
Grade 12
Applied Mathematics
Standards Test

Marking Guide

January 2012

Manitoba Education Cataloguing in Publication Data

Grade 12 applied mathematics standards test.
Marking guide. January 2012 [electronic resource]

ISBN: 978-0-7711-4988-7

1. Mathematics—Examinations, questions, etc.
 2. Mathematics—Examinations.
 3. Mathematical ability—Testing.
 4. Educational tests and measurements.
 5. Mathematics—Study and teaching (Secondary)—Manitoba.
- I. Manitoba. Manitoba Education.
510.76

Manitoba Education
School Programs Division
Winnipeg, Manitoba, Canada

Permission is hereby given to reproduce this document for non-profit educational purposes provided the source is cited.

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.

Ce document est disponible en français.

Contents

General Marking Instructions	1
Answer Key for Multiple-Choice Questions	5
Marking Keys and Scoring Rubrics for Constructed-Response Questions	11
Marking Keys and Scoring Rubrics for the Inquiry Task.....	53
Appendices.....	79
<i>A–Table of Questions by Unit and Learning Outcome</i>	81
<i>B–Table of Questions by Type and Learning Outcome</i>	83
<i>C–Sheets for Marking the Inquiry Tasks</i>	85
<i>D–Irregularities in Standards Tests</i>	87
<i>E–Irregular Test Booklet Report</i>	89

General Marking Instructions

Please do not make any marks in the test booklets. Any marks in a test booklet will have to be erased by departmental staff before the sample marking if the booklet is selected.

Please ensure that

- the student booklet number and the number on the *Answer/Scoring Sheet* (Written Test) and *Scoring Sheet* (Inquiry Task) are identical
- **only a pencil is used to complete the *Answer/Scoring Sheets* and *Scoring Sheets*, by both students and markers**
- each student's final result is recorded, by booklet number, on the corresponding *Answer/Scoring Sheet* and *Scoring Sheet*
- the totals for the Written Test and the Inquiry Task are written at the bottom of the sheets
- the *Answer/Scoring Sheet* and *Scoring Sheet* are complete, and a copy has been made for school records

Once marking is completed, please forward the *Answer/Scoring Sheets* and *Scoring Sheets* to Manitoba Education in the envelope provided (for more information, see the administration manual).

Marking the Multiple-Choice Questions

Please refer to the answer key provided on page 5.

Marking the Constructed-Response Questions

Please allow a flexibility of ± 3 mm and $\pm 3^\circ$ when marking scale diagrams in the Vectors Unit.

Restricted-response questions (with or without explanation)

Each question of this type is designed to elicit a well-defined response according to the associated learning outcomes and relevant mathematical processes. Its purpose is to determine whether a student meets the standard for the course (level 2) as it relates to the knowledge and skills associated with the question.

To receive full marks for the question, a student's response must be complete and correct. Partial marks may be awarded for an "appropriate strategy" with execution errors. **An appropriate strategy is defined as one that is consistent with the learning outcomes and mathematical processes associated with the question and, if properly executed, would lead to the correct answer.**

Some questions require a form of explanation or justification from students. Depending on the student's learning style, the explanation or justification can be given through a labelled diagram, in words, by showing mathematical operations for answer verification, or by referring to a software or calculator program. For this reason, appropriate flexibility is required when marking student responses.

Open-response questions

Each question of this type is designed to elicit student responses at any of the three levels of achievement as defined in the *Senior 4 Mathematics: Manitoba Curriculum Framework of Outcomes and Senior 4 Standards* (Applied Mathematics section). The rubrics contain the language of the curricular standards in order to facilitate marking in a manner that is consistent with those standards. The recommended procedure for marking this type of question is as follows:

1. Read the corresponding learning outcomes in the document *Senior 4 Applied Mathematics: A Foundation for Implementation* (2000).
2. Read the possible solutions provided in this document.
3. Study the student exemplars provided and the rationales for the assigned marks in relation to the marking key.
4. Carefully view all of the student's response and decide which of the three levels of achievement ("exceptional understanding," "good understanding," or "limited understanding") best applies. This process will narrow down the number of possible marks that can be assigned to the response.
5. Compare the features of the student's response with the marking key. Where other answering methods are possible, the answer key attempts to address the most common solutions.

Student Errors

As a guiding principle, students should only be penalized once for each error committed in the context of a test question. For example, students may choose an inappropriate strategy for a question but carry it through correctly and arrive at an incorrect answer. In such cases, students should be penalized for having selected an inappropriate strategy for the task at hand, but should be given credit for having arrived at an answer consistent with their choice of strategy.

Trivial errors

These are errors for which no marks are to be deducted. In order to be considered trivial, an error must be conceptually unrelated to the learning outcomes associated with the question and not lead to a mathematically incorrect answer. Some examples include not rounding a final answer, transposition errors, expressing percentages as decimals, expressing decimals as percentages, and not including units in the final answer.

Technical communication errors

These are errors of mathematical notation that are conceptually related to the learning outcomes associated with the question but which can lead to mathematically correct answers.

The student

- forgets to use brackets on matrices
- does not express transition matrices in decimal or percentage form
- does not state a scale when using scale diagrams as a strategy
- forgets more than one arrowhead in scale vector diagrams or required vector sketches
- does not buy materials in whole units or rounds to whole units too soon
- forgets to include or incorrectly places “ $y =$ ”, “sin”, or “ x ” when asked for equations
- does not draw a clearly labelled graph—a clearly labelled graph will include labels with units on both axes, an indication of scales on both axes, and an appropriate shape
- does not include the final outcomes when asked for sample spaces

Students are to be penalized no more than half of a mark per question for each technical communication error, and only when the corresponding criterion was awarded.

Irregularities in Standards Tests

During the administration of standards tests, supervising teachers may encounter irregularities. Markers may also encounter irregularities during local marking sessions. Appendices D and E provide examples of such irregularities as well as procedures to follow to report irregularities.

If an *Answer/Scoring Sheet* or 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*.

Assistance

If any issues arise during marking that cannot be resolved locally, please call Manitoba Education at the earliest opportunity to advise us of the situation and, if necessary, seek assistance.

You must contact the Assessment Consultant responsible for this project before making any modifications to the answer/marking keys or scoring rubrics.

Barbara Riou
Assessment Consultant
Grade 12 Applied Mathematics Standards Test
Telephone: 204-945-4035
Toll-Free: 1-800-282-8069, ext. 4035
Email: barbara.riou@gov.mb.ca

Answer Key for Multiple-Choice Questions

Question	Answer	Learning Outcome
1	B	A1
2	D	A2
3	A	C1
4	C	D1
5	A	D2
6	D	E2
7	B	G1
8	B	H1
9	B	H1

MULTIPLE-CHOICE QUESTIONS QUESTIONS À CHOIX MULTIPLE	
Fill in the best answer for each question. Choisir la meilleure réponse pour chaque question.	
1 (A) (B) (C) (D)	6 (A) (B) (C) (D)
2 (A) (B) (C) (D)	7 (A) (B) (C) (D)
3 (A) (B) (C) (D)	8 (A) (B) (C) (D)
4 (A) (B) (C) (D)	9 (A) (B) (C) (D)
5 (A) (B) (C) (D)	

Explanations for common errors have been provided if applicable.

1. State the value of M_{32} if $[M] = [A] + [B]$.

$$A = \begin{bmatrix} 2 & 1 & 4 \\ 0 & -3 & 1 \\ -5 & 2 & -3 \end{bmatrix} \quad B = \begin{bmatrix} 4 & 2 & -2 \\ 1 & 0 & 1 \\ 3 & -2 & 4 \end{bmatrix}$$

- A) -2
✓ B) 0
C) 1
D) 2

Common Errors

A: B_{32}
C: B_{23}
D: M_{23}

2. Which of the following matrices is an example of a correct transition matrix?

A) $T = \begin{matrix} & \text{A} & \text{B} \\ \text{A} & \begin{bmatrix} 0 & 0.20 \\ 0.80 & 0 \end{bmatrix} \\ \text{B} & \end{matrix}$

B) $T = \begin{matrix} & \text{A} & \text{B} \\ \text{A} & \begin{bmatrix} 0.60 & 0.40 \\ 0.80 & 0.30 \end{bmatrix} \\ \text{B} & \end{matrix}$

C) $T = \begin{matrix} & \text{A} & \text{B} \\ \text{A} & \begin{bmatrix} 0.70 & 0.20 \\ 0.30 & 0.80 \end{bmatrix} \\ \text{B} & \end{matrix}$

✓ D) $T = \begin{matrix} & \text{A} & \text{B} \\ \text{A} & \begin{bmatrix} \mathbf{0.70} & \mathbf{0.30} \\ \mathbf{0.20} & \mathbf{0.80} \end{bmatrix} \\ \text{B} & \end{matrix}$

Common Errors

A: complements are not complete
B: only one row adding to 1
C: both rows not adding to 1

3. Which of the following is the most liquid asset?

- ✓ A) \$10 000.00 in a chequing account
- B) \$10 000.00 in stocks
- C) \$10 000.00 in an RRSP
- D) \$10 000.00 in a mutual fund

4. Imagine that you are standing at the corner of 5th Street and Gilmour Street. How many ways can you get to the corner of 9th Street and Thornhill Street, if you travel on the streets and can only go south or west?



- A) 14
- B) 16
- ✓ C) 19
- D) 24

Common Errors
 A: stopping at the corner of Nelson and Thornhill Street
 B: a “2” at the corner of 7th Street and Thornhill Street
 D: a “10” at the corner of 8th Street and Thornhill Street

5. In how many different ways can all 5 letters of the word “GEESE” be arranged?

- ✓ A) 20
- B) 40
- C) 60
- D) 120

Common Errors

B: $\frac{5 \times 4 \times 3 \times 2 \times 1}{3}$

C: $\frac{5 \times 4 \times 3 \times 2 \times 1}{2}$

D: $5 \times 4 \times 3 \times 2 \times 1$

6. Nicole’s z-score on an exam was 2.31. If the mean for the exam was 58% and the standard deviation was 7%, what was Nicole’s percentage mark?

- A) 41.83%
- B) 58.33%
- C) 61.03%
- ✓ D) 74.17%

Common Errors

A: $-2.31 \times 7 + 58$

B: $\frac{2.31}{7} + 58$

C: $\frac{7}{2.31} + 58$

7. What is the minimum value of the following sinusoidal function?

$$y = 12 \sin(8.37x) + 36$$

- A) 12
- ✓ B) 24
- C) 36
- D) 48

Common Errors

A: a

C: d

D: $a + d$

8. A town with a population of 4000 people has an annual growth rate of 3.2%. What will its population be after 14 years?

A) 6024

✓ B) 6217

C) 6416

D) 195 027

Common Errors

A: after 13 years

C: after 15 years

D: multiplying by 1.32

9. George takes 500 mg of medication Monday morning. If his body eliminates 65% daily, how much medication will remain in his system Friday morning if he does not take any more medication?

A) 2.63

✓ B) 7.50

C) 89.25

D) 497.40

Common Errors

A: $500 \times (0.35)^5$

C: $500 \times (0.65)^4$

D: $500 - (0.65 \times 4)$

Marking Keys and Scoring Rubrics for Constructed-Response Questions

Please note that this *Marking Guide* contains authentic screen captures taken from a TI-83 Plus graphing calculator.

Question No. 10 and Answer

10. Julie decides to plant three different kinds of tomato plants: Beefsteak, Roma, and Tiny Tim. She wants to plant a different number of each kind in her garden and in her greenhouse as shown below.

**Total:
3 marks**

	Garden	Greenhouse
$A =$	Beefsteak	18 24
	Roma	24 30
	Tiny Tim	12 30

Each Beefsteak plant will produce 40 tomatoes, each Roma plant will produce 50 tomatoes, and each Tiny Tim plant will produce 20 tomatoes.

- a) Determine the number of tomatoes produced in her garden and in her greenhouse. Show your work using matrix operations.

(2 marks)

$$P = \begin{bmatrix} & \text{Beefsteak} & \text{Roma} & \text{Tiny Tim} \\ & 40 & 50 & 20 \end{bmatrix}$$

$$P \times A = \begin{bmatrix} & \text{Garden} & \text{Greenhouse} \\ & 2160 & 3060 \end{bmatrix}$$

- b) Julie wants to sell 60% of the tomatoes produced. Based on your answer in (a), determine the number of tomatoes she can sell from her garden and the number of tomatoes she can sell from her greenhouse.

(1 mark)

$$0.60 \times [2160 \quad 3060] = [1296 \quad 1836]$$

She can sell 1296 tomatoes from her garden and 1836 tomatoes from her greenhouse.

Marker Note(s):

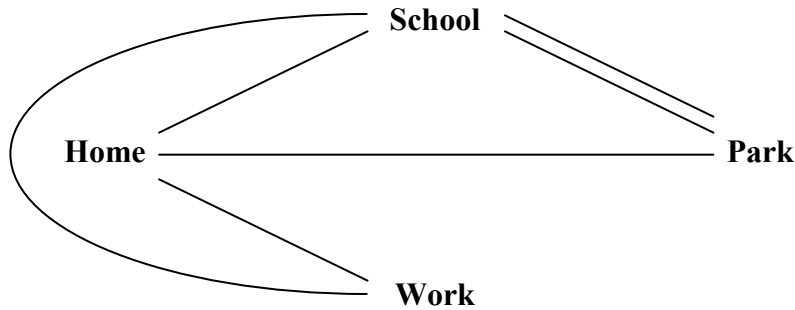
→ Maximum 0.5 mark deduction per question if student forgets to use brackets on matrices.

Marking Key	
①	<i>1 mark for appropriate work in (a)</i>
②	<i>1 mark for correct answer in (a)</i>
③	<i>1 mark for correct answer in (b)</i>

Question No. 11 and Answer

11. Allan sketches the following diagram to represent the sites on his walking routes:

**Total:
4 marks**



a) Create a direct route matrix R that represents the diagram above.

(1 mark)

$$R = \begin{matrix} & \begin{matrix} \text{Home} & \text{School} & \text{Park} & \text{Work} \end{matrix} \\ \begin{matrix} \text{Home} \\ \text{School} \\ \text{Park} \\ \text{Work} \end{matrix} & \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 2 & 1 \\ 1 & 2 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix} \end{matrix}$$

b) Determine the number of routes that Allan can take to go from the park to his work passing through exactly one other site. Show your work using matrix operations.

(2 marks)

$$R^2 = \begin{matrix} & \begin{matrix} \text{Home} & \text{School} & \text{Park} & \text{Work} \end{matrix} \\ \begin{matrix} \text{Home} \\ \text{School} \\ \text{Park} \\ \text{Work} \end{matrix} & \begin{bmatrix} 3 & 3 & 2 & 1 \\ 3 & 6 & 1 & 1 \\ 2 & 1 & 5 & \textcircled{3} \\ 1 & 1 & 3 & 2 \end{bmatrix} \end{matrix}$$

There are 3 routes.

Question No. 11 continued

- c) Allan thinks that he should calculate R^3 to determine the number of routes he could take to go from the park to his work passing through at most two other sites. Explain why Allan is wrong.

(1 mark)

Calculating R^3 is used to find the number of routes passing through exactly two other sites.

OR

He should have calculated $R + R^2 + R^3$ to find the number of routes passing through at most two other sites.

Marker Note(s):

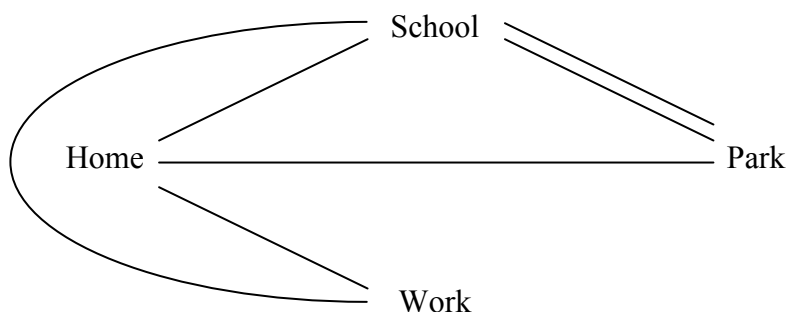
→ Maximum 0.5 mark deduction per question if student forgets to use brackets on matrices.

Marking Key	
①	1 mark for correct matrix in (a)
②	1 mark for appropriate work in (b)
③	1 mark for correct answer in (b)
④	1 mark for correct explanation in (c)

Exemplar 1

11. Allan sketches the following diagram to represent the sites on his walking routes:

Total:
4 marks



a) Create a direct route matrix R that represents the diagram above.

(1 mark)

$$R = \begin{matrix} & \begin{matrix} \text{Home} & \text{School} & \text{Park} & \text{Work} \end{matrix} \\ \begin{matrix} \text{Home} \\ \text{School} \\ \text{Park} \\ \text{Work} \end{matrix} & \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 2 & 1 \\ 1 & 2 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix} \end{matrix}$$

b) Determine the number of routes that Allan can take to go from the park to his work passing through exactly one other site. Show your work using matrix operations.

(2 marks)

$$R + R^2 = \begin{matrix} & \begin{matrix} \text{H} & \text{S} & \text{P} & \text{W} \end{matrix} \\ \begin{matrix} \text{H} \\ \text{S} \\ \text{P} \\ \text{W} \end{matrix} & \begin{bmatrix} 3 & 4 & 3 & 2 \\ 4 & 6 & 3 & 2 \\ 3 & 3 & 5 & \textcircled{3} \\ 2 & 2 & 3 & 2 \end{bmatrix} \end{matrix}$$

3 ways to go from the park to work going through exactly one other site.

Exemplar 1 continued

- c) Allan thinks that he should calculate R^3 to determine the number of routes he could take to go from the park to his work passing through at most two other sites. Explain why Allan is wrong.

(1 mark)

$$R^3 = \begin{matrix} & \text{H} & \text{S} & \text{P} & \text{W} \\ \text{H} & 6 & 8 & 9 & 6 \\ \text{S} & 8 & 6 & 15 & 9 \\ \text{P} & 9 & 15 & 4 & 3 \\ \text{W} & 6 & 9 & 3 & 2 \end{matrix}$$

$R + R^2 + R^3$ = Proper formula

$$= \begin{matrix} & \text{H} & \text{S} & \text{P} & \text{W} \\ \text{H} & 9 & 12 & 12 & 8 \\ \text{S} & 12 & 12 & 18 & 11 \\ \text{P} & 12 & 18 & 9 & 6 \\ \text{W} & 8 & 11 & 6 & 4 \end{matrix}$$

3 marks:

- ❶ → 1 mark for correct matrix in (a)
- ❸ → 1 mark for correct answer in (b)
- ❹ → 1 mark for correct explanation in (c)

Question No. 12 and Answer

12. Claire invests \$20 000.00 on her 25th birthday and plans to add \$2000.00 to her investment each year until her 40th birthday. The interest rate is 5.5% compounded annually.

**Total:
4 marks**

- a) What will be the value of Claire's investment on her 40th birthday? Show your work.

(2 marks)

```
N=15
I%=5.5
PV=-20000
PMT=-2000
FV=89466.85684
P/Y=1
C/Y=1
PMT: [ ] [ ] BEGIN
```

The value of her investment will be \$89 466.86.

OR

```
Plot1 Plot2 Plot3
nMin=0
u(n)=u(n-1)*1.055+2000
u(nMin)=(20000)
v(n)=
v(nMin)=
w(n)=
```

Year	Value of the Investment (\$)
0	20 000.00
1	23 100.00
2	26 370.50
⋮	⋮
15	89 466.86

The value of her investment will be \$89 466.86.

Question No. 12 continued

b) How much interest will her investment have earned by her 40th birthday?

(1 mark)

$\Sigma\text{Int}(1,15)$ 39466.85684

The total amount of interest earned will be \$39 466.86.

OR

$$89\,466.86 - [20\,000 + (15 \times 2000)] = \$39\,466.86$$

The total amount of interest earned will be \$39 466.86.

c) Claire's friend suggests that she should have invested her money in the stock market. Do you agree or disagree with her friend? Explain your answer.

(1 mark)

I disagree because stocks are a riskier investment and Claire could lose a lot of money.

OR

I agree because, over a long period of time, the rate of return on stocks could be greater than 5.5%.

Other answers are possible.

Marking Key	
①	<i>1 mark for appropriate work in (a)</i>
②	<i>1 mark for correct answer in (a)</i>
③	<i>1 mark for correct answer in (b)</i>
④	<i>1 mark for appropriate explanation in (c)</i>

Exemplar 1

12. Claire invests \$20 000.00 on her 25th birthday and plans to add \$2000.00 to her investment each year until her 40th birthday. The interest rate is 5.5% compounded annually.

Total:
4 marks

- a) What will be the value of Claire's investment on her 40th birthday? Show your work.

(2 marks)

TVM Solver

$$\begin{aligned} N &= 180 \\ I\% &= 5.5 \\ PV &= -20000 \\ PMT &= 2000 \\ FV &= 250\,760.761.60 \\ P/Y &= 1 \\ C/Y &= 1 \end{aligned}$$

- b) How much interest will her investment have earned by her 40th birthday?

(1 mark)

$$\Sigma \text{Int}(1, 180) = \$250\,420.761.60$$

- c) Claire's friend suggests that she should have invested her money in the stock market. Do you agree or disagree with her friend? Explain your answer.

(1 mark)

I don't agree because the stock market is always changing and its not realiable.

2 marks:

- ③ → 1 mark for correct answer in (b)
④ → 1 mark for appropriate explanation in (c)

Exemplar 2

12. Claire invests \$20 000.00 on her 25th birthday and plans to add \$2000.00 to her investment each year until her 40th birthday. The interest rate is 5.5% compounded annually.

Total:
4 marks

- (2 marks) a) What will be the value of Claire's investment on her 40th birthday? Show your work.

$$\begin{array}{l}
 1100 \quad 25 = 20000 \times 1.055 + 2000 \quad 1970 \quad 32 = 34000 + 2000 \quad 39 = 49000 + 2000 \quad 2640 \\
 1210 \quad 26 = 22000 + 2000 \quad 1980 \quad 33 = 36000 + 2000 \quad 40 = 50000 \quad 2750 \\
 1320 \quad 27 = 24000 + 2000 \quad 2090 \quad 34 = 38000 + 2000 \\
 1430 \quad 28 = 26000 + 2000 \quad 2200 \quad 35 = 40000 + 2000 \\
 1540 \quad 29 = 28000 + 2000 \quad 2310 \quad 36 = 42000 + 2000 \\
 1650 \quad 30 = 30000 + 2000 \quad 2420 \quad 37 = 44000 + 2000 \\
 1760 \quad 31 = 32000 + 2000 \quad 2530 \quad 38 = 46000 + 2000
 \end{array}$$

50 000 \$
30 800 \$ interest

\$ 80 800

- (1 mark) b) How much interest will her investment have earned by her 40th birthday?

Her investment earned \$30 800 interest.

2 marks:

- ③ → 1 mark for correct answer in (b)
- ④ → 1 mark for appropriate explanation in (c)

- (1 mark) c) Claire's friend suggests that she should have invested her money in the stock market. Do you agree or disagree with her friend? Explain your answer.

I disagree because this way, she is getting 5.5% compounded annually no matter what, and with the amount of money she has, the interest gets pretty high. With stocks you don't know if there going to go up or down, so your taking to much of a risk.

Question No. 13 and Answer

13. Sylvie and Roland want to purchase a new house and can afford to make monthly payments of \$1000.00. They go to the bank and obtain a mortgage for \$195 000.00 compounded semi-annually and amortized over 25 years.

Total:
4 marks

- a) What is the interest rate (to 2 decimal places) of the mortgage? Show your work.
(2 marks)

```
N=300
I%=3.754943587
PV=195000
PMT=-1000
FV=0
P/Y=12
C/Y=2
PMT: [ ] BEGIN
```

The interest rate is 3.75%.

- b) Sylvie and Roland wonder if it would be wise to find a less expensive house to reduce the amortization period to 20 years. Assuming that only the amortization period changes, what would be the maximum mortgage they could afford? Show your work.
(2 marks)

```
N=240
I%=3.754943587
PV=169023.1406
PMT=-1000
FV=0
P/Y=12
C/Y=2
PMT: [ ] BEGIN
```

Their maximum affordable mortgage is \$169 023.14.

Marking Key

- | | |
|---|------------------------------------|
| ① | 1 mark for appropriate work in (a) |
| ② | 1 mark for correct answer in (a) |
| ③ | 1 mark for appropriate work in (b) |
| ④ | 1 mark for correct answer in (b) |

Exemplar 1

13. Sylvie and Roland want to purchase a new house and can afford to make monthly payments of \$1000.00. They go to the bank and obtain a mortgage for \$195 000.00 compounded semi-annually and amortized over 25 years.

Total:
4 marks

- a) What is the interest rate (to 2 decimal places) of the mortgage? Show your work.

(2 marks)

Use TVM

$$25 \times 12 = 300$$

$$N = 300$$

$$I\% = ?$$

$$PV = 195\,000$$

$$PMT = -1000$$

$$FV = 0$$

$$P/Y = 12$$

$$C/Y = 12$$

$$PMT = \boxed{\text{END}}$$

Solve for I%

$$I\% = 3.7259$$

$$\boxed{3.73\%}$$

- b) Sylvie and Roland wonder if it would be wise to find a less expensive house to reduce the amortization period to 20 years. Assuming that only the amortization period changes, what would be the maximum mortgage they could afford? Show your work.

(2 marks)

Use TVM

$$12 \times 20 = 240$$

$$N = 240$$

$$I\% = 3.7259$$

$$PV = ?$$

$$PMT = 1000$$

$$FV = 0$$

$$P/Y = 12$$

$$C/Y = 12$$

$$PMT = \boxed{\text{END}}$$

Solve for PV

$$PV = -169023.1406$$

$$\boxed{\$169023.14}$$

3 marks:

- ② → 1 mark for correct answer in (a)
- ③ → 1 mark for appropriate work in (b)
- ④ → 1 mark for correct answer in (b)

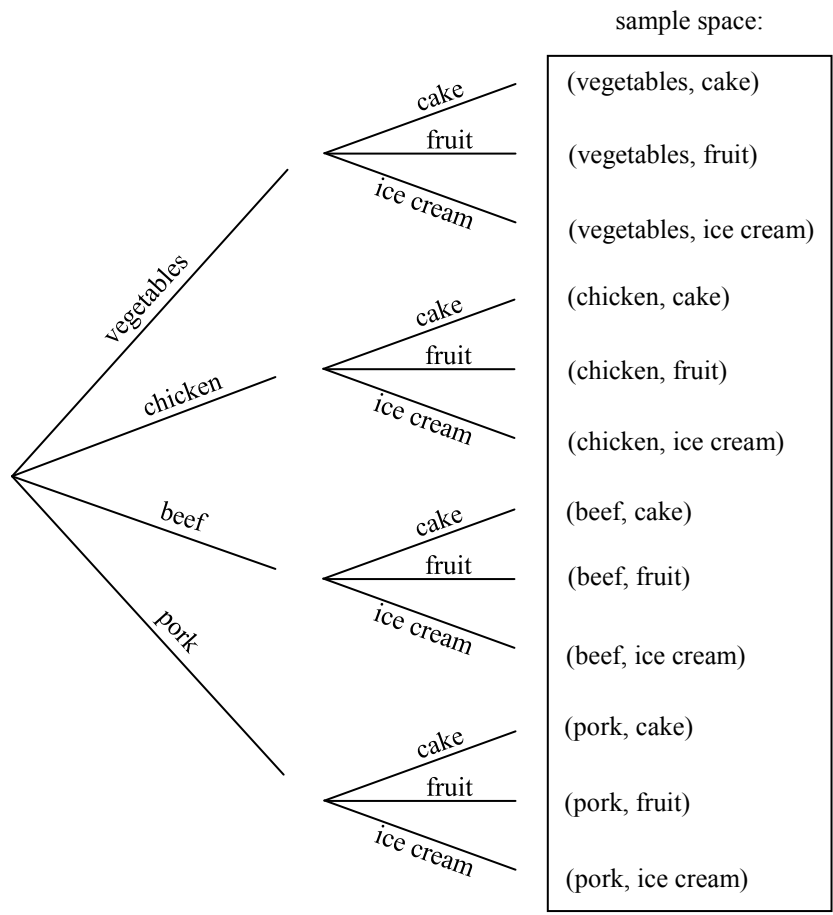
Question No. 14 and Answer

14. A student orders lunch at the school cafeteria. She must choose one of the four main courses (vegetables, chicken, beef, or pork) and one of the three desserts (cake, fruit, or ice cream).

**Total:
2 marks**

a) Create a sample space to indicate all of the possibilities for lunch.

(1 mark)



b) What is the probability that she will not order beef as a main course and will order cake or fruit for dessert?

(1 mark)

$$P(\text{not beef and cake or fruit}) = \frac{6}{12} \text{ or } \frac{1}{2}$$

Question No. 14 continued

Marker Note(s):

→ *Maximum 0.5 mark deduction per question if student does not include the final outcomes when asked for sample spaces.*

Marking Key	
①	<i>1 mark for correct sample space in (a)</i>
②	<i>1 mark for correct answer in (b)</i>

Question No. 15 and Answer

15. A survey of 65 students shows that:

Total:
4 marks

- 45 are enrolled in a Chemistry course
- 25 are enrolled in a Physics course
- 20 are enrolled in both a Chemistry and a Physics course

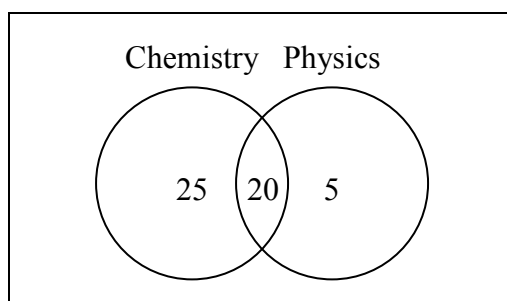
a) How many students are enrolled in only a Chemistry course?

(1 mark)

25 students are enrolled in only a chemistry course

b) If a student is selected at random, what is the probability that the student is enrolled in a Chemistry or a Physics course? Show your work.

(2 marks)



$$P(\text{Chemistry or Physics}) = \frac{50}{65} \text{ or } \frac{10}{13} \text{ or } 0.7692 \text{ or } 76.92\%$$

c) Explain why these events are not mutually exclusive.

(1 mark)

They are not mutually exclusive because it's possible for the student to be enrolled in both courses.

Marking Key	
1	<i>1 mark for correct answer in (a)</i>
2	<i>1 mark for appropriate work in (b)</i>
3	<i>1 mark for correct answer in (b)</i>
4	<i>1 mark for appropriate explanation in (c)</i>

Exemplar 1

15. A survey of 65 students shows that:

Total:
4 marks

- 45 are enrolled in a Chemistry course
- 25 are enrolled in a Physics course
- 20 are enrolled in both a Chemistry and a Physics course

a) How many students are enrolled in only a Chemistry course?

(1 mark)

there are 45 students only in chemistry

b) If a student is selected at random, what is the probability that the student is enrolled in a Chemistry or a Physics course? Show your work.

(2 marks)

$$\begin{array}{r} 45 \\ + 25 \\ \hline = 70 \\ - 20 \\ \hline = 50 \\ - 65 \\ \hline 15 \end{array}$$

$$\begin{array}{r} 50 \\ \div 65 \\ \hline = .77 \end{array}$$

there is a 77%
chance that the
student is in chemistry
OR physics

2 marks:

- ② → 1 mark for appropriate work in (b)
- ③ → 1 mark for correct answer in (b)

c) Explain why these events are not mutually exclusive.

(1 mark)

They are not mutually exclusive because they are just picking on one group

Exemplar 2

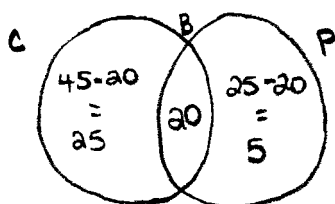
15. A survey of 65 students shows that:

Total:
4 marks

- 45 are enrolled in a Chemistry course
- 25 are enrolled in a Physics course
- 20 are enrolled in both a Chemistry and a Physics course

a) How many students are enrolled in only a Chemistry course?

(1 mark)



25 students are only enrolled in chemistry.

b) If a student is selected at random, what is the probability that the student is enrolled in a Chemistry or a Physics course? Show your work.

(2 marks)

$$P(A \text{ or } B) = P(A) + P(B) - P(A \cap B)$$

A = chem
B = Physics

$$P(A \text{ or } B) = 25 + 5 - 20$$

$$P(A \text{ or } B) = 10$$

probability would be 10 kids enrolled in physics or chem.

2 marks:

- ① → 1 mark for correct answer in (a)
- ④ → 1 mark for appropriate explanation in (c)

c) Explain why these events are not mutually exclusive.

(1 mark)

Because being you can be in both courses, you don't have to choose just one

Question No. 16 and Answer

16. The data below represents the ages (in years) of 20 trees in an area of natural vegetation.

**Total:
3 marks**

15	17	18	19	19	22	24	25	26	27
28	28	29	32	34	35	37	38	42	43

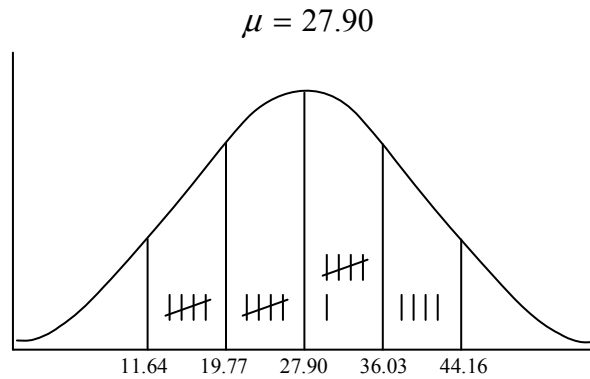
a) Determine the population standard deviation for this data (to 2 decimal places).

(1 mark)

$$\sigma = 8.13$$

b) Determine if this data represents a normal distribution. State 2 reasons to support your answer. Show your work using statistics.

(2 marks)



-1σ to 1σ
range is from 19.77 to 36.03 } $\frac{11}{20}$ or 55% of the numbers fall in this range
(normal is 68%)

-2σ to 2σ
range is from 11.64 to 44.16 } $\frac{20}{20}$ or 100% of the numbers fall in this range
(normal is 95%)

This does not represent a normal distribution since it does not follow the 68-95-99 rule.

Marking Key	
1	1 mark for correct standard deviation in (a)
2	1 mark for first reason with support in (b)
3	1 mark for second reason with support in (b)

Question No. 17 and Answer

17. A survey of 1600 randomly selected Canadians showed that 74% of them have cellphones.

**Total:
5 marks**

- a) Calculate the mean and standard deviation for the number of Canadians who have cellphones.

(2 marks)

$$\begin{aligned}\mu &= np \\ &= 1600 \times 0.74 \\ &= 1184\end{aligned}$$

$$\begin{aligned}\sigma &= \sqrt{npq} \\ &= \sqrt{1600 \times 0.74 \times 0.26} \\ &= 17.55\end{aligned}$$

- b) Determine the 90% confidence interval for the Canadians who have cellphones. Show your work using statistics.

(2 marks)

```
1-PropZInt
x:1184
n:1600
C-Level:90
Calculate
```

```
1-PropZInt
(.72196,.75804)
p=.74
n=1600
```

The percentage of Canadians is between 72.2% and 75.8%.

OR

$$0.72196 \times 1600 = 1155.14$$

$$0.75804 \times 1600 = 1212.86$$

The number of Canadians is between 1156 and 1212.

- c) Explain what the confidence interval represents in this situation.

(1 mark)

90% of the time, 1155 to 1212 Canadians out of every 1600 have cellphones.

OR

90% of the time, between 72.2% and 75.8% of 1600 Canadians have cellphones.

Question No. 17 continued

Marker Note(s):

→ *The number of Canadians may be rounded up, rounded down, or left in decimal form.*

Marking Key	
1	<i>1 mark for correct mean in (a)</i>
2	<i>1 mark for correct standard deviation in (a)</i>
3	<i>1 mark for appropriate work in (b)</i>
4	<i>1 mark for correct answer in (b)</i>
5	<i>1 mark for correct explanation in (c)</i>

Exemplar 1

17. A survey of 1600 randomly selected Canadians showed that 74% of them have cellphones.

Total:
5 marks

- a) Calculate the mean and standard deviation for the number of Canadians who have cellphones.

(2 marks)

$$\mu = 1600 \times 0.74 = 1184$$
$$\sigma = \sqrt{1600 \times 0.74 \times (1 - 0.74)} = 17.55$$

- b) Determine the 90% confidence interval for the Canadians who have cellphones. Show your work using statistics.

(2 marks)

STAT
calc
A: PropZInt

$x = 74$
 $N = 1600$
C-level = 90

$(.03761, .05489)$
 $P = .04625$
 $n = 1600$

$1600 \times .03761 = 60.18\%$
 $1600 \times .05489 = 87.82\%$

- c) Explain what the confidence interval represents in this situation.

(1 mark)

we can be confident
that between 962 to 1405
Canadians out of 1600 Canadians
have cellphones

2 marks:

- ① → 1 mark for correct mean in (a)
- ② → 1 mark for correct standard deviation in (a)

Exemplar 2

17. A survey of 1600 randomly selected Canadians showed that 74% of them have cellphones.

Total:
5 marks

- a) Calculate the mean and standard deviation for the number of Canadians who have cellphones.

(2 marks)

$$\begin{aligned}\mu &= n \cdot p \\ \mu &= 1600 \cdot 0.74 \\ \mu &= 1184\end{aligned}$$

$$\begin{aligned}\sigma &= \sqrt{n \cdot p \cdot (1-p)} \\ \sigma &= \sqrt{1184 \cdot 0.74 \cdot (1-0.74)} \\ \sigma &= 15.09\end{aligned}$$

4 marks:

- ① → 1 mark for correct mean in (a)
- ③ → 1 mark for appropriate work in (b)
- ④ → 1 mark for correct answer in (b)
- ⑤ → 1 mark for correct explanation in (c)

$$\begin{aligned}\mu &= 1184 \\ \sigma &= 15.09\end{aligned}$$

- b) Determine the 90% confidence interval for the Canadians who have cellphones. Show your work using statistics.

(2 marks)

1-PropZInt (0.72196, 0.75804)

$$\begin{aligned}x &: 1184 && 0.72196 \times 1600 = 1155.136 \\ n &: 1600 && 0.75804 \times 1600 = 1212.86 \\ C\text{-level} &: 90\end{aligned}$$

90% of the time in a similar study we can be confident that between 1213 and 1155 Canadians have cell phones out of 1600

- c) Explain what the confidence interval represents in this situation.

(1 mark)

This confidence interval represents the range of data the amount of Canadians with cell phones has a 90% chance of being within.

Question No. 18 and Answer

18. The water levels (in metres above sea level) for one year at Cedar Lake are shown in the table below.

Total:
5 marks

Month	Water Level (metres above sea level)
January	838.9
February	836.2
March	833.0
April	833.6
May	836.0
June	838.4
July	840.2
August	841.3
September	842.1
October	841.2
November	841.2
December	838.4

- a) Assuming January is month 1, determine the sinusoidal equation that models this data using technology. Explain how you arrived at your answer.

(2 marks)

$$y = 4.21\sin(0.57x + 2.65) + 838.40$$

I entered the data into L1 and L2 and used SinReg to find the equation.

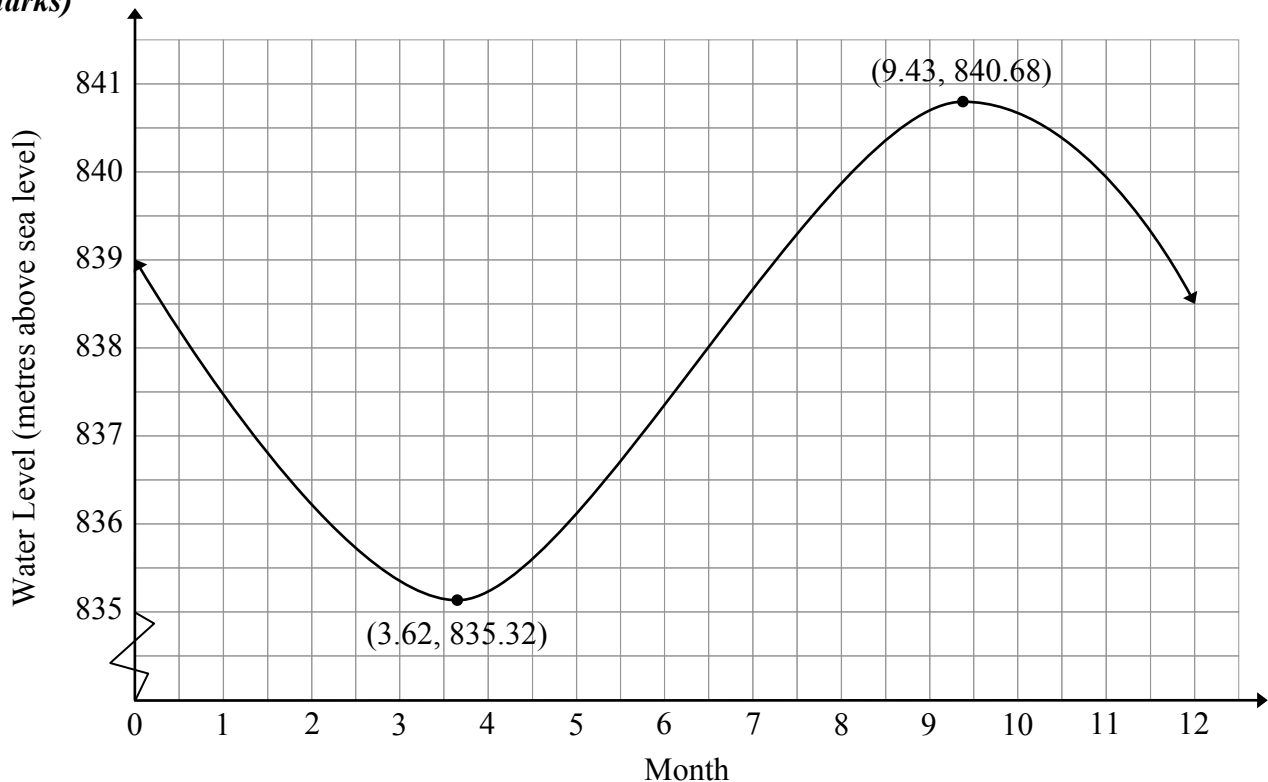
Question No. 18 continued

- b) The following sinusoidal equation represents the historic average water levels during the same months at Cedar Lake:

$$y = 2.68\sin(0.54x + 2.76) + 838$$

Draw a clearly labelled graph to represent the historic average water levels for Cedar Lake for one year. Indicate the maximum and minimum values to 2 decimal places.

(2 marks)



maximum value = 840.68

minimum value = 835.32

- c) Scientists predict that climate change will have an impact on the water levels at Cedar Lake. Describe one possible change in climate and its effect on one of the values in the sinusoidal equation in (b).

(1 mark)

- The average precipitation might decrease, which would cause a decrease in the d value.
- There might be a wetter summer with a drier winter, which would cause an increase in the a value.

Other answers are possible.

Question No. 18 continued

Scoring Rubric

General Performance Indicators	
Level 1—limited understanding	
1 mark weak attempt: inappropriate strategy or no strategy 1 criterion correct	2 marks reasonable attempt: appropriate strategy with major errors or omissions 2 criteria correct
Level 2—good understanding	
3 marks reasonable strategy, minor errors and/or omissions 3 criteria correct	4 marks sound strategy, mostly complete, minor errors 4 criteria correct
Level 3—exceptional understanding	
5 marks complete and correct 5 criteria correct	

Marker Note(s):

- Maximum 0.5 mark deduction per question if student forgets to include or incorrectly places “y =”, “sin”, or “x” when asked for equations.
- Maximum 0.5 mark deduction per question if student does not draw a clearly labelled graph. A clearly labelled graph will include labels with units on both axes, an indication of scales on both axes, and an appropriate shape.

Marking Key

1	<i>1 mark for correct sinusoidal equation in (a)</i>
2	<i>1 mark for correct explanation in (a)</i>
3	<i>1 mark for appropriate shape and period of graph for one year in (b)</i>
4	<i>1 mark for correct maximum and minimum values in (b)</i>
5	<i>1 mark for correct change in value based on description of climate change in (c)</i>

THIS PAGE WAS INTENTIONALLY LEFT BLANK.

Exemplar 1

18. The water levels (in metres above sea level) for one year at Cedar Lake are shown in the table below.

Total:
5 marks

Month	Water Level (metres above sea level)
January	838.9
February	836.2
March	833.0
April	833.6
May	836.0
June	838.4
July	840.2
August	841.3
September	842.1
October	841.2
November	841.2
December	838.4

- a) Assuming January is month 1, determine the sinusoidal equation that models this data using technology. Explain how you arrived at your answer.

(2 marks)

I used my
calculators list
and sin regression
functions.

SinReg

$$y = a \sin(bx + c) + d$$

$$a = 4.205177848$$

$$b = 0.5700035923$$

$$c = 2.649856678$$

$$d = 838.3996209$$

$$y = 4.21 \sin(0.57x + 2.65) + 834.40$$

3.5 marks:

- ① → 1 mark for correct sinusoidal equation in (a)
- ② → 1 mark for correct explanation in (a)
- ③ → 1 mark for appropriate shape and period of graph for one year in (b)
- ④ → 1 mark for correct maximum and minimum values in (b)
→ deduction of 0.5 marks for not drawing a clearly labelled graph

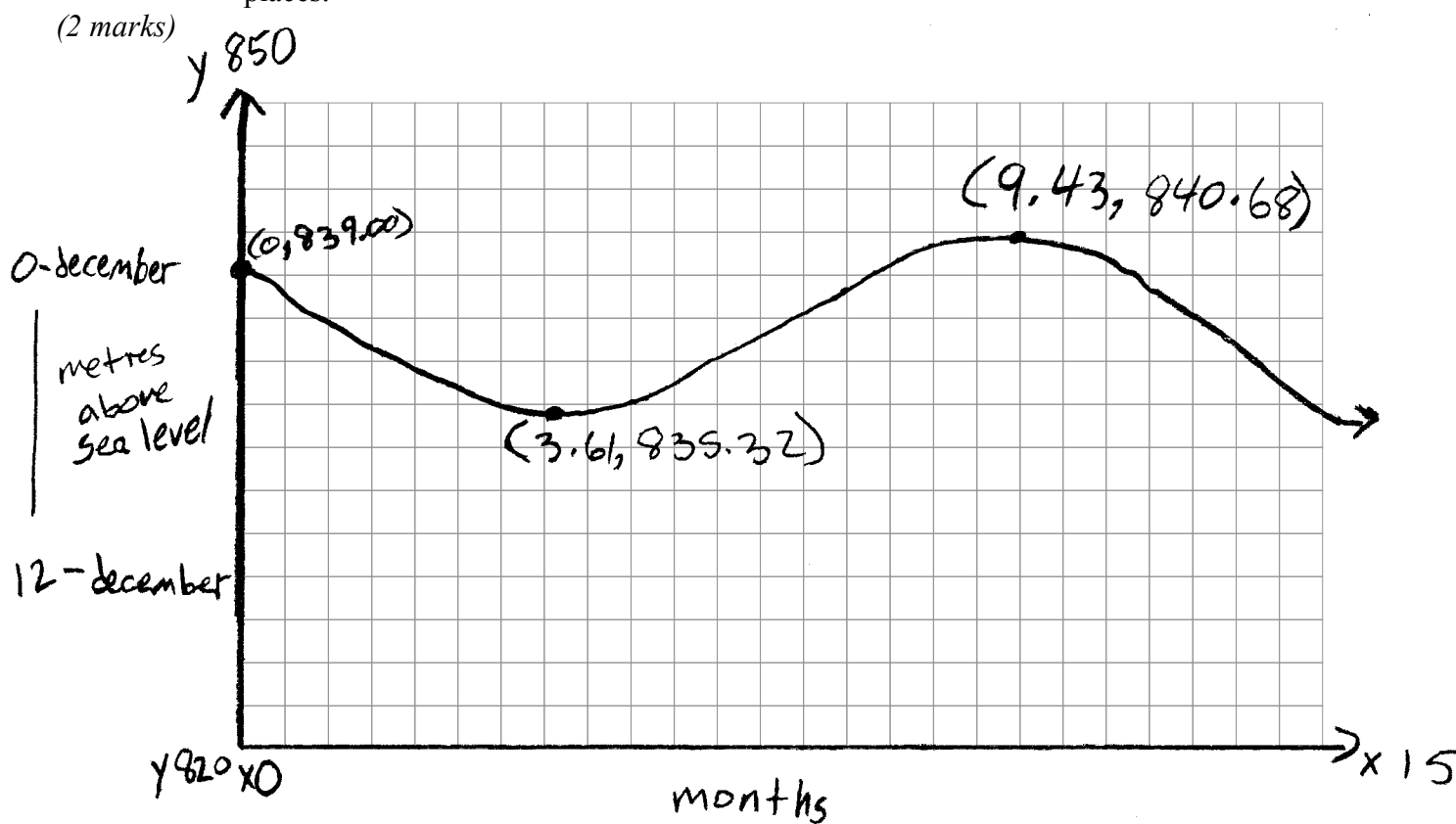
Note: No mark deduction for trivial error in (a) (d value).

Exemplar 1 continued

- b) The following sinusoidal equation represents the historic average water levels during the same months at Cedar Lake:

$$y = 2.68 \sin(0.54x + 2.76) + 838$$

Draw a clearly labelled graph to represent the historic average water levels for Cedar Lake for one year. Indicate the maximum and minimum values to 2 decimal places.



maximum value = 840.68m

minimum value = 835.32m

- c) Scientists predict that climate change will have an impact on the water levels at Cedar Lake. Describe one possible change in climate and its effect on one of the values in the sinusoidal equation in (b).

(1 mark)

Rain would increase sea levels.

Exemplar 2

18. The water levels (in metres above sea level) for one year at Cedar Lake are shown in the table below.

Total:
5 marks

Month	Water Level (metres above sea level)
January	838.9
February	836.2
March	833.0
April	833.6
May	836.0
June	838.4
July	840.2
August	841.3
September	842.1
October	841.2
November	841.2
December	838.4

- a) Assuming January is month 1, determine the sinusoidal equation that models this data using technology. Explain how you arrived at your answer.

(2 marks)

$$D = \frac{\max + \min}{2}$$

$$= \frac{(842.1) + (833)}{2}$$

$$= \frac{1675.1}{2}$$

$$= 837.55$$

$$A = \frac{\max - \min}{2}$$

$$= \frac{842.1 - 833}{2}$$

$$= \frac{9.1}{2}$$

$$= 4.55$$

$$B = \frac{P}{2\pi}$$

$$= \frac{12}{2\pi}$$

$$= .52$$

$$y = 4.55 \sin(.52x) + 837.55$$

3 marks:

- ② → 1 mark for correct explanation in (a)
- ④ → 1 mark for correct maximum and minimum values in (b)
- ⑤ → 1 mark for correct change in value based on description of climate change in (c)

Note(s): The mark was awarded in (a) since the a , b , and d values are correct (Pre-Calculus method).

No mark deduction for trivial error in (b).

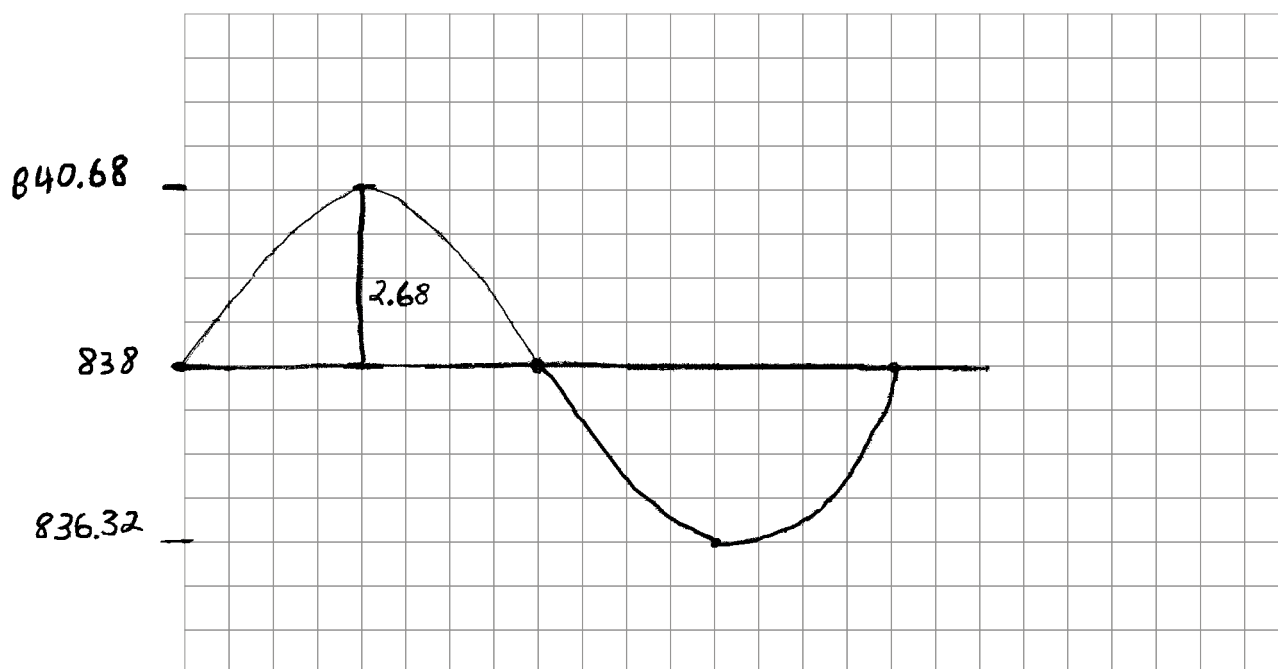
Exemplar 2 continued

- b) The following sinusoidal equation represents the historic average water levels during the same months at Cedar Lake:

$$y = 2.68\sin(0.54x + 2.76) + 838$$

Draw a clearly labelled graph to represent the historic average water levels for Cedar Lake for one year. Indicate the maximum and minimum values to 2 decimal places.

(2 marks)



maximum value = 840.68

minimum value = 836.32

- c) Scientists predict that climate change will have an impact on the water levels at Cedar Lake. Describe one possible change in climate and its effect on one of the values in the sinusoidal equation in (b).

(1 mark)

Gets really hot, water evaporates lowering the average water height changing the d value.

Question No. 19 and Answer

19. A stone gets stuck in the tire of a tractor plowing a field. The following sinusoidal equation models the height of the stone as the tire turns:

**Total:
3 marks**

$$y = 70\sin(1.4x + 4.71) + 70$$

where y represents the height of the stone with respect to the ground (in cm) and x represents the time (in seconds).

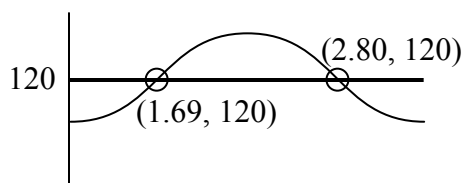
- a) How long does it take for the tire to make one complete rotation?

(1 mark)

$$\begin{aligned} \text{period} &= \frac{2\pi}{b} \\ &= \frac{6.28}{1.4} \\ &= 4.49 \text{ seconds} \end{aligned}$$

- b) For how many seconds (to 2 decimal places) is the stone at least 120 cm above the ground during the first rotation of the tire? Show your work.

(2 marks)



$$\begin{aligned} \text{time} &= 2.80 - 1.69 \\ &= 1.11 \text{ seconds} \end{aligned}$$

Marking Key	
❶	1 mark for correct answer in (a)
❷	1 mark for appropriate work in (b)
❸	1 mark for correct answer in (b)

Exemplar 1

19. A stone gets stuck in the tire of a tractor plowing a field. The following sinusoidal equation models the height of the stone as the tire turns:

Total:
3 marks

$$y = 70 \sin(1.4x + 4.71) + 70$$

where y represents the height of the stone with respect to the ground (in cm)
and x represents the time (in seconds).

- a) How long does it take for the tire to make one complete rotation?

(1 mark)

1.4 second

- b) For how many seconds (to 2 decimal places) is the stone at least 120 cm above the ground during the first rotation of the tire? Show your work.

(2 marks)

$$2.81 - 1.7 = 1.11 \text{ second}$$

2 marks:

- ② → 1 mark for appropriate work in (b)
③ → 1 mark for correct answer in (b)

Exemplar 2

19. A stone gets stuck in the tire of a tractor plowing a field. The following sinusoidal equation models the height of the stone as the tire turns:

Total:
3 marks

$$y = 70 \sin(1.4x + 4.71) + 70$$

where y represents the height of the stone with respect to the ground (in cm)
and x represents the time (in seconds).

- a) How long does it take for the tire to make one complete rotation?

(1 mark)

$$P = \frac{2\pi}{b} = \frac{2\pi}{1.4} = 4.49 \text{ s}$$

- b) For how many seconds (to 2 decimal places) is the stone at least 120 cm above the ground during the first rotation of the tire? Show your work.

(2 marks)

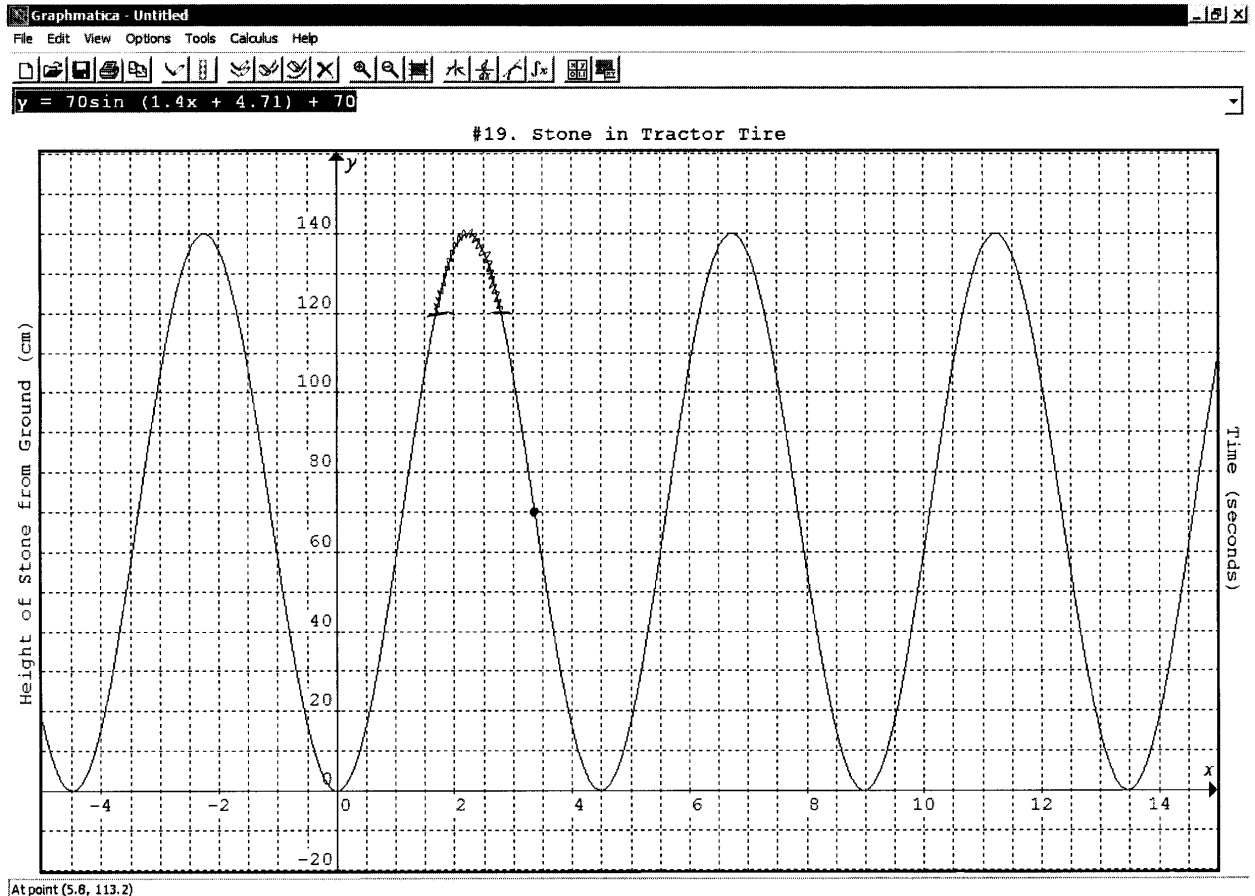
From graph: 1.7 to 2.75

$$2.75 - 1.7 = 1.05 \text{ s}$$

2 marks:

- ① → 1 mark for correct answer in (a)
② → 1 mark for correct answer in (b)

Exemplar 2 continued



Question No. 20 and Answer

20. Charles decides to start an ostrich farm with a population of 200 ostriches. The expected annual birth rate is 5%. Charles will purchase 50 additional ostriches each year.

Total:
4 marks

- a) If he sells 40% of the ostriches each year, how many ostriches will there be in the herd after 5 years? Show your work.

(2 marks)

There will be 149 ostriches in the herd after 5 years.

- b) Charles must always keep a minimum of 76 ostriches on the farm. Will his plan maintain this level in the long term? Show your work to support your answer.

(2 marks)

	Answer 1	Answer 2	Answer 3	Answer 4
Year	$u(n-1)*0.65+50$	$(u(n-1)*1.05+50)*0.6$	$u(n-1)*1.05*0.6+50$	$(u(n-1)+50)*0.65$
0	200	200	200	200
1	180	156	176	162.5
2	167	128.28	160.88	138.13
3	158.55	110.82	151.35	122.28
4	153.06	99.81	145.35	111.98
a) 5	149.49	92.88	141.57	105.29
⋮	⋮	⋮	⋮	⋮
b) stabilizes at:	142.86	81.08	135.14	92.86

The population of ostriches stabilizes at 143, so his plan will maintain this level in the long term.

Other answers are possible.

Marking Key	
①	1 mark for appropriate work in (a)
②	1 mark for correct answer in (a)
③	1 mark for correct answer in (b)
④	1 mark for appropriate work to support answer in (b)

Exemplar 1

20. Charles decides to start an ostrich farm with a population of 200 ostriches. The expected annual birth rate is 5%. Charles will purchase 50 additional ostriches each year.

Total:
4 marks

- a) If he sells 40% of the ostriches each year, how many ostriches will there be in the herd after 5 years? Show your work.

(2 marks)

$$\begin{array}{r} 200 \times 0.35 + 50 \\ 120 \times 0.35 + 50 \\ 92 \times 0.35 + 50 \\ 82.2 \times 0.35 + 50 \end{array} \quad \begin{array}{l} 200 \\ 120 \\ 92 \\ 82.2 \\ 78.77 \text{ ostriches} \end{array}$$

- b) Charles must always keep a minimum of 76 ostriches on the farm. Will his plan maintain this level in the long term? Show your work to support your answer.

(2 marks)

*yes because the number of ostriches
levels off at 76*

2 marks:

- ③ → 1 mark for correct answer in (b)
④ → 1 mark for appropriate work to support answer in (b)

Exemplar 2

20. Charles decides to start an ostrich farm with a population of 200 ostriches. The expected annual birth rate is 5%. Charles will purchase 50 additional ostriches each year.

Total:
4 marks

$$.95u(n-1) + 50$$

$n_{\min} = 0$
 $u_{\min} = 200$

- a) If he sells 40% of the ostriches each year, how many ostriches will there be in the herd after 5 years? Show your work.

(2 marks)

$$(1.05u(n-1) + 50) \times 0.6$$

$$u(n_{\min}) = \{200\}$$

Yr	#
0	200
1	156
2	129
3	111
4	100
5	89

- b) Charles must always keep a minimum of 76 ostriches on the farm. Will his plan maintain this level in the long term? Show your work to support your answer.

(2 marks)

yes!

After year 28, it stays steady at 81.081 or 82 head. He is well above the 76 he must keep.

3 marks:

- ① → 1 mark for appropriate work in (a)
- ③ → 1 mark for correct answer in (b)
- ④ → 1 mark for appropriate work to support answer in (b)

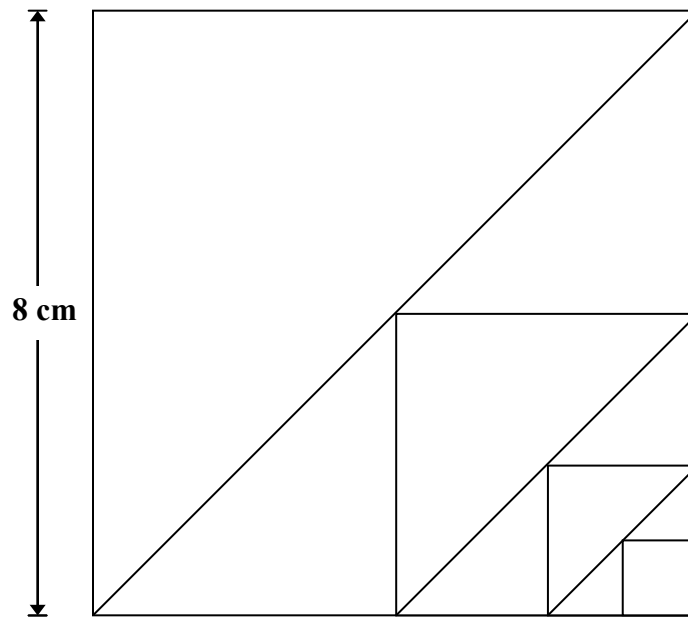
Question No. 21 and Answer

21. a) Use the original square below to create a fractal given the following steps:

**Total:
3 marks**

1. Draw a diagonal line from the lower left corner to the upper right corner of the original square.
2. From the midpoint of the diagonal line, draw a horizontal line to the right side of the original square and a vertical line to the bottom of the original square, in order to create a new square.
3. Repeat steps 1 and 2 two more times with each new square.

(2 marks)



Original

b) Determine the perimeter of the last square that was drawn.

(1 mark)

$$\begin{aligned} \text{perimeter} &= 4(1) \\ &= 4 \text{ cm} \end{aligned}$$

Marking Key	
①	<i>1 mark for 3 correct diagonals in (a)</i>
②	<i>1 mark for 3 correct squares in (a)</i>
③	<i>1 mark for correct answer in (b)</i>

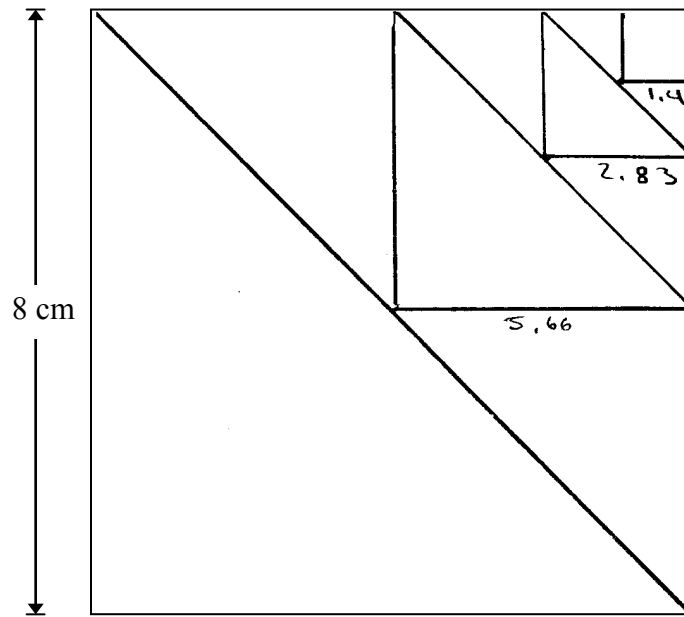
Exemplar 1

21. a) Use the original square below to create a fractal given the following steps:

Total:
3 marks

1. Draw a diagonal line from the lower left corner to the upper right corner of the original square.
2. From the midpoint of the diagonal line, draw a horizontal line to the right side of the original square and a vertical line to the bottom of the original square, in order to create a new square.
3. Repeat steps 1 and 2 two more times with each new square.

(2 marks)



Original

b) Determine the perimeter of the last square that was drawn.

(1 mark)

$$1.41(4) = 5.64 \text{ cm}$$

1 mark:

② → 1 mark for 3 correct squares in (a)
Note: Deduction of 1 mark in (a) because of consistent directional error.

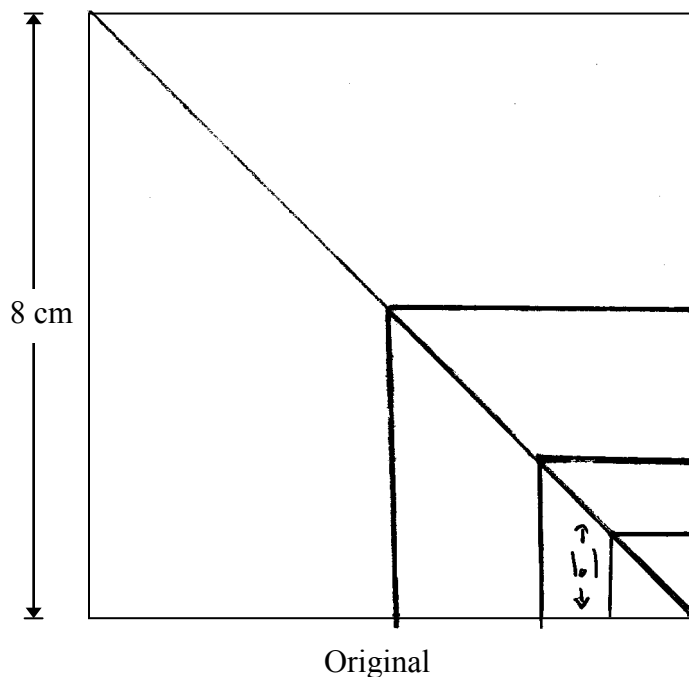
Exemplar 2

21. a) Use the original square below to create a fractal given the following steps:

Total:
3 marks

1. Draw a diagonal line from the lower left corner to the upper right corner of the original square.
2. From the midpoint of the diagonal line, draw a horizontal line to the right side of the original square and a vertical line to the bottom of the original square, in order to create a new square.
3. Repeat steps 1 and 2 two more times with each new square.

(2 marks)



b) Determine the perimeter of the last square that was drawn.

(1 mark)

4.4 cm is the perimeter of the last drawn square.

$$\begin{array}{r} 1.1 \\ \times 4 \\ \hline 4.4 \end{array}$$

2 marks:

- ② → 1 mark for 3 correct squares in (a)
- ③ → 1 mark for correct answer in (b)

Marking Keys and Scoring Rubrics for the Inquiry Task

Inquiry Task Question No. 1 and Answer

DESIGN AND MEASUREMENT

1. You have been asked to design the layout for a new community fitness centre. The centre measures 36 feet by 40 feet and must meet the following specifications:

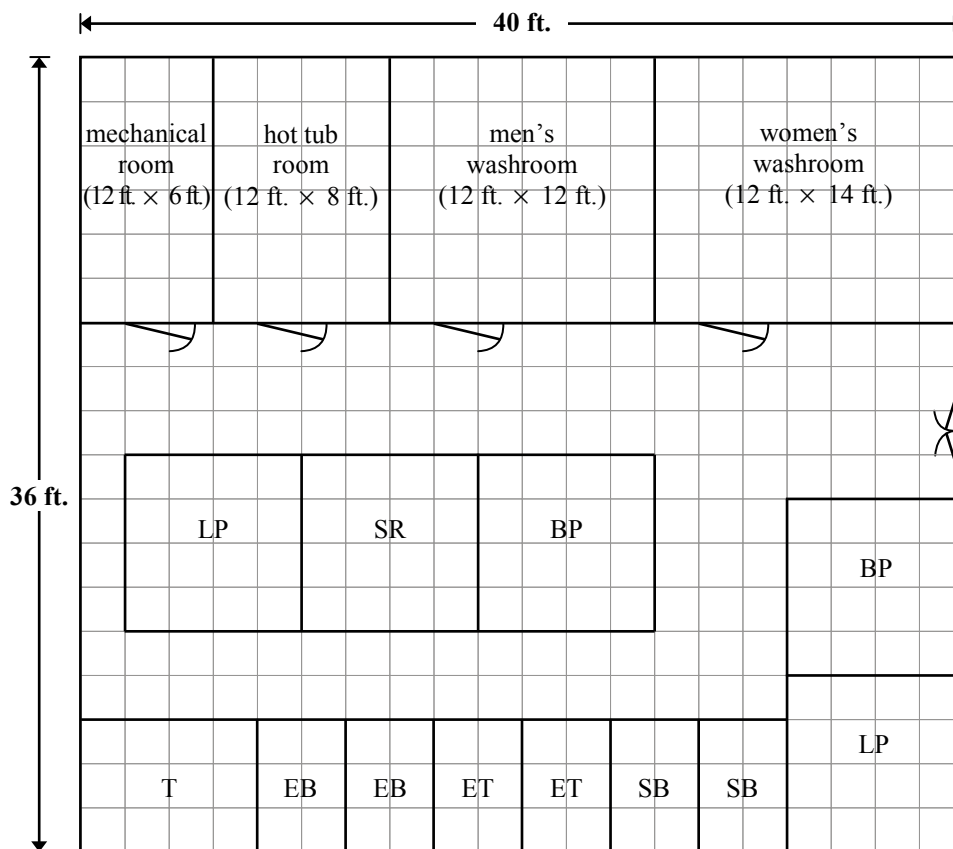
**Total:
10 marks**

- The women’s washroom, with change room, must have an area between 150 ft.² and 200 ft.²
- The men’s washroom, with change room, must have an area between 120 ft.² and 170 ft.²
- The hot tub room must measure 8 ft. by 12 ft.
- The mechanical room must have an area between 50 ft.² and 100 ft.²
- The rest of the centre must be an open space reserved for equipment and for clients to move around.
- Each room must have a door that is 36 in. wide and 80 in. high.
- The entrance to the fitness centre must have a double door that is 60 in. wide and 80 in. high.

a) Complete a scale diagram of the centre. Draw all the walls with a solid line and indicate the location of all the doors. When considering distances and areas, ignore the thickness of the walls. Label each room and indicate the dimensions.

(3 marks)

Scale: 1 square = 2 feet



Question No. 1 continued

Other answers are possible.

Mark(s):

- ① → 1 mark for correct scale diagram including all rooms
- ② → 1 mark for indicating the location of all doors and labelling each room
- ③ → 1 mark for meeting the required specifications for the area of each room

- b) You have also been asked to install equipment in the open space, allowing a certain amount of space for each piece of equipment to be used safely. You can spend between \$12 000.00 and \$16 000.00, not including taxes, and must have at least one of each of the pieces indicated in the chart below.

Complete the last column of the chart. Indicate where each piece of equipment will be located on your diagram in (a). Use the labels provided and draw lines around each piece to indicate the area of safe use. Determine the total cost of the equipment, not including taxes.

(2 marks)

Equipment	Label	Cost (not including taxes)	Area of Safe Use	Quantity
Bench press	BP	\$850.00	8 ft. × 8 ft.	2
Leg press	LP	\$650.00	8 ft. × 8 ft.	2
Squat rack	SR	\$550.00	8 ft. × 8 ft.	1
Treadmill	T	\$1550.00	8 ft. × 6 ft.	1
Exercise bench	EB	\$550.00	6 ft. × 4 ft.	2
Elliptical trainer	ET	\$1450.00	6 ft. × 4 ft.	2
Stationary bicycle	SB	\$1575.00	6 ft. × 4 ft.	2

Bench press:	$2 \times \$850.00 =$	\$1700.00
Leg press:	$2 \times \$650.00 =$	\$1300.00
Squat rack:	$1 \times \$550.00 =$	\$550.00
Treadmill:	$1 \times \$1550.00 =$	\$1550.00
Exercise bench:	$2 \times \$550.00 =$	\$1100.00
Elliptical trainer:	$2 \times \$1450.00 =$	\$2900.00
Stationary bicycle:	$2 \times \$1575.00 =$	\$3150.00
		\$12 250.00

Other answers are possible.

Mark(s):

- ④ → 1 mark for indicating where each piece of equipment is located on the diagram in (a) with lines drawn indicating the area of safe use for each piece
- ⑤ → 1 mark for having at least one of each of the pieces of equipment and having a correct total cost between \$12 000.00 and \$16 000.00, not including taxes

Question No. 1 continued

- c) The walls surrounding the open space reserved for the equipment are 10 feet high and must be painted. The doors do not need to be painted. You will need one coat of primer and two coats of paint. How many cans of each will be needed if one can of primer covers 300 ft.^2 and one can of paint covers 400 ft.^2 ?

(3 marks)

area to be painted:

$$\begin{aligned} & 10(24 + 40 + 24 + 40) - \left[4\left(6\frac{2}{3} \times 3\right) + 1\left(6\frac{2}{3} \times 5\right) \right] \\ & = 10(128) - [4(20) + 33.\bar{3}] \\ & = 1166.67 \text{ ft.}^2 \end{aligned}$$

primer:

$$\frac{1166.67 \text{ ft.}^2}{300 \text{ ft.}^2/\text{can}} = 3.89 \text{ cans or 4 cans}$$

paint:

$$\begin{aligned} & 1166.67 \times 2 \text{ coats} = 2333.34 \text{ ft.}^2 \\ & \frac{2333.34 \text{ ft.}^2}{400 \text{ ft.}^2/\text{can}} = 5.83 \text{ cans or 6 cans} \end{aligned}$$

Other answers are possible.

Marker Note(s):

→ Maximum 0.5 mark deduction per question if student rounds to whole units too soon.

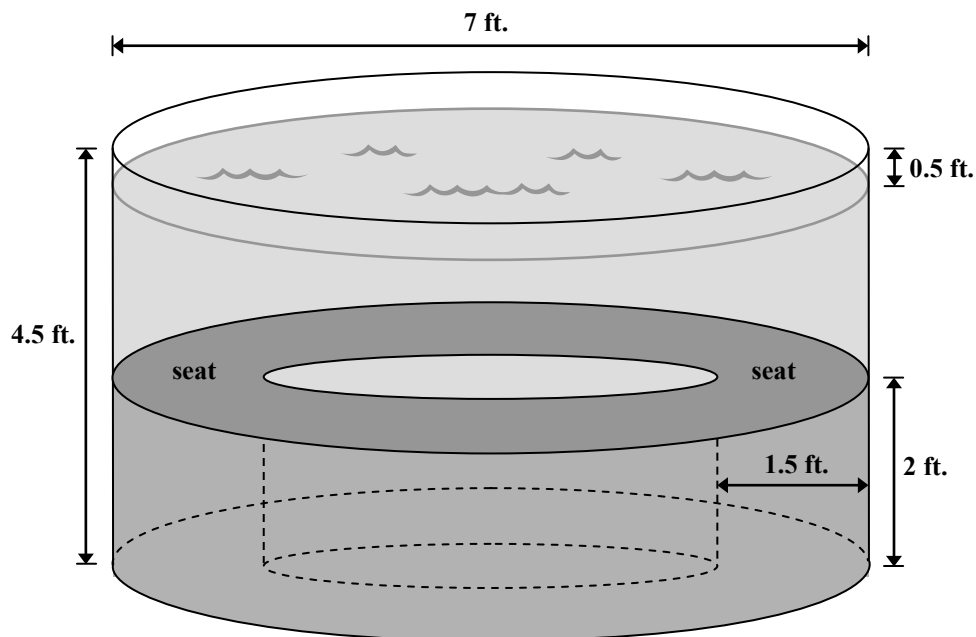
Mark(s):

- ⑥ → 1 mark for correct area of walls (with doors)
- ⑦ → 1 mark for correct area to be painted (without doors)
- ⑧ → 1 mark for correct number of cans of primer and paint

Question No. 1 continued

- d) The dimensions for the hot tub are indicated on the diagram below. Determine the volume of water necessary to fill the hot tub to 0.5 feet from the top. Show your work. (Diagram is not drawn to scale.)

(2 marks)



$$\begin{aligned}\text{volume}_{\text{bottom}} &= \pi r^2 h \\ &= \pi (2)^2 (2) \\ &= 25.13 \text{ ft}^3\end{aligned}$$

$$\begin{aligned}\text{volume}_{\text{top}} &= \pi r^2 h \\ &= \pi (3.5)^2 (2) \\ &= 76.97 \text{ ft}^3\end{aligned}$$

$$\text{total volume} = 25.13 + 76.97 = \mathbf{102.10 \text{ ft}^3}$$

Mark(s):

- 9 → 1 mark for appropriate work
10 → 1 mark for correct answer

Question No. 1 continued

Scoring Rubric

General Performance Indicators			
Level 1—limited understanding			
1 mark weak attempt: inappropriate strategy or no strategy 1 criterion correct	2 marks reasonable attempt: inappropriate strategy, major errors or omissions 2 criteria correct	3 marks reasonable attempt: inappropriate strategy but carried through correctly 3 criteria correct	
Level 2—good understanding			
4 marks sound strategy with major errors 4 criteria correct	5 marks sound strategy with minor errors 5 criteria correct	6 marks mostly complete with some omissions 6 criteria correct	7 marks almost complete and correct, major errors 7 criteria correct
Level 3—exceptional understanding			
8 marks complete, two minor errors, trivial errors 8 criteria correct	9 marks complete, one minor error 9 criteria correct	10 marks complete and correct 10 criteria correct	

Marker Note(s):

→ Maximum 0.5 mark deduction per question if student rounds to whole units too soon in (c).

Marking Key		
1		<i>1 mark for correct scale diagram including all rooms</i>
2	a)	<i>1 mark for indicating the location of all doors and labelling each room</i>
3		<i>1 mark for meeting the required specifications for the area of each room</i>
4	b)	<i>1 mark for indicating where each piece of equipment is located on the diagram in (a) with lines drawn indicating the area of safe use for each piece</i>
5		<i>1 mark for having at least one of each of the pieces of equipment and having a correct total cost between \$12 000.00 and \$16 000.00, not including taxes</i>
6	c)	<i>1 mark for correct area of walls (with doors)</i>
7		<i>1 mark for correct area to be painted (without doors)</i>
8		<i>1 mark for correct number of cans of primer and paint</i>
9	d)	<i>1 mark for appropriate work</i>
10		<i>1 mark for correct answer</i>

THIS PAGE WAS INTENTIONALLY LEFT BLANK.

Exemplar 1

DESIGN AND MEASUREMENT

1. You have been asked to design the layout for a new community fitness centre. The centre measures 36 feet by 40 feet and must meet the following specifications:

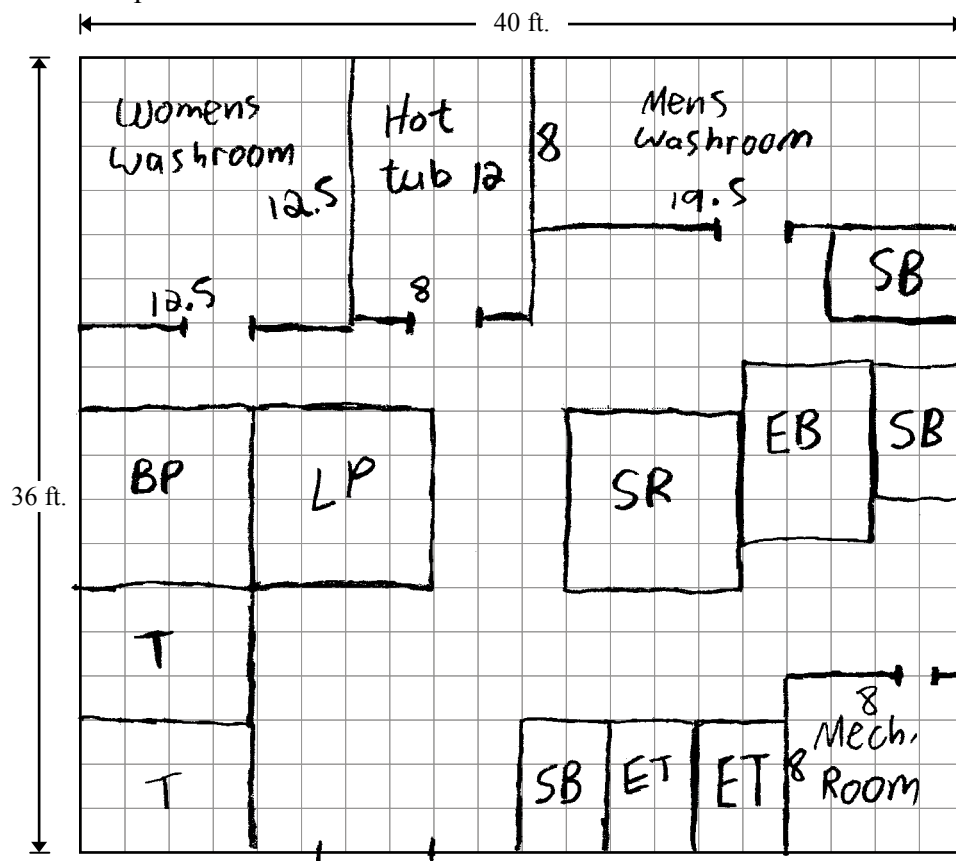
Total:
10 marks

- The women's washroom, with change room, must have an area between 150 ft.² and 200 ft.²
- The men's washroom, with change room, must have an area between 120 ft.² and 170 ft.²
- The hot tub room must measure 8 ft. by 12 ft.
- The mechanical room must have an area between 50 ft.² and 100 ft.²
- The rest of the centre must be an open space reserved for equipment and for clients to move around.
- Each room must have a door that is 36 in. wide and 80 in. high.
- The entrance to the fitness centre must have a double door that is 60 in. wide and 80 in. high.

a) Complete a scale diagram of the centre. Draw all the walls with a solid line and indicate the location of all the doors. When considering distances and areas, ignore the thickness of the walls. Label each room and indicate the dimensions.

(3 marks)

Scale: 1 square = 2 feet



Exemplar 1 continued

- b) You have also been asked to install equipment in the open space, allowing a certain amount of space for each piece of equipment to be used safely. You can spend between \$12 000.00 and \$16 000.00, not including taxes, and must have at least one of each of the pieces indicated in the chart below.

Complete the last column of the chart. Indicate where each piece of equipment will be located on your diagram in (a). Use the labels provided and draw lines around each piece to indicate the area of safe use. Determine the total cost of the equipment, not including taxes.

(2 marks)

Equipment	Label	Cost (not including taxes)	Area of Safe Use	Quantity
Bench press	BP	\$850.00	8 ft. × 8 ft.	1
Leg press	LP	\$650.00	8 ft. × 8 ft.	1
Squat rack	SR	\$550.00	8 ft. × 8 ft.	1
Treadmill	T	\$1550.00	8 ft. × 6 ft.	2
Exercise bench	EB	\$550.00	6 ft. × 4 ft.	1
Elliptical trainer	ET	\$1450.00	6 ft. × 4 ft.	2
Stationary bicycle	SB	\$1575.00	6 ft. × 4 ft.	3

$$850 + 650 + 550 + 2(1550) + 550 + 2(1450) + 3(1575) =$$

$$\$13325$$

Exemplar 1 continued

- c) The walls surrounding the open space reserved for the equipment are 10 feet high and must be painted. The doors do not need to be painted. You will need one coat of primer and two coats of paint. How many cans of each will be needed if one can of primer covers 300 ft.^2 and one can of paint covers 400 ft.^2 ?

(3 marks)

$$\text{Doors} = 4(3) + 5 = 17 \text{ ft not painted}$$

$$2 \times 36 \times 10 = 720$$

$$2 \times 40 \times 10 = 800$$

$$17 \times 10 = 170$$

$$720 + 800 - 170 = 1350 \text{ ft}^2$$

$$\frac{1350}{300} = 4.5 = 5$$

$$\frac{1350}{400} = 3.375 = 4 \times 2 = 8$$

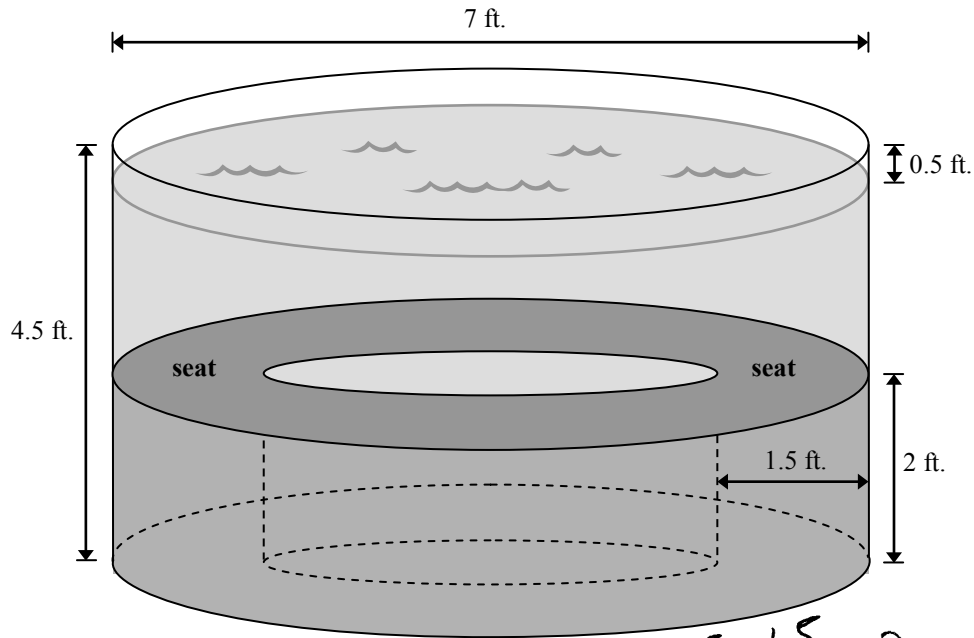
5 cans Primer

8 cans Paint

Exemplar 1 continued

- d) The dimensions for the hot tub are indicated on the diagram below. Determine the volume of water necessary to fill the hot tub to 0.5 feet from the top. Show your work. (Diagram is not drawn to scale.)

(2 marks)



$$\begin{aligned} \pi r^2 &= x \\ \pi 3.5^2 &= \\ x &= 38.5 \times 2 \end{aligned}$$

$$x = 77L$$

$$77 + 25 = \boxed{102L}$$

$$\frac{7 - 1.5 - 1.5}{2} = 2$$

$$\begin{aligned} \pi r^2 &= y \\ \pi 2^2 &= 12.5 \times 2 = \\ y &= 25L \end{aligned}$$

7.5 marks:

①		1 mark for correct scale diagram including all rooms
②	a)	1 mark for indicating the location of all doors and labelling each room
③		1 mark for meeting the required specifications for the area of each room
④		1 mark for indicating where each piece of equipment is located on the diagram in (a)
⑤	b)	with lines drawn indicating the area of safe use for each piece 1 mark for having at least one of each of the pieces of equipment and having a correct total cost between \$12 000.00 and \$16 000.00, not including taxes
⑧	c)	1 mark for correct number of cans of primer and paint
⑨	d)	1 mark for appropriate work
⑩		1 mark for correct answer

→ deduction of 0.5 marks for rounding to whole units too soon in (c)
Note: No mark deduction for trivial error in (b) (“EB” is too big).

Exemplar 2

DESIGN AND MEASUREMENT

1. You have been asked to design the layout for a new community fitness centre. The centre measures 36 feet by 40 feet and must meet the following specifications:

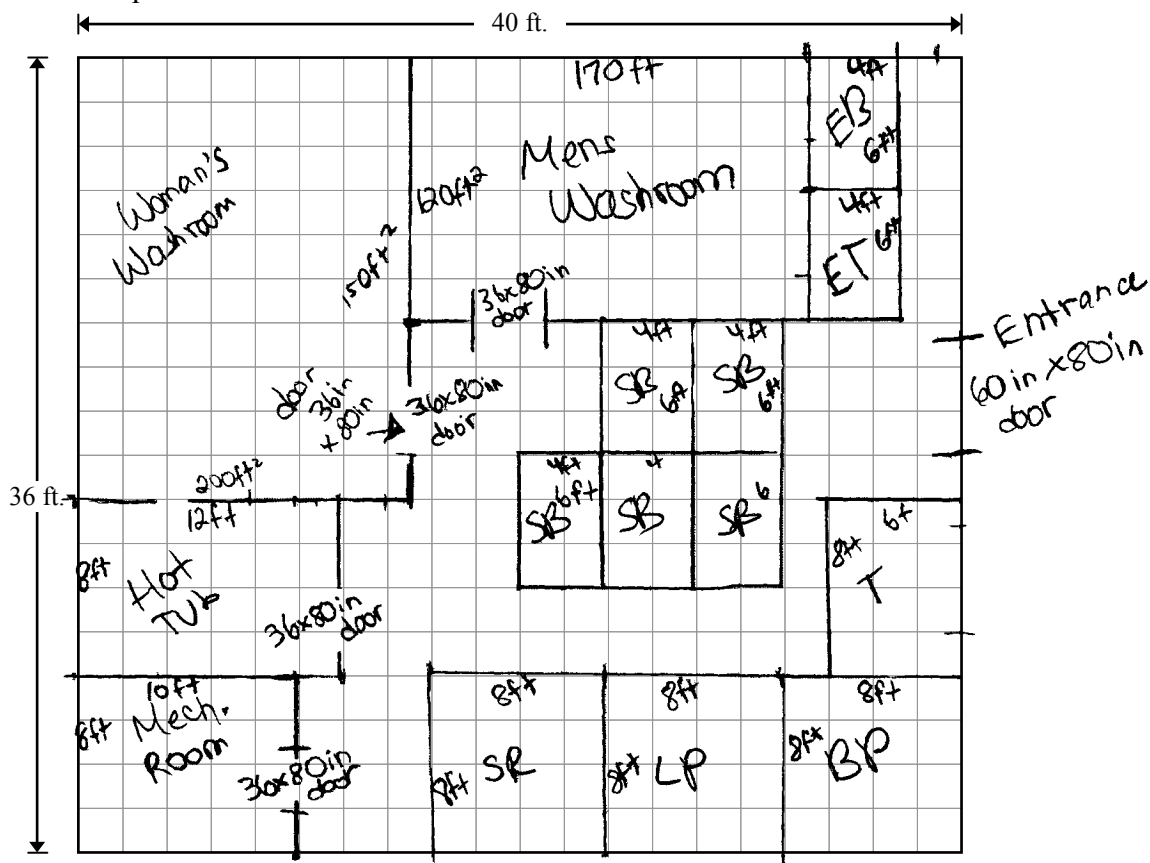
Total:
10 marks

- The women's washroom, with change room, must have an area between 150 ft.² and 200 ft.²
- The men's washroom, with change room, must have an area between 120 ft.² and 170 ft.²
- The hot tub room must measure 8 ft. by 12 ft.
- The mechanical room must have an area between 50 ft.² and 100 ft.²
- The rest of the centre must be an open space reserved for equipment and for clients to move around.
- Each room must have a door that is 36 in. wide and 80 in. high.
- The entrance to the fitness centre must have a double door that is 60 in. wide and 80 in. high.

a) Complete a scale diagram of the centre. Draw all the walls with a solid line and indicate the location of all the doors. When considering distances and areas, ignore the thickness of the walls. Label each room and indicate the dimensions.

(3 marks)

Scale: 1 square = 2 feet



Exemplar 2 continued

- b) You have also been asked to install equipment in the open space, allowing a certain amount of space for each piece of equipment to be used safely. You can spend between \$12 000.00 and \$16 000.00, not including taxes, and must have at least one of each of the pieces indicated in the chart below.

Complete the last column of the chart. Indicate where each piece of equipment will be located on your diagram in (a). Use the labels provided and draw lines around each piece to indicate the area of safe use. Determine the total cost of the equipment, not including taxes.

(2 marks)

Equipment	Label	Cost (not including taxes)	Area of Safe Use	Quantity
Bench press	BP	\$850.00	8 ft. × 8 ft.	1
Leg press	LP	\$650.00	8 ft. × 8 ft.	1
Squat rack	SR	\$550.00	8 ft. × 8 ft.	1
Treadmill	T	\$1550.00	8 ft. × 6 ft.	1
Exercise bench	EB	\$550.00	6 ft. × 4 ft.	1
Elliptical trainer	ET	\$1450.00	6 ft. × 4 ft.	1
Stationary bicycle	SB	\$1575.00	6 ft. × 4 ft.	5

$$\begin{array}{r}
 \text{BP} \quad 850 \\
 \text{LP} \quad + 650 \\
 \text{SR} \quad + 550 \\
 \text{T} \quad + 1550 \\
 \text{EB} \quad + 550 \\
 \text{ET} \quad + 1450 \\
 \text{SB} \quad + 7875 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \hline
 \$ 13500
 \end{array}$$

$$\begin{array}{r}
 1575 \\
 \times \quad 5 \\
 \hline
 7875
 \end{array}$$

It will cost \$13,500 before taxes

Exemplar 2 continued

- c) The walls surrounding the open space reserved for the equipment are 10 feet high and must be painted. The doors do not need to be painted. You will need one coat of primer and two coats of paint. How many cans of each will be needed if one can of primer covers 300 ft.^2 and one can of paint covers 400 ft.^2 ?

(3 marks)

$$\begin{array}{l} \text{Women Washroom walls} \rightarrow 8\text{ft} \\ \text{Mens Washroom walls} \rightarrow 14\text{ft} + 12\text{ft} \\ \text{Hot tub wall} \rightarrow 2\text{ft} + 5\text{ft} \\ \text{left over space} \rightarrow 3\text{ft} + 30\text{ft} + 31\text{ft} + 3\text{ft} \\ \text{mech. room} \rightarrow 5\text{ft} \\ \hline 83\text{ft} \end{array}$$

$$83 \times 10 = 830\text{ft}$$

primer

$$830 \div 30 = 27.6 \\ \rightarrow 28 \text{ cans}$$

paint

$$830 \div 40 = 20.75 \\ \begin{array}{r} \times 2 \\ \hline 41.5 \\ \rightarrow 42 \text{ cans} \end{array}$$

you need 28 cans of primer and 42 cans of paint

Exemplar 2 continued

- d) The dimensions for the hot tub are indicated on the diagram below. Determine the volume of water necessary to fill the hot tub to 0.5 feet from the top. Show your work. (Diagram is not drawn to scale.)

(2 marks)

The diagram shows a cylindrical hot tub with a diameter of 7 ft and a total height of 4.5 ft. Inside, there are two seats, each 2 ft high. The radius of the hot tub is 3.5 ft. The water level is 0.5 ft from the top. Handwritten calculations show the volume of water needed by subtracting the volume of the seats from the total volume of the hot tub.

$V = \pi r^2 h$

$= \pi 3.5^2 \times 4$

$= 307.876$

$= 153.938$

$= 153.94$

$7 - 3 = 4$

$V = \pi r^2 h$

$= \pi 2^2 \times 2$

$= 25.132$

$V = \pi r^2 \times h$

$= \pi 3.5^2 \times 2$

$= 76.969$

$= 76.97$

153.94
 $- 76.97$

 76.97
 $+ 25.13$

 102.1

4.5
 $- .5$

 4
 $- 2$

 2

you need 102.1 ft of water for the hot tub

5 marks:

①	a)	1 mark for correct scale diagram including all rooms
②		1 mark for indicating the location of all doors and labelling each room
④	b)	1 mark for indicating where each piece of equipment is located on the diagram in (a) with lines drawn indicating the area of safe use for each piece
⑨	d)	1 mark for appropriate work
⑩		1 mark for correct answer

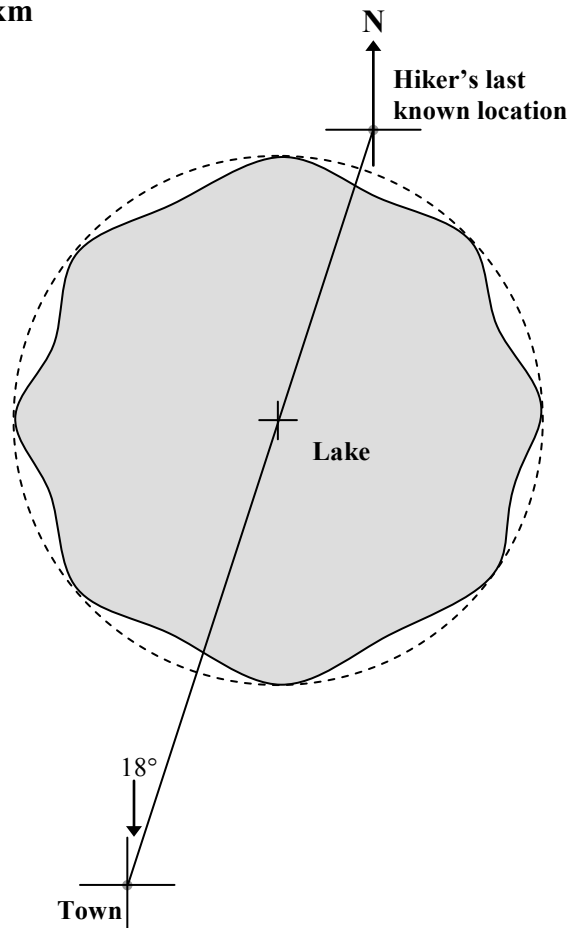
Inquiry Task Question No. 2 and Answer

VECTORS

2. A hiker is lost in the woods. His last known location is 105 km from the nearest town, where a search and rescue operation has been organized. The following scale diagram describes the situation.

Total:
9 marks

Scale: 1 cm = 10 km



- a) What is the direction from the town to the hiker's last known location?
(1 mark)

The direction is N 18° E.

Mark(s):

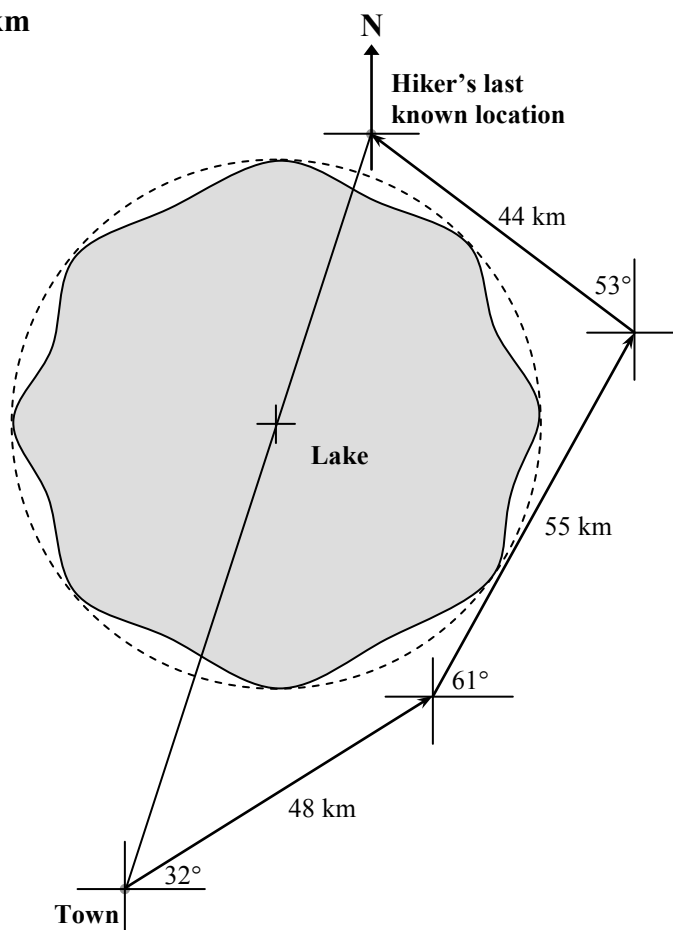
① → 1 mark for correct answer

Question No. 2 continued

- b) Avoiding the lake, create a route for the rescue crew to travel from the town to the hiker's last known location. Complete the scale diagram on the previous page stating all distances and directions.

(2 marks)

Scale: 1 cm = 10 km



The rescue crew could travel 48 km in a direction of E 32° N,
then 55 km in a direction of E 61° N,
and then 44 km in a direction of N 53° W.

Other answers are possible.

Marker Note(s):

- Maximum 0.5 mark deduction per question if student forgets more than one arrowhead in scale vector diagrams or required vector sketches.
- Maximum 1 mark deduction per question if student uses the **same** incorrect directional method.

Mark(s):

- ② → 1 mark for correct distances
- ③ → 1 mark for correct directions

Question No. 2 continued

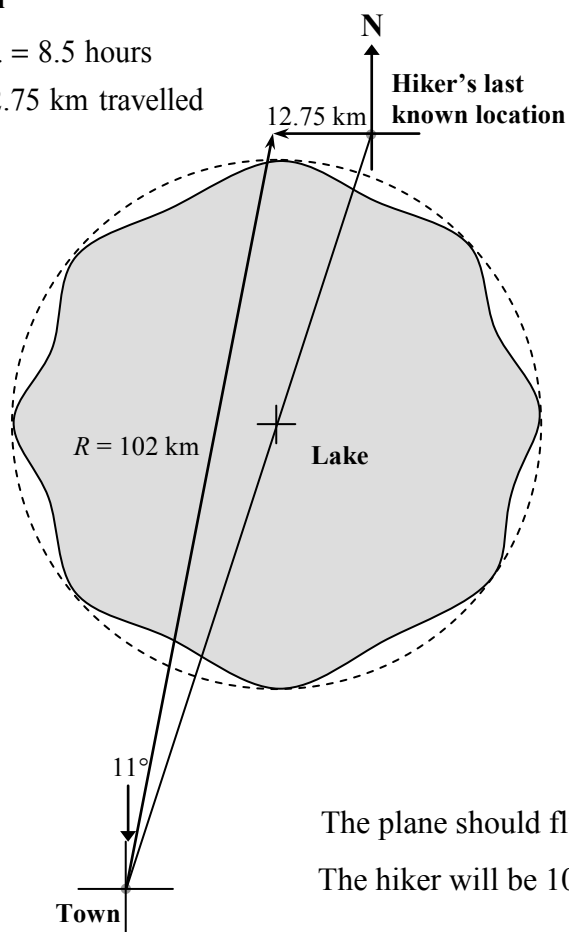
- c) Once the rescue crew reaches the hiker's last known location, they find an arrow in the sand pointing due west and "8:30 a.m." is written below it. The rescue crew estimates that the hiker can walk 1.5 km/h in the woods. If a rescue plane leaves from the town, at what bearing should the pilot fly in order to intercept the hiker at 5:00 p.m.? How far away from the town will the hiker be when he is found? Show your work.

(4 marks)

Scale: 1 cm = 10 km

8:30 a.m. to 5:00 p.m. = 8.5 hours

$8.5 \text{ h} \times 1.5 \text{ km/h} = 12.75 \text{ km}$ travelled



The plane should fly at a bearing of 11° .

The hiker will be 102 km from the town.

Marker Note(s):

- Maximum 0.5 mark deduction per question if student forgets more than one arrowhead in scale vector diagrams or required vector sketches.
- Maximum 1 mark deduction per question if student uses the **same** incorrect directional method.

Mark(s):

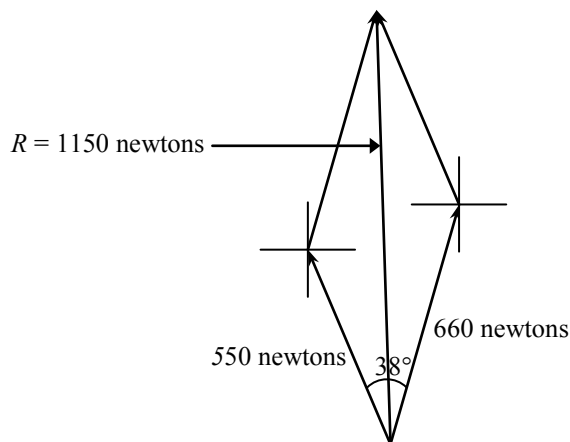
- ④ → 1 mark for correct distance of 12.75 km
- ⑤ → 1 mark for appropriate work
- ⑥ → 1 mark for correct bearing the plane should fly
- ⑦ → 1 mark for correct distance of hiker from the town

Question No. 2 continued

- d) The pilot is unable to find the hiker. The rescue crew finds him the next morning, trapped under a fallen tree. Two of the rescuers tie ropes on the end of the tree and form an angle of 38° to each other. One rescuer pulls on his rope with a force of 550 newtons. If 1150 newtons of force is needed to move the tree, what is the magnitude of the minimum force the other rescuer will need to exert on his rope? Show your work.

(2 marks)

Scale: 1 cm = 200 newtons



The other rescuer will need to exert a minimum force of $3.3 \times 200 = 660$ newtons.

OR

Trisolve:

	142	
	665.612	550
17.124		20.876
1150		
SIDE	ANGLE	
1150	A	142
550	B	17.124
665.612	C	20.876

The other rescuer will need to exert a minimum force of 665.61 newtons.

Marker Note(s):

- Maximum 0.5 mark deduction per question if student does not state a scale when using scale diagrams as a strategy.
- Maximum 0.5 mark deduction per question if student forgets more than one arrowhead in scale vector diagrams or required vector sketches.
- Award no marks if student adds the vectors tail-to-tail.

Mark(s):

- ⑧ → 1 mark for appropriate work
- ⑨ → 1 mark for correct answer

Question No. 2 continued

Scoring Rubric

General Performance Indicators			
Level 1—limited understanding			
1 mark weak attempt: inappropriate strategy or no strategy 1 criterion correct	2 marks reasonable attempt: inappropriate strategy, major errors or omissions 2 criteria correct	3 marks reasonable attempt: inappropriate strategy but carried through correctly 3 criteria correct	
Level 2—good understanding			
4 marks sound strategy with major errors 4 criteria correct	5 marks sound strategy with minor errors 5 criteria correct	6 marks mostly complete with some omissions 6 criteria correct	7 marks almost complete and correct, minor errors 7 criteria correct
Level 3—exceptional understanding			
8 marks complete, one minor error 8 criteria correct		9 marks complete and correct 9 criteria correct	

Marker Note(s):

- Maximum 0.5 mark deduction per question if student does not state a scale when using scale diagrams as a strategy.
- Maximum 0.5 mark deduction per question if student forgets more than one arrowhead in scale vector diagrams or required vector sketches.
- Maximum 1 mark deduction per question if student uses the **same** incorrect directional method.
- Award no marks if student adds the vectors tail-to-tail in (d).

Marking Key		
1	a)	1 mark for correct answer
2 3	b)	1 mark for correct distances 1 mark for correct directions
4 5 6 7	c)	1 mark for correct distance of 12.75 km 1 mark for appropriate work 1 mark for correct bearing the plane should fly 1 mark for correct distance of hiker from the town
8 9	d)	1 mark for appropriate work 1 mark for correct answer

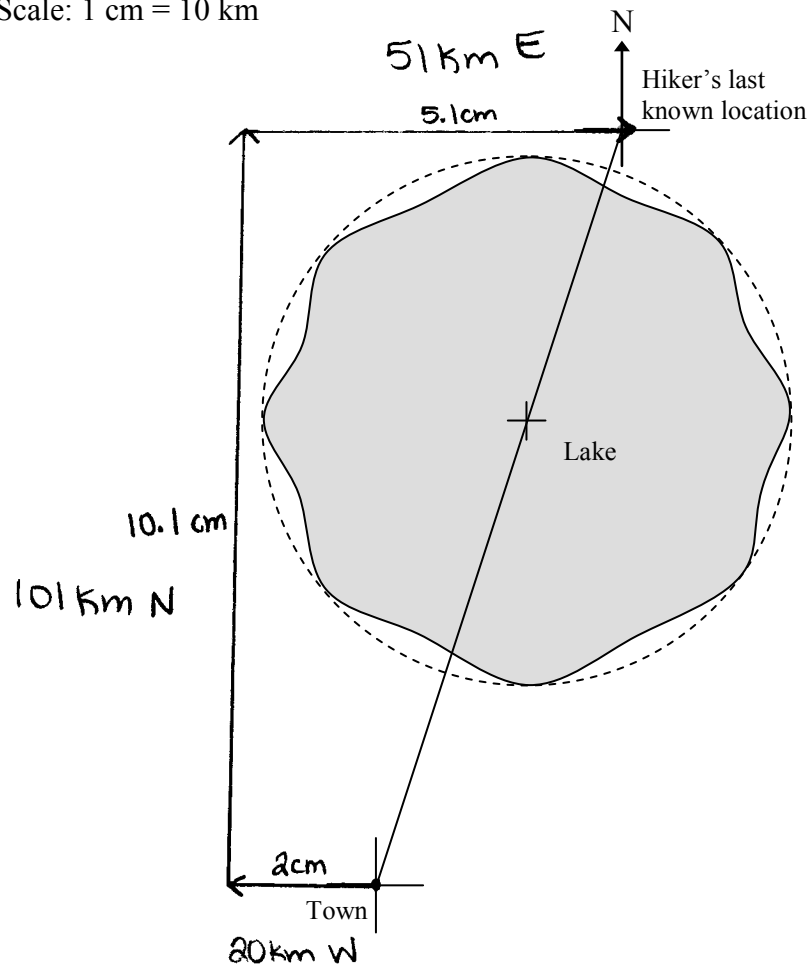
Exemplar 1

VECTORS

2. A hiker is lost in the woods. His last known location is 105 km from the nearest town, where a search and rescue operation has been organized. The following scale diagram describes the situation.

Total:
9 marks

Scale: 1 cm = 10 km



- a) What is the direction from the town to the hiker's last known location?

(1 mark)

72° N of E

Exemplar 1 continued

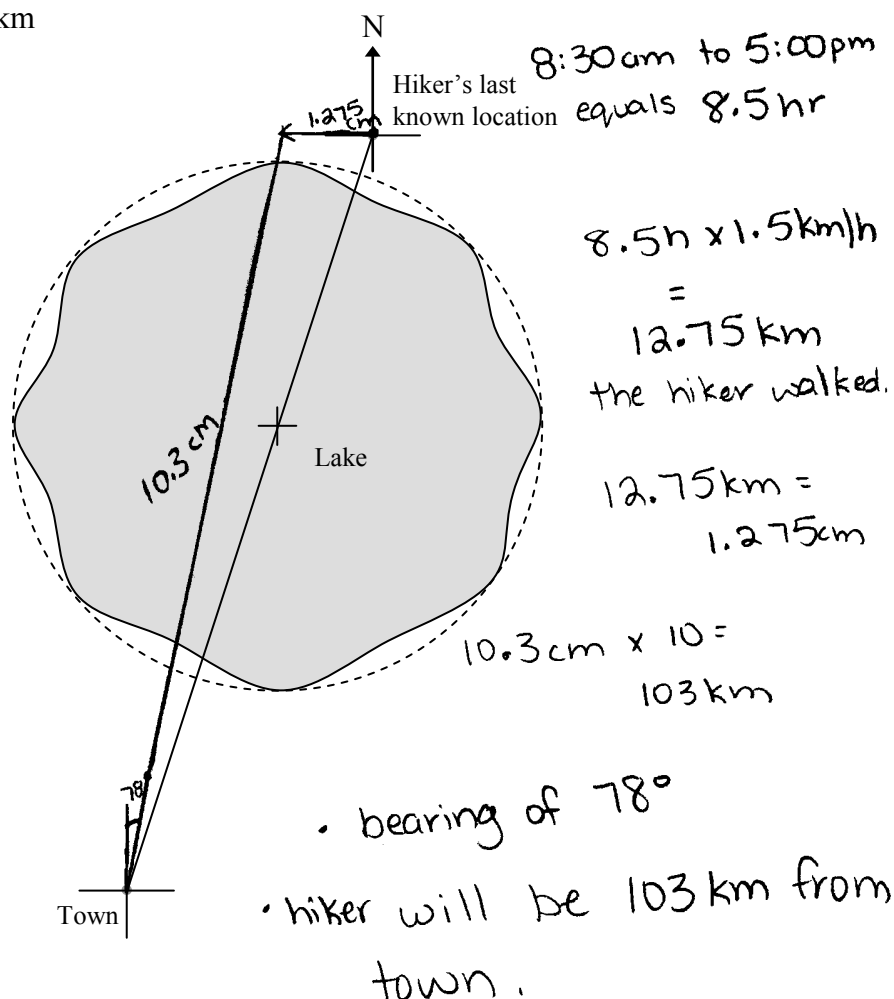
- b) Avoiding the lake, create a route for the rescue crew to travel from the town to the hiker's last known location. Complete the scale diagram on the previous page stating all distances and directions.

(2 marks)

- c) Once the rescue crew reaches the hiker's last known location, they find an arrow in the sand pointing due west and "8:30 a.m." is written below it. The rescue crew estimates that the hiker can walk 1.5 km/h in the woods. If a rescue plane leaves from the town, at what bearing should the pilot fly in order to intercept the hiker at 5:00 p.m.? How far away from the town will the hiker be when he is found? Show your work.

(4 marks)

Scale: 1 cm = 10 km

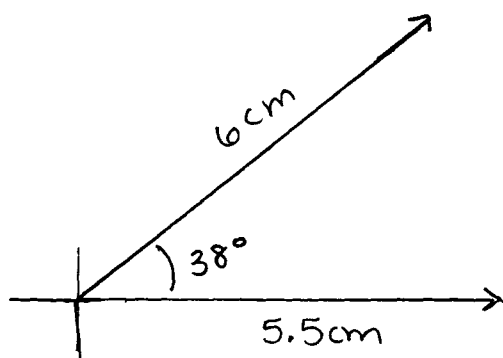


Exemplar 1 continued

- d) The pilot is unable to find the hiker. The rescue crew finds him the next morning, trapped under a fallen tree. Two of the rescuers tie ropes on the end of the tree and form an angle of 38° to each other. One rescuer pulls on his rope with a force of 550 newtons. If 1150 newtons of force is needed to move the tree, what is the magnitude of the minimum force the other rescuer will need to exert on his rope? Show your work.

(2 marks)

$$1\text{cm} = 100\text{N}$$



other rescuer
needs to exert a
magnitude of at least
600 N to move the
tree.

1150 needed to move tree.
- 550 newtons already
exerted = 600n

6 marks:		
❶	a)	1 mark for correct answer
❷	b)	1 mark for correct distances
❸		1 mark for correct directions
❹	c)	1 mark for correct distance of 12.75 km
❺		1 mark for appropriate work
❻		1 mark for correct distance of hiker from the town

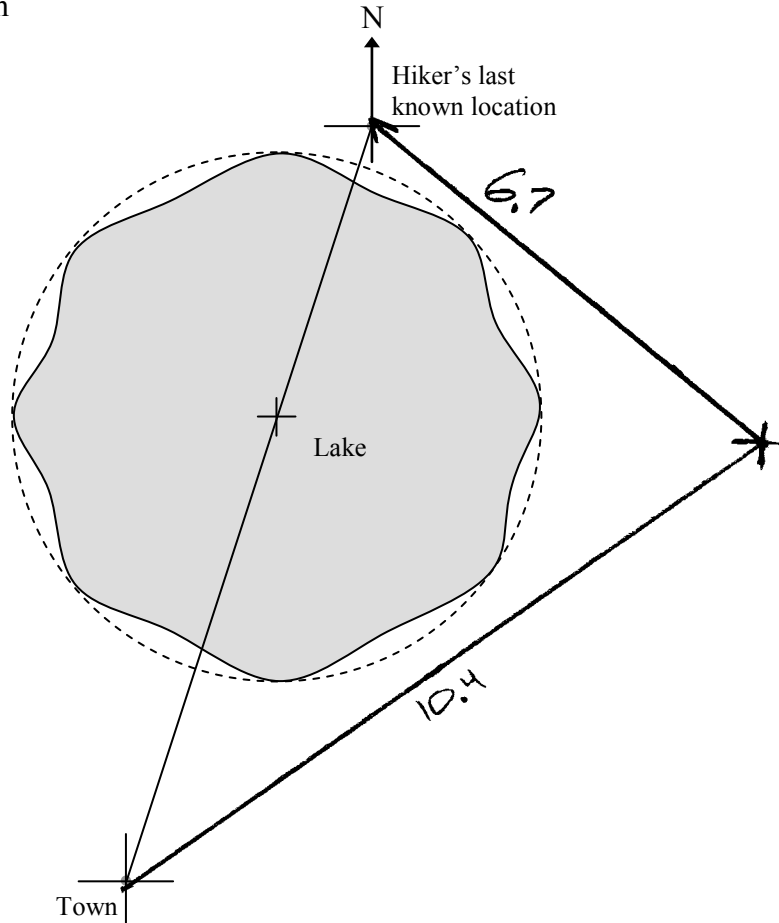
Exemplar 2

VECTORS

2. A hiker is lost in the woods. His last known location is 105 km from the nearest town, where a search and rescue operation has been organized. The following scale diagram describes the situation.

Total:
9 marks

Scale: 1 cm = 10 km



- a) What is the direction from the town to the hiker's last known location?

(1 mark)

$$10.7 \text{ cm} \times 10 = 107 \text{ km Bearing of } [19^\circ \text{ N}]$$

Exemplar 2 continued

- b) Avoiding the lake, create a route for the rescue crew to travel from the town to the hiker's last known location. Complete the scale diagram on the previous page stating all distances and directions.

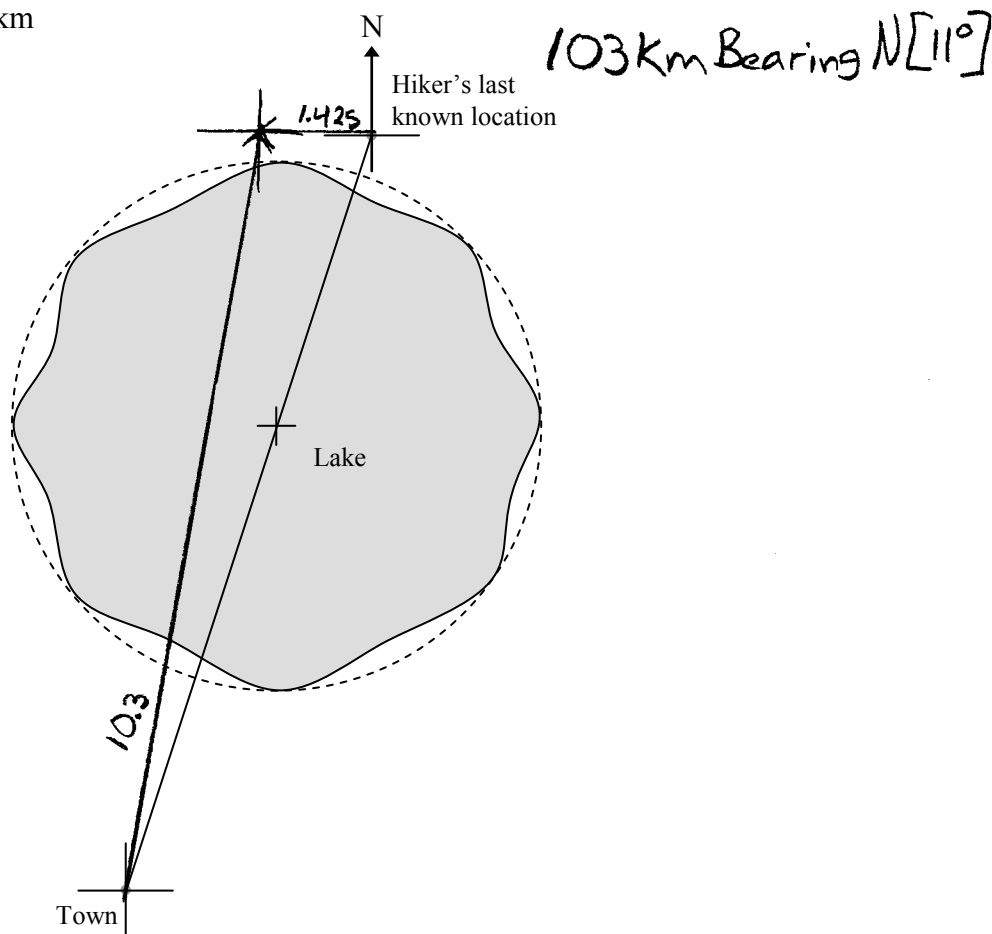
(2 marks)

Go: 104km [55° E of N]
 then 67km [40° W of N]

- c) Once the rescue crew reaches the hiker's last known location, they find an arrow in the sand pointing due west and "8:30 a.m." is written below it. The rescue crew estimates that the hiker can walk 1.5 km/h in the woods. If a rescue plane leaves from the town, at what bearing should the pilot fly in order to intercept the hiker at 5:00 p.m.? How far away from the town will the hiker be when he is found? Show your work.

(4 marks)

Scale: 1 cm = 10 km

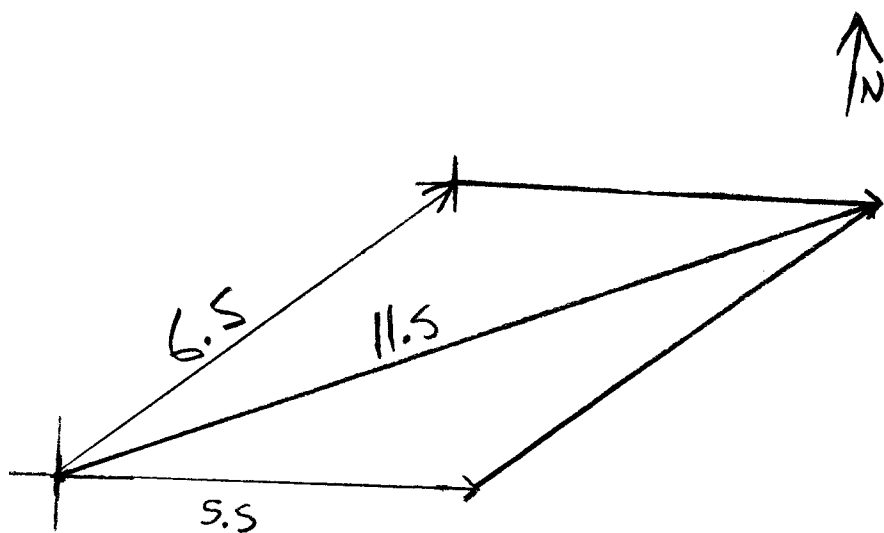


Exemplar 2 continued

- d) The pilot is unable to find the hiker. The rescue crew finds him the next morning, trapped under a fallen tree. Two of the rescuers tie ropes on the end of the tree and form an angle of 38° to each other. One rescuer pulls on his rope with a force of 550 newtons. If 1150 newtons of force is needed to move the tree, what is the magnitude of the minimum force the other rescuer will need to exert on his rope? Show your work.

(2 marks)

$$1\text{cm} = 100\text{N}$$



The other rescuer needed to put 650 N of force on the rope.

7 marks:		
①	a)	1 mark for correct answer
②	b)	1 mark for correct distances
⑤	c)	1 mark for appropriate work
⑥		1 mark for correct bearing the plane should fly
⑦		1 mark for correct distance of hiker from the town
⑧	d)	1 mark for appropriate work
⑨		1 mark for correct answer

Appendices

APPENDIX A

Table of Questions by Unit and Learning Outcome

Unit*	Question	Type*	Learning Outcome	Mark
A	1	MC	1	1
A	2	MC	2	1
A	10	RR	2	3
A	11	RRE	2	4
Total = 9				
B	Inquiry 2	OR	1, 2, 3	9
Total = 9				
C	3	MC	1	1
C	12	RRE	1, 4	4
C	13	RR	1, 2	4
Total = 9				
D	4	MC	1	1
D	5	MC	2	1
D	14	RR	2, 3	2
D	15	RRE	4	4
Total = 8				
E	6	MC	2	1
E	16	RR	1, 3	3
E	17	RRE	1, 3	5
Total = 9				
F	Inquiry 1	OR	1, 2, 3	10
Total = 10				
G	7	MC	1	1
G	18	OR	1, 2, 3	5
G	19	RR	1, 3	3
Total = 9				
H	8	MC	1	1
H	9	MC	1	1
H	20	RRE	1	4
H	21	RR	2, 3	3
Total = 9				

***Legend for Units:**

A: Matrices
 B: Vectors
 C: Personal Finance
 D: Probability
 E: Variability and Statistical Analysis
 F: Design and Measurement
 G: Periodic Functions
 H: Sequences

***Legend for Question Types:**

MC: Multiple Choice
 RR: Restricted Response
 RRE: Restricted Response with Explanation
 OR: Open Response

APPENDIX B

Table of Questions by Type and Learning Outcome

Type*	Question	Unit*	Learning Outcome	Mark
MC	1	A	1	1
MC	2	A	2	1
MC	3	C	1	1
MC	4	D	1	1
MC	5	D	2	1
MC	6	E	2	1
MC	7	G	1	1
MC	8	H	1	1
MC	9	H	1	1
Total = 9				
RR	10	A	2	3
RR	13	C	1, 2	4
RR	14	D	2, 3	2
RR	16	E	1, 3	3
RR	19	G	1, 3	3
RR	21	H	2, 3	3
Total = 18				
RRE	11	A	2	4
RRE	12	C	1, 4	4
RRE	15	D	4	4
RRE	17	E	1, 3	5
RRE	20	H	1	4
Total = 21				
OR	18	G	1, 2, 3	5
OR	Inquiry 1	F	1, 2, 3	10
OR	Inquiry 2	B	1, 2, 3	9
Total = 24				

***Legend for Units:**

A: Matrices
 B: Vectors
 C: Personal Finance
 D: Probability
 E: Variability and Statistical Analysis
 F: Design and Measurement
 G: Periodic Functions
 H: Sequences

***Legend for Question Types:**

MC: Multiple Choice
 RR: Restricted Response
 RRE: Restricted Response with Explanation
 OR: Open Response

APPENDIX C

Sheets for Marking the Inquiry Tasks

Inquiry Task 1: Design and Measurement		Booklet Numbers					
1	a)	1 mark for correct scale diagram including all rooms					
2		1 mark for indicating the location of all doors and labelling each room					
3		1 mark for meeting the required specifications for the area of each room					
4	b)	1 mark for indicating where each piece of equipment is located on the diagram in (a) with lines drawn indicating the area of safe use for each piece					
5		1 mark for having at least one of each of the pieces of equipment and having a correct total cost between \$12 000.00 and \$16 000.00, not including taxes					
6	c)	1 mark for correct area of walls (with doors)					
7		1 mark for correct area to be painted (without doors)					
8		1 mark for correct number of cans of primer and paint					
9	d)	1 mark for appropriate work					
10		1 mark for correct answer					
Maximum 0.5 mark deduction per question if student rounds to whole units too soon (mark 8).			-0.5	-0.5	-0.5	-0.5	-0.5
Totals							

Inquiry Task 1: Design and Measurement		Booklet Numbers					
1	a)	1 mark for correct scale diagram including all rooms					
2		1 mark for indicating the location of all doors and labelling each room					
3		1 mark for meeting the required specifications for the area of each room					
4	b)	1 mark for indicating where each piece of equipment is located on the diagram in (a) with lines drawn indicating the area of safe use for each piece					
5		1 mark for having at least one of each of the pieces of equipment and having a correct total cost between \$12 000.00 and \$16 000.00, not including taxes					
6	c)	1 mark for correct area of walls (with doors)					
7		1 mark for correct area to be painted (without doors)					
8		1 mark for correct number of cans of primer and paint					
9	d)	1 mark for appropriate work					
10		1 mark for correct answer					
Maximum 0.5 mark deduction per question if student rounds to whole units too soon (mark 8).			-0.5	-0.5	-0.5	-0.5	-0.5
Totals							

Inquiry Task 2: Vectors			Booklet Numbers				
①	a)	1 mark for correct answer					
②	b)	1 mark for correct distances					
③		1 mark for correct directions					
④	c)	1 mark for correct distance of 12.75 km					
⑤		1 mark for appropriate work					
⑥		1 mark for correct bearing the plane should fly					
⑦		1 mark for correct distance of hiker from the town					
⑧	d)	1 mark for appropriate work					
⑨		1 mark for correct answer					
Maximum 0.5 mark deduction per question if student does not state a scale when using scale diagrams as a strategy (mark ⑧).			-0.5	-0.5	-0.5	-0.5	-0.5
Maximum 0.5 mark deduction per question if student forgets more than one arrowhead in scale vector diagrams or required vector sketches (marks ②, ③, ⑤, and ⑧).			-0.5	-0.5	-0.5	-0.5	-0.5
Totals							

Inquiry Task 2: Vectors			Booklet Numbers				
①	a)	1 mark for correct answer					
②	b)	1 mark for correct distances					
③		1 mark for correct directions					
④	c)	1 mark for correct distance of 12.75 km					
⑤		1 mark for appropriate work					
⑥		1 mark for correct bearing the plane should fly					
⑦		1 mark for correct distance of hiker from the town					
⑧	d)	1 mark for appropriate work					
⑨		1 mark for correct answer					
Maximum 0.5 mark deduction per question if student does not state a scale when using scale diagrams as a strategy (mark ⑧).			-0.5	-0.5	-0.5	-0.5	-0.5
Maximum 0.5 mark deduction per question if student forgets more than one arrowhead in scale vector diagrams or required vector sketches (marks ②, ③, ⑤, and ⑧).			-0.5	-0.5	-0.5	-0.5	-0.5
Totals							

APPENDIX D

Irregularities in Standards Tests

A Guide for Local Marking

During the marking of standards tests, irregularities are occasionally encountered in test booklets. The following list provides examples of irregularities for which an *Irregular Test Booklet Report* (Appendix E) 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 standards 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.

APPENDIX E

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: _____

<p>For Department Use Only—After Marking Complete</p> <p>Consultant: _____</p> <p>Date: _____</p>
--