Grade 12
Essential Mathematics
Achievement Test

Marking Guide

June 2014

Manitoba

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Available in alternate formats upon request.

Contents

Marking Guidelines

The *Grade 12 Essential Mathematics Achievement Test: Marking Guide (June 2014)* is based on *Grades 9 to 12 Mathematics: Manitoba Curriculum Framework of Outcomes* (2009).

Please make no marks in the student test booklets. If the booklets have marks in them, the marks need to be removed by departmental staff prior to sample marking should the booklet be selected.

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.

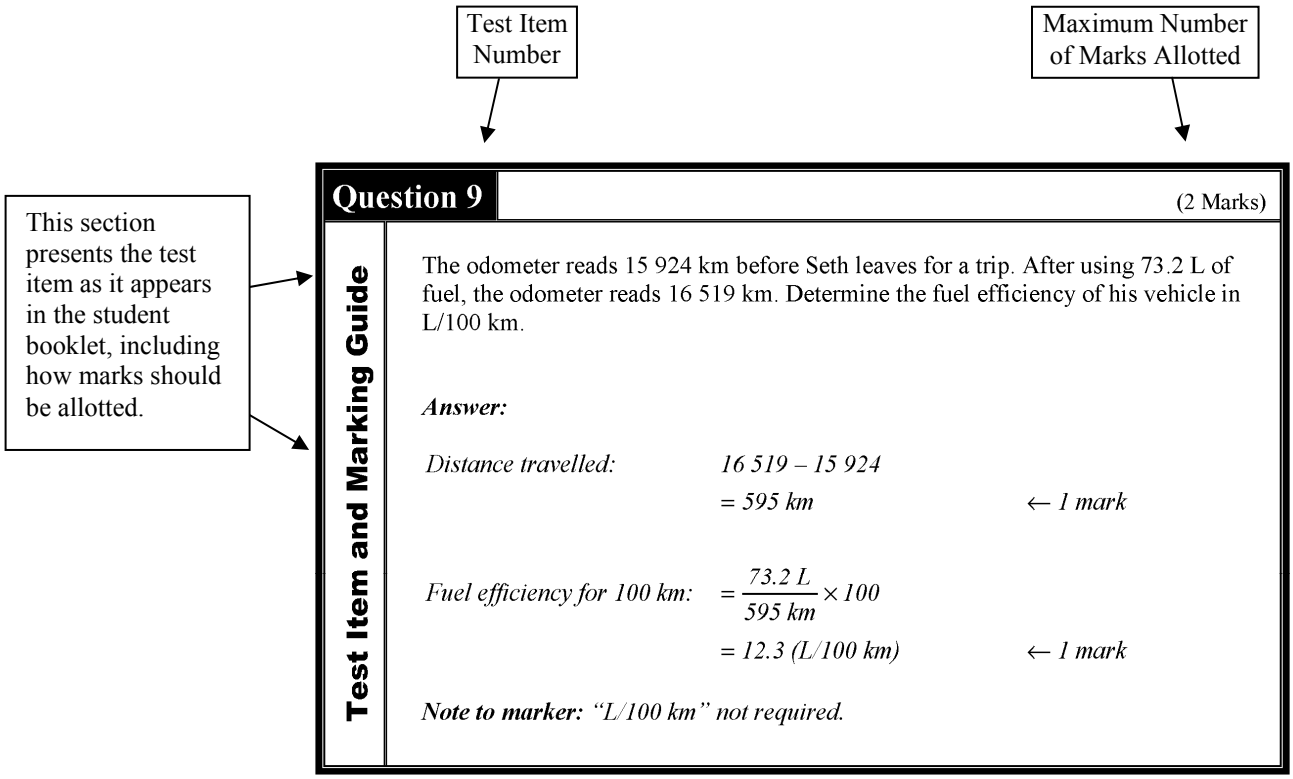
Irregularities in Provincial Tests

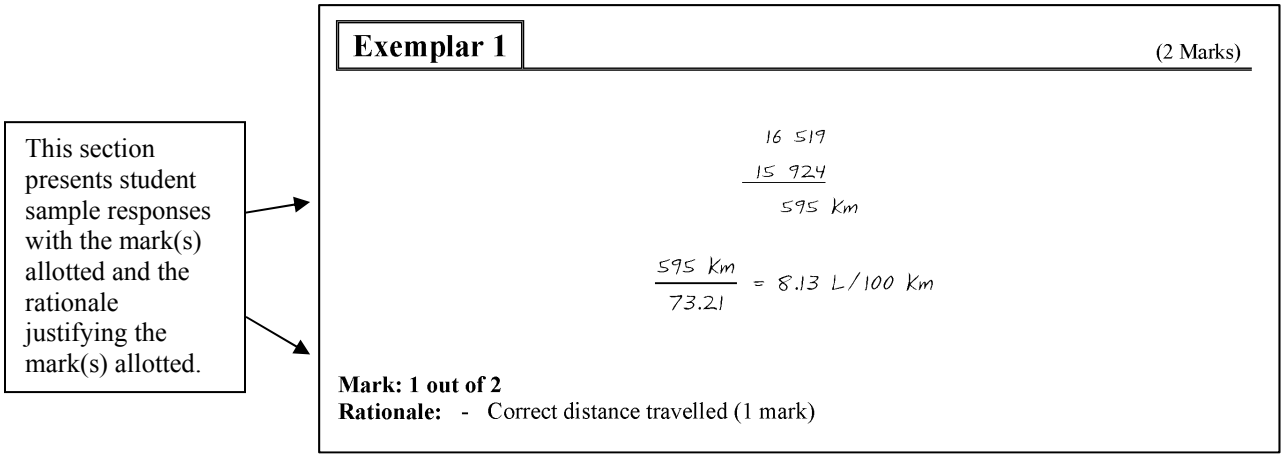
During the administration of provincial tests, supervising teachers may encounter irregularities. Markers may also encounter irregularities during local marking sessions. The appendix provides examples of such irregularities as well as procedures to follow to report irregularities.

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:





Home Finance

Question 1

(1 Mark)

Test Item and Marking Guide

A new homeowner has the following costs:

Monthly heating cost	$150
Mortgage	$925
Land transfer tax	$250
Home insurance	$1000
Property tax adjustment	$200
Property tax	$1200

Identify a one-time (or additional) cost from the above list.

Answer:

Land transfer or property tax adjustment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Question 2

(4 Marks)

Test Item and Marking Guide

Complete the following amortization table by filling in the empty boxes.

Date	Payment	Interest	Principal	Unpaid Balance
April 15	\$789.00	\$500.00	\$289.00	\$149 711.00
May 15	\$789.00	\$499.04		\$149 421.04
June 15		\$498.07	\$290.93	
July 15	\$789.00		\$291.90	\$148 838.21

Answer:

Date	Payment	Interest	Principal	Unpaid Balance
April 15	\$789.00	\$500.00	\$289.00	\$149 711.00
May 15	\$789.00	\$499.04	***\$289.96***	\$149 421.04
June 15	***\$789.00***	\$498.07	\$290.93	***\$149 130.11***
July 15	\$789.00	***\$497.10***	\$291.90	\$148 838.21

(4 × 1 mark)

Note to marker: *Answers must be exact.*

Exemplar 1

(4 Marks)

Date	Payment	Interest	Principal	Unpaid Balance
April 15	$789.00	$500.00	$289.00	$149 711.00
May 15	$789.00	$499.04	289.96	$149 421.04
June 15	789.00	$498.07	$290.93	149 131.08
July 15	$789.00	497.09	$291.90	$148 838.21

Mark: 2 out of 4

Rationale: - Two correct answers (payment and principal) (2 × 1 mark)
- Incorrect answers (interest and unpaid balance)

Question 3

(4 Marks)

Test Item and Marking Guide

The monthly heating payment for a home is $250.

A) State the homeowner's heating costs for 5 years. (1 mark)

Answer:

$250 \times 12 \times 5$

$= \$15\,000$ $\leftarrow$ *1 mark*

B) If the homeowner installs new windows, it will reduce the heating costs by 30%. Calculate the homeowner's expected heating costs for 5 years if new windows are installed. (2 marks)

Answer:

$$\$15\,000 - \underbrace{(0.3)(\$15\,000)}_{1 \text{ mark}} = \underbrace{\$10\,500}_{1 \text{ mark}}$$

OR

$$\$15\,000 \times \underbrace{0.70}_{1 \text{ mark}} = \underbrace{\$10\,500}_{1 \text{ mark}}$$

C) The total cost for the windows is $12 000. Explain whether replacing the windows is a good financial decision. (1 mark)

Answer:

No, because the owner will spend an additional $7500 over 5 years if new windows are installed.

OR

Yes, because installing new windows will increase the value of the home.

OR

No, the owner saves $4500 but spends $12 000.

Exemplar 1

(4 Marks)

A) 5 x 12 = 60
250 x 60 = $15 000

B) 250 x .30 = $75 / month
75 x 60 = $4500

C) I think it is a good decision because they would be paying $15 000 in 5 years with the older windows and with the new ones they would only pay $4500 in 5 years. It's a better decision in the long run.

Mark: 3 out of 4

Rationale:
- Correct answer in Part A (1 mark)
- Correct calculation in Part B (savings) (1 mark)
- Correct response in Part C (follow-through error) (1 mark)

Exemplar 2

(4 Marks)

A) ₵250 x 5 = ₵1250
It will cost ₵1250 over the next 5 years to heat his home.

B) 1250 x 0.30 = 375
1250 - 375 = ₵875 it costs with new windows to heat his house over the next 5 years

C) It is not a good decision because he only saves ₵375 dollars over 5 years. So spending ₵12 000 dollars is a waste of time because he will have to save up that will take him a while.

Mark: 3 out of 4

Rationale:
- Incorrect answer in Part A
- Correct solution in Part B (follow-through error) (2 × 1 mark)
- Correct response in Part C (follow-through error) (1 mark)

Exemplar 3

(4 Marks)

A) $250 x 60 = $15 000.00
(12 x 5 = 60)
The homeowners heating cost over a duration of 5 years will cost $15 000.00

B) $250 x .3 = 75
250 - 75 = $175
$175 x 60 = $10 500.00
With the windows installed, the heating cost over a duration of 5 years changes to $10 500.00. (saves $4500)

C) ($12 000.00 - $4500.00 = $7500)
It does not seem like a good financial decision because you are ultimately spending more than you save. Although if you look at the $12 000 investment on a longer duration of time rather than the 5 years, then it will possibly be worth it. (you're saving more money over time)

Mark: 4 out of 4

Rationale:
- Correct answer in Part A (1 mark)
- Correct solution in Part B (2 × 1 mark)
- Correct response in Part C (1 mark)

Question 4

(2 Marks)

Test Item and Marking Guide

A couple has chosen a house to purchase. The bank calculates the couple's Gross Debt Service Ratio (GDSR) to be 40%. State two ways the couple could decrease their GDSR.

Sample answers:

- *Get another job/earn more money.*
- *Negotiate a lower interest rate to decrease the mortgage payment.*
- *Lengthen the amortization period to decrease the mortgage payment.*
- *Increase the down payment to decrease the mortgage payment.*
- *Decrease the heating costs.*

(2 × 1 mark)

Exemplar 1

(2 Marks)

The couple could decrease their GDSR by cutting down their mortgage payments that are monthly or how much they want to pay on property tax.

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

Exemplar 2

(2 Marks)

They could save up more money for a down payment, or look for a different house that doesn't cost as much.

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

Exemplar 3

(2 Marks)

They could try and lower the heating cost and could make more money.

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

Question 5

(2 Marks)

Test Item and Marking Guide

Homeowners pay a Land Transfer Tax when purchasing a property. This tax is calculated as follows:

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%

Calculate the Land Transfer Tax due on a property valued at \$90 000.

Answer:

First \$30 000: *no tax or \$0* ← *1 mark*

Next \$60 000: $\$60\,000 \times 0.005$
$= \$300$ ← *1 mark*

OR

Taxable amount: $\$90\,000 - \$30\,000$
$= \$60\,000$ ← *1 mark*

Tax payable: $\$60\,000 \times 0.005$
$= \$300$ ← *1 mark*

Exemplar 1

(2 Marks)

90 000 x 0.005 = 450

Mark: 1 out of 2
Rationale: - Incorrect taxable amount
- Correct solution (follow-through error) (1 mark)

Exemplar 2

(2 Marks)

$300

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

Exemplar 3

(2 Marks)

NEXT $60 000

$1300

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

Question 6

(4 Marks)

Test Item and Marking Guide

State two benefits of owning a house and two benefits of renting a property assuming the monthly payments are the same.

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

Sample answers:

Benefit of owning a house	Benefit of renting a property
– *equity* – *landlord approval not required for renovations* – *acts as an investment (asset)*	– *no maintenance costs* – *lower insurance cost* – *no property tax*

(4 × 1 mark)

Exemplar 1

(4 Marks)

Benefit of owning a house	Benefit of renting a property
- house belongs to you - can renovate how you want to	- you don't insure the building - cheaper

Mark: 2 out of 4
Rationale: - One correct benefit of owning (renovate) (1 mark)
- One correct benefit of renting (insure) (1 mark)

Exemplar 2

(4 Marks)

Benefit of owning a house	Benefit of renting a property
- you can have pets - you can smoke in your own house	- no yard work - owner pays for anything that goes wrong

Mark: 4 out of 4
Rationale: - Two correct benefits of owning (2 × 1 mark)
- Two correct benefits of renting (2 × 1 mark)

Exemplar 3

(4 Marks)

Benefit of owning a house	Benefit of renting a property
– it is your own and you can make as many changes as you like – money spent actually goes towards owning that house versus just going to rent	– utilities are included in rent – no maintenance costs

Mark: 4 out of 4
Rationale: - Two correct benefits of owning (2 × 1 mark)
- Two correct benefits of renting (2 × 1 mark)

Vehicle Finance

Question 7

(4 Marks)

Test Item and Marking Guide

John wants to lease a vehicle for 3 years. The monthly lease payment is $650. A down payment of $5000 is required. All taxes are included in the payments.

A) Calculate the total cost of the lease. (2 marks)

Answer:

$\$650 \times 36$

$= \$23\,400$ ← *1 mark*

$\$23\,400 + \$5000$

$= \$28\,400$ ← *1 mark*

B) John decides to purchase the vehicle at the end of the lease. The initial value of the vehicle was $45 000 including taxes. Its residual value after 3 years is 45%. Calculate the total amount he will pay for the vehicle. (2 marks)

Answer:

Residual value: $\$45\,000 \times 0.45$

$= \$20\,250$ ← *1 mark*

Total amount: $\$28\,400 + \$20\,250$

$= \$48\,650$ ← *1 mark*

Exemplar 1

(4 Marks)

A) $650 \times 1.13 = \$734.50$

$36 \times 734.50 + 5000 = \$31\,442$

B) $\$45\,000 \times 0.45 = \$20\,250 \times 1.13 = \$22\,882.50$

$\$22\,882.50 + \$31\,442 = \$54\,324.50$

Mark: 2 out of 4

Rationale:
- Incorrect lease payment in Part A
- Correct solution in Part A (follow-through error) (1 mark)
- Incorrect calculation in Part B (residual value)
- Correct solution in Part B (follow-through error) (1 mark)

Exemplar 2

(4 Marks)

A)

3	650	\$23 400
× 12	× 36	+ 5000
36	\$23 400	\$28 400

B)

\$45 000	45 000
× 45%	− 20 250
\$20 250	\$24 750

Mark: 3 out of 4

Rationale:
- Correct solution in Part A (2 × 1 mark)
- Correct calculation in Part B (residual value) (1 mark)

Exemplar 3

(4 Marks)

A) $(1.13)(\$650) = \$734.50$ ← after tax

tax

cost of lease = (5000) + (3 yrs)(734.50) = \$7203.50

Down pay

B $(0.45)(45\,000) = \$20\,250$

7203.50

$+ 20\,250$

$\$27\,453.50$ ← after 3 years

Mark: 3 out of 4

Rationale:
- Incorrect lease payment in Part A
- Correct solution in Part A (follow-through error) (1 mark)
- Correct solution in Part B (follow-through error) (2 × 1 mark)

Question 8

(2 Marks)

Test Item and Marking Guide

Describe one benefit of buying a new vehicle and one benefit of buying a used vehicle.

Benefit of buying a new vehicle	Benefit of buying a used vehicle

Sample answers:

Benefit of buying a new vehicle	Benefit of buying a used vehicle
– *better warranty* – *choice of options* – *newer technology (safety, Bluetooth, backup cameras)*	– *cheaper insurance* – *cheaper cost for same type of vehicle* – *no GST (private sale)*

1 mark for each correct response (2 × 1 mark)

Exemplar 1

(2 Marks)

Benefit of buying a new vehicle	Benefit of buying a used vehicle
– no surprises	– you don't have to pay taxes when you buy it – cheaper

Mark: 0 out of 2
Rationale: - Incorrect responses

Exemplar 2

(2 Marks)

Benefit of buying a new vehicle	Benefit of buying a used vehicle
– new car smell	– cheaper than new because of depreciation

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

Exemplar 3

(2 Marks)

Benefit of buying a new vehicle	Benefit of buying a used vehicle
– You're the first owner so you don't need to worry or care about previous wear on the vehicle.	– Your insurance on your vehicle will be cheaper due to the year, model and make.

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

Question 9

(2 Marks)

Test Item and Marking Guide

The odometer reads 15 924 km before Seth leaves for a trip. After using 73.2 L of fuel, the odometer reads 16 519 km. Determine the fuel efficiency of his vehicle in L/100 km.

Answer:

Distance travelled: $16\,519 - 15\,924$

$= 595 \text{ km}$ ← *1 mark*

Fuel efficiency for 100 km: $= \frac{73.2 \text{ L}}{595 \text{ km}} \times 100$

$= 12.3 \text{ (L/100 km)}$ ← *1 mark*

Note to marker: *"L/100 km" not required.*

Exemplar 1

(2 Marks)

$$\begin{array}{r} 16\ 519 \\ -\ 15\ 924 \\ \hline 595\ km \end{array}$$

$$\frac{595\ km}{73.21} = 8.13\ L/100\ km$$

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

Exemplar 2

(2 Marks)

$$16\ 519 - 15\ 924$$

$$\frac{73.2 \times 595}{1000} = \boxed{43.55\ FE}$$

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

Exemplar 3

(2 Marks)

$$\begin{array}{r} 16\ 519 \\ -\ 15\ 924 \\ \hline 577\ km \end{array}$$

$$FE = \frac{73.2 \times 100}{577}$$

$$FE = 12.7\ L / 100\ km$$

Mark: 1 out of 2
Rationale: - Incorrect distance travelled
- Correct solution (follow-through error) (1 mark)

Question 10

(4 Marks)

Test Item and Marking Guide

Brian bought a car valued at $28 600. It depreciates at 20% per year. Complete the table to find the value of the vehicle after 2 years.

Year	Vehicle Value	Depreciation Amount	Year-end Value of Vehicle
1	$28 600		
2			

Answer:

Year	Vehicle Value	Depreciation Amount	Year-end Value of Vehicle
1	$28 600	$\$28\,600 \times 0.2 = \underbrace{\$5720}_{1\ mark}$	$\$28\,600 - \$5720 = \underbrace{\$22\,880}_{1\ mark}$
2	*$22 880*	$\$22\,880 \times 0.2 = \underbrace{\$4576}_{1\ mark}$	$\$22\,880 - \$4576 = \underbrace{\$18\,304}_{1\ mark}$

(4 × 1 mark)

Exemplar 1

(4 Marks)

Year	Vehicle Value	Depreciation Amount	Year-end Value of Vehicle
1	$28 600	$57.20	$28 542.80
2	28 542.80	$57.08	$28 485.72

Mark: 2 out of 4
Rationale: - Incorrect calculations (depreciation)
- Two correct answers (follow-through error) (2 × 1 mark)

Exemplar 2

(4 Marks)

Year	Vehicle Value	Depreciation Amount	Year-end Value of Vehicle
1	$28 600	28 600 × 0.20 = $5720	28 600 + 5720 = $34 320
2	$34 320	34 320 × 0.20 = $6864	34 320 + 6864 = $41 184

Mark: 2 out of 4
Rationale: - One correct answer (year 1 depreciation) (1 mark)
- One correct answer (year 2 depreciation) (follow-through error) (1 mark)

Exemplar 3

(4 Marks)

Year	Vehicle Value	Depreciation Amount	Year-end Value of Vehicle
1	$28 600	28 600 – 5720	22 880
2	22 880	28 880 – 4576	18 304

Mark: 2 out of 4
Rationale: - Two correct answers (year-end values) (2 × 1 mark)

Question 11

(3 Marks)

Test Item and Marking Guide

Joe borrows $16 750 at 7% over 5 years to purchase a car.

A) Calculate his monthly payment. (2 marks)

Answer:

$$\frac{16\,750}{1000} \times \underbrace{19.80}_{1\ mark} = \underbrace{\$331.65}_{1\ mark}$$

Note to marker: *Award 1 mark if the correct table value is indicated.*

B) State the amount of interest paid in the first month. (1 mark)

Answer:

$$16\,750 \times 0.07 \times \frac{1}{12}$$
$$= \$97.71 \qquad \leftarrow 1\ mark$$

Note to marker: *Allow for various roundings.*

Exemplar 1

(3 Marks)

A) 16 750 x 0.07 x 5 = 5862.50

58 652.50 ÷ 12 = $488.54

B)

Mark: 0 out of 3
Rationale: - Incorrect solution in Part A
- Incorrect answer in Part B

Exemplar 2

(3 Marks)

A) 19.80 X 12 X 5 = $1188

B) 1188 X 0.07 = $83.16

Mark: 1 out of 3
Rationale: - Correct table value in Part A (1 mark)
- Incorrect answer in Part B

Exemplar 3

(3 Marks)

A) $\frac{16\,750}{1000} \times 19.80 = \$331.65$

B) 16 750 x .07 x 5 = $5862.50

5862.5 ÷ 5 ÷ 12 = $97.71

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

Question 12

(1 Mark)

Test Item and Marking Guide

Choose the letter that best completes the statement below.

When insuring a vehicle in Manitoba, the factor that affects your premium is:

a) your education
b) where you live
c) your gender
d) the insurance agent you purchase from
e) your age

Answer: *b)*


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Precision Measurement

Question 13

(2 Marks)

Test Item and Marking Guide

State a measurement situation where a degree of precision would be required. Justify your answer.

Sample answers:

- *A clock would require a precision of 1 minute, so that people can know the time/be on time.*
- *A thermometer used to determine body temperature would require a precision of 0.1ºC/ºF, to know whether medical treatment is necessary.*
- *A weigh scale at the post office would require a precision of 0.1 kg, because mailing costs are determined by weight.*

Exemplar 1

(2 Marks)

When constructing a wheelchair ramp. If it is too high, someone in a wheel chair could fall over, it if's too low it might not reach the door.

Mark: 0 out of 2
Rationale: - Incorrect response

Exemplar 2

(2 Marks)

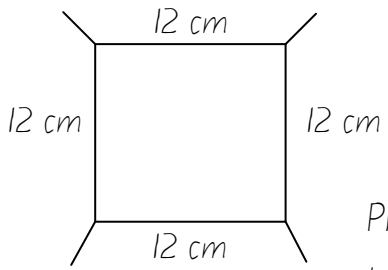
Building a house, putting a window in, it has to fit tight but can have a little bit of tolerance on each side.

Mark: 0 out of 2
Rationale: - Incorrect response

Exemplar 3

(2 Marks)

When your measuring if your table will fit in the space provided.



Precision = 1 cm

Uncertainty = 0.5 cm

Mark: 0 out of 2
Rationale: - Incorrect response

Question 14

(2 Marks)

Test Item and Marking Guide

Dave wants to install three new cupboards in his bathroom. Each cupboard is 40 cm wide. He measured the space to be 120 cm wide. Explain why the cupboards may not fit using one of the following concepts: accuracy, tolerance, or uncertainty.

Sample answers:

Accuracy

A measuring tape used to measure cupboards (or space) may not be accurate. A reading of 40 cm on the tape may actually be 41 cm and so even though the cupboards were precisely measured, it would not fit in 120 cm of space (cupboards would need 123 cm).

OR

Tolerance

Cupboard specifications may have been $40\ cm \pm 1\ cm$. The three cupboards may meet the specifications but the sum could be more than 120 cm and not fit in the space.

OR

Uncertainty

A measuring tape whose smallest unit of precision is 1 cm would have an uncertainty of 0.5 cm. Consequently, if the cupboards were accurately measured to 40 cm, the uncertainty could add another 0.5 cm to each cupboard and the three cupboards would not fit in the space.

Exemplar 1

(2 Marks)

40 × 3 = 120

They may not fit by 5 mm because the precision we have is in cm so the cupboards may be 5 mm too big or too small.

Mark: 0 out of 2
Rationale: - Incorrect response

Exemplar 2

(2 Marks)

40 X 3 = 120

They may not fit because it would be too close of a fit and it might not be as accurate as you.

Mark: 0 out of 2
Rationale: - Incorrect response

Exemplar 3

(2 Marks)

The cupboards may not fit because of the uncertainty of measuring devices. Measuring devices can't get the points in between their lines and if the cupboard lies in between then something will be wrong.

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

Question 15

(2 Marks)

Test Item and Marking Guide

A manufacturer creates ball bearings with diameters that have nominal values of 5 cm and tolerances of 0.02 cm. State the minimum and maximum diameter of a ball bearing if the nominal value is the midpoint of the tolerance range.

Minimum: _____

Maximum: _____

Answer:

Minimum: *4.99 (cm)* ← *1 mark*

Maximum: *5.01 (cm)* ← *1 mark*

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

Exemplar 1

(2 Marks)

Minimum: - 0.02

Maximum: + 0.02

Mark: 0 out of 2
Rationale: - Incorrect answers

Exemplar 2

(2 Marks)

Minimum: 4.98 cm

Maximum: 5.02 cm

Mark: 1 out of 2
Rationale: - Incorrect answer (minimum)
- Correct answer (maximum) (follow-through error) (1 mark)

Exemplar 3

(2 Marks)

Minimum: 5 -0.01 cm

Maximum: 5 +0.01 cm

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

Question 16

(2 Marks)

Test Item and Marking Guide

Given the following diagram of a measuring device:

State the precision and uncertainty of the measuring device:

Precision: _____

Uncertainty: _____

Answer:

Precision: *5 (cm)* ← *1 mark*

Uncertainty: *2.5 (cm) or ± 2.5 (cm)* ← *1 mark*

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

Exemplar 1

(2 Marks)

Precision: 10 cm

Uncertainty: 5 mm

Mark: 0 out of 2
Rationale: - Incorrect answers

Exemplar 2

(2 Marks)

Precision: multiples of 5

Uncertainty: anything in between

Mark: 0 out of 2
Rationale: - Incorrect answers

Exemplar 3

(2 Marks)

Precision: 1 cm

Uncertainty: 5 mm

Mark: 1 out of 2
Rationale: - Incorrect answer (precision)
- Correct answer (uncertainty) (follow-through error) (1 mark)

Question 17

(2 Marks)

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 of how tolerance is used.

Answer:

2 marks for example with support

Exemplar 1

(2 Marks)

Tolerance could be used if you were putting a statue in a display case in a museum. If the display was 6 ft tall and so was the statue, you'd want to either make the display 6.02 feet tall or the statue 5.98 feet tall so that it would for sure fit into the display.

Mark: 0 out of 2
Rationale: - Incorrect response

Exemplar 2

(2 Marks)

Tolerance is used when trying to set the oven temperature for baking. The recipe says you need 305°F but some ovens are different and might be a little bit off. like +/- 5°F so it could be 300°F or 310°F which should be fine. But too much of a tolerance for baking isn't good and the food won't turn out good.

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

Exemplar 3

(2 Marks)

Tolerance is used in many places in everyday lives, best example would be in the construction of shelves.

ex. you have to make an exact cut to 40 cm, the tolerance is ± 1 cm

maximum: 41 cm

Tolerance = 2 cm

minimum: 39 cm

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

Probability

Question 18

(2 Marks)

Test Item and Marking Guide

The first day of the month falls on a Sunday 48 times in 28 years.

A) State the probability of the first day of any given month falling on a Sunday. (1 mark)

Answer:

$28 \times 12 = 336$ *months*

$\frac{48}{336}$ *or* $\frac{1}{7}$ *or* $1:7$ *or* 0.143 *or* *one out of seven* ← *1 mark*

B) State the odds in favour of this happening. (1 mark)

Answer:

$336 - 48 = 288$

$48:288$ *or* $1:6$ *or* *one to six* ← *1 mark*

Note to marker: *Accept reduced ratios.*

Exemplar 1

(2 Marks)

A) 28 x 12m = 336 months
48 ÷ 336 = 0.14

B) 48 : 336

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

Exemplar 2

(2 Marks)

A) $\frac{48}{288}$

B) 48 : 240

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

Exemplar 3

(2 Marks)

A) 28 x 12 = 336
48 / 336

336 – 336, 160, 112, 84, 56, 28, 24, 14, 7
48 –

2 / 14

B) 48 : 288
or
2 : 12

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

Question 19

(2 Marks)

Test Item and Marking Guide

The probability of an eagle returning to the same nest year after year is $\frac{7}{8}$.

A) State this probability as a decimal. (1 mark)

Answer:

0.875

B) State the probability of the eagle **not** returning to the same nest. (1 mark)

Answer:

$\frac{1}{8}$ *or* *0.125* *or* *12.5%* *or* *1:8* *or* *1 in 8*

Exemplar 1

(2 Marks)

A) 0.75

B) 2/8

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

Exemplar 2

(2 Marks)

A) $P(\text{EAGLE}) = \frac{7}{8} = 0.875$

B) $P(\text{EAGLES NOT RETURNING TO THE SAME NEST}) = \frac{1}{8} = 0.125$

$= \underline{12.5\%}$

$P(\text{EAGLES NOT RETURNING TO THE SAME NEST}) = \frac{0}{8} = \underline{0\%}$

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

Exemplar 3

(2 Marks)

A) 0.88

B) 0.12

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

Question 20

(2 Marks)

Test Item and Marking Guide

The Cook Construction Company is bidding on a $200 000 contract to apply gravel on the roads in the Rural Municipality of Timber Valley. It costs the company $5250 to draft the bid. This company has a 10% chance of winning the contract.

Calculate the expected value of the Cook Construction Company's bid.

Answer:

$\$gain = \$200\,000 - \$5250 = \$194\,750$

$EV = P(win) \times \$gain - P(lose) \times \$loss$

$EV = \frac{1}{10}(\$194\,750) - \frac{9}{10}(\$5250)$ ← *1 mark for correct substitutions*

$= \$19\,475 - \$4725$

$= \$14\,750$ ← *1 mark*

OR

Average winnings: $\$200\,000 \times 0.10$
$= \$20\,000$ ← *1 mark*

Expected value: $\$20\,000 - \$5250$
$= \$14\,750$ ← *1 mark*

Exemplar 1

(2 Marks)

$200,000
- 5250
= $194 750

Mark: 1 out of 2
Rationale: - Incorrect calculation (average winnings)
- Correct solution (follow-through error) (1 mark)

Exemplar 2

(2 Marks)

EV = PW(Win) - bet
$194 750 = 0.10 (200 000) - 5250

Mark: 1 out of 2
Rationale: - Correct calculation (average winnings) (1 mark)

Exemplar 3

(2 Marks)

EV = (0.1)(200 000) - 5250
EV = 14 750

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

Question 21

(1 Mark)

Test Item and Marking Guide

Choose the letter that best completes the statement below.

Probability compares the number of favourable outcomes to

a) the likelihood of it not occurring
b) the total number of outcomes
c) the number of unfavourable outcomes
d) the likelihood of it occurring

Answer: *b)*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Question 22

(1 Mark)

Test Item and Marking Guide

The odds against hitting a moose on the highway are $193 : 7$. State the probability of hitting a moose.

Answer:

$\frac{7}{200}$ *or* 0.035 *or* 3.5% *or* $7 : 200$ *or* *seven out of 200*

Exemplar 1

(1 Mark)

$$\frac{193}{7} = \frac{7}{193} = 0.036$$

Mark: 0 out of 1
Rationale: - Incorrect answer

Exemplar 2

(1 Mark)

$$\frac{7}{193+7} = \frac{7}{200} \text{ or } 0.035 \text{ or } 10.5\%$$

Mark: 0 out of 1
Rationale: - Incorrect answer

Exemplar 3

(1 Mark)

$$\frac{7}{200} \qquad 193 + 7 = 200$$

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

Question 23

(2 Marks)

Test Item and Marking Guide

Eagle Motors has determined that the theoretical probability of a vehicle breaking down is 0.001. In a sample of 5000 vehicles, 100 have broken down.

A) State the experimental probability of an Eagle Motors vehicle breaking down. (1 mark)

Answer:

$\frac{100}{5000}$ *or* 0.02 *or* 2% *or* $100:5000$ *or* *100 out of 5000*

Note to marker: *Accept reduced answers.*

B) State the number of vehicles, from the 5000 sampled, that can be expected to break down based on the theoretical probability. (1 mark)

Answer:

5000×0.001

$= 5$ $\leftarrow$ *1 mark*

Exemplar 1

(2 Marks)

A) $\frac{100}{5000} = 0.02\%$

B) $\frac{5}{5000} = 0.001\%$

$100 = 0.02\%$
$\div 10 = 0.002\%$
$\div 2 = 0.001\%$

Mark: 0 out of 2
Rationale: - Incorrect answer in Part A
- Incorrect answer in Part B

Exemplar 2

(2 Marks)

A) 5000:100
5:1

B) Every 1 in 5 cars would break down

Mark: 0 out of 2
Rationale: - Incorrect answer in Part A
- Incorrect answer in Part B

Exemplar 3

(2 Marks)

A) 100 / 5000

B) 5 / 5000

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

Geometry and Trigonometry

Question 24

(2 Marks)

Test Item and Marking Guide

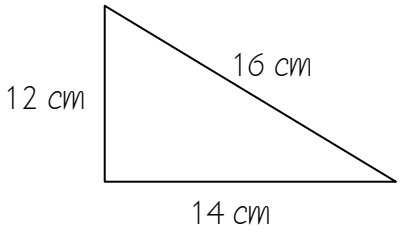
A triangle has sides of 12 cm, 14 cm, and 16 cm. Justify whether the triangle has two congruent angles.

Answer:

No, in order to have two congruent angles, two side lengths must be the same.

Exemplar 1

(2 Marks)

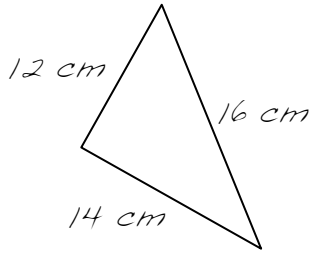


There are no congruent lines because all measurements are different

Mark: 0 out of 2
Rationale: - Incorrect response

Exemplar 2

(2 Marks)

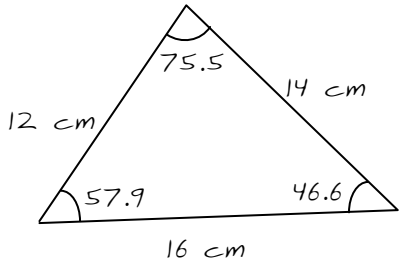


No, because it's a scalene triangle and all sides/angles are different.

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

Exemplar 3

(2 Marks)



$\frac{14^2 + 16^2 - 12^2}{2(14)(16)} \quad \frac{308}{448} = 46.6$

$\frac{12^2 + 16^2 - 14^2}{2(12)(16)} \quad \frac{204}{384} = 57.9$

No it does not have 2 congruent angles.

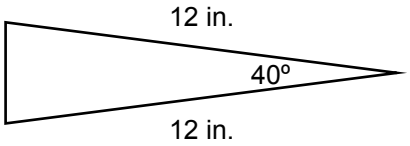
Mark: 2 out of 2
Rationale: - Correct response (2 marks)

Question 25

(3 Marks)

Test Item and Marking Guide

Johnny needs a wedge that will raise his bookshelf at least 4 inches.



A) Calculate the length of the third side of the wedge. (2 marks)

Answer:

$c^2 = a^2 + b^2 - 2ab\cos\theta$

$c^2 = 12^2 + 12^2 - 2(12)(12)\cos 40°$ ← *1 mark for correct substitution*

$c^2 = 144 + 144 - 220.6$

$c^2 = 67.4$

$c = \sqrt{67.4}$

$c = 8.2$ *(inches)* ← *1 mark*

B) Explain whether the wedge shown above will work for Johnny. (1 mark)

Answer:

It will work because the height is more than 4 inches.

Note to marker: *Various solutions exist, including those using Sine Law or right-angled trigonometry. Allow for various roundings.*

Exemplar 1

(3 Marks)

A) $(12) \sin 40 = X$

$X = 7.7$ in

B) It will work because he needs to raise his shelf at least 4 inches, and the wedge will only raise it 7.7 inches.

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

Exemplar 2

(3 Marks)

A) 8.2 inches

B) The wedge will work because it is more than 4 inches.

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

Exemplar 3

(3 Marks)

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

$a^2 = 12^2 + 12^2 - 2(12)(12)(\cos 40^\circ)$

$= 288 - 220.6$

$a^2 = \sqrt{67.4} = 8.2$

B) No

Mark: 2 out of 3
Rationale: - Correct solution in Part A (2 × 1 mark)
- Incorrect response in Part B

Question 26

(3 Marks)

Test Item and Marking Guide

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

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

- State a specific example where Cosine Law is used.
- Support your example with a written explanation of how Cosine 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

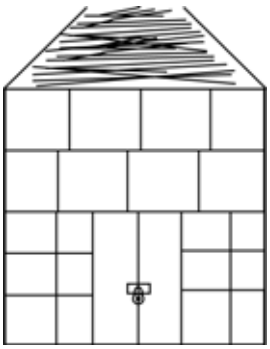
Exemplar 1

(3 Marks)

A) 1) When you need to figure out another side or angle of what it is you're making.

2) When building a shed, deck or house, you may need to know a side or the angle of it.

B)



Mark: 0 out of 3

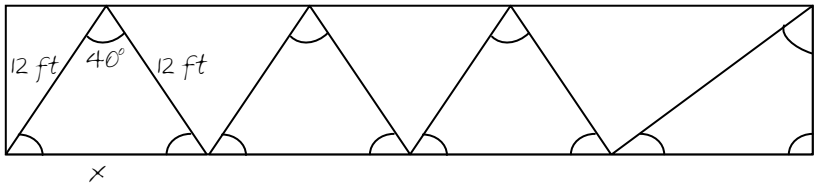
Rationale: - Incorrect response in Part A
- Incorrect sketch in Part B

Exemplar 2

(3 Marks)

A) Building Bridges
Determining the angles of how they need to be built.

B)



Mark: 1 out of 3

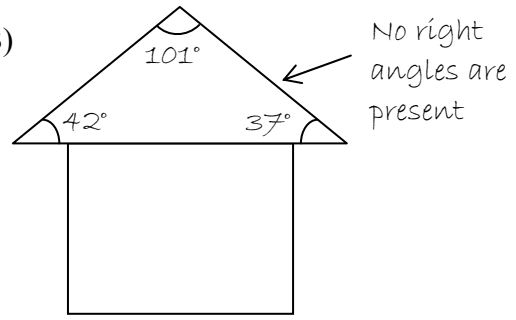
Rationale: - Incorrect response in Part A
- Correct sketch in Part B (1 mark)

Exemplar 3

(3 Marks)

A) In the construction of a roof, because a roof does not have a 90° angle you are unable to use SOHCAHTOA, therefore to be accurate on your sides and angles to be precise and prevent unnecessary matter from leaking in you will need to use the Cosine Law.

B)



Mark: 2 out of 3

Rationale: - Correct response in Part A (2 marks)
- Incorrect sketch in Part B

Question 27

(1 Mark)

Test Item and Marking Guide

Choose the letter that best completes the statement below.

If all sides of a 4-sided polygon are equal, then:

a) The adjacent angles are equal.
b) The quadrilateral is a square.
c) The diagonals intersect at 90º.
d) The diagonals do not bisect the interior angles of the quadrilateral.

Answer: *c)*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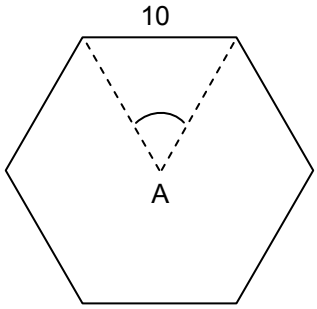
Question 28

(2 Marks)

Test Item and Marking Guide

A regular hexagon has a side length of 10 metres.

A) State the measure of angle A, the central angle, in degrees. (1 mark)



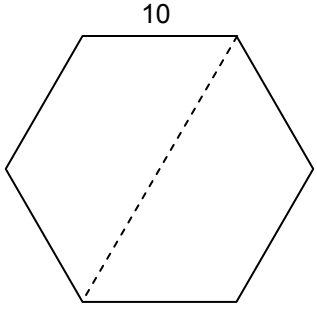
Answer:

$\frac{360^o}{6}$

$= 60^o$ ← *1 mark*

Note to marker: *Degrees not required.*

B) State the measure of the given diagonal in metres. (1 mark)



Answer:

$= 10 + 10$

$= 20$ (m) ← *1 mark*

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

Exemplar 1

(2 Marks)

A) $180(n-2)$ $(360 \div n)$

$180(10-2)$

$180(8) =$

1440

B) 30 m

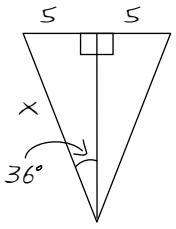
Mark: 0 out of 2

Rationale: - Incorrect answer in Part A
- Incorrect answer in Part B

Exemplar 2

(2 Marks)

A) $C = \frac{360°}{5} = 72°$

B) 

$72 \div 2 = 36°$ $\sin 36° = \frac{5}{x}$ $x = \frac{5}{\sin 36°}$ $x = 8.5 \times 2$

$= 17$

Mark: 1 out of 2

Rationale: - Incorrect answer in Part A
- Correct answer in Part B (follow-through error) (1 mark)

Exemplar 3

(2 Marks)

A) $C = \frac{6}{360°} = 0.02°$

B) $10 + 10 = 20$

Mark: 1 out of 2

Rationale: - Incorrect answer in Part A
- Correct answer in Part B (1 mark)

Question 29

(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 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:

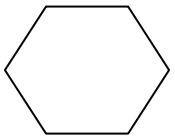
1 mark for sketch

Exemplar 1

(3 Marks)

A) ex.) Sum of interior angles = 180°(n-2)
↖ number of sides, central angle of polygons

ex.) equilateral - all sides and angles are equal
scalene - two sides and angles are different
isosceles - two sides and angles are equal

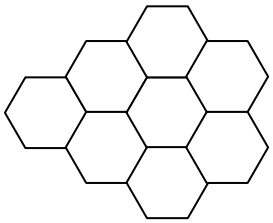
B) 

Mark: 0 out of 3
Rationale: - Incorrect response in Part A
- Incorrect sketch in Part B

Exemplar 2

(3 Marks)

A) Laying hexagonal stone outside in a yard, they all must have equal sides in order to fit properly.

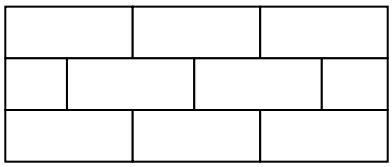
B) 

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

Exemplar 3

(3 Marks)

A) Various properties of polygons are used in building walls.
The properties of polygons are used in building walls because they have equal sides or angles and fit together nicely.

B) 

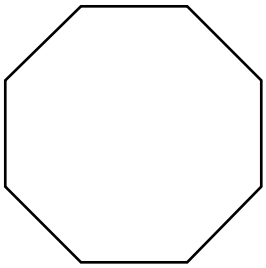
Mark: 3 out of 3
Rationale: - Correct response in Part A (2 marks)
- Correct sketch in Part B (1 mark)

Question 30

(3 Marks)

Test Item and Marking Guide

Given the following regular polygon:



A) Calculate the sum of the interior angles in the polygon. (2 marks)

Answer:

$S = 180°(n-2)$

$S = 180°(8-2)$ ← *1 mark for correct substitution*

$S = 180°(6)$

$S = 1080°$ ← *1 mark*

Note to marker: *Degrees not required.*

B) State the measure of each interior angle in the polygon. (1 mark)

Answer:

$1080 \div 8$

$= 135°$ ← *1 mark*

Note to marker: *Degrees not required.*

Exemplar 1

(3 Marks)

A) $C = \frac{360}{8} = 45$

B) $> = 180°(8-2) = 1080$

Mark: 0 out of 3
Rationale: - Incorrect solution in Part A
- Incorrect answer in Part B

Exemplar 2

(3 Marks)

A) $180 \times \frac{(8-2)}{8} = 135°$

B) $135 \div 8 = 16.9°$

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

Exemplar 3

(3 Marks)

A) $135° \times 8 = 1080°$

B) $180° \div 8 = 22.5°$
$\approx 23°$

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

Statistics

Question 31

(4 Marks)

Test Item and Marking Guide

The scores for a unit test in mathematics are listed below.

30	45	45	55	65	70	70	70	75	80	95

A) State the median: (1 mark)

Answer:

Median: *70*

B) The teacher decides not to count the lowest mark. State whether each of the following will increase, decrease, or have no change. (3 marks)

Answer:

Mode: *no change* ← *1 mark*

Median: *no change* ← *1 mark*

Mean: *increase* ← *1 mark*

Exemplar 1

(4 Marks)

A) Median: 70

B) Mode: 70

Median: 70

Mean: 63.63

Mark: 2 out of 4

Rationale: - Correct answer in Part A (1 mark)
- One correct response in Part B (median) (1 mark)

Exemplar 2

(4 Marks)

A) Median: 70

B) Mode: increase

Median: increase

Mean: increase

Mark: 2 out of 4

Rationale: - Correct answer in Part A (1 mark)
- One correct answer in Part B (mean) (1 mark)

Exemplar 3

(4 Marks)

A) Median: 70

B) Mode: no change

Median: no change

Mean: 67

$$\text{Mean} \quad \frac{45 + 45 + 55 + 65 + 70 + 70 + 70 + 75 + 80 + 95}{10}$$

The mean is the only number that would be affected by the lowest mark.

Mark: 3 out of 4

Rationale: - Correct answer in Part A (1 mark)
- Two correct answers in Part B (mode, median) (2 × 1 mark)

Question 32

(3 Marks)

Test Item and Marking Guide

On a course outline, the teacher has indicated that the course work is worth 70% of the final mark and the exam is worth 30% of the final mark.

Calculate the final mark of a student who has achieved 67% on the course work and 82% on the final exam.

Answer:

67×0.7

$= 46.9\%$ ← *1 mark*

82×0.3

$= 24.6\%$ ← *1 mark*

$46.9 + 24.6$

$= 71.5\%$ ← *1 mark*

OR

$$\underbrace{(67 \times 0.7)}_{1 \text{ mark}} + \underbrace{(82 \times 0.3)}_{1 \text{ mark}} = \underbrace{71.5(\%)}_{1 \text{ mark}}$$

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

Exemplar 1

(3 Marks)

70%
+ 30%
100%

67%
+ 82%
149 ÷ 2 = 74.5%

Mark: 0 out of 3
Rationale: - Incorrect solution

Exemplar 2

(3 Marks)

FM - 70% 0.70 X 67 = 47%

Exam - 30% 0.30 X 82 = 25%

Mark: 2 out of 3
Rationale: - Correct calculations (course work and exam) (2 × 1 mark)

Exemplar 3

(3 Marks)

70 X 0.67 = 47
30 X 0.82 = 25

47 + 25 = 72

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

Question 33

(3 Marks)

Test Item and Marking Guide

In a university class of 230 students, Kegan achieved 92% on the final exam. There were 23 students who scored lower than Kegan.

A) Calculate Kegan's percentile rank. (2 marks)

Answer:

$$P = \frac{b}{n} \times 100$$

$$P = \frac{23}{230} \times 100 \qquad \leftarrow \textit{1 mark for correct substitution}$$

$$P = 10 \quad or \quad 10th \quad or \quad P_{10} \quad \leftarrow \textit{1 mark}$$

Note to marker: *Accept* $\frac{23.5}{230} = P_{10}$ *or* P_{11}

B) The university will only give an award to the top 10% of students. Explain whether Kegan will get an award. (1 mark)

Answer:

He will not receive an award as they only recognize the top 10% of students and he only ranked in the 10th percentile.

Exemplar 1

(3 Marks)

A) $P = \frac{b}{n} \times 100$

$P = \frac{23}{207} \times 100$

$P = 0.11 \times 100$

$P = 11.1$

B) he will not get an award because he is 11.1% in the class

Mark: 1 out of 3

Rationale:
- Incorrect substitution in Part A
- Correct solution in Part A (follow-through error) (1 mark)
- Incorrect response in Part B

Exemplar 2

(3 Marks)

A) $P = \frac{b}{n} \times 100$

$= \frac{23}{230} \times 100 = \boxed{10\%}$

B) Yes, because he has a percentile rank of 10%

Mark: 1 out of 3

Rationale:
- Correct substitution in Part A (1 mark)
- Incorrect response in Part B

Exemplar 3

(3 Marks)

A) $Pr = \frac{23}{230} \times 100$

$= \boxed{10\text{th percentile rank}}$

B) Yes, Kegan will get an award because he is in the 10th percentile rank.

Mark: 2 out of 3

Rationale:
- Correct solution in Part A (2 × 1 mark)
- Incorrect response in Part B

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: _____