angle of a Regular Polygon	$\text{Exterior angle} = \dfrac{360°}{n}$	n = number of sides
Central Angle of Regular Polygons (C)	$C = \dfrac{360°}{n}$	n = number of sides
Number of Diagonals in a Polygon (D)	$D = \dfrac{n \, (n - 3)}{2}$	n = number of sides

Additional formulas on next page.

Trigonometric Laws	
Sine Law $$\dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$$ $$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$$	Cosine Law $$a^2 = b^2 + c^2 - (2bc \cos A)$$ $$\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$$

Tax Rates	
Provincial Retail Sales Tax (RST) 7%	Federal Goods and Services Tax (GST) 5%

Taxes on Vehicle Purchases

	RST	GST
Buying New	Yes	Yes
Buying Used from a Dealership	Yes	Yes
Buying Used Privately	Yes, calculated on greater of book value or purchase price	No
Safety	No	Yes
Materials and Labour	Yes	Yes
Lien Search	No	No

Note: Provincial sales tax (PST) is now called retail sales tax (RST).

Note: Since July 1, 2020, RST is no longer added to home insurance.