



PLACE YOUR CANDIDATE
LABEL HERE

MATHEMATICS METHODS - Foundation

(MTM315117)

Pages:	24
Questions:	22
Attachment:	Information Sheet

PART 1

Calculators are NOT allowed to be used

Time: 80 minutes

Candidate Instructions

1. You **MUST** make sure that your responses to the questions in this examination paper will show your achievement in the criteria being assessed.
2. Answer **ALL** questions. Answers must be written in the spaces provided on the examination paper.
3. You should make sure you answer all parts within each question so that the criterion can be assessed.
4. This examination is 3 hours in length. It is recommended that you spend approximately 80 minutes in total answering the questions in this booklet.
5. The 2018 External Examination Information Sheet for Mathematics Methods - Foundation can be used throughout the examination. No other written material is allowed into the examination.
6. All written responses must be in English.

On the basis of your performance in this examination, the examiners will provide results on each of the following criteria taken from the course statement:

- Criterion 4** Manipulate algebraic expressions and solve equations.
- Criterion 5** Understand linear, quadratic and cubic functions.
- Criterion 6** Understand logarithmic, exponential and trigonometric functions.
- Criterion 7** Use differential calculus in the study of functions.
- Criterion 8** Understand experimental and theoretical probabilities and of statistics.

Additional Instructions for Candidates

This part (**Part 1**) of the examination is worth 80 marks in total. Each section is worth 16 marks.

You **MUST NOT** use your calculator(s) during reading time nor during the first 80 minutes of the examination. This is the time allocated for completing Part 1 of the examination paper. You may start Part 2 during this time but you cannot use your calculator.

Part 1 will be collected after 80 minutes (the time allocated to complete this part).

The exam supervisors will instruct you when you can use your calculator(s).

You will have a further 100 minutes to complete Part 2 and you can use your calculator(s) during this time.

For questions worth 1 mark, whilst no working is required, markers will look at the presentation of the answer(s) and at the arguments(s) leading to the answer(s).

For questions worth 2 or more marks **you are required** to show relevant working. Marks will be allocated:

- according to the degree to which workings convey a logical line of reasoning, and
- for suitable justifications and explanations of methods and processes when requested.

A spare set of diagrams has been provided in the back of the answer booklet for you to use if required. If you use the spare diagrams, you **MUST** indicate you have done so in your answer to that question.

SECTION A

For
Marker
Use
Only

Answer **ALL** questions in this section.

This section assesses **Criterion 4**.

Section A Marks = 16

Question 1

Expand the following expression:

$$(x - 2)(x + 2) \qquad (1 \text{ mark})$$

.....

.....

Question 2

Solve the following for x :

(a) $2x + 7 = x - 1$ (1 mark)

.....

.....

(b) $\frac{2x}{3} - \frac{5x}{2} = 1$ (2 marks)

.....

.....

.....

.....

.....

.....

Section A continues.

Section A (continued)

**For
Marker
Use
Only**

Question 3

Factorise the following:

(a) $x^2 - 14x + 49$ (1 mark)

.....
.....

(b) $(x - 3)^2 - 36$ (2 marks)

.....
.....
.....

(c) $x^3 + 27$ (2 marks)

.....
.....
.....

Question 4

Using Pascal's triangle or the binomial theorem to assist, expand $(x - 2)^4$. (3 marks)

.....
.....
.....
.....
.....
.....
.....
.....

Section A continues.

Section A (continued)

Question 5

(a) Use the **remainder theorem** to find the remainder when

$P(x) = 2x^3 + x^2 - 3x + 10$ is divided by $(x - 2)$. (1 mark)

.....
.....
.....

(b) Given that $(x + 1)$ is a factor of $f(x) = x^3 + 6x^2 + 11x + 6$,
fully factorise this function. (3 marks)

.....
.....
.....
.....
.....
.....
.....
.....
.....

Criterion 4 Total

SECTION B

For
Marker
Use
Only

Answer **ALL** questions in this section.

This section assesses **Criterion 5**

Section B Marks = 16

Question 6

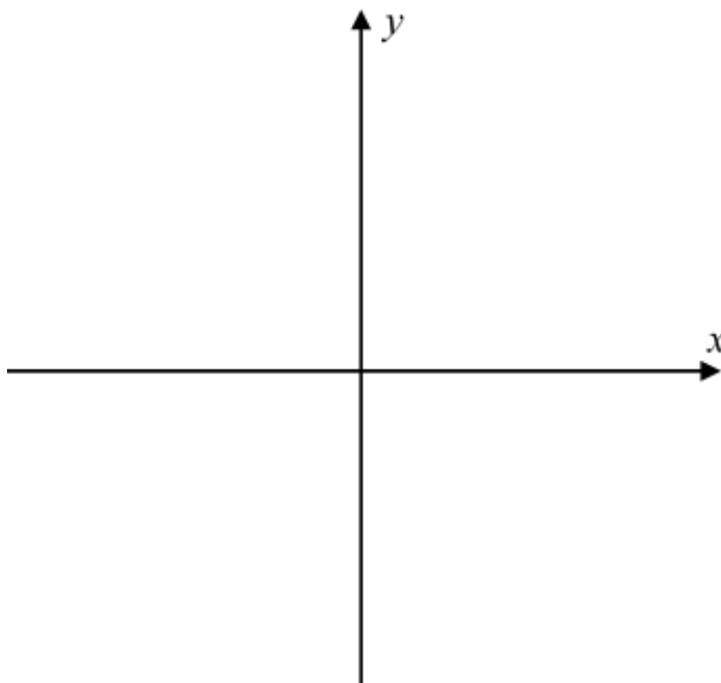
For the equation: $4y - 6 = 2x$

- (a) Determine the gradient. (1 mark)

.....
.....
.....

- (b) Sketch the graph on the axes below, labelling the x and y intercepts. (2 marks)

.....
.....
.....
.....



Section B continues.

Section B (continued)

**For
Marker
Use
Only**

Question 7

For the function: $y = x^2 - 13$

- (a) Determine the x and y intercepts. (2 marks)

.....

.....

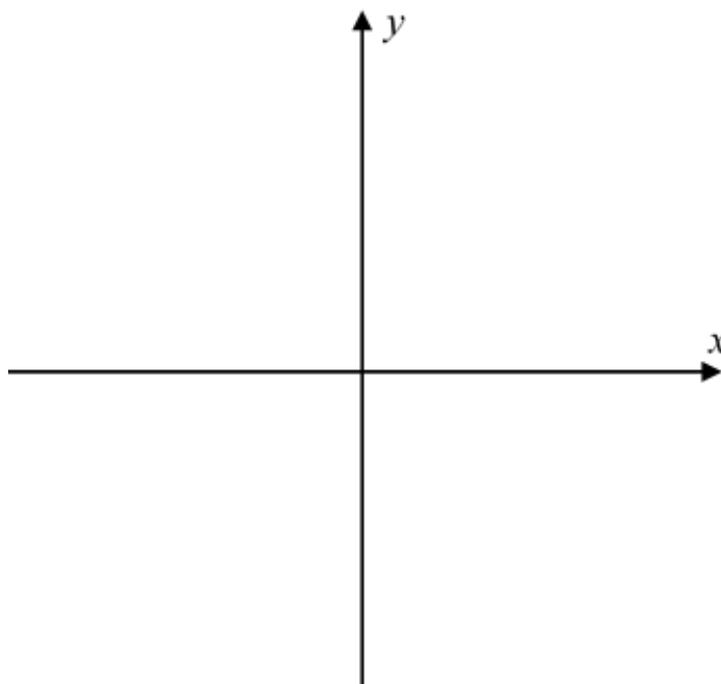
.....

.....

.....

.....

- (b) Sketch the graph on the axes below, labelling the x and y intercepts. (2 marks)



Section B continues.

Section B (continued)

**For
Marker
Use
Only**

Question 8

For the function: $y = 3(x - 2)^3 - 1$

- (a) Determine the point of inflection and the y intercept. (The x intercept is not required).

Sketch the graph on the axes below, labelling the point of inflection and the y intercept.

(3 marks)

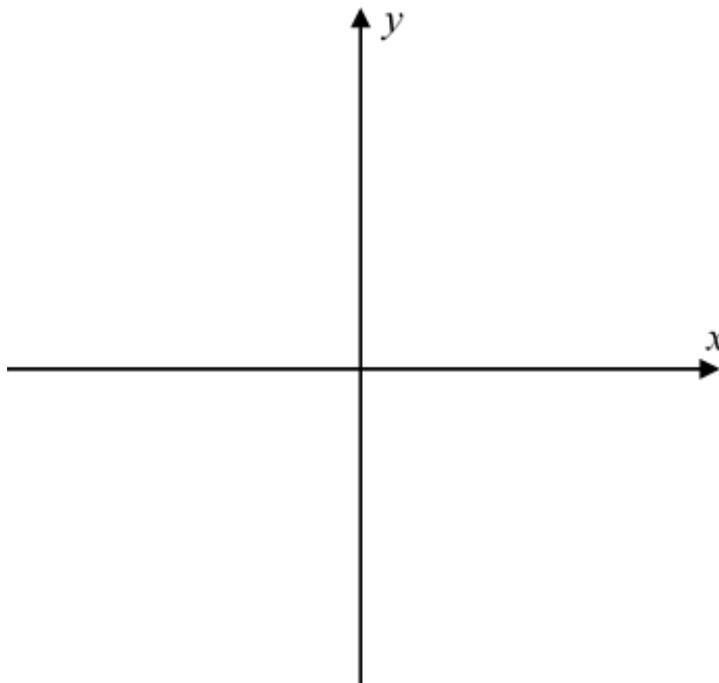
.....

.....

.....

.....

.....



- (b) Find the corresponding y value, when $x = 4$.

(1 mark)

.....

.....

.....

.....

Section B continues.

Section B (continued)

**For
Marker
Use
Only**

Question 9

For the function: $f: (-2, 2] \rightarrow R$, where $f(x) = (x - 2)^2(x + 1)$

- (a) Determine the x and y intercepts of the function (2 marks)

.....

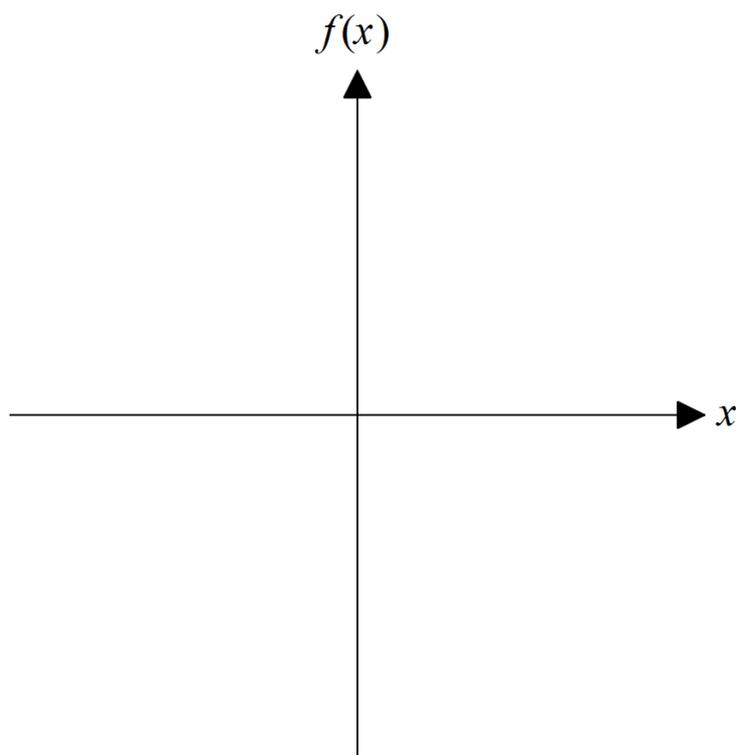
.....

.....

.....

.....

- (b) Sketch the graph on the axes below, labelling the x and y intercepts and the end points. (3 marks)



Criterion 5 Total

SECTION C

Answer **ALL** questions in this section.

This section assesses **Criterion 6**.

Section C Marks = 16

Question 10

Simplify the following expressions:

**For
Marker
Use
Only**

(a) $xy^2 \times (x^3y)^4$ (1 mark)

.....
.....

(b) $\frac{2^3 \times 3^4}{2^{11} \times 3^0}$ (2 marks)

.....
.....
.....
.....

(c) $\log_4(8) - \log_4\left(\frac{1}{2}\right)$ (2 marks)

.....
.....
.....
.....
.....

Section C continues.

Section C (continued)

Question 11

Solve the following equations for x .

(a) $\log_3(3x - 6) = 1$ (1 mark)

.....
.....
.....

(b) $5^{2x} \times 25^x = \frac{5}{125^{x-3}}$ (2 marks)

.....
.....
.....
.....
.....
.....

Section C continues.

Section C (continued)

**For
Marker
Use
Only**

Question 12

For the function $f(x) = 2^x - 3$.

(4 marks)

Determine the x and y intercepts and the asymptote.

.....

.....

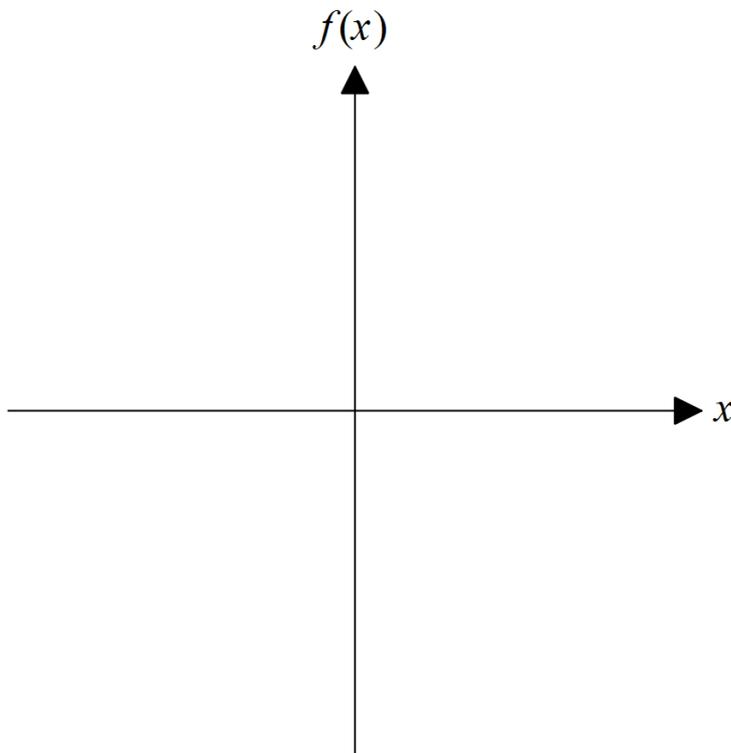
.....

.....

.....

.....

Sketch the graph, labelling the x and y intercepts and the asymptote on the axes below.



Section C continues.

Section C (continued)

Question 13

For the function: $y = 2 \cos \frac{x}{2}$ for $x \in [0, 4\pi]$.

(a) State the amplitude: (1 mark)

.....

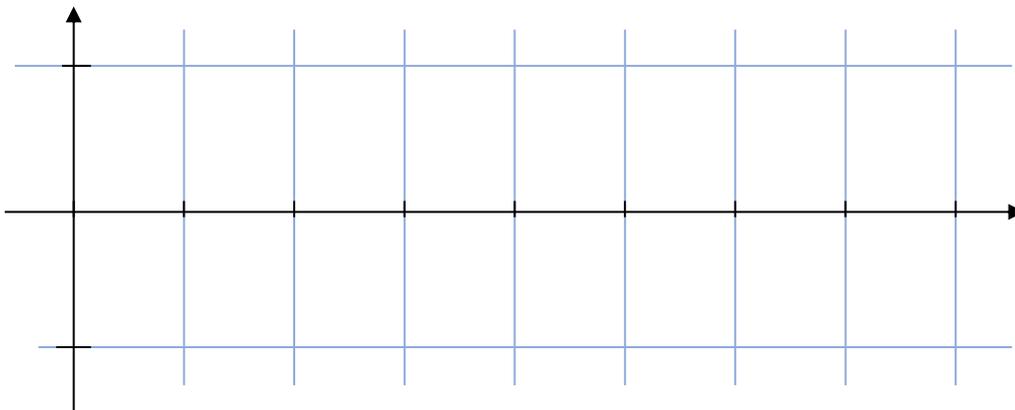
(b) Determine the period: (1 mark)

.....

.....

(c) Sketch this function, clearly indicate all intercepts and the amplitude.

Scale the x axis in radians. (2 marks)



**Criterion
6 Total**

--

SECTION D

Answer **ALL** questions in this section.

This section assesses **Criterion 7**.

Section D Marks = 16

Question 14

**For
Marker
Use
Only**

Determine the derivative of each of the following functions.

(a) $f(x) = x^4 - 5x^2$ (1 mark)

.....
.....

(b) $y = \frac{1}{3}x^3 - \frac{2}{7}x^2 - 7x + 1$ (2 marks)

.....
.....
.....

(c) $f(x) = \sqrt[3]{x^4} - \frac{2}{x^3}$ Express the answer with positive indices. (3 marks)

.....
.....
.....
.....
.....
.....

Section D continues.

Section D (continued)

**For
Marker
Use
Only**

Question 15

Find the derivative of $y = -x^2(3x - 7)$.

(2 marks)

.....
.....
.....

Question 16

Find the derivative of $f(x) = 3x - 6$ using **first principles**.

(3 marks)

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

Section D continues.

Section D (continued)

**For
Marker
Use
Only**

Question 17

The profit (P) of a company in dollars, is given by the equation: (2 marks)

$$P = -2x^2 + 200x - 13 \text{ where } x \text{ is the number of items sold.}$$

Use **calculus techniques** to determine the number of items the company must sell in order to make its **maximum** profit.

.....
.....
.....
.....
.....
.....

Question 18

Determine the **gradient** of the tangent to the curve:

$$f(x) = 2x^3 - 6x^2 - 10x - 2 \text{ at the point } (2, -30). \quad (3 \text{ marks})$$

.....
.....
.....
.....
.....
.....

Criterion 7 Total

SECTION E

Answer **ALL** questions in this section.

This section assesses **Criterion 8**.

Section 3 marks = 16

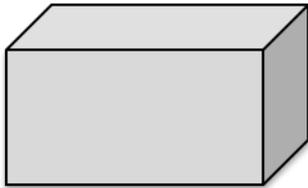
Question 19

**For
Marker
Use
Only**

There are 2 identical boxes to choose from:

Box 1 contains 3 red and 5 blue balls.

Box 2 contains 4 red and 4 blue balls.



BOX 1
3 red and 5 blue

BOX 2
4 red and 4 blue

A ball is drawn from either Box 1 or Box 2.

Determine the probability that it is:

- (a) A blue ball from Box 1. (1 mark)

.....
.....

- (b) A red ball from either Box 1 or Box 2. (2 marks)

.....
.....

- (c) From Box 1, given it is a red ball. (2 marks)

.....
.....
.....

Section E continues.

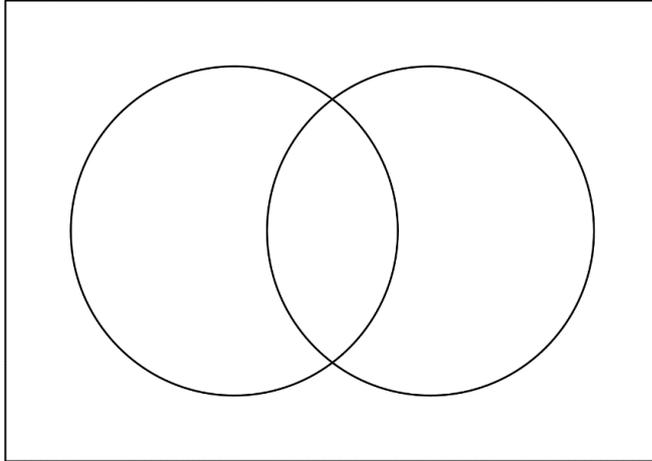
Section E (continued)

**For
Marker
Use
Only**

Question 20

From a group of 100 students, 45 students are enrolled in Science (S), 50 are enrolled in Art (A) and 35 are enrolled in both.

- (a) Complete the Venn diagram below, showing this information. (2 marks)



- (b) Determine the probability of randomly selecting:

- (i) A student enrolled in Art (A). (1 mark)

.....
.....

- (ii) A student enrolled in Science (S) only. (1 mark)

.....
.....

- (iii) A student enrolled in Art (A), given that they are also enrolled in Science (S). (2 marks)

.....
.....
.....
.....

Section E continues.

Section E (continued)

**For
Marker
Use
Only**

Question 21

The following data was extracted from a probability table:

$$\Pr(A) = 0.7$$

$$\Pr(B) = 0.5$$

$$\Pr(A \cup B) = 0.8$$

- (a) Find $\Pr(A \cap B)$. (2 marks)

.....
.....
.....
.....

- (b) Find $\Pr(A \cup B)'$. (1 mark)

.....
.....

Question 22

A student misses the bus to school 1 day out of every 10 days.

- (a) Find the probability that they catch the bus on any day. (1 mark)

.....
.....
.....

- (b) Find the probability that they catch the bus for 2 days in a row. (1 mark)

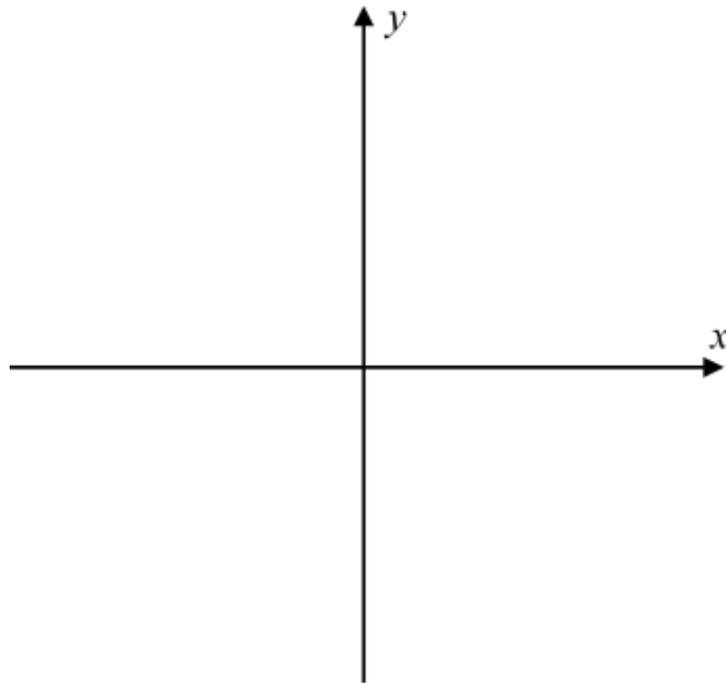
.....
.....
.....

**Criterion
8 Total**

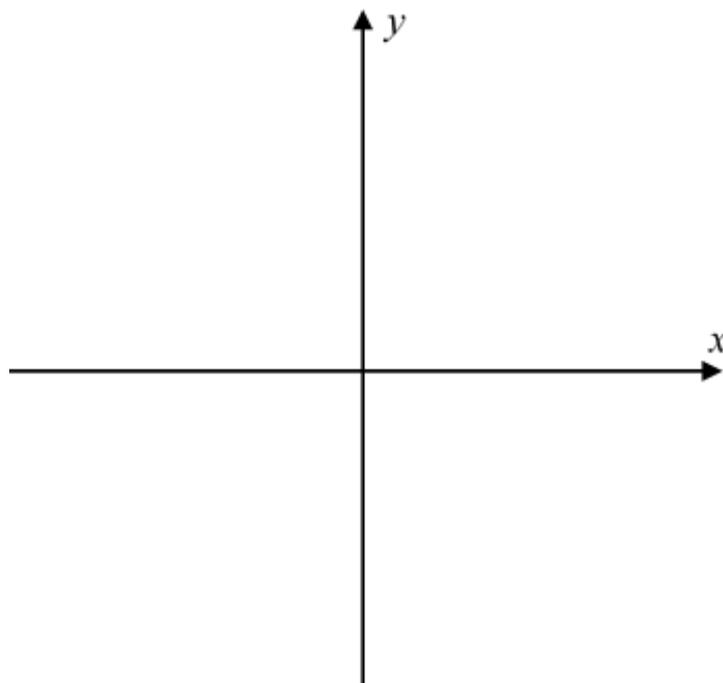
--

SPARE DIAGRAMS

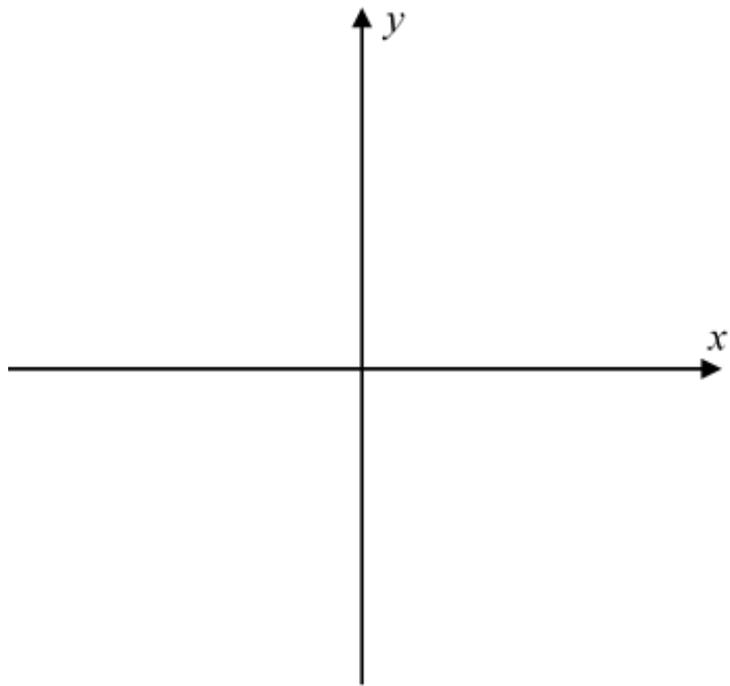
Question 6 (b)



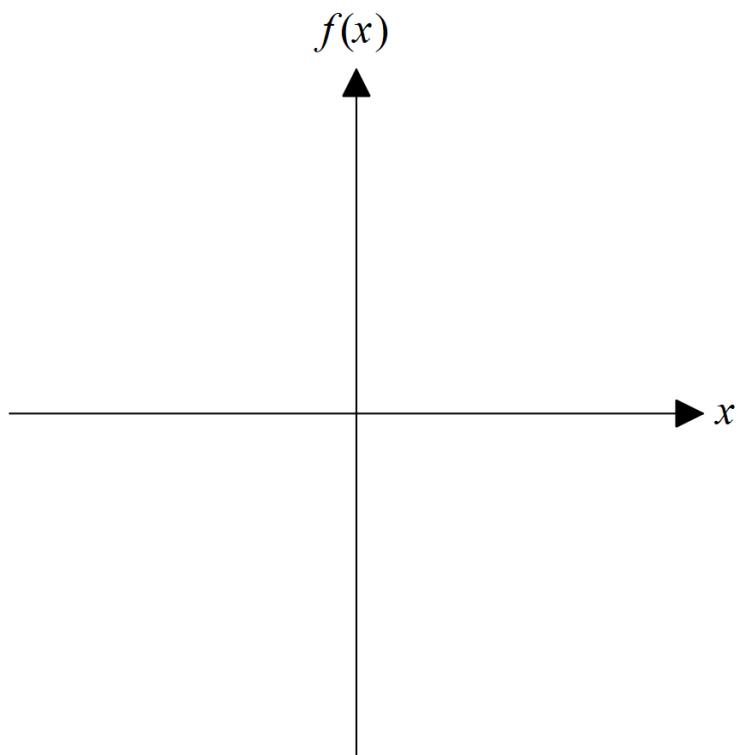
Question 7 (b)



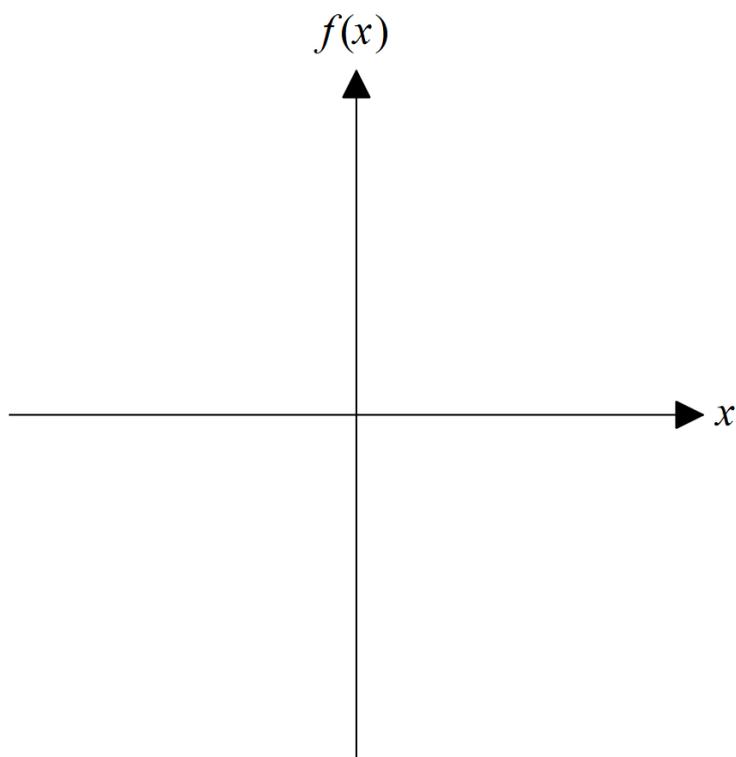
Question 8 (a)



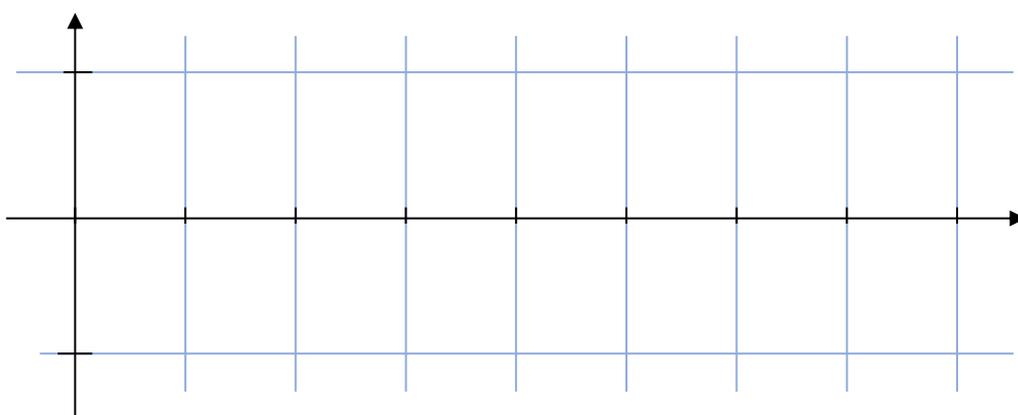
Question 9 (b)



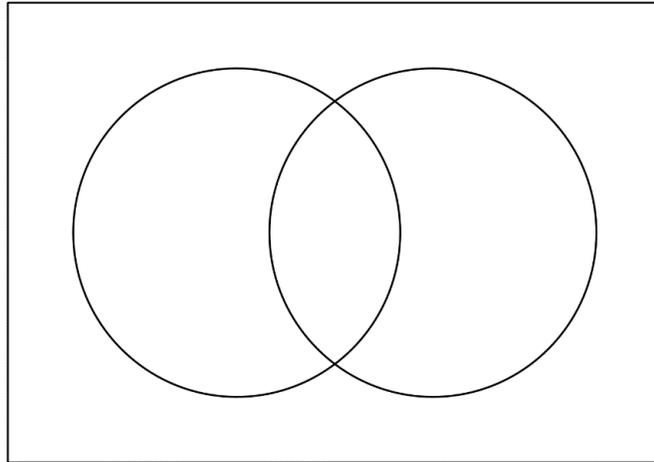
Question 12



Question 13 (c)



Question 20 (a)





OFFICE OF TASMANIAN
ASSESSMENT, STANDARDS
& CERTIFICATION

This question paper and any materials associated with this examination (including answer booklets, cover sheets, rough note paper, or information sheets) remain the property of the Office of Tasmanian Assessment, Standards and Certification.



OFFICE OF TASMANIAN
ASSESSMENT, STANDARDS
& CERTIFICATION

PLACE YOUR CANDIDATE
LABEL HERE

MATHEMATICS METHODS – Foundation (MTM315117)

Pages:	28
Questions:	27
Attachment:	Information Sheet

PART 2

Calculators are allowed to be used

Time: 100 minutes

Candidate Instructions

7. You **MUST** make sure that your responses to the questions in this examination paper will show your achievement in the criteria being assessed.
8. Answer **ALL** questions. Answers must be written in the spaces provided on the examination paper.
9. You should make sure you answer all parts within each question so that the criteria can be assessed.
10. This examination is 3 hours in length. It is recommended that you spend approximately 100 minutes in total answering the questions in this booklet.
11. The 2018 External Examination Information Sheet for Mathematics Methods - Foundation can be used throughout the examination. No other written material is allowed into the examination.
12. A TASC approved calculator can be used throughout this part of the examination.
13. All written responses must be in English.

On the basis of your performance in this examination, the examiners will provide results on each of the following criteria taken from the course statement:

- Criterion 4** Manipulate algebraic expressions and solve equations.
- Criterion 5** Understand linear, quadratic and cubic functions.
- Criterion 6** Understand logarithmic, exponential and trigonometric functions.
- Criterion 7** Use differential calculus in the study of functions.
- Criterion 8** Understand experimental and theoretical probabilities and of statistics.

© Copyright for part(s) of this examination may be held by individuals and/or organisations other than the Office of Tasmanian Assessment, Standards and Certification.

Additional Instructions for Candidates

This part (**Part 2**) of the examination is worth 100 marks in total. Each section is worth 20 marks.

You are expected to provide a calculator(s) as approved by the Office of the Tasmanian Assessment, Standards and Certification.

You **MUST NOT** use your calculator(s) during reading time nor during the first 80 minutes of the examination. This is the time allocated for completing Part 1 of the examination paper. **You may start Part 2 during this time but you cannot use your calculator.**

Part 1 will be collected after 80 minutes (the time allocated to complete this part).

The exam supervisors will instruct you when you can use your calculator(s).

You will have a further 100 minutes to complete Part 2 and you can use your calculator(s) during this time.

For questions worth 1 mark, whilst no working is required, markers will look at the presentation of the answer(s) and at the arguments(s) leading to the answer(s).

For questions worth 2 or more marks **you are required** to show relevant working. Marks will be allocated:

- according to the degree to which workings convey a logical line of reasoning, and
- for suitable justifications and explanations of methods and processes when requested.

A spare diagram has been provided in the back of the answer booklet for you to use if required. If you use the spare diagrams, you **MUST** indicate you have done so in your answer to that question.

SECTION A

Answer **ALL** questions in this section.

This section assesses **Criterion 4**.

Section A Marks = 20

**For
Marker
Use
Only**

Question 23

A delivery service will pick up food from a restaurant and deliver the food to your house.

Their charges are as follows:

- \$5.45 to pick up the food
- \$2.85 to deliver the food
- \$1.50 per kilometre of distance from the restaurant to your house.

(a) Write an equation that models this, where C is the cost and d is the distance. (2 marks)

.....
.....

(b) Determine the cost you have to pay if your house was 13 km from the restaurant. (1 mark)

.....
.....

Question 24

Make r the subject of the formula: $I = \frac{P}{4\pi r^2}$ (2 marks)

.....
.....
.....
.....
.....
.....

Section A continues.

Section A (continued)

**For
Marker
Use
Only**

Question 25

- (a) Use the discriminant to predict the **number** and **type** (rational or irrational) of solution(s) for the equation:

$$6x^2 - 11x + 7 = 0 \qquad (2 \text{ marks})$$

.....

.....

.....

.....

.....

- (b) Determine the value(s) for k for which the following equation has **one real solution**:

$$-x^2 + 2kx - 36 = 0 \qquad (3 \text{ marks})$$

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Section A continues.

Section A (continued)

**For
Marker
Use
Only**

Question 26

(a) Use the **quadratic formula** to fully solve the equation:

$$5x^2 = 12 - 4x$$

(2 marks)

.....

.....

.....

.....

.....

.....

.....

(b) Solve $x^3 + 5x^2 - 24x = 0$ showing some **algebraic working**.

(2 marks)

.....

.....

.....

.....

.....

.....

.....

(c) By **completing the square** put $y = 2x^2 - 12x - 4$ in **turning point form**. (3 marks)

.....

.....

.....

.....

Section A continues.

Section A (continued)

Question 27

Solve the following simultaneous equations. Show some **algebraic working**.

$$2 = -\frac{2}{3}x - y$$

$$3y - 5x = 1$$

(3 marks)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**For
Marker
Use
Only**

Criterion 4 Total

SECTION B

Answer **ALL** questions in this section.

This section assesses **Criterion 5**.

Section B Marks = 20

Question 28

Determine the gradient of a line that extends between the points $(-1, 4)$ and $(3, -1)$.
(1 mark)

.....
.....
.....
.....

Question 29

Find the equation that is **perpendicular** to $y = -2x + 3$ and passes through the point $(4, -5)$. Show some **algebraic working**.
(3 marks)

.....
.....
.....
.....
.....
.....
.....

**For
Marker
Use
Only**

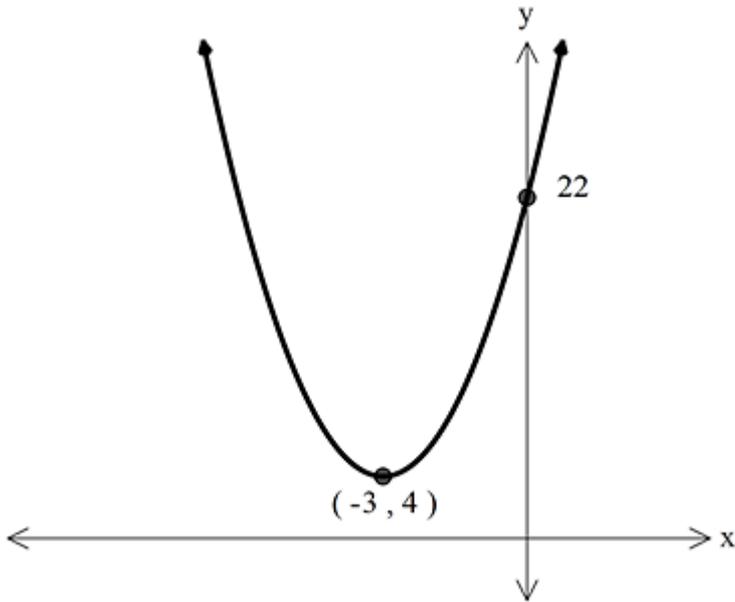
Section B continues.

Section B (continued)

**For
Marker
Use
Only**

Question 30

A quadratic function is represented below.



- (a) Determine the equation of this function in the form $y = a(x - h)^2 + k$. (3 marks)

.....
.....
.....
.....
.....

- (b) List the translations from $y = x^2$ of this function. (2 marks)

.....
.....
.....

- (c) State the dilation of this function. (1 mark)

.....

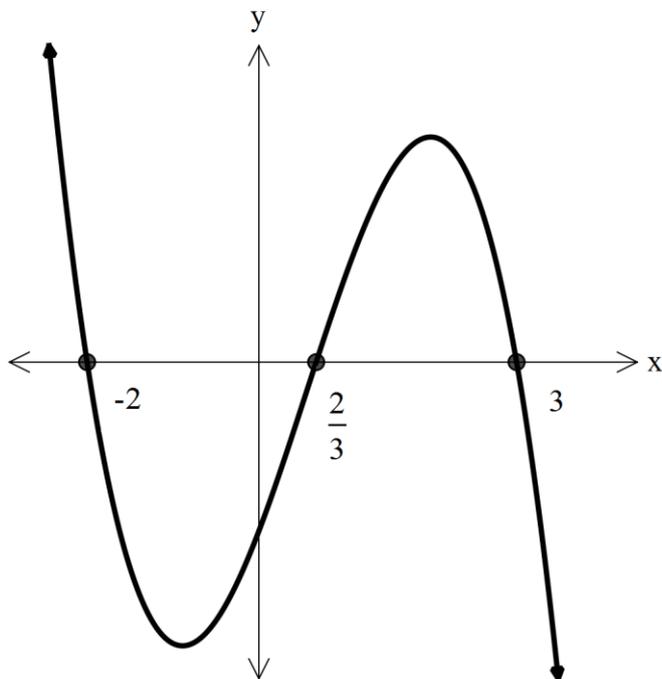
Section B continues.

Section B (continued)

**For
Marker
Use
Only**

Question 31

The graph of a cubic function is shown below.



- (a) This function has a dilation factor of -3 , calculate the y intercept. (1 mark)

.....
.....
.....

- (b) Determine the equation of this function. (2 marks)

.....
.....
.....
.....
.....
.....

Section B continues.

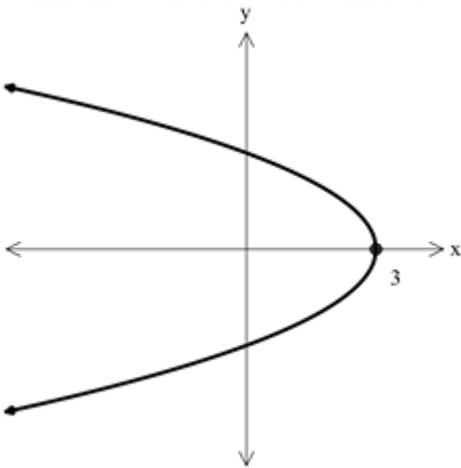
Section B (continued)

**For
Marker
Use
Only**

Question 32

Determine if the following graphs are functions or relations, giving a reason for each choice.

State the domain and range for each graph. (4 marks)

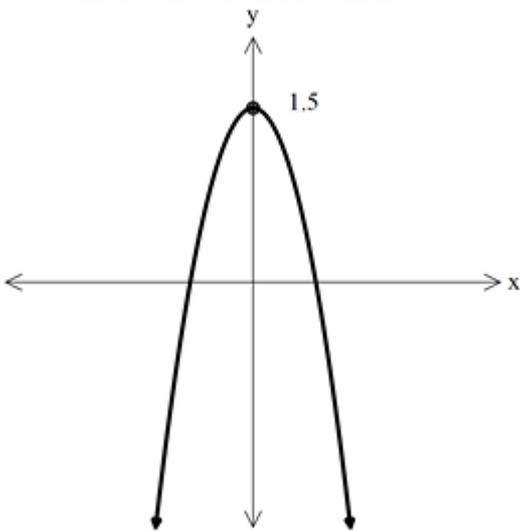


Function or relation?

Reason:
.....

Domain:

Range:



Function or relation?

Reason:
.....

Domain:

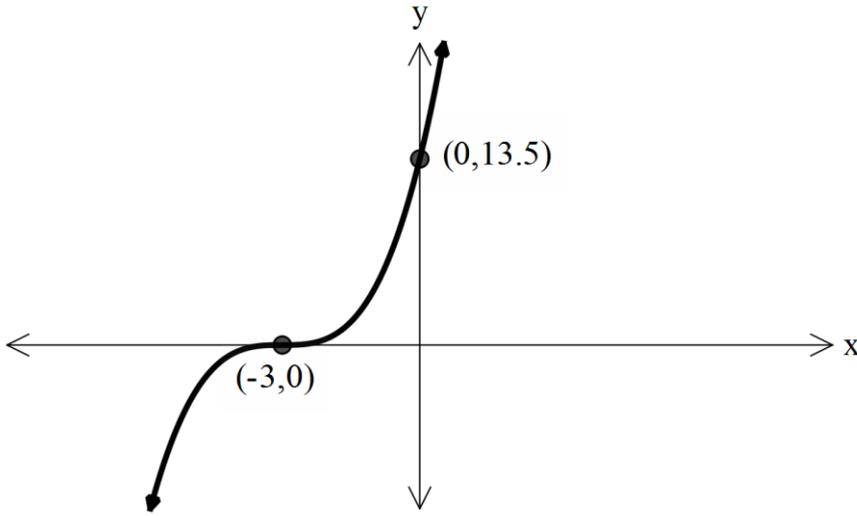
Range:

Section B continues.

Section B (continued)

Question 33

The graph of a cubic function is shown below.



Determine the equation of this function in the form $y = a(x - h)^3 + k$. (3 marks)

.....

.....

.....

.....

.....

.....

.....

Criterion 5 Total

SECTION C

Answer **ALL** questions in this section.

This section assesses **Criterion 6**.

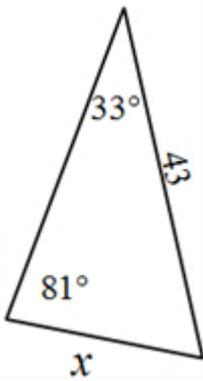
Section C Marks = 20

Question 34

Determine the side length, x .

(2 marks)

**For
Marker
Use
Only**



.....

.....

.....

.....

.....

Question 35

Convert $\frac{7\pi}{2}$ radians to degrees.

(1 mark)

.....

.....

Section C continues.

Section C (continued)

**For
Marker
Use
Only**

Question 36

If, $\tan \theta = 1.78$, for $\theta \in [0, 2\pi]$ then find:

(a) $\tan(\pi + \theta)$ (1 mark)

.....
.....

(b) $\tan(2\pi - \theta)$ (1 mark)

.....
.....

Question 37

Find the exact value of $\tan 150^\circ$. (1 mark)

.....
.....
.....

Question 38

If $\sin \theta = 0.31$ and $0^\circ < \theta < 90^\circ$.
Find $\cos \theta$, correct to 2 decimal places. (2 marks)

.....
.....
.....
.....
.....
.....

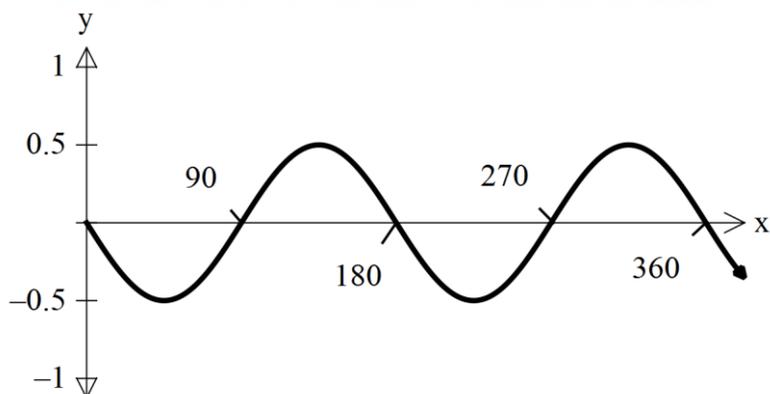
Section C continues.

Section C (continued)

**For
Marker
Use
Only**

Question 39

For the function below (the angles are in degrees):



- (a) State the amplitude. (1 mark)

.....

- (b) State the period. (1 mark)

.....

- (c) Determine a possible equation of this function. (2 marks)

.....
.....
.....
.....

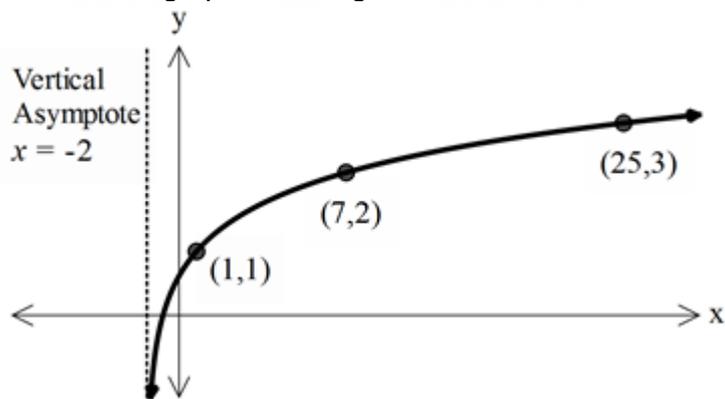
Section C continues.

Section C (continued)

For
Marker
Use
Only

Question 40

Consider the graph of the log function below:



- (a) Determine the equation of this log function in the form:
 $y = a \log_3(x - h)$

(2 marks)

.....

.....

.....

.....

.....

- (b) State the domain of the function.

(1 mark)

.....

- (c) State the range of the function.

(1 mark)

.....

Section C continues.

Section C (continued)

**For
Marker
Use
Only**

Question 41

At the beginning of January an initial mouse population was 1000. It was found to **double** every month after that.

- (a) What was the mouse population in two months time (at the beginning of March)? (1 mark)

.....
.....

- (b) Write an equation that models this population growth. (2 mark)

.....
.....

- (c) How many months did it take for the mouse population to reach 100 000?
Give your answer to one decimal place. (1 mark)

.....
.....
.....
.....

**Criterion
6 Total**

--

SECTION D

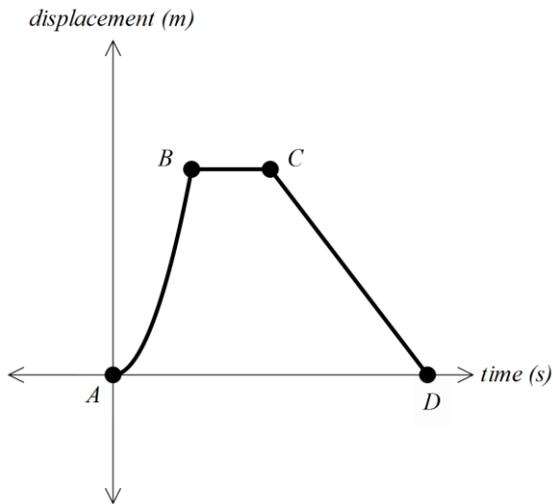
Answer **ALL** questions in this section.

This section assesses **Criterion 7**.

Section C Marks = 20

Question 42

The displacement – time graph below shows the motion of a particle over a period of time.



**For
Marker
Use
Only**

Describe the **rate of change** (velocity) of this displacement – time graph for the segments listed below. Use the following terms:

- (i) positive, negative or zero; **and**
- (ii) increasing, decreasing or constant. (3 marks)

Segment A to B

- (i)
- (ii)

Segment B to C

- (i)
- (ii)

Segment C to D

- (i)
- (ii)

Section D continues.

Question 43

The function $y = x^2 + 5x - 11$ has a gradient of 1, at a particular point.

Use calculus techniques to determine this point. (3 marks)

.....

.....

.....

.....

.....

.....

Question 44

Use calculus techniques to determine the equation of the **tangent** to the function below at the point $(-3, -19)$.

$f(x) = \frac{2}{3}x^2 + 7x - 4$ (3 marks)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Section D continues.

Section D (continued)

**For
Marker
Use
Only**

Question 45

An object is launched vertically upwards so that its height, H metres, above the ground at any time, t seconds after launching is given by the equation:

$$H = 100t - 5t^2$$

- (a) At what time does the object reach its maximum height? (1 mark)

.....
.....
.....

- (b) What maximum height does the object reach? (1 marks)

.....
.....
.....

- (c) At what velocity (metres per second) is the object moving at 2 seconds after launching? (2 marks)

.....
.....
.....

- (d) At what time is the object moving at a velocity of -25 m/s? (2 marks)

.....
.....
.....

Section D continues.

Section D (continued)

Question 46

A rectangular piece of card has the dimensions 8 cm by 5 cm. It will have 4 equal squares cut out of the corners as shown. It is then folded to form an open rectangular box.

**For
Marker
Use
Only**

(a) Find the volume V of the box in terms of x . (1 mark)

.....

.....

.....

(b) Use **calculus techniques** to determine the value of x , that will give the **maximum** volume of this open box. (3 marks)

.....

.....

.....

.....

.....

.....

.....

.....

(c) What is the maximum volume of the box? (1 mark)

.....

Criterion 7 Total

SECTION E

Answer **ALL** questions in this section.

This section assesses **Criterion 8**.

Section E Marks = 20

Question 47

**For
Marker
Use
Only**

A stall has 12 t-shirts.

7 are black, 3 are white and 2 are blue; and each has a different design.

3 t-shirts are chosen randomly.

- (a) Determine the number of possible ways of selecting 3 black t-shirts. (1 mark)

.....
.....

- (b) Determine the **probability** of selecting 2 black and 1 blue t-shirts. (2 marks)

.....
.....
.....
.....

- (c) Determine the **probability** of selecting 3 t-shirts that are the same colour. (3 marks)

.....
.....
.....
.....
.....

Section E continues.

Section E (continued)

**For
Marker
Use
Only**

Question 48

A student sits 3 exams. They estimate the probability of passing each exam as:

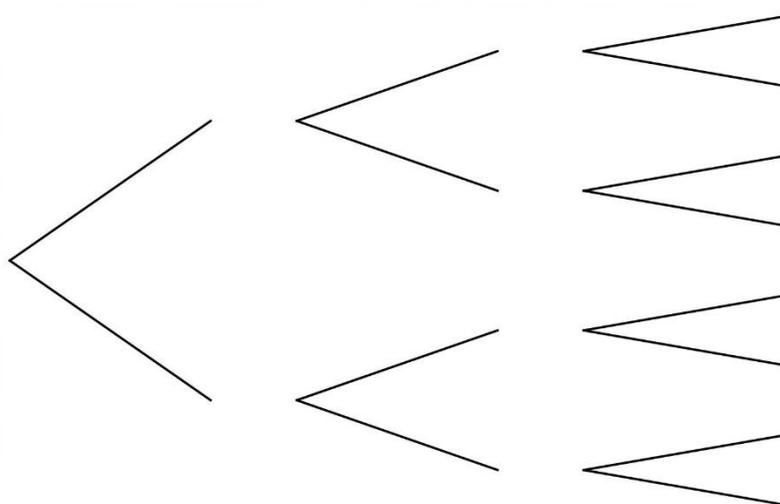
Maths 0.75

English 0.95

History 0.55

(a) Complete the tree diagram below.

Illustrate all the possible outcomes and include the probabilities. (3 marks)



(b) Determine the probability that they do not pass any exams. (2 marks)

.....
.....

(c) Determine the probability that they pass **at least 2** exams. (3 marks)

.....
.....
.....
.....
.....

Section E continues.

Section E (continued)

**For
Marker
Use
Only**

Question 49

A primary school has 29 grade six students across 3 different classes.

Class A has 11 students

Class B has 10 students

Class C has 8 students

A committee of 4 students will be chosen at random to represent grade six.

- (a) How many possible combinations of students are there, if they can come from any class? (1 mark)

.....
.....

- (b) How many possible combinations are there, if at least 1 student must be chosen from each class? (3 marks)

.....
.....
.....
.....
.....

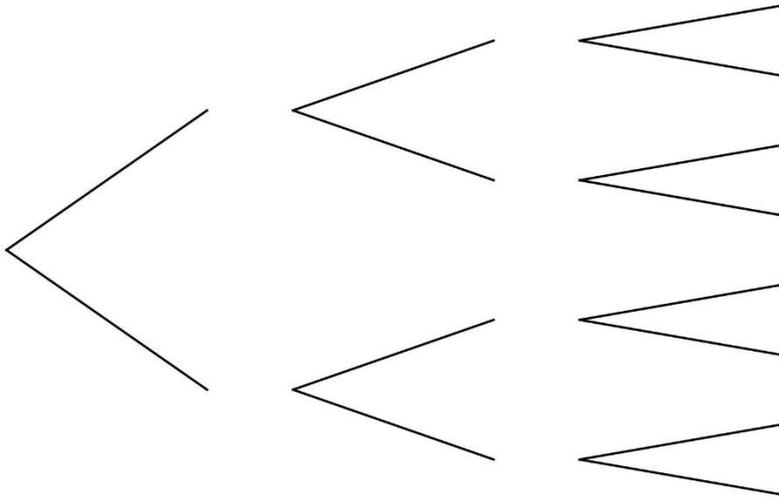
- (c) Find the **probability** that 2 students are chosen from Class A, if at least 1 student must be chosen from each class? (2 marks)

.....
.....
.....
.....

Criterion 8 Total

SPARE DIAGRAM

Question 48 (a)



BLANK PAGE

BLANK PAGE

BLANK PAGE



OFFICE OF TASMANIAN
ASSESSMENT, STANDARDS
& CERTIFICATION

This question paper and any materials associated with this examination (including answer booklets, cover sheets, rough note paper, or information sheets) remain the property of the Office of Tasmanian Assessment, Standards and Certification.