## Grade 12

Essential Mathematics
Achievement Test

## Student Booklet

January 2015

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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.
\(\left.\left.$$
\begin{array}{ll}\text { The word } & \text { The question is asking for... } \\
\hline \text { identify/choose } & \text { the appropriate answer(s) from a given list of choices } \\
\text { state } & \begin{array}{l}\text { a word, sentence, or number, without an explanation } \\
\text { describe/explain }\end{array} \\
\text { words or symbols, diagrams, charts or graphs, or other methods } \\
\text { that clearly show what you are thinking }\end{array}
$$\right] \begin{array}{l}an explanation, information, or evidence that shows why your <br>

method, idea, or answer is correct\end{array}\right]\)| 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

4 Marks

1. Chris buys a house in Carman for $\$ 225000$. 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 <br> (Blended payment of principal and interest per \$1000 of loan) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Interest Rate | $\mathbf{5}$ years | $\mathbf{1 0}$ years | $\mathbf{1 5}$ years | $\mathbf{2 0}$ years | $\mathbf{2 5}$ 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 |

2. State two factors that may increase or decrease a homeowner's insurance premium.
3. Describe 2 energy-efficient upgrades that are available to homeowners.

| Upgrade |  |
| :--- | :--- |
|  |  |
| 1. |  |
|  |  |
| 2. |  |
|  |  |
|  |  |

4. A home has a portioned assessment of $\$ 160000$ 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


## No marks awarded for work done on this page.

 Provide your answers on p. 4.5. 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 |  |
| :--- | :--- |
| 1. |  |
|  |  |
| 2. |  |
| 3. |  |

## Probability

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: $\qquad$

Percent:
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)
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)
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)
10. The weather forecast states that there is a $30 \%$ probability of rain for tomorrow. State the odds against it raining tomorrow.
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
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.
14. Bonnie wishes to buy a new vehicle from a Manitoba dealership for $\$ 16200$ 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)
15. A car travels 2400 km and consumes 200 L of fuel. Calculate the fuel economy in $\mathrm{L} / 100 \mathrm{~km}$ for the car.
16. Frank has been leasing his pickup truck for the last 3 years. He has made a total of $\$ 16028$ in payments; which included a down payment of $\$ 3500$.

Calculate Frank's monthly lease payments.
17. Sam has been involved in a car accident. Explain if this will affect the cost of his Manitoba vehicle insurance.
18. A brand new car costs $\$ 26800$ 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

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 $32^{\circ}$. 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 $15^{\circ}$.


Calculate how far the plane is from Tom.
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)
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)
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)

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
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.
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:

$\qquad$

Uncertainty: $\qquad$
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: $\qquad$

Minimum: $\qquad$
30. A welding company has determined that the desired length of a steel arm is $12 \mathrm{~cm} \pm 2.5 \mathrm{~cm}$. The tolerance is given in the form nominal value ${ }_{-0}^{+ \text {tolerance }}$. State the nominal value and tolerance.
nominal value: $\qquad$
tolerance: $\qquad$

## Statistics

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.
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 <br> Mark | Weight |
| :--- | :---: | :---: |
| Assignments | 90 | $10 \%$ |
| Tests | 65 | $60 \%$ |
| Final Exam | 60 | $30 \%$ |

Using a weighted mean, calculate Tatiana's final mark in the course.
35. Calculate the trimmed mean by eliminating the highest and the lowest number for the following set of data.

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

## Formula Sheet: Essential Mathematics

| Name of Formula | Details | Formula |
| :---: | :---: | :---: |
| Percentile Rank <br> (PR) | $\begin{aligned} b= & \text { number of raw scores } \\ & \text { below the given score } \\ n= & \text { total number } \\ & \text { of raw scores } \end{aligned}$ | $P R=\frac{b}{n} \times 100$ |
| Simple Interest $(I)$ | $\begin{aligned} & P=\text { principal } \\ & r=\text { annual interest rate } \\ & t=\text { time in years } \end{aligned}$ | $I=P r t$ |
| Gross Debt Service Ratio (GDSR) |  | $\left.G D S R=\frac{\begin{array}{c} \text { Monthly } \\ \text { mortgage }+ \text { property } \\ \text { payment } \end{array} \begin{array}{c} \text { Monthly } \\ \text { taxes } \end{array}}{\text { Gross monthly income }} \begin{array}{c} \text { costs } \end{array}\right) \times 100$ |
| Fuel Economy in $\mathrm{L} / 100 \mathrm{~km}$ (FE) |  | $F E=\frac{\text { Fuel used in litres }}{\text { Distance in km }} \times 100$ |
| Expected Value (EV) | $P=$ probability | $E V=P($ win $) \times \$$ gain $-P($ lose $) \times$ \$ loss |
| Sum of Interior Angles of Polygons <br> (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 <br> (D) | $n=$ number of sides | $D=\frac{n(n-3)}{2}$ |
| Trigonometric Laws |  |  |
| Sine Law $\frac{\sin }{a}$ | $=\frac{\sin \mathrm{B}}{b}=\frac{\sin \mathrm{C}}{c}$ | Cosine Law $\quad a^{2}=b^{2}+c^{2}-2 b c \cos \mathrm{~A}$ |
| Tax Rates |  |  |
| Federal Goo | and Services ax (GST) | Provincial Provincial Sales <br> Tax (PST) $8 \%$ |

