Grade 12
Essential Mathematics
Achievement Test

Marking Guide

January 2013

Manitoba

> After the administration of this test, print copies of this resource will be available for purchase from the Manitoba Text Book Bureau. Order online at <www.mtbb.mb.ca>.
>
> This resource will also be available on the Manitoba Education website at <www.edu.gov.mb.ca/k12/assess/archives/index.html>.
>
> Websites are subject to change without notice.

Disponible en français.

Available in alternate formats upon request.

Contents

Marking Guidelines

The *Grade 12 Essential Mathematics Achievement Test: Marking Guide (January 2013)* is based on *Grades 9 to 12 Mathematics: Manitoba Curriculum Framework of Outcomes* (2009).

The recommended procedure for scoring student responses is as follows:

1. Read the *Marking Guide*.

2. Study the student samples provided and the rationales for the allotted scores.

3. Determine the mark for the student's response by comparing its features with the *Marking Guide* descriptions. The descriptions and samples only typify a student's response to a given question; an exact match is not anticipated.

Irregularities in Provincial Tests

During the administration of provincial tests, supervising teachers may encounter irregularities. Markers may also encounter irregularities during local marking sessions. The appendix provides examples of such irregularities as well as procedures to follow to report irregularities.

If a *Scoring Sheet* is marked with "0" and/or "NR" only (e.g., student was present but did not attempt any questions) please document this on the *Irregular Test Booklet Report*.

Presentation of the Student Samples

Each constructed-response question is presented using the following sections:

Test Item
Number

Maximum Number
of Marks Allotted

This section presents the test item as it appears in the student booklet, including how marks should be allotted.

Test Item and Marking Guide

Question 4   (2 Marks)

A couple purchased a house in Winnipeg valued at $175 000. The couple also plans on buying comprehensive homeowner's insurance. Calculate the cost of insuring this house if the purchasers choose a policy with a $200 deductible.

Use the *Manitoba Homeowner's Insurance Rates* table on the facing page.

Answer:

$$\underbrace{\$668}_{1\,mark} \times 1.10 = \underbrace{\$734.80}_{1\,mark}$$

OR

$$\underbrace{\$668}_{1\,mark} + \$668 \times 0.10 = \underbrace{\$734.80}_{1\,mark}$$

This section presents student sample responses with the mark(s) allotted and the rationale justifying the mark(s) allotted.

Exemplar 1   (2 Marks)

$$\frac{175\,000}{1000} \times 668$$

$$\$175 \times 668 = \$116\,900$$

Mark: 1 out of 2
Rationale: - Correct table value (1 mark)

Home Finance

Question 1 (4 Marks)

List two (2) types of additional or one-time costs to consider when initially purchasing a home. Do not include the down payment or mortgage payment. Explain these costs.

Additional Costs	Explanations
1.	1.
2.	2.

2 marks for each explanation that matches the additional cost (2 × 2 marks)

Sample answers:

Additional Costs	Explanations
utility service charges	*cost of hooking up utilities (gas, telephone, cable, etc.)*
interest adjustment	*difference between date of purchase and date the mortgage is available*
property tax adjustment	*amount paid to owner for prepaid property taxes*
homeowner insurance adjustment	*prorated cost of insurance on home of greater value*
land transfer tax	*fee paid to transfer ownership*
moving	*cost of moving either to moving company or just gas*
decorating	*optional cost for purchaser–to personalize or upgrade the house*
appliances	*optional cost for purchaser–may not be previously owned*
immediate repairs	*optional cost for purchaser–to upgrade or may be essential*
furniture	*optional cost for purchaser–may not be previously owned*
property survey	*may be needed for mortgage (legal document)*
home inspection fee	*optional cost for purchaser–some purchasers wish to know if the house is mechanically and structurally sound before spending large amounts of money*
lawyer/legal fees	*necessary for transfer of ownership*
appraisal fee	*charged by the bank for mortgage*
mortgage insurance	*high ratio mortgage–a fee from the bank if down payment is minimal*

Exemplar 1

(4 Marks)

1.	New Windows	1.	You only have to buy windows when you need them
2.	Shingles	2.	The roof is leaking and the shingles need to be replaced to fix the leak

Mark: 2 out of 4
Rationale: - Correct explanations for additional costs (2 marks)
- Conceptual error—both answers are "immediate repairs"

Exemplar 2

(4 Marks)

1.	Hydro	1.	hydro bill comes once a month
2.	Moving	2.	cost of moving belongings

Mark: 2 out of 4
Rationale: - Correct explanation of additional cost (Moving) (2 marks)

Exemplar 3

(4 Marks)

1.	Appliances	1.	need new microwave, fridge, oven
2.	Internet	2.	initial hook up to house

Mark: 4 out of 4
Rationale: - Correct explanations (2 × 2 marks)

Test Item and Marking Guide

Jared is moving away from home and must decide where to live. There are various benefits to owning a house or renting a property.

State two (2) benefits of owning a house and two (2) benefits of renting a property. You may choose from the following list:

– equity

– no maintenance costs

– lower insurance cost

– easier to renovate

– no property taxes

– acts as an investment

Benefits of owning a house	Benefits of renting a property
1.	1.
2.	2.

Answers:

Benefits of owning a house	Benefits of renting a property
– *equity* – *easier to renovate* – *acts as an investment*	– *no maintenance costs* – *lower insurance cost* – *no property tax*

1 mark for each correct response. (4 × 1 mark)

Note to marker: *Accept appropriate student responses that do not come from the provided list.*

Exemplar 1 (4 Marks)

Benefits of owning a house	Benefits of renting a property
1. easier to renovate	1. no maintenance costs
2. act as an investment	2. acts as an investment

Mark: 3 out of 4

Rationale: - Two correct benefits of owning (2 × 1 mark)
- One correct benefit of renting (no maintenance cost) (1 mark)

Exemplar 2 (4 Marks)

Benefits of owning a house	Benefits of renting a property
1. can remodel the house the way you like	1. no property taxes
2. big enough for guests either temporarily or permanently	2. no down payment

Mark: 3 out of 4

Rationale: - One correct benefit of owning (remodel) (1 mark)
- Two correct benefits of renting (2 × 1 mark)

Exemplar 3 (4 Marks)

Benefits of owning a house	Benefits of renting a property
1. you own the house / you can do what you want to the house	1. no taxes
2. when you sell, you get the money	2. some bills included in rent

Mark: 4 out of 4

Rationale: - Four correct answers (4 × 1 mark)

Question 3 (2 Marks)

Describe two (2) ways people can decrease their Gross Debt Service Ratio (GDSR).

Sample Answers:

– *decrease your heating costs (new windows, new furnace, change thermostat, etc.)*
– *purchase a less expensive house*
– *purchase in an area with lower property taxes*
– *get a better interest rate from the bank*
– *increase your gross income*
– *increase down payment*
– *increase amortization period*

(2 × 1 mark)

Test Item and Marking Guide

Exemplar 1

(2 Marks)

You can take less time to pay your mortgage and lower your property taxes.

Mark: 0 out of 2
Rationale: - Two incorrect answers

Exemplar 2

(2 Marks)

Pay the mortgage over a longer period of time (lower payments) or get a smaller mortgage amount

Mark: 1 out of 2
Rationale: - One correct answer (amortization) (1 mark)

Exemplar 3

(2 Marks)

Install a high efficiency furnace

Install newer windows with proper insulation

Mark: 1 out of 2
Rationale: - One correct answer (1 mark)
           - Conceptual error—both answers reduce heating costs

Question 4 (2 Marks)

A couple purchased a house in Winnipeg valued at $175 000. The couple also plans on buying comprehensive homeowner's insurance. Calculate the cost of insuring this house if the purchasers choose a policy with a $200 deductible.

Use the *Manitoba Homeowner's Insurance Rates* table on the facing page.

Answer:

$$\underbrace{\$668}_{1\ mark} \times 1.10 = \underbrace{\$734.80}_{1\ mark}$$

OR

$$\underbrace{\$668}_{1\ mark} + \$668 \times 0.10 = \underbrace{\$734.80}_{1\ mark}$$

Exemplar 1

(2 Marks)

$$\frac{175\,000}{1000} \times 668$$

$175 \times 668 = \$116\,900$

Mark: 1 out of 2
Rationale: - Correct table value (1 mark)

Exemplar 2

(2 Marks)

$175\,000$ Comprehensive 200 deductible

$668 \times 0.10 = 66.80 + 668 = 734.80$

$734.80 + 200 = \$934.80$

It would cost $934.80 to insure the house including the deductible

Mark: 1 out of 2
Rationale: - Correct table value (1 mark)
       - Incorrect answer

Exemplar 3

(2 Marks)

$668 \times 10\% = \$66.80$

$668 + 66.80 = \$734.80$

Mark: 2 out of 2
Rationale: - Correct solution (2×1 mark)

Question 5 (4 Marks)

Test Item and Marking Guide

Juan's property has a total assessed value of $150 000. The portioned percentage on his property is 45%.

A) Calculate the portioned assessment of the property. (1 mark)

Answer:

Portioned assessment: $\$150\,000 \times 0.45$
                              $= \$67\,500$ *← 1 mark*

B) The municipal tax rate is 12.5 mills. The amount of school division tax due is $1 451.25. The provincial tax credit this year is $775. Calculate Juan's total property tax bill for this year. (3 marks)

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

Answer:

Municipal tax: $\$67\,500 \times \underbrace{\dfrac{12.5}{1\,000}}_{1\ mark} = \underbrace{\$843.75}_{1\ mark}$

Total taxes due: $\$843.75 + \$1\,451.25 - \$775$
                        $= \$1\,520$ *← 1 mark*

Exemplar 1

(4 Marks)

A)   67 500

B) $\dfrac{150\,000}{1000} \times 12.5$

         = 1875

Mark: 2 out of 4
Rationale: - Correct answer in Part A (1 mark)
              - Correct rate in Part B (1 mark)

Exemplar 2

(4 Marks)

A) $(15\,000)(0.45) = 6750$

B) 6750×12.5 mills $= 84.38$

                        84.38
                     + 1451.25
                     − 775.00
                     ─────────
                       $760.63

Mark: 3 out of 4
Rationale: - Incorrect answer in Part A
              - Correct solution in Part B (follow-through error) (3 × 1 mark)

Exemplar 3

(4 Marks)

A) $150\,000 \times 0.45 = \$67\,500$

B) $\dfrac{67\,500}{1000} \times 12.5 \quad = \quad 843.75$

                              +1451.25
                              ─────────
                              $2295.00
                 Tax Credit   − 775.00
                              ─────────
                              $1520.00

Mark: 4 out of 4
Rationale: - Correct answer in Part A (1 mark)
              - Correct solution in Part B (3 × 1 mark)

Probability

You are given the data set: 1, 2, 3, 4, 5.

A) Express the probability of the number 2 being randomly selected from the set. (1 mark)

Answer:

$\frac{1}{5}$ or 0.2 or 20% or 1 out of 5

B) Express the probability of **not** selecting the number 5 from the set. (1 mark)

Answer:

$\frac{4}{5}$ or 0.8 or 80% or 4 out of 5

Test Item and Marking Guide

Exemplar 1

A)   1:4, one out of five

B)   4:5

Mark: 0 out of 2
Rationale: - Incorrect answer in Part A (Correct answer not indicated clearly)
                    - Incorrect answer in Part B

Exemplar 2

A) 20%

B) 20%, 100 - 20 = 80%

Mark: 2 out of 2
Rationale: - Correct answer in Part A (1 mark)
                    - Correct answer in Part B (1 mark)

Exemplar 3

A) One out of five, 1:4 odds

B) Four out of five, 4:1 odds

Mark: 2 out of 2
Rationale: - Correct answer in Part A (1 mark)
                    - Correct answer in Part B (1 mark)

Question 7

Test Item and Marking Guide

The probability of an event occurring is 3 out of 5. Express this probability as a decimal or percent.

Answer:

0.6 or 60%

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Test Item and Marking Guide

Explain what it means if an event, such as a game or a business contract, has an expected value of 0.

Sample answers:

– *Over time, you will not gain or lose.*
– *The average amount you win is equal to the average amount you pay.*
– *You will eventually break even.*

Exemplar 1

(2 Marks)

It means that the chances of winning or losing are even.

Mark: 0 out of 2
Rationale: - Incorrect response

Exemplar 2

(2 Marks)

No chance of winning.

Mark: 0 out of 2
Rationale: - Incorrect response

Exemplar 3

(2 Marks)

This means that if you play this game you will most likely break even. Not lose anything, but not win anything either.

Mark: 2 out of 2
Rationale: - Correct response (2 marks)

Question 9 (1 Mark)

On a quiz out of 10 marks, the scores of several students were: 3, 4, 6, 7, 7, 8, and 10. Express the odds that a randomly selected student scored greater than 50% on the quiz.

Answer:

5:2

Exemplar 1

$$\frac{5}{7} \qquad 0.71 \quad 71\%$$

Mark: 0 out of 1
Rationale: - Incorrect response

Exemplar 2

$5/7$ = PASSING

5:2

THE ODDS OF SELECTING A STUDENT WHO PASSED WOULD BE 5:2.

Mark: 1 out of 1
Rationale: - Correct response (1 mark)

Question 10 (1 Mark)

The odds **against** an event occurring are $1:5$. Express the probability **for** the event occurring.

Answer:

$\dfrac{5}{6}$ or 0.83 or 83% or 5 out of 6

Test Item and Marking Guide

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Question 11 (3 Marks)

A company knows that 1 out of every 100 vacuums sold will be defective in some way. A store sells 100 of these vacuums and 10 people return them because they are defective.

A) Express the **experimental** probability of buying a defective vacuum. (1 mark)

Answer:

$\frac{10}{100}$ or 0.1 or 10%

B) Explain the difference between "theoretical probability" and "experimental probability". (2 marks)

Sample answers:

A theoretical probability is based on the prediction of how many will be defective. ← *1 mark*

An experimental probability is based on what actually happened in a sample situation. ← *1 mark*

OR

A theoretical probability is how many should break down. ← *1 mark*

An experimental probability is how many did break down. ← *1 mark*

Exemplar 1

(3 Marks)

A) *1:10*

B) *Theoretical probability is guessing and experimental is putting your Theory To a Test To find actual results.*

Mark: 1 out of 3
Rationale: - Incorrect answer in Part A
- One correct explanation (experimental) in Part B (1 mark)

Exemplar 2

(3 Marks)

A) $\dfrac{10}{100} = \dfrac{1}{10}$

B) *Theoretical probabilities mean using math, formulas, numbers, etc. to figure out the probability. Experiment probabilities means going out and actually testing the probability.*

Mark: 3 out of 3
Rationale: - Correct answer in Part A (1 mark)
- Two correct explanations in Part B (2 × 1 mark)

Test Item and Marking Guide

A manufacturing plant is concerned with controlling the quality of its products. It was determined that the probability of producing a defective product is 1%.

An employee takes two products from the plant and finds that one of them is defective. The employee is worried that 50% of the products are defective. Explain whether this employee is justified in being worried by these results.

Sample answers:

Choosing only two products is not a large enough sample to verify the theory.

OR

Finding the one defective product in such a small sample could have been bad luck. A much larger sample is needed.

Exemplar 1

(2 Marks)

Because he just might have gotten it.

Mark: 0 out of 2
Rationale: - Incorrect response

Exemplar 2

(2 Marks)

The employee only took 2 products to test and saw one was defective. The plant likely took all outcomes into consideration as well as past experience, and at the end says the probability of having a defective product is 1%. It could have been that the employee just so happened to take that 1%.

Mark: 2 out of 2
Rationale: - Correct response (2 marks)

Exemplar 3

(2 Marks)

To sample just 2 is not enough for an actual trial. That was just a fluke.

Mark: 2 out of 2
Rationale: - Correct response (2 marks)

Vehicle Finance

Test Item and Marking Guide

Sally recently graduated from college and has started working at her first job. She has decided to lease a car. State one reason why leasing may be a good choice for Sally. Justify your reason.

Sample Answers:

Reasons for leasing	Justifications
Lower monthly payment	*More affordable in the short term*
No repair costs	*Leased vehicles are covered by the dealer*
Unable to afford a new car	*Monthly payments would be higher*
Not sure what to buy	*Can return the car after the lease is up*

1 mark for reason
1 mark for justification that matches the reason

Exemplar 1

(2 Marks)

Reason for leasing	Justifications
Monthly payments	Does not have to buy it all at once

Mark: 0 out of 2

Rationale: - Incorrect responses

Exemplar 2

(2 Marks)

Reason for leasing	Justifications
Cheaper to lease than buy	You don't pay tax on it

Mark: 1 out of 2

Rationale: - Correct reason (1 mark)

Exemplar 3

(2 Marks)

Reason for leasing	Justifications
Repair	She doesn't have to worry about fixing it. Leased car would have warranty.

Mark: 2 out of 2

Rationale: - Correct responses (2 × 1 mark)

Question 14 (5 Marks)

Lindsay takes her car to a Manitoba car dealership for servicing. The dealership charges $95 per hour for labour. The following items were replaced: four (4) spark plugs for $2.25 each, one (1) air filter for $12.50 and one (1) headlight for $30. The job took 1.25 hours to complete.

Calculate the total cost of repairs including taxes.

Answer:

Materials:	*4 × $2.25 + $12.50 + $30*	
	= $51.50	*← 1 mark*
Taxes on materials:	*$51.50 × 0.12*	
	= $6.18	*← 1 mark*
Labour:	*1.25 × $95*	
	= $118.75	*← 1 mark*
GST on labour:	*$118.75 × 0.05*	
	= $5.94	*← 1 mark*
Total cost:	*$51.50 + $6.18 + $118.75 + $5.94*	
	= $182.37	*← 1 mark*

OR

Materials: $\underbrace{(4 \times \$2.25 + \$12.50 + \$30)}_{1\ mark} \times 1.12 = \underbrace{\$57.68}_{1\ mark}$

Labour: $\underbrace{(\$95 \times 1.25)}_{1\ mark} \times 1.05 = \underbrace{\$124.69}_{1\ mark}$

Total cost: $\$57.68 + \$124.69$
$= \$182.37$ *← 1 mark*

Exemplar 1

materials + labour = total cost

57.68 + 124.69 = 182.37

Mark: 3 out of 5
Rationale: - Correct totals (3 × 1 mark)

Exemplar 2

4 × 2.25 = 9

1 × 12.50 = 12.50

1 × 30 = 30

1.25 × 95 = 118.75

total $170.25

Mark: 3 out of 5
Rationale: - Incorrect taxes
- Correct solution (follow-through error) (3 × 1 mark)

Exemplar 3

```
4   ×   2.25 =   9.00
            +  12.50
              30.00  costs
            _____
              51.50
            + 118.75  labour
            _____
             170.25  × 12% = 20.43 taxes
            + 20.43  taxes
            _____
             190.68
```

Mark: 4 out of 5
Rationale: - Incorrect tax (no PST on labour)
- Correct solution (follow-through error) (4 × 1 mark)

Question 15

Test Item and Marking Guide

Maryann borrows $12 500 from her bank to purchase a car. The bank offers her a rate of 6.75% per year for 5 years.

A) Calculate the monthly payment. (2 marks)

Answer:

$$\frac{\$12\,500}{1\,000} \times \underbrace{19.68}_{1\,mark} = \underbrace{\$246}_{1\,mark}$$

B) Calculate the total amount of interest paid over the life of the car loan. (2 marks)

Answer:

Total paid: $246 × 12 × 5
            = $14 760   ← 1 mark

Interest paid: $14 760 − $12 500
            = $2 260   ← 1 mark

Exemplar 1 (4 Marks)

A) $(5)(12) = 60 \text{ months}$

$$\frac{12500}{60} = \boxed{\$208.33}$$

MaryAnn's monthly payment will be $208.33

B) $$\frac{12500.00}{1000.00} = \boxed{12.5}$$

$(12.5)(19.68) = \boxed{\$246.00}$

MaryAnn will pay $246.00 in interest over the life of the car loan.

Mark: 0 out of 4
Rationale: - Incorrect answer in Part A
- Incorrect answer in Part B

Exemplar 2 (4 Marks)

A) $6.50 \times 19.68 = \$127.92$

B) $60 \text{ months} \times \$127.92 = \$7675.20$

Mark: 2 out of 4
Rationale: - Correct table value in Part A (1 mark)
- Correct total paid in Part B (follow-through error) (1 mark)

Exemplar 3 (4 Marks)

A) $246
(student circled 19.68 on the table)

B) $2260

Mark: 3 out of 4
Rationale: - Correct solution in Part A (2 × 1 mark)
- Correct final answer in Part B (1 mark)

Drew has recently purchased a vehicle for $17 100. He borrowed $15 000 at 6.25% interest for 5 years. Complete the amortization table below.

Month	Monthly Payment	Interest	Principal	Unpaid Balance
				$15 000.00
1	$291.75	$78.13	$213.62	$14 786.38
2	$291.75	$77.01	$214.74	
3	$291.75			$14 355.78

Answer:

Month	Monthly Payment	Interest	Principal	Unpaid Balance
				$15 000.00
1	$291.75	$78.13	$213.62	$14 786.38
2	$291.75	$77.01	$214.74	*$14 571.64*
3	$291.75	*$75.89*	*$215.86*	$14 355.78

(3 × 1 mark)

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Question 17

Test Item and Marking Guide

Choose the letter that best completes the statement below.

When purchasing car insurance, a deductible is:

a) the amount you pay every year for the insurance.

b) a one-time lump sum you pay the insurance company when you first buy the car.

c) the amount of the insurance claim you must pay when at fault for an accident.

d) the amount you pay for extra coverage against damage to another person or their property.

Answer: _____c)_____

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Question 18 (4 Marks)

State and explain two (2) factors that may increase a car insurance premium in Manitoba.

Factors	Explanations
1.	1.
2.	2.

Sample Answers:

Factors	Explanations
Accidents or traffic tickets	*Premiums increase based on past driving history*
Decreased deductible	*Added benefits increase costs*
Increase third-party liability	*Added benefits increase costs*
Move to a new location	*Higher crime rates/increased traffic increase chances for claims*
Change type of insurance (all-purpose)	*Driving to work increases the chance of an accident*
Change of vehicle	*A more expensive car would cost more to repair/replace*

1 mark for each factor (2 × 1 mark)
1 mark for each explanation that matches the factor (2 × 1 mark)

Exemplar 1

(4 Marks)

Factors	Explanations
1. Accident at fault	1. may be more dangerous driver
2. Age	2. may be a more irresponsible driver

Mark: 2 out of 4
Rationale: - Correct factor (accident at fault) and explanation (2 × 1 mark)

Exemplar 2

(4 Marks)

Factors	Explanations
1. paying on time	1. become more trusted
2. decrease deductible	2. added benefits increase costs

Mark: 2 out of 4
Rationale: - Correct factor (deductible) and explanation (2 × 1 mark)

Exemplar 3

(4 Marks)

Factors	Explanations
1. Accident	1. less trustworthy driver
2. Ticket	2. shows bad driving history

Mark: 2 out of 4
Rationale: - Conceptual error (both factors relate to driving history)
        - One correct factor and explanation (2 × 1 mark)

Question 19 (1 Mark)

Test Item and Marking Guide

Explain why a car insurance policy with a $200 deductible will cost more than a similar policy with a $500 deductible.

Sample Answers:

– *You must pay more for the policy to decrease the amount you pay in the event of a claim.*

– *Choosing a smaller deductible usually means a belief in an increased chance of making a claim: the cost of the policy increases to offset this increased chance.*

– *You may receive more coverage with a lower deductible (windshield coverage, accidents involving wildlife, etc.).*

Exemplar 1 (1 Mark)

Because you increase your premium by 10%

Mark: 0 out of 1
Rationale: - Incorrect response

Exemplar 2 (1 Mark)

It is the classification of the insurance chosen by the owner when purchasing insurance for the first time.

200 deductible = 1 000 000

500 deductible = 2 000 000

Mark: 0 out of 1
Rationale: - Incorrect response

Exemplar 3 (1 Mark)

Because you will pay less after being in a collision and is better for people who often get in accidents. With a $500 deductible you pay less throughout the year but will pay $500 when you get into an accident.

Mark: 1 out of 1
Rationale: - Correct response (1 mark)

Geometry and Trigonometry

Test Item and Marking Guide

The Sine Law is often used in construction, commercial, industrial, or artistic applications.

A) Demonstrate one use of the Sine Law in the real world by performing the following two steps: (2 marks)

   - State a specific example where Sine Law is used.
   - Support your example with a written explanation, or with other information or evidence, of how Sine Law is used.

Answer:

2 marks for example with support

B) Sketch a reasonably neat picture or diagram (not necessarily to scale) that supports your example in Part A. (1 mark)
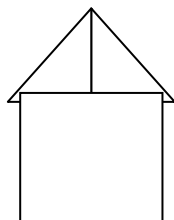
Answer:

1 mark for sketch

Exemplar 1

(3 Marks)

A) Roofing angle to determine whether runoff would be proper when it rains.
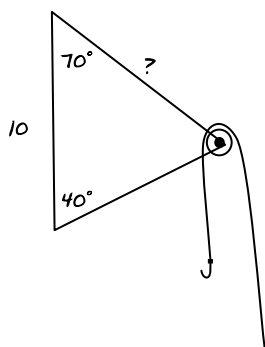
B)

Mark: 0 out of 3
Rationale: - Conceptual error (no evidence of Sine Law requirement)

Exemplar 2

(3 Marks)

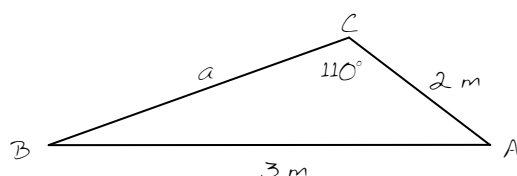A)

B)

70°   ?

10

40°

J

Mark: 1 out of 3
Rationale: - Correct sketch in Part B (1 mark)

Exemplar 3

(3 Marks)

A) Building a roof truss, that has oblique triangular roof trusses (not 90s).

B)

C

a   110°   2 m

B

3 m   A

Mark: 3 out of 3
Rationale: - Correct response in Part A (2 marks)
            - Correct sketch in Part B (1 mark)

Question 21 (2 Marks)

In triangle ABC, the length of side AB is 14 cm and the length of side AC is 18 cm. The measure of angle A is 31º. Calculate the length of side BC in cm.

Answer:

$a^2 = b^2 + c^2 - 2bc \cos A$

$BC^2 = 18^2 + 14^2 - 2(18)(14)(\cos 31º)$ ← *1 mark for substitution*

$BC^2 = 520 - 432.012$

$BC^2 = 87.988$

$BC = \sqrt{87.988}$

$BC = 9.38 \ (cm) \ \ or \ \ 9.4 \ \ or \ \ 9$ ← *1 mark*

Note to marker: *"cm" not required. Allow for various roundings.*

Test Item and Marking Guide

Exemplar 1

Exemplar 1 (2 Marks)

$Tan\ 31° = \dfrac{x}{14}$

$x = 8.4$

Mark: 0 out of 2

Rationale: - Incorrect solution

Exemplar 2 (2 Marks)

$a^2 = b^2 + c^2 - 2bc\ \cos A$

$a^2 = 18^2 + 14^2 - 2(18)(14)\cos(31)$
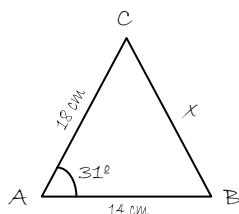
$a^2 = 52\emptyset - 5\emptyset 4\cos(31)$

$a^2 = 16 - \cos(31)$

$\sqrt{a^2} = \sqrt{15.14}$

$x = 3.89 \quad or \quad 3.9$

Mark: 1 out of 2

Rationale: - Correct substitution (1 mark)

Exemplar 3 (2 Marks)

$a^2 = b^2 + c^2 - 2bc\ \cos A$

$a^2 = 18^2 + 14^2 - 2(18)(14)\cos 31$
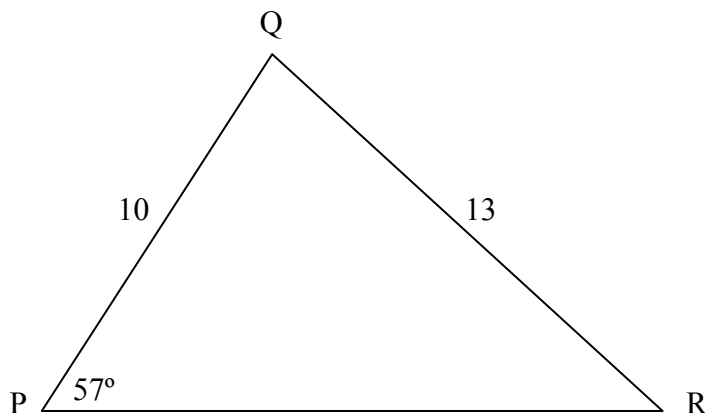
$a^2 = 520 - 432$

$\sqrt{a^2} = \sqrt{88}$

$a = 9.38 \quad or \quad 9.4$

Mark: 2 out of 2

Rationale: - Correct solution (2 × 1 mark)

Test Item and Marking Guide

Given triangle PQR:

Determine the measure of angle R in degrees.

Answer:

$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

$$\frac{\sin R}{10} = \frac{\sin 57°}{13} \qquad \leftarrow 1 \ mark \ for \ substitution$$

$$\sin R = \frac{10\left(\sin 57°\right)}{13}$$

$$\sin R = 0.645$$

$$angle \ R = \sin^{-1}\left(0.645\right)$$

$$angle \ R = 40.18° \ \ or \ \ 40.2° \ \ or \ \ 40° \qquad \leftarrow 1 \ mark$$

Note to marker: *Degrees are not required. Allow for various roundings.*

Exemplar 1

(2 Marks)

$x = 40°$

Mark: 1 out of 2
Rationale: - Correct answer (1 mark)

Exemplar 2

(2 Marks)

$$\frac{sinx}{10} = \frac{sin57}{13}$$

$sinx = 0.465$

$x = 27.7$

Mark: 1 out of 2
Rationale: - Correct substitution (1 mark)

Exemplar 3

(2 Marks)

$$SIN R = \frac{10 (SIN 57°)}{13}$$

$SIN R = 0.65$

$ANGLE R = 0.65$

Mark: 1 out of 2
Rationale: - Correct substitution (1 mark)

Question 23 (2 Marks)

The sum of the interior angles of a polygon is $900°$. Determine the number of sides of the polygon.

Answer:

$900° = 180° (n - 2)$ $\leftarrow$ *1 mark for substitution*

$\dfrac{900°}{180°} = n - 2$

$5 = n - 2$

$n = 7$ $\leftarrow$ *1 mark*

OR

$900° = 180° (n - 2)$ $\leftarrow$ *1 mark for substitution*

$900° = 180° (n) - 360°$

$1\,260° = 180° (n)$

$n = 7$ $\leftarrow$ *1 mark*

Note to marker: Demonstrating "trial and error" is an acceptable solution.

Exemplar 1

$$900 = 180(n-2)$$

Mark: 1 out of 2
Rationale: - Correct substitution (1 mark)

Exemplar 2

7 sides

Mark: 1 out of 2
Rationale: - Correct answer (1 mark)

Exemplar 3

$S = 180(n-2)$

$3 : 180°$

$5 : 540°$

$\boxed{7 : 900°}$

Mark: 2 out of 2
Rationale: - Correct solution (trial and error) (2 × 1 mark)

Question 24

(2 Marks)

State two (2) properties that would prove a quadrilateral is a parallelogram.

Sample Answers:

- *Both pairs of opposite sides are equal.*
- *Both pairs of opposite sides are parallel.*
- *One pair of opposite sides are equal and parallel.*
- *Consecutive angles are supplementary.*
- *Diagonals bisect each other.*
- *Opposite angles are congruent.*

(2 × 1 mark)

Test Item and Marking Guide

Exemplar 1

(2 Marks)

The sides are the same, everything equals 360°.

Mark: 0 out of 2
Rationale: - Incorrect response

Exemplar 2

(2 Marks)

– *2 sides are parallel*

– *2 sides have equal lengths*

Mark: 1 out of 2
Rationale: - Correct response (combined) (1 mark)

Exemplar 3

(2 Marks)

Diagonals bisect each other.

Mark: 1 out of 2
Rationale: - One correct response (1 mark)

Question 25 (3 Marks)

Test Item and Marking Guide

Polygons are often used in construction, commercial, industrial, or artistic applications.

A) Demonstrate one use of the various properties of polygons in the real world by performing the following two steps: (2 marks)

- State a specific example where the various properties of polygons are used.
- Support your example with a written explanation, or with other information or evidence, of how the various properties of polygons are used.

Answer:

2 marks for example with support

B) Sketch a reasonably neat picture or diagram (not necessarily to scale) that supports your example in Part A. (1 mark)
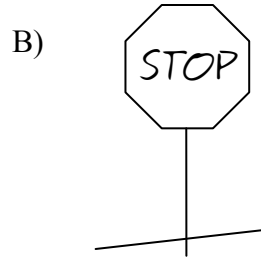
Answer:

1 mark for sketch

Exemplar 1
(3 Marks)

A) The use of a stop sign. They are found everywhere.

B)

Mark: 0 out of 3
Rationale: - Incorrect response

Exemplar 2
(3 Marks)

A) When building a building that uses polygon shapes. There are domes that use polygons like a soccer ball to make the roof. Other shapes don't work as well.
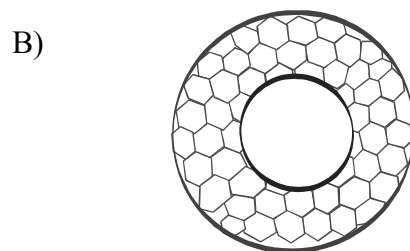
B)

Mark: 2 out of 3
Rationale: - Correct response in Part A (2 marks)

Exemplar 3
(3 Marks)

A) AIRLESS TIRES USE POLYGONS. THERE ARE THINGS LIKE HONEYCOMBS INSIDE THE TIRE TO GIVE STRUCTURE, INSTEAD OF AIR.

B)

Mark: 3 out of 3
Rationale: - Correct response in Part A (2 marks)
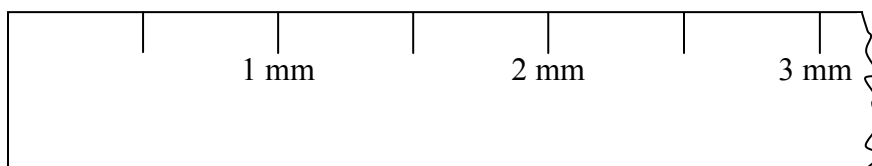- Correct sketch in Part B (1 mark)

Precision Measurement

Question 26 (2 Marks)

Given the measuring device below, express its precision and uncertainty in mm.

	1 mm	2 mm	3 mm

Precision: _____

Uncertainty: _____

Answer:

Precision: _____0.5 (mm)_____ ← *1 mark*

Uncertainty: ___0.25 (mm)___ ← *1 mark*

Note to marker: *"mm" not required*

Exemplar 1

(2 Marks)

Precision: _____1 mm_____

Uncertainty: _____0.5 mm_____

Mark: 0 out of 2
Rationale: - Incorrect answers

Exemplar 2

(2 Marks)

Precision: _____mm_____

Uncertainty: _____0.5 mm_____

Mark: 0 out of 2
Rationale: - Incorrect answers

Exemplar 3

(2 Marks)

Precision: _____0.5_____

Uncertainty: _____0.05 mm_____

Mark: 1 out of 2
Rationale: - One correct answer (Precision) (1 mark)

Test Item and Marking Guide

Explain why you cannot rely on a measuring device to determine the exact length of an object.

Sample answers:

— *Each measuring device has a limitation on its measurement, which is the smallest calibration on it (precision).*

— *A ruler marked in cm can only measure to the nearest half-cm (uncertainty).*

— *You cannot be sure that the manufacturer built the measuring device properly (accuracy).*

Exemplar 1

(2 Marks)

All objects have a margin of error.

Mark: 0 out of 2
Rationale: - Incorrect response

Exemplar 2

(2 Marks)

You can never measure the exact length of an object because all objects are different lengths. Some are longer or shorter.

Mark: 0 out of 2
Rationale: - Incorrect response

Exemplar 3

(2 Marks)

Because the object's length can lie in between the tick marks of a ruler.

Mark: 2 out of 2
Rationale: - Correct response (2 marks)

Question 28   (2 Marks)

A manufacturer drills a hole into a board. An employee measures the diameter of the hole to be 4.37 mm. She knows that the device used to measure the hole has an uncertainty of 0.02 mm. Express the minimum and maximum diameters of the hole in mm.

Minimum Diameter: _____

Maximum Diameter: _____

Answer:

Minimum Diameter: ___*4.35 (mm)*___ ← *1 mark*

Maximum Diameter: ___*4.39 (mm)*___ ← *1 mark*

Note to marker: *"mm" not required*

Exemplar 1

(2 Marks)

Minimum Diameter: **0.02**

Maximum Diameter: **4.37**

Mark: 0 out of 2
Rationale: - Incorrect answers

Exemplar 2

(2 Marks)

Minimum Diameter: 2.18

Maximum Diameter: 2.20

4.37 mm − 0.02 = 4.35 mm

4.35 mm ÷ 2 = 2.18 mm

0.02 + 2.18 mm = 2.20 mm

Mark: 0 out of 2
Rationale: - Incorrect answers

Exemplar 3

(2 Marks)

Minimum Diameter: 4.37 - 0.02

Maximum Diameter: 4.37 + 0.02

Mark: 2 out of 2
Rationale: - Two correct answers (2 × 1 mark)

Test Item and Marking Guide

An engineering drawing states that a certain part has the following length:

$$4.2 \atop 4.0 \; mm$$

Express the nominal value and tolerance for this part, in mm.

Nominal value: _____

Tolerance: _____

Answer:

Nominal value: _____*4.1 (mm)*_____ ← *1 mark*

Tolerance: _____$\pm$ *0.1 (mm) or 0.2 (mm)*_____ ← *1 mark*

Note to marker: *"mm" not required.*

Exemplar 1 (2 Marks)

Nominal value: __0.1mm__

Tolerance: __±0.05mm__

Mark: 0 out of 2
Rationale: - Incorrect answers

Exemplar 2 (2 Marks)

Nominal value: __0.2__

Tolerance: __0.2__

Mark: 1 out of 2
Rationale: - One correct answer (tolerance) (1 mark)

Exemplar 3 (2 Marks)

Nominal value: __4.1__

Tolerance: __0.1__

Mark: 1 out of 2
Rationale: - One correct answer (nominal value) (1 mark)

Question 30

Test Item and Marking Guide

Tolerance is often used in construction, commercial, industrial, or artistic applications.

Demonstrate one use of tolerance in the real world by performing the following two steps:

- State a specific example where tolerance is used.
- Support your example with a written explanation, or with other information or evidence, of how tolerance is used.

Answer:

2 marks for example with support

Exemplar 1

(2 Marks)

When dealing with very small objects and measurements.

Mark: 0 out of 2
Rationale: - Incorrect response

Exemplar 2

(2 Marks)

You need a small tolerance on a cap for a pen. Caps don't stay on if it is too big or too small.

Mark: 2 out of 2
Rationale: - Correct response (2 marks)

Exemplar 3

(2 Marks)

A situation where you would require a small tolerance value would be when dealing with car parts. If a car part is even decimals of a millimetre off they won't fit or work properly.

Mark: 2 out of 2
Rationale: - Correct response (2 marks)

Statistics

You are given the following set of marks from a recent quiz:

7	4.5	2.5	8.5	4	7	4.5	9.5	6.5

Express the mean and median for this set of marks.

Mean: _____

Median: _____

Answer:

Mean: _____6_____   ← *1 mark*

Median: ____6.5____   ← *1 mark*

Test Item and Marking Guide

Question 32 (2 Marks)

Explain why a student might request that her course mark be calculated using a "trimmed mean" method.

Answer:

The student may have had one very bad mark that was not indicative of the student's normal performance (it was an outlier).

Test Item and Marking Guide

Exemplar 1 (2 Marks)

BECAUSE IT TAKES OFF THE LOWER SCORE AND THE HIGHEST SCORE. THIS WOULD TELL YOU AN EQUAL AVERAGE.

Mark: 0 out of 2
Rationale: - Incorrect response

Exemplar 2 (2 Marks)

To have an equal mark by taking the high and low numbers out of data, then take the rest numbers and add, then divide by how many numbers there are.

Mark: 0 out of 2
Rationale: - Incorrect response

Exemplar 3 (2 Marks)

If there are any outliers (marks far different from average) that are a lot lower than average, using trimmed mean would take out the low outliers making the mean better for the student.

Mark: 2 out of 2
Rationale: - Correct response (2 marks)

Question 33 (4 Marks)

Jim had the following results during his recent mathematics course:

Term: 400 out of a possible 500 marks
Final Exam: 30 out of a possible 50 marks

A) Calculate Jim's final mark if the teacher weights the term and final exam marks equally. (2 marks)

Answer:

$$\text{Term:} \quad \frac{400}{500} = 80\%$$

$$\text{Final Exam:} \quad \frac{30}{50} = 60\%$$

$\left. \right\}$ *1 mark for process*

$$\text{Mean:} \quad \frac{80\% + 60\%}{2}$$
$$= 70\% \quad \leftarrow \textit{1 mark}$$

B) Calculate Jim's final mark if the teacher gives an 80% weight to the term and a 20% weight to the final exam. (2 marks)

Answer:

$$\text{Weighted mean:} \quad \begin{aligned} (80\%)(80\%) + (60\%)(20\%) \\ = 64\% + 12\% \end{aligned}$$ *1 mark for process*

$$= 76\% \quad \leftarrow \textit{1 mark}$$

Exemplar 1 (4 Marks)

A)

$400 + 30 = 430$

$500 + 50 = 550$ $= 78 \times 100$

$\dfrac{430}{550} = 78$ $= 78\%$

B)

$\dfrac{400}{500} = 0.80$ $\dfrac{30}{50} = 0.6$

Mark: 0 out of 4
Rationale: - Incorrect solutions

Exemplar 2 (4 Marks)

A)

$\dfrac{400}{500} \times 100 = 80\%$

$\dfrac{30}{50} \times 100 = 60\%$

B)

$80\% \times 60\%$

$= 0.48$

$= 48\%$

Mark: 1 out of 4
Rationale: - Correct process in Part A (1 mark)

Exemplar 3 (4 Marks)

A)

$= \dfrac{400 \times 50}{500} + \dfrac{30 \times 50}{50}$

$= \quad 40 \quad + \quad 30$

$= 70\%$

B)

$= \dfrac{400 \times 80}{500} + \dfrac{30 \times 20}{50}$

$= \quad 64 \quad + \quad 12$

$= 76\%$

Mark: 4 out of 4
Rationale: - Correct solution in Part A (2 × 1 mark)
           - Correct solution in Part B (2 × 1 mark)

Question 34 (3 Marks)

The following measurements represent the weights (in pounds) of players on a football team:

Players' Weights (in pounds)			
225	250	270	295
225	250	280	300
230	250	285	315
245	265	295	320

Calculate the percentile rank of a player that weighs 250 pounds.

Answer:

$$P = \left[\frac{B + 0.5E}{n}\right] \times 100$$

$$P = \left[\frac{4 + 0.5(3)}{16}\right] \times 100 \begin{cases} \textit{No mark for 1 correct substitution} \\ \textit{OR} \\ \textit{1 mark for 2 correct substitutions} \\ \textit{OR} \\ \textit{2 marks for all correct substitutions} \end{cases}$$

P = 34.3
∴ *34 or 34th percentile or* P_{34} ← *1 mark*

OR

∴ *35 or 35th percentile or* P_{35} ← *1 mark*

Note to marker: *accept* $\frac{4}{16} = P_{25}$

Exemplar 1
<div align="right">(3 Marks)</div>

$$P = \frac{(4 + 0.5(3))}{16} \times 100$$

$$= 1.75 \times 100$$

$$= 175$$

Mark: 2 out of 3

Rationale: - All correct substitutions (2 marks)

Exemplar 2
<div align="right">(3 Marks)</div>

$$P = \frac{(B + 0.5E)}{n} \times 100$$

$$= \frac{(4 + 0.5(4))}{16} \times 100$$

$$= P_{38}$$

Mark: 2 out of 3

Rationale: - Two correct substitutions (1 mark)
- Correct answer (follow-through error) (1 mark)

Exemplar 3
<div align="right">(3 Marks)</div>

$$P = \frac{(B + 0.5E)}{n} \times 100$$

$$= \frac{(4 + 0.5(3))}{16} \times 100$$

$$= 35\%$$

Mark: 2 out of 3

Rationale: - All correct substitutions (2 marks)
- Incorrect answer (conceptual error)

Appendix:

Irregularities in Provincial Tests

A Guide for Local Marking

During the marking of provincial tests, irregularities are occasionally encountered in test booklets. The following list provides examples of irregularities for which an *Irregular Test Booklet Report* should be completed and sent to the Department:

- completely different penmanship in the same test booklet
- incoherent work with correct answers
- notes from a teacher indicating how he or she has assisted a student during test administration
- student offering that he or she received assistance on a question from a teacher
- student submitting work on unauthorized paper
- evidence of cheating or plagiarism
- disturbing or offensive content
- no responses provided by the student (all "NR") or only incorrect responses ("0")

Student comments or responses indicating that the student may be at personal risk of being harmed or of harming others are personal safety issues. This type of student response requires an immediate and appropriate follow-up at the school level. In this case, please ensure the Department is made aware that follow-up has taken place by completing an *Irregular Test Booklet Report*.

Except in the case of cheating or plagiarism where the result is a provincial test mark of 0%, it is the responsibility of the division or the school to determine how they will proceed with irregularities. Once an irregularity has been confirmed, the marker prepares an *Irregular Test Booklet Report* documenting the situation, the people contacted, and the follow-up. The original copy of this report is to be retained by the local jurisdiction and a copy is to be sent to the Department along with the test materials.

Irregular Test Booklet Report

Test: _____

Date marked: _____

Booklet No.: _____

Problem(s) noted: _____

_____

_____

_____

_____

Question(s) affected: _____

_____

_____

Action taken or rationale for assigning marks: _____

_____

_____

_____

_____

_____

_____

Follow-up: _____

_____

_____

_____

_____

_____

Decision: _____

_____

_____

_____

_____

_____

_____

Marker's Signature: _____

Principal's Signature: _____

For Department Use Only—After Marking Complete

Consultant: _____

Date: _____