TASMANIAN ASSESSMENT, STANDARDS & CERTIFICATION

External Assessment 2025

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MATHEMATICS METHODS – FOUNDATION

MTM315117

Section A

Pages: 24
Questions: 20
Information Sheets: 1

Preparation time for this exam: 15 minutes

Suggested working time: 80 minutes

Instructions:

Calculators are not allowed to be used in this section.

Section A will be collected after 80 minutes.

- There are **five (5) parts** to this section.
- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
  - Spare diagrams have been provided at the end of each part.
    Indicate in the box provided if you have used the spare diagram.
- The exam is **three (3) hours** in length. The suggested working time for this section is **approximately 80 minutes**.
- During the first 80 minutes of the exam you may move onto Section B, but you **cannot** use your calculator until told by your supervisor(s).
- The Mathematics Methods – Foundation Information Sheet can be used throughout the exam.
- All answers must be written in **English**.

Marker use	
C4	/ 16
C5	/ 16
C6	/ 16
C7	/ 16
C8	/ 16

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Additional Exam Instructions

- You **must** make sure your answers address the listed criteria.
- For questions worth **one (1)** mark, you **are not required** to show workings. Markers will look at the presentation of the answer(s) and at the argument(s) leading to the final answer(s).
- For questions worth **two (2)** or more marks you **are required** to show relevant workings.
- 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.

Criteria

You **must** make sure your answers address:

- 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.

Guide to Exam Structure

	Parts	Questions available	Questions to answer	Suggested working time	Marks available
Section A	Part 1	4	4	16 minutes	16 marks
	Part 2	4	4	16 minutes	16 marks
	Part 3	4	4	16 minutes	16 marks
	Part 4	4	4	16 minutes	16 marks
	Part 5	4	4	16 minutes	16 marks
Totals		**20**	**20**	**80 minutes**	**80 marks**
Section B	Part 1	6	6	20 minutes	20 marks
	Part 2	4	4	20 minutes	20 marks
	Part 3	5	5	20 minutes	20 marks
	Part 4	5	5	20 minutes	20 marks
	Part 5	4	4	20 minutes	20 marks
Totals		**24**	**24**	**100 minutes**	**100 marks**
Totals		**44**	**44**	**180 minutes (3 hours)**	**180 marks**

Part 1

Marker use

- Answer **all** questions in this part.
- This part assesses **Criterion 4**.

Question 1

Expand $(3x + 1)(x - 2)$.

/1

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Question 2

Simplify the following expressions:

a) $\frac{3a^2b^{-2} \times 4a^3b^3}{2a^{-2}}$

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b) $\sqrt{8x^5} \div (2\sqrt{x})$

/2

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Question 3

Marker use

Solve the following:

a) $x^2 + 9x + 14 = 0$

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b) $4x^2 - 9 = 0$ by factorising.

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c) $\frac{6x-1}{5} + 3 = \frac{x}{2}$

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d) $3x + y = 9$ and $-2x - 2y = 4$ using simultaneous methods.

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Question 4

Marker use

$x^3 - 8x^2 + 11x + 20$ can be written as $(x - 4)(ax^2 + bx + c)$.

a) Determine the values of a, b and c.

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b) Hence, solve $0 = x^3 - 8x^2 + 11x + 20$

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Total P1

/16

Part 2

Marker use

- Answer **all** questions in this part.
- This part assesses **Criterion 5**.

Question 5

a) Find the gradient of the line shown in Figure 1.

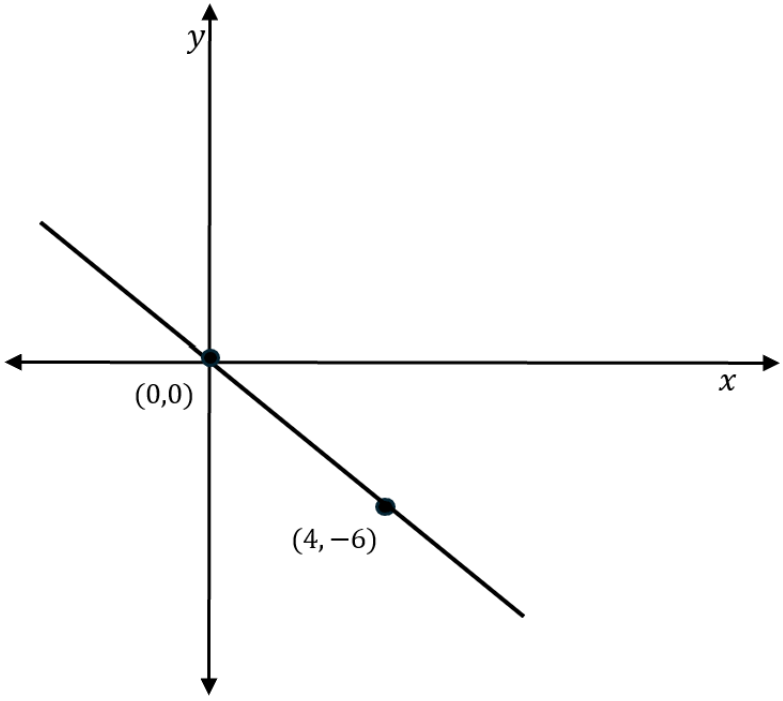

Figure 1

Spare diagram used (X) ☐

/1

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b) On the same axes, sketch the linear function which has an x-intercept at $(6, 0)$ and is parallel to the line shown.

/1

c) Find the equation of the linear function sketched in part b).

/2

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Question 6

Marker use

The function $f(x) = 2x^2 - 8x - 10$ can be written in the following ways:

$f(x) = (2x + 2)(x - 5)$

$f(x) = 2(x - 2)^2 - 18$

Sketch $f(x)$ using the axes provided in Figure 2, labelling any intercepts and the turning point.

/3

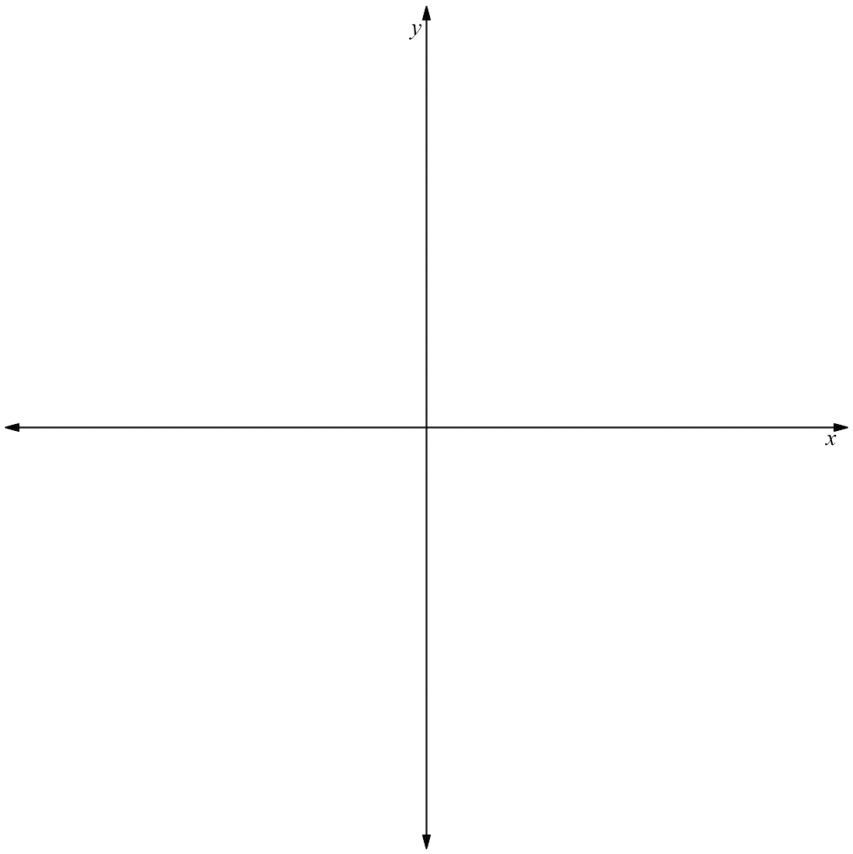

Figure 2

Spare diagram used (X) ☐

Question 7

Marker use

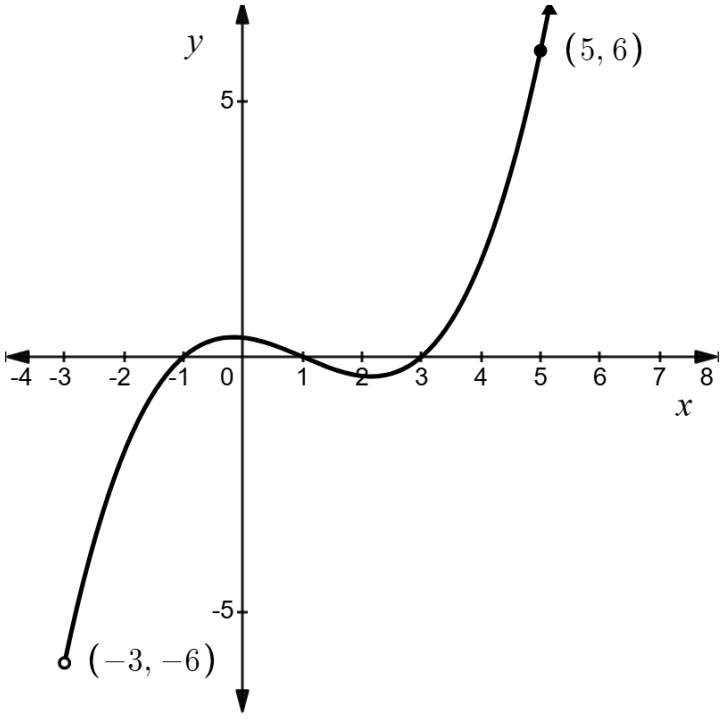

Figure 3

Spare diagram used (X) ☐

a) Find the equation of the cubic function shown in Figure 3. /2

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b) State the domain and range. /2

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c) Using Figure 3, graph the cubic function after a reflection in the x-axis has been applied. /1

Question 8

Marker use

a) Sketch a possible graph for the quadratic function $y = ax^2 + bx + c$, where:

$$a < 0,\ b < 0,\ c = 0 \text{ and } \Delta > 0$$

using the axes provided in Figure 4. /2

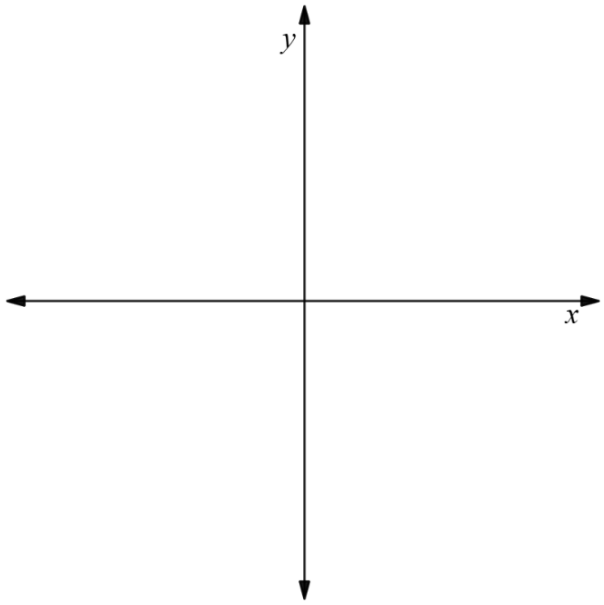

Figure 4

Spare diagram used (X) ☐

b) Explain why the graph is a function. /1

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c) Sketch a relation which is **not** a function using the axes provided in Figure 5. /1

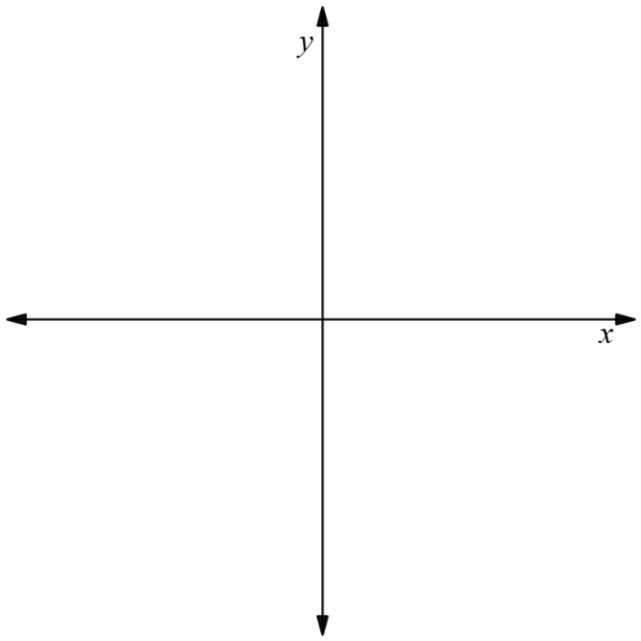

Figure 5

Total P2 /16

Spare diagram used (X) ☐

Spare Diagrams

Question 5

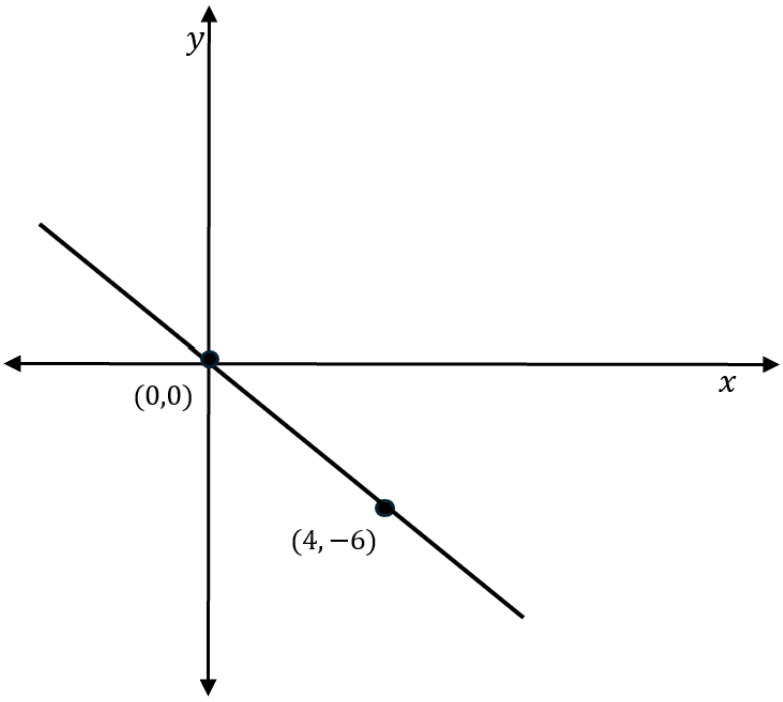

Figure 1

Question 6

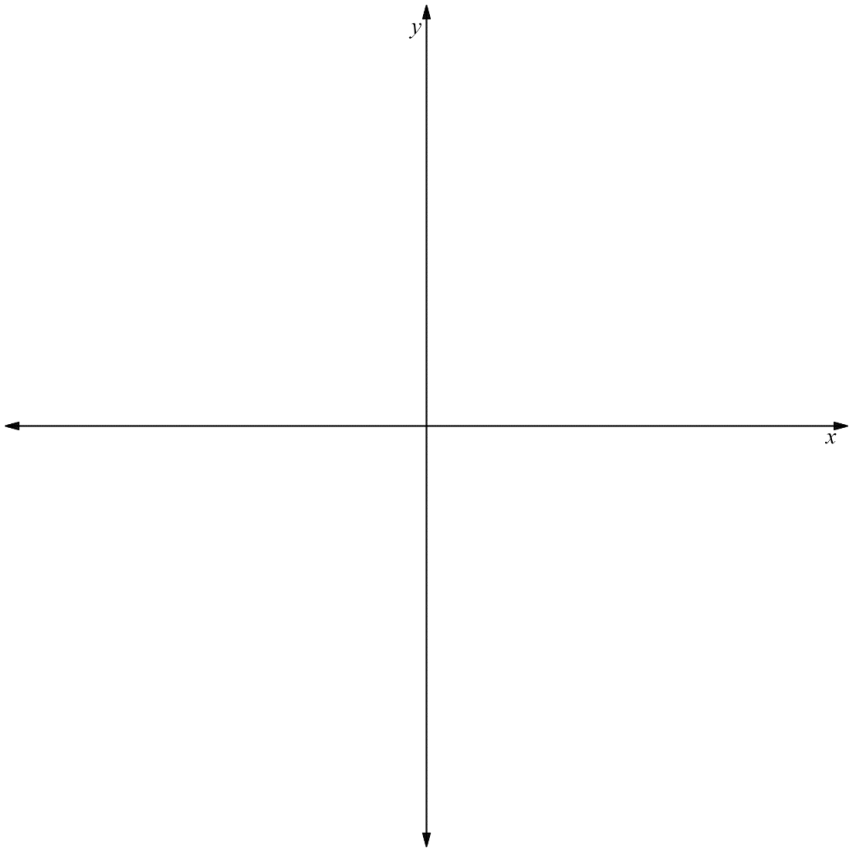

Figure 2

Spare Diagrams

Question 7

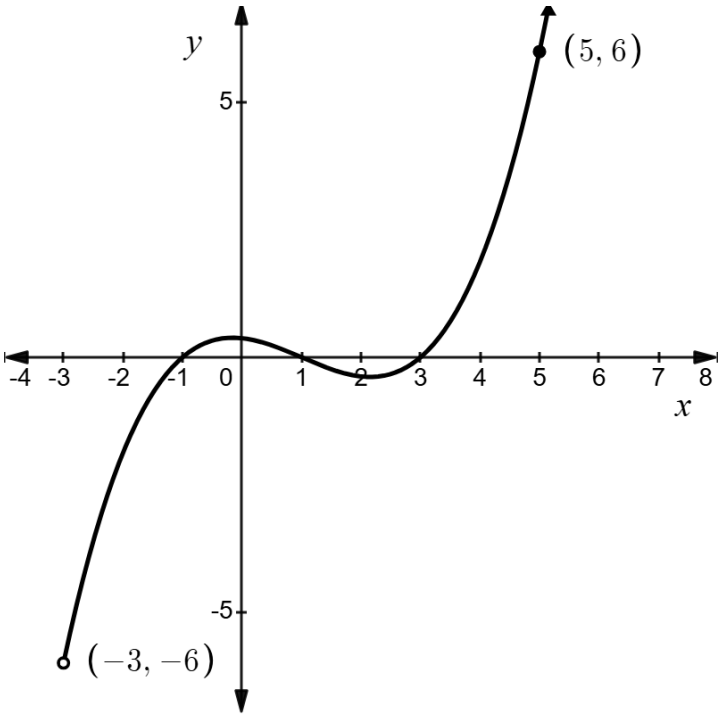

Figure 3

Question 8 a)

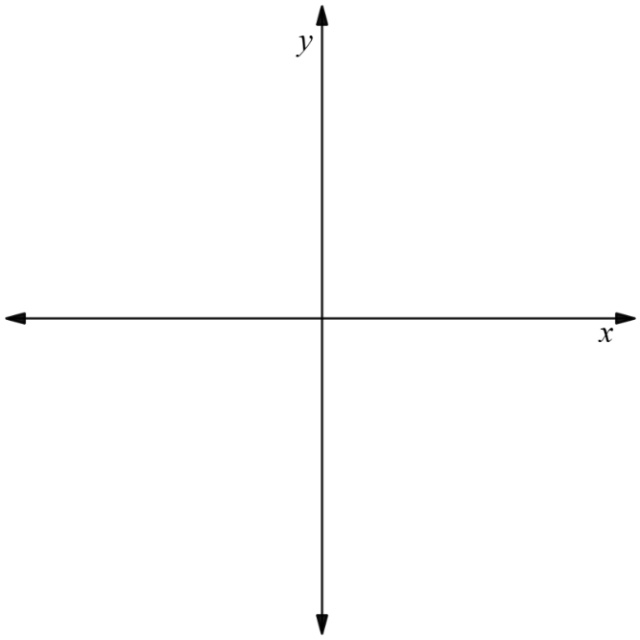

Figure 4

Spare Diagrams

Question 8 c)

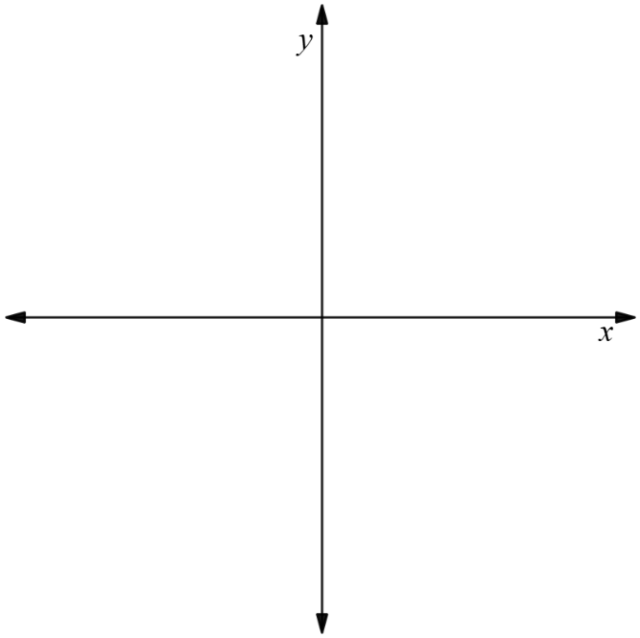

Figure 5

Part 3

Marker use

- Answer **all** questions in this part.
- This part assesses **Criterion 6**.

Question 9

Solve the following for x:

a) $2^{x-5} \times 2^2 = \sqrt{2}$

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b) $\log_x(\frac{4}{25}) = -2$

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Question 10

Marker use

The graph of the logarithmic function $y = 5\log_3(x) - 10$ is shown in Figure 6.

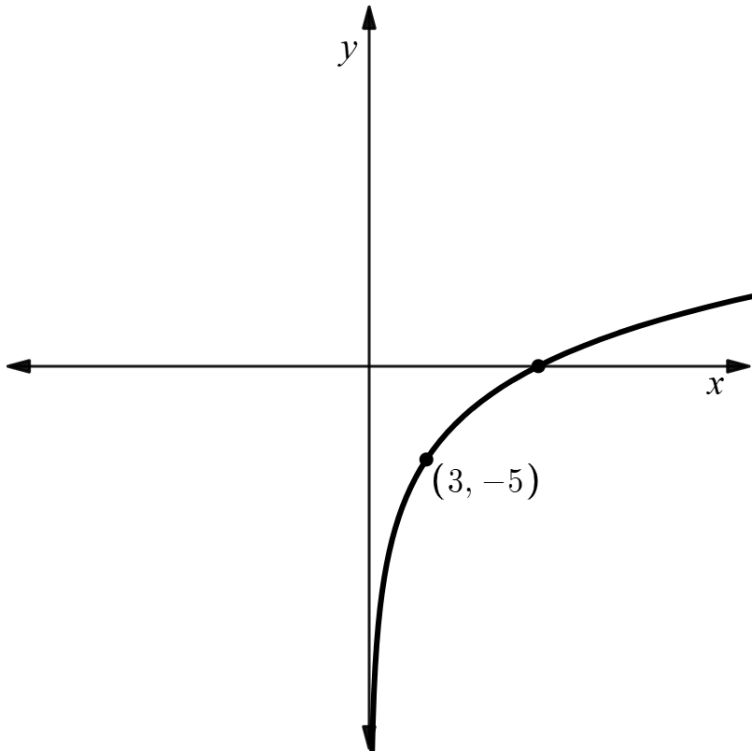

Figure 6

Spare diagram used (X) ☐

a) Determine the x-intercept of the function. /2

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The function is translated 2 units to the right and then reflected in the y-axis.

b) Sketch the transformed function using Figure 6 above, showing the new locations of the asymptote and the points marked. /2

Question 11

Marker use

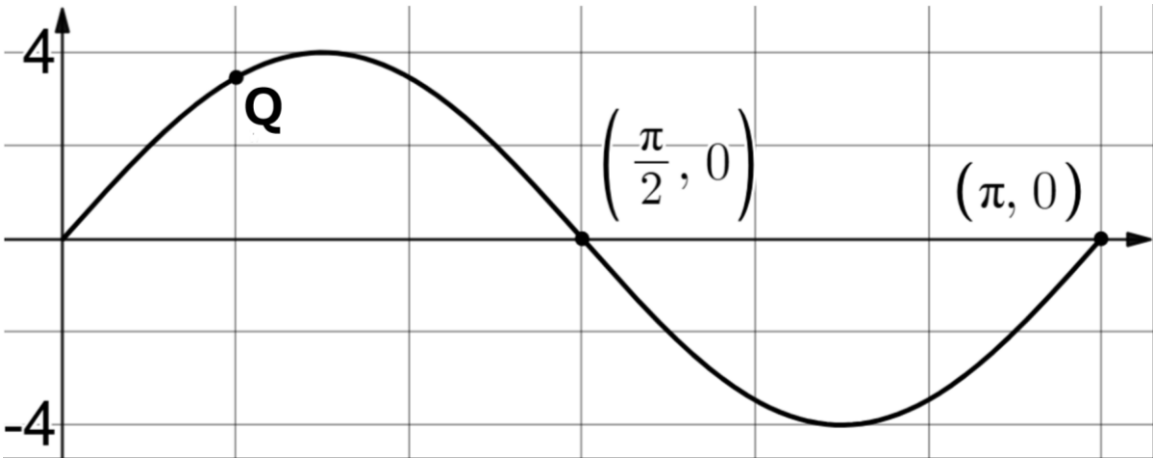

Figure 7

a) Find the equation of the function shown in Figure 7, that has form $y = a\sin(nx)$. /2

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b) State the exact co-ordinates of the Point Q. /2

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Question 12

Marker use

The unit circle is displayed in Figure 8.

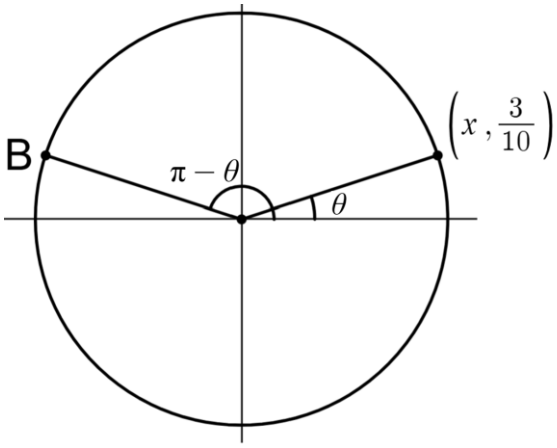

Figure 8

a) The angle θ is approximately $18°$. Convert $18°$ into radians.

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b) Use a basic identity to determine x, the exact value of $\cos(\theta)$.

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c) State the exact co-ordinates of Point B.

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Total P3

/16

Spare Diagram

Question 10

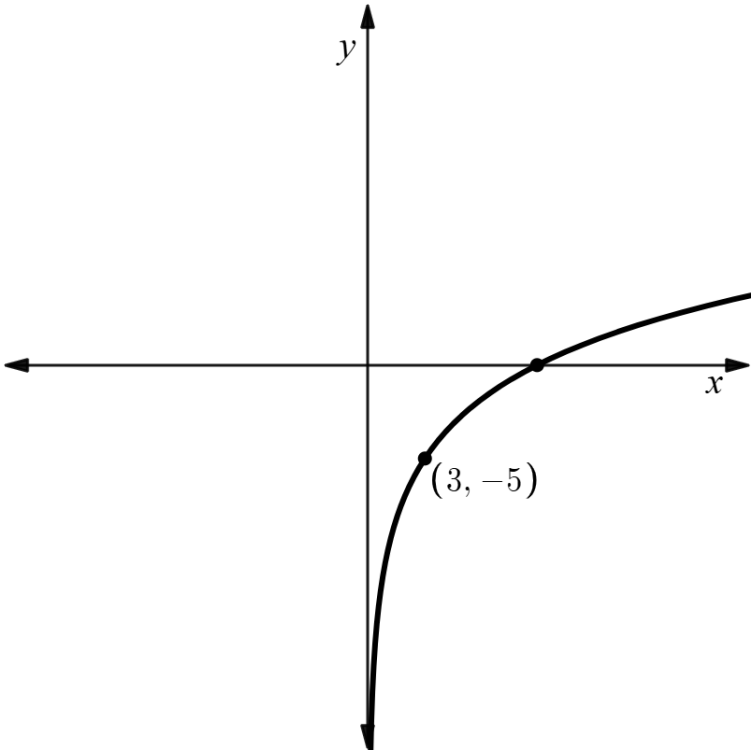

Figure 6

Part 4

Marker use

- Answer **all** questions in this part.
- This part assesses **Criterion 7**.

Question 13

Determine the derivative of each of the following:

a) $y = 4x^5 - 6x + 7 + 2x^{-4}$ /2

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b) $y = 3x^2(5 - x)$ /2

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c) $y = 8\sqrt{x} + \sqrt[4]{x^7}$ /2

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Question 14

Use first principles to differentiate $f(x) = 7x - 1$. /2

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Question 15

Marker use

For the function $f(x) = 3x^2 - 7x + 5$

a) Find $f'(1)$.

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b) Determine the equation of the tangent of $f(x)$ at $x = 2$.

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Question 16

Find the co-ordinates of the stationary points for the function $f(x) = x^3 + x^2 - x$.

Do not classify their nature.

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Total P4

/16

Part 5

Marker use

- Answer **all** questions in this part.
- This part assesses **Criterion 8**.

Question 17

An unbiased 6-sided die is rolled.

a) State the probability of rolling an odd number.

..... /1

b) State the probability of rolling a '3' twice in a row.

..... /1

Question 18

	B	B'	
A	0.23	-0.11	0.12
A'	0.33	0.56	0.89
	0.56	0.45	1.01

Table 1

List **two (2)** reasons why Table 1 is not a valid probability table. /2

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Question 19

Marker use

When 100 random tourists leaving Tasmania were surveyed, 48 had been to a national park, 22 had not been to a national park but had been to a museum, and 13 had been to both a national park and a museum.

a) Show this information in a Venn diagram. /2

b) If a surveyed tourist is randomly selected to win a prize, calculate the probability that they had been to a museum. /1

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c) Given that a tourist has been to a national park, calculate the probability that they have not been to a museum. /2

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d) Use an example to explain a method of selecting tourists for the survey that would not be considered random. /1

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Question 20

Marker use

A wildlife research team wants to conduct a conservation study on 4 of Tasmania's 11 endemic mammals, which are grouped by species in Table 2.

Marsupials	Rodents	Bats
• Bennetts Wallaby • Eastern Barred Bandicoot • Eastern Quoll • Spotted-tailed Quoll • Southern Bettong • Tasmanian Devil • Tasmanian Pademelon	• Broad-toothed Mouse • Long-tailed Mouse	• Little Forest Bat • Long-eared Bat

Table 2

How many ways can the team make this selection if:

a) there are no restrictions on which endemic mammal species are studied.

/2

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b) they must study exactly 2 marsupials and 1 bat.

/2

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c) they must study more rodents than bats. Answer as a combination expression in the form ${}^{n}C_{r}$ (no simplification required).

/2

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Total P5

/16

End of Section A

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TASMANIAN ASSESSMENT, STANDARDS & CERTIFICATION

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MATHEMATICS METHODS – FOUNDATION

MTM315117

Section B

Pages: 28

Questions: 24

Information Sheets: 1

Suggested working time: 100 minutes

Instructions:

Calculators are allowed to be used in this section.

- There are **five (5) parts** to this section.
- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
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C4	/ 20
C5	/ 20
C6	/ 20
C7	/ 20
C8	/ 20

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Totals		**20**	**20**	**80 minutes**	**80 marks**
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	Part 2	4	4	20 minutes	20 marks
	Part 3	5	5	20 minutes	20 marks
	Part 4	5	5	20 minutes	20 marks
	Part 5	4	4	20 minutes	20 marks
Totals		**24**	**24**	**100 minutes**	**100 marks**
Totals		**44**	**44**	**180 minutes (3 hours)**	**180 marks**

Part 1

Marker use

- Answer **all** questions in this part.
- This part assesses **Criterion 4**.

Question 21

For the formula $M = \frac{1}{3t} + \frac{h-5}{t^2} - \frac{2}{t}$

a) Combine the fractions so that M is equal to a single fraction.

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b) Determine the value of M when $h = 10.2$ and $t = 0.8$.

Answer correct to **one (1)** decimal place.

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c) Rearrange the formula to make h the subject.

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Question 22

Marker use

Write $(\sqrt{3}x + 2y)(3x^2 - 2\sqrt{3}xy + 4y^2)$ as a sum of two cubes.

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Question 23

A student has attempted to expand $(2x - 5)^4$ as shown:

$$1\,(\,2x\,)^4 \;+\; 2\,(\,2x\,)^3\,(\,-5\,) \;+ 6\,(\,2x\,)^2(\,-5\,)^3 \;+\; 4\,2x\,(\,-5\,)^3 \;-\; 1\,(\,5\,)^4$$

a) Locate and correct the mistakes made in their working above.

/2

b) Hence, simplify the expansion of $(2x - 5)^4$.

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Question 24

Solve the following for x:

a) $3x^3 - 7\sqrt{2}x = 0$, answering correct to **two (2)** decimal places.

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b) $x^2 - 4x - 10 = 0$, by completing the square.

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Question 25

Marker use

Use the discriminant to determine a value of k such that the quadratic function $f(x) = -3x^2 + 2x + k$ has:

a) Exactly one x-intercept. /2

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b) Two rational x-intercepts. /2

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Question 26

A triangle with an area of 4 cm^2 has a height 2 cm more than the length of its base.

a) Show that the equation $0 = h^2 - 2h - 8$ describes the height of the triangle, h cm, by using the formula $Area = \frac{1}{2} \times base \times height$. /1

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b) Determine the height of the triangle by solving $0 = h^2 - 2h - 8$ with the quadratic formula. /2

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Total P1 /20

Part 2

Marker use

- Answer **all** questions in this part.
- This part assesses **Criterion 5**.

Question 27

For the line $8 - 2y = 4x$

a) Determine the gradient.

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b) Determine the equation of the perpendicular line which intersects the line above at $x = 2$.

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Question 28

Marker use

/4

Sketch the function $f:(-3,1] \to R$ where $f(x) = 3x^2 + 8x - 3$, using Figure 9.

Label the x and y intercepts and the end points.

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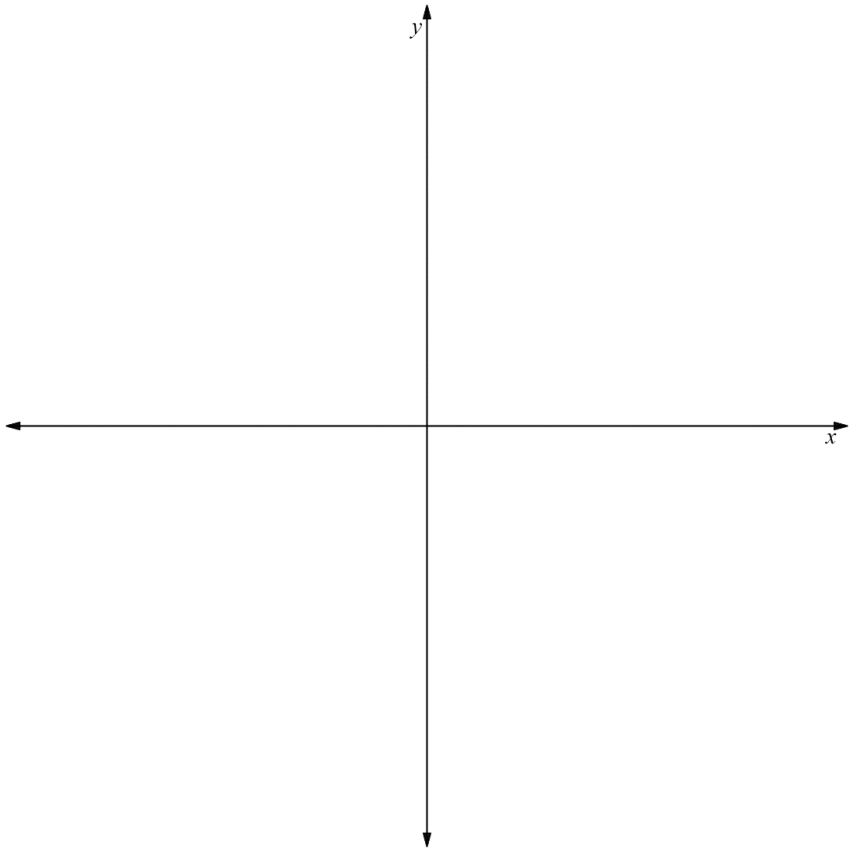

Figure 9

Spare diagram used (X) ☐

Question 29

Marker use

The function $f(x) = (x - 2)^3$ is translated 3 units left and 1 unit down.

a) State the equation of the new function.

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b) Sketch the new function on the axes in Figure 10. Label any intercepts and the inflection point.

/2

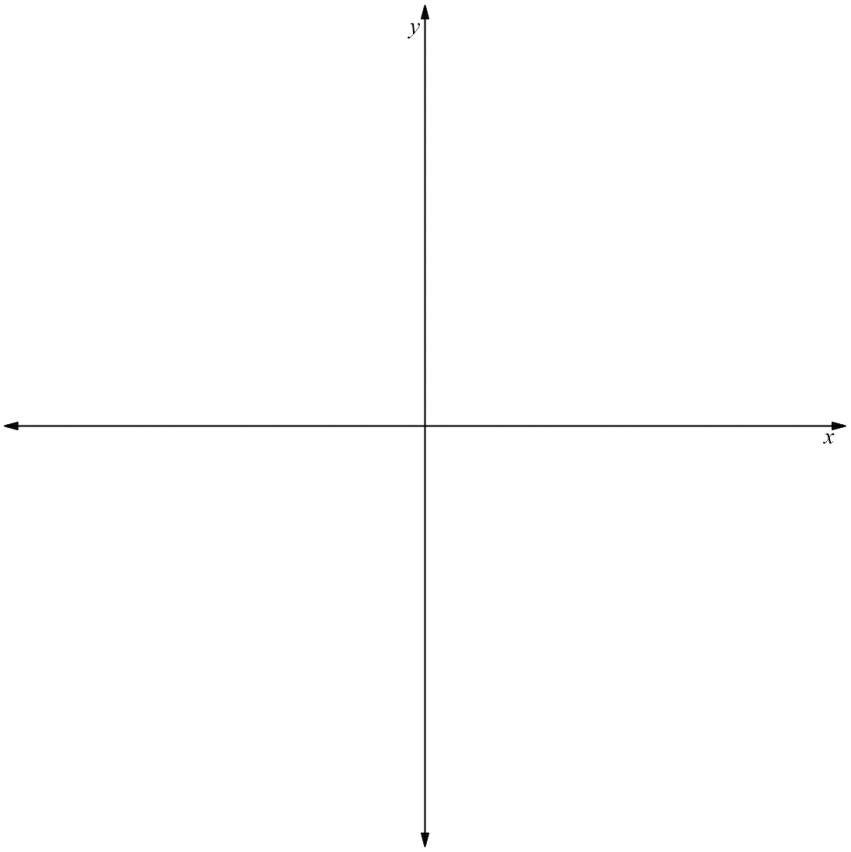

Figure 10

Spare diagram used (X) ☐

Question 30

Marker use

The map in Figure 11 shows the voyage of the ships captained by Scallywag Sally and Pirate Pete.

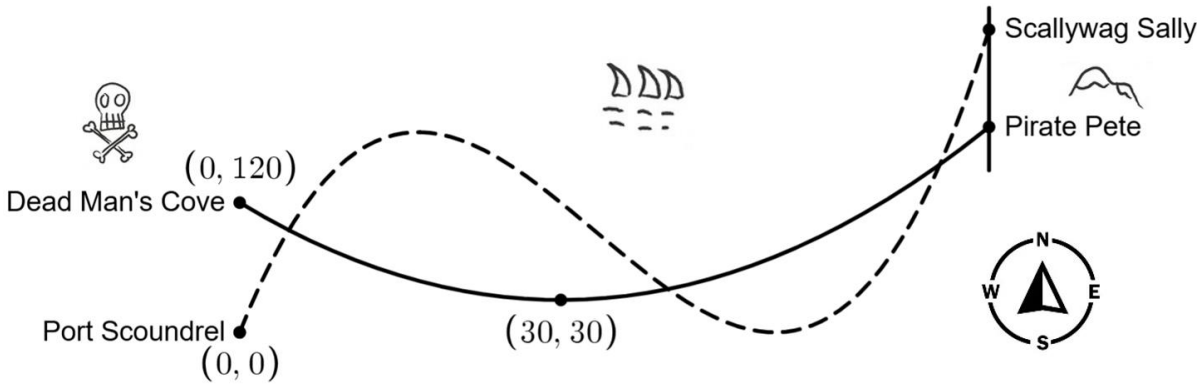

Figure 11

The voyage of Scallywag Sally is given by the equation $y = \frac{1}{100}x(x-50)^2$, where she is y km north and x km east of her starting point at Port Scoundrel.

a) How far north is Sally when she has travelled 10 km east?

/1

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b) How far north (to the nearest km) does Sally get, before she heads south?

/1

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c) How far east (to the nearest km) is Sally when she is 200 km north?

/1

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Question 30 continues

Question 30 continued

Marker use

The voyage of Pirate Pete starts at Dead Man's Cove, located exactly 120 km north of Port Scoundrel, and can be described by the equation $y = a(x - h)^2 + k$.

The furthest south Pete reaches is the co-ordinate $(30,\ 30)$.

d) Determine a, h and k.

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/2

e) How many times do the ships pass through exactly the same location?

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/1

f) State the co-ordinates of one of these locations to the nearest km.

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/1

Both ships finish their journey when they hit the coast 70 km east of Port Scoundrel.

g) How much further north is Sally than Pete at this point?

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/2

Total P2

/20

Spare Diagrams

Question 28

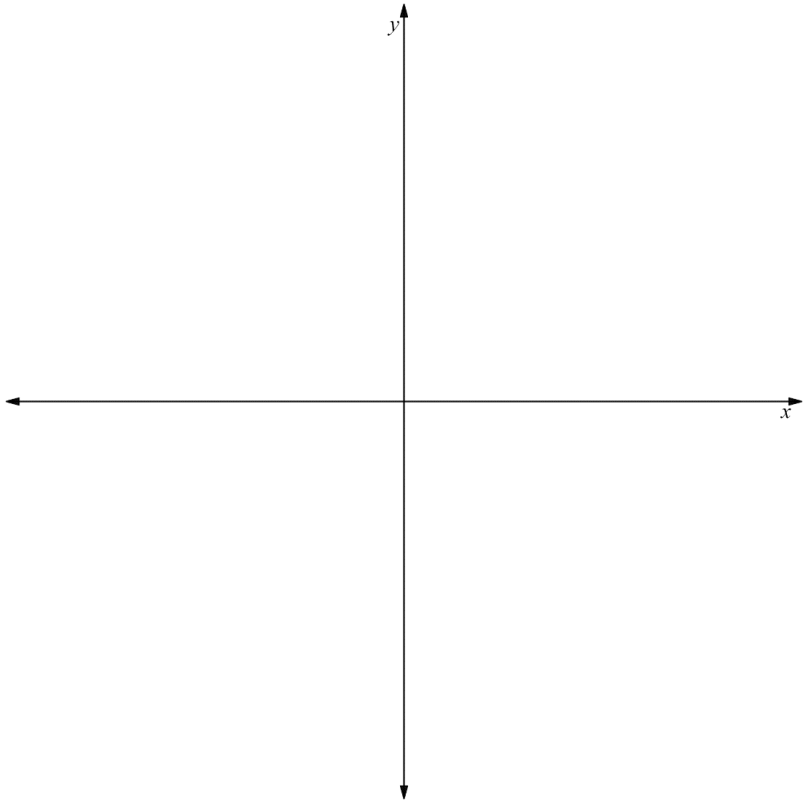

Figure 9

Question 29 b)

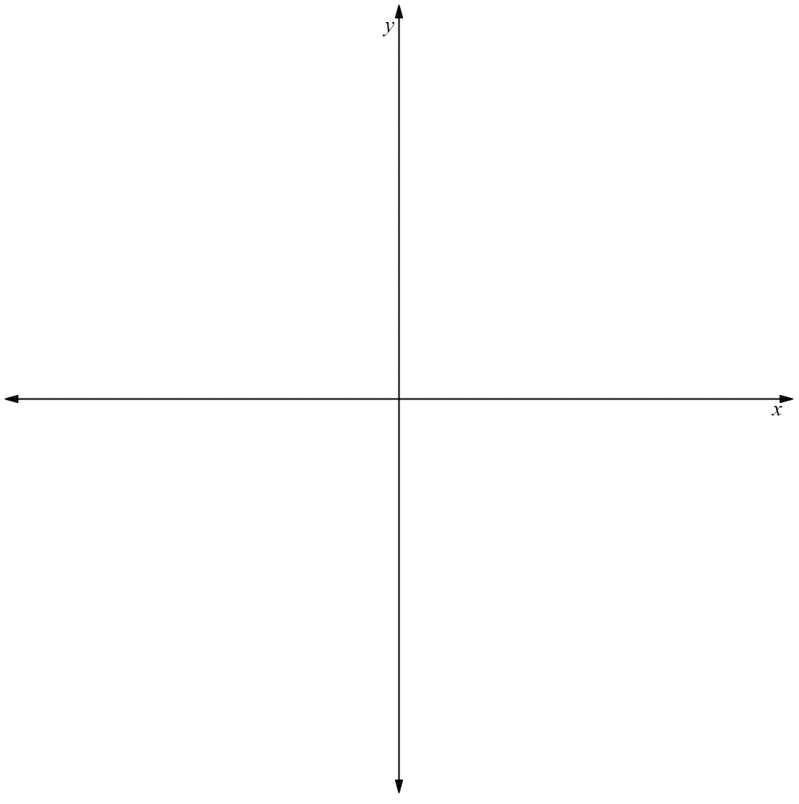

Figure 10

Part 3

Marker use

- Answer **all** questions in this part.
- This part assesses **Criterion 6**.

Question 31

For the function $y = \tan\left(\frac{x}{3}\right)$

a) Determine the period.

.....

/1

b) State the range.

.....

/1

c) What is the equation of the first positive asymptote?

.....

/1

.....

Question 32

Marker use

a) Sketch the graph of $y = -1 \times 2^{x+1} + 5$ for the domain $-\infty < x < 3$ using the axes in Figure 12. Clearly label any asymptotes, intercepts and endpoints.

/4

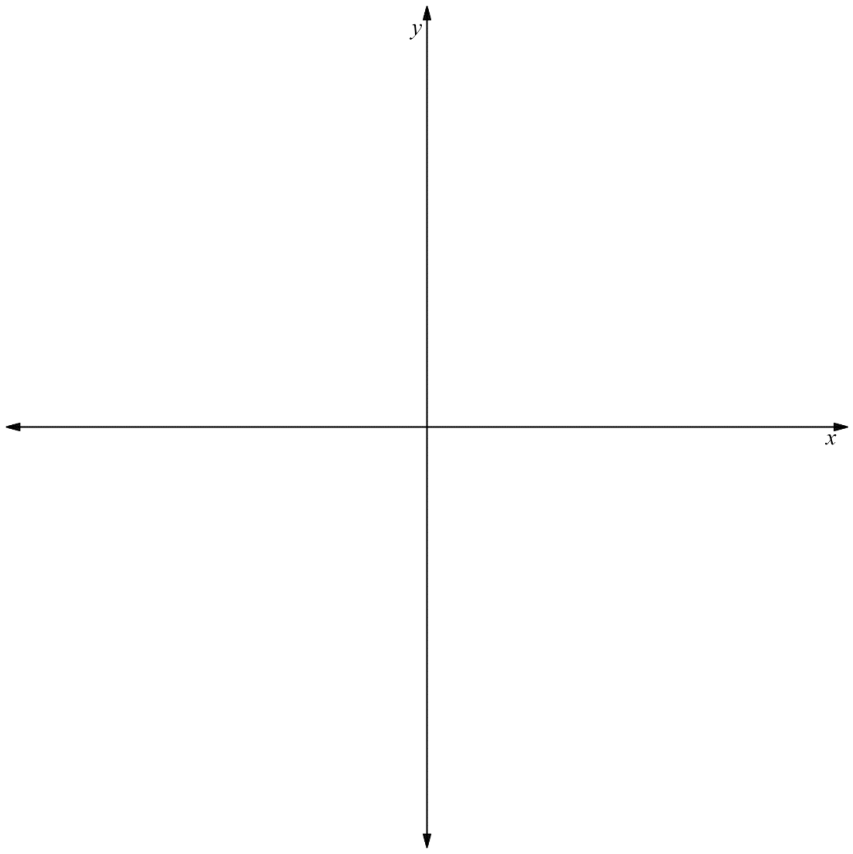

Figure 12

Spare diagram used (X) ☐

b) State the range.

.....

/1

Question 33

Marker use

/4

The height (in metres) of the tide above the average sea level can be modelled by a cosine function.

- High tide is 3 metres above average and occurs at midnight.
- Low tide is 3 metres below average and occurs 6 hours later.
- This pattern repeats every 12 hours.

Sketch a graph of the height of the tide over a 24-hour period (starting from midnight) using the axes in Figure 13.

Clearly indicate the height the tide reaches when it is above and below average, and what times these occur.

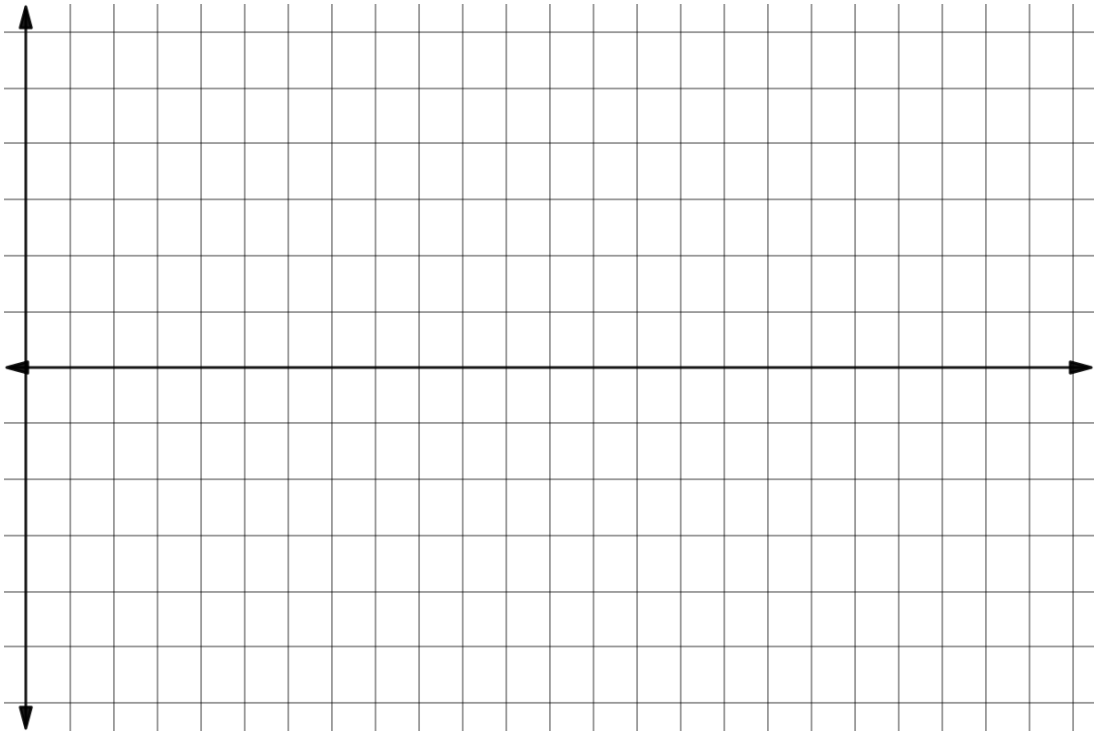

Figure 13

Spare diagram used (X) ☐

Question 34

Marker use

A shape with four sides of equal length, known as a rhombus, is shown in Figure 14. The perimeter is 120 cm and the length of the diagonal BD is 20 cm.

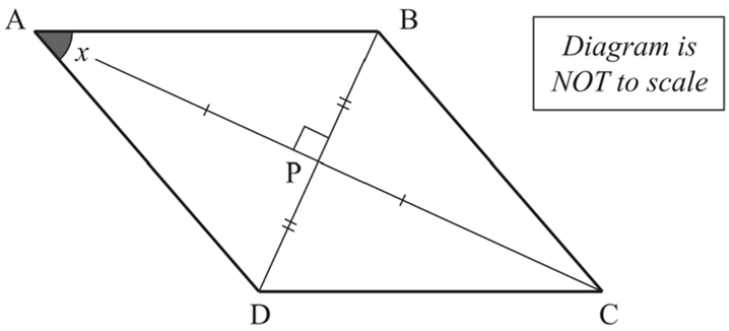

Figure 14

Find the size of x (the angle BAD) to the nearest degree.

/3

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Question 35

Marker use

The pOH scale is used to express how acidic a solution is using the formula

$$pOH = a\log_{10}(x) + b$$

where x represents the concentration of hydroxide ions in mol/litre.

- A concentration of 1 mol/litre gives a pOH of 14.
- A concentration of 10^{-3}mol/litre gives a pOH of 11.

a) Determine a and b.

.....

.....

.....

.....

.....

/3

b) A pOH level of 7 is considered neutral. What hydroxide ion concentration does this correspond to?

.....

.....

.....

/2

Total P3

/20

Spare Diagrams

Question 32 a)

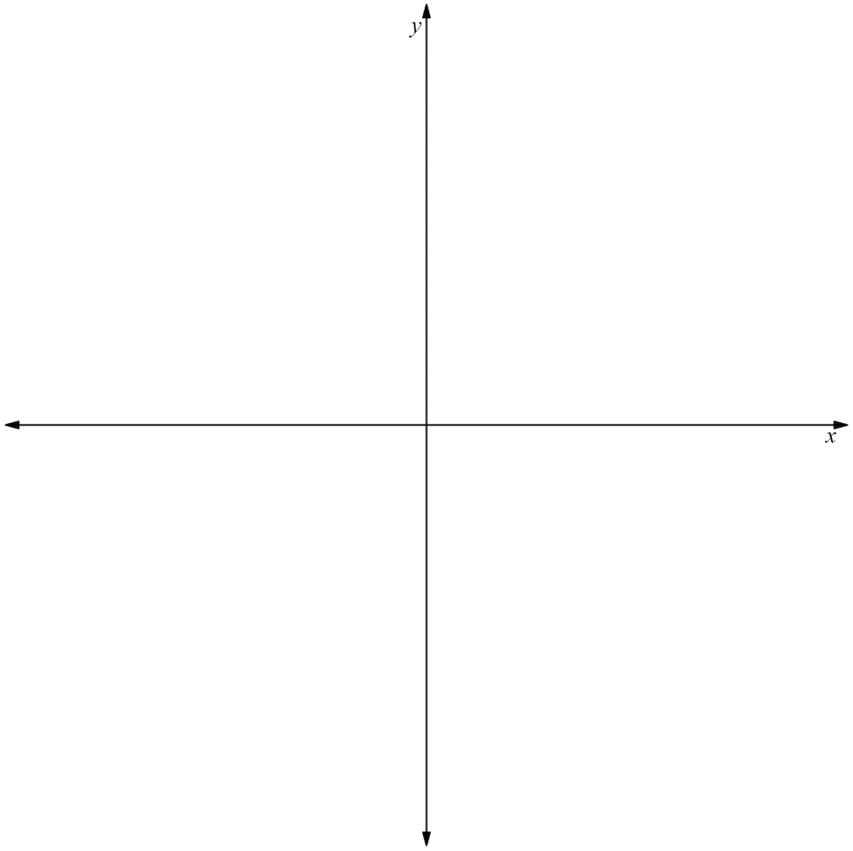

Figure 12

Question 33

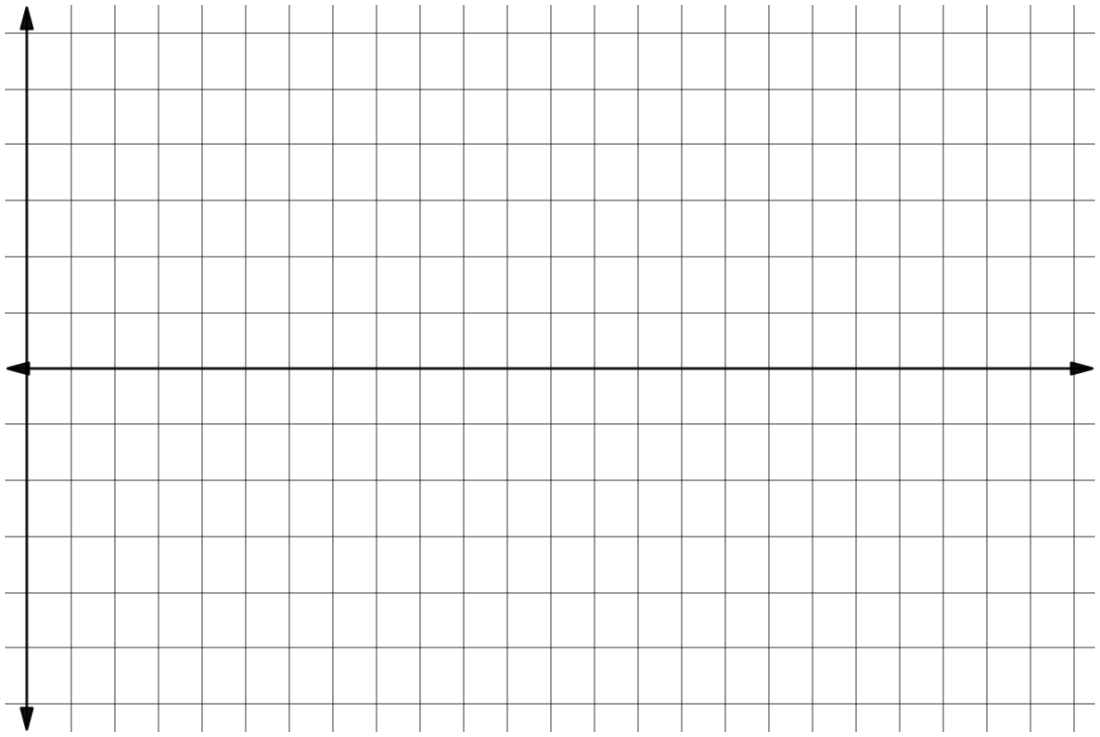

Figure 13

Part 4

Marker use

- Answer **all** questions in this part.
- This part assesses **Criterion 7**.

Question 36

The displacement of a spanner thrown vertically upwards is given by $H(t) = 15t - 5t^2$ where H is the height in metres, and t is the time in seconds after the spanner is thrown.

a) Use calculus techniques to determine when the spanner reaches its maximum height. /2

.....

.....

.....

b) What is the maximum height? /1

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.....

.....

c) Determine the velocity of the spanner 2 seconds after being thrown. /1

.....

.....

.....

d) At what time is the spanner moving at a velocity of 10 m/s downwards? /1

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.....

.....

Question 37

Marker use

The profit, P thousand dollars, recorded by a shop over several years is graphed in Figure 15 and given by the equation $P = t^3 - 7t^2 + 15t - 4$.

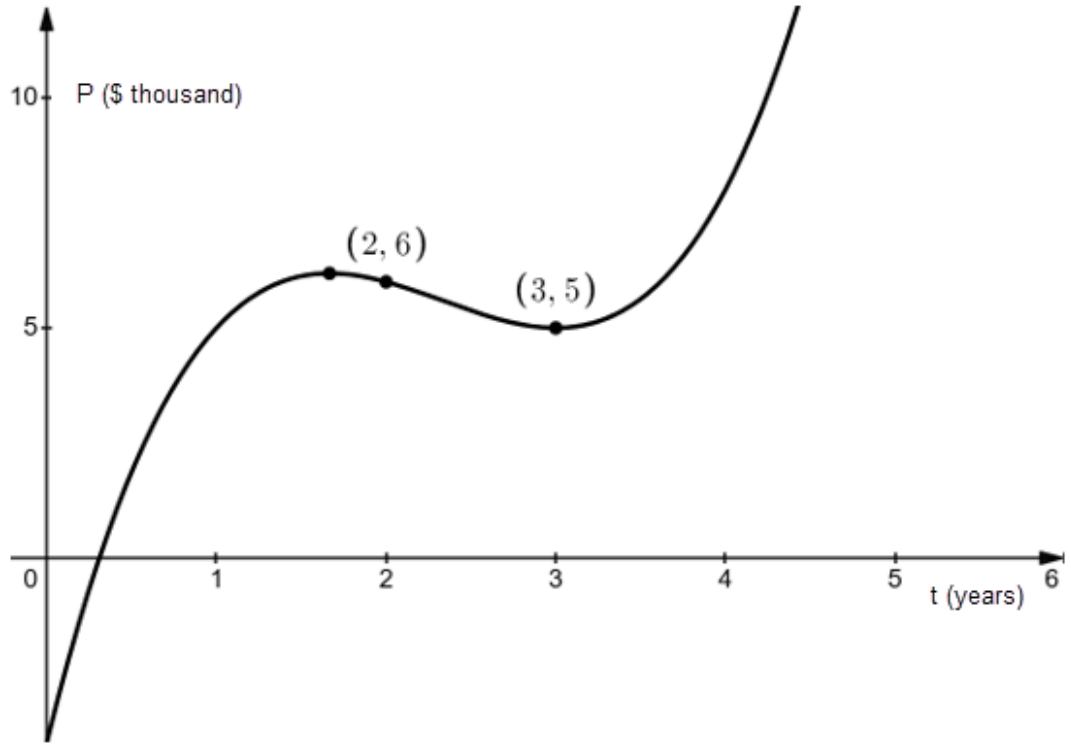

Figure 15

Spare diagram used (X) ☐

a) Determine the average rate of change of the company's profit from year 2 to year 3.

/2

.....

.....

b) At what time(s) is the company's instantaneous rate of change in profit the same as the average rate calculated in part a)?

/2

.....

.....

.....

.....

c) Sketch $\frac{dP}{dt}$ using the same axes as Figure 15.

/2

Question 38

Marker use

Figure 16 is a graph of a function $f(x)$ that has range $f(x) \in (-\infty, 3]$.

a) State the nature of the co-ordinate:

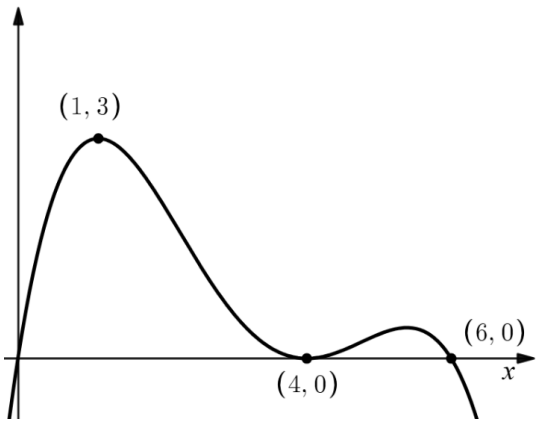

Figure 16

i. $(1, 3)$

..... /1

.....

ii. $(4, 0)$

..... /1

.....

b) True or false: $f'(2) < 0$?

..... /1

Question 39

The volume of water in a pond is given by $V(t) = \frac{1}{2}(t-3)^3 + 100$, where V is the volume in litres and t is the time in days since measuring began.

a) State the initial volume of the pond.

..... /1

.....

b) Determine the rate at which the volume is changing after 2 days.

..... /2

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.....

.....

Question 40

Marker use

Use calculus techniques to find the equation of the tangent to $f(x) = 5x^2 - 20x + 30$ that is parallel to the x axis.

/3

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Total P4

/20

Spare Diagram

Question 37

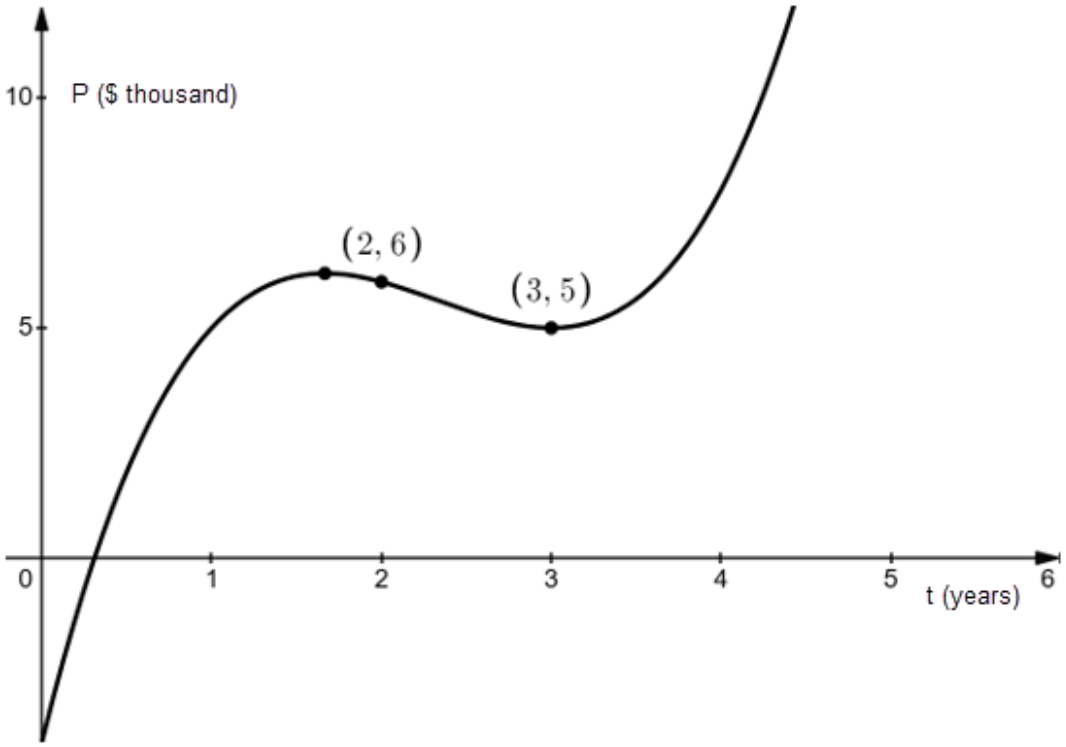

Figure 15

Part 5

Marker use

- Answer **all** questions in this part.
- This part assesses **Criterion 8**.

Question 41

Two events A and B are such that $\Pr(A) = 0.36$, $\Pr(B) = 0.28$ and $\Pr(A \cap B) = 0.15$.

a) Determine if A and B are independent.

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.....

/2

b) Calculate $\Pr(A \cup B)$.

.....

.....

/1

c) Calculate $\Pr\big((A \cap B)'\big)$.

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/1

Question 42

In my house, 4 of 12 jars of honey are not properly sealed.

If I select 3 jars at random, without replacement, calculate the probability that at most 1 is not properly sealed.

/3

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Question 43

Marker use

Approximately 72% of visitors to Tasmania arrived by air last year, with the rest arriving by sea. Of those who arrived by air, 62% arrived via Hobart Airport and 24% arrived via Launceston Airport. Of those who arrived by sea, 60% arrived on a cruise ship, with the rest arriving on a ferry.

a) Complete Figure 17 which presents the information above using a tree diagram. /3

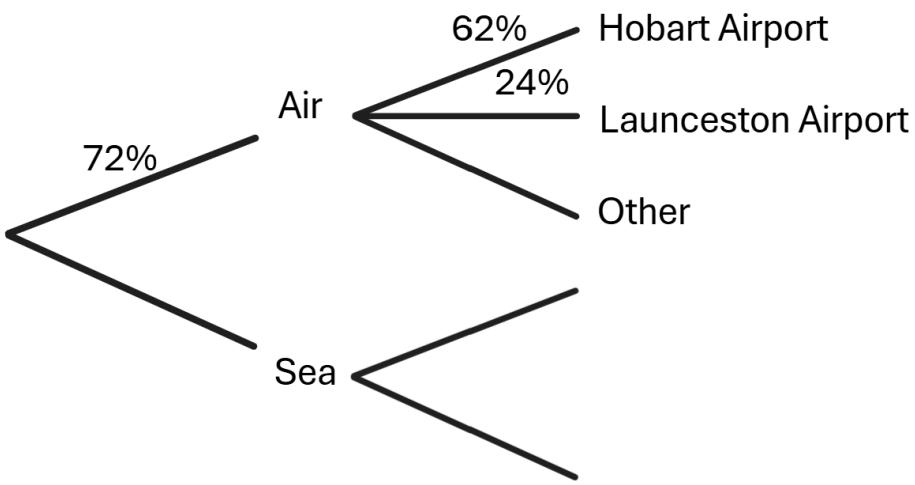

Figure 17

Spare diagram used (X) ☐

b) Given that a visitor arrived by sea, what is the probability that they arrived via ferry? /1

.....

c) Determine the probability that a visitor arrives by ferry or Launceston Airport. /2

.....

.....

.....

d) Modelling suggests Tasmania will have around 1.5 million visitors this year. What number of these visitors are predicted to arrive via Hobart Airport? /2

.....

.....

.....

Question 44

Marker use

Ash is buying 3 bikes from a shop that stocks 12 mountain bikes. There are 6 different blue bikes, 4 different green bikes, and the remaining are different red bikes.

a) How many different combinations of 3 bikes could Ash choose?

.....

/1

b) Determine the probability of Ash choosing exactly 1 red bike.

/2

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.....

c) Determine the probability of Ash choosing 3 bikes of the same colour.

/2

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Total P5

/20

Spare Diagram

Question 43

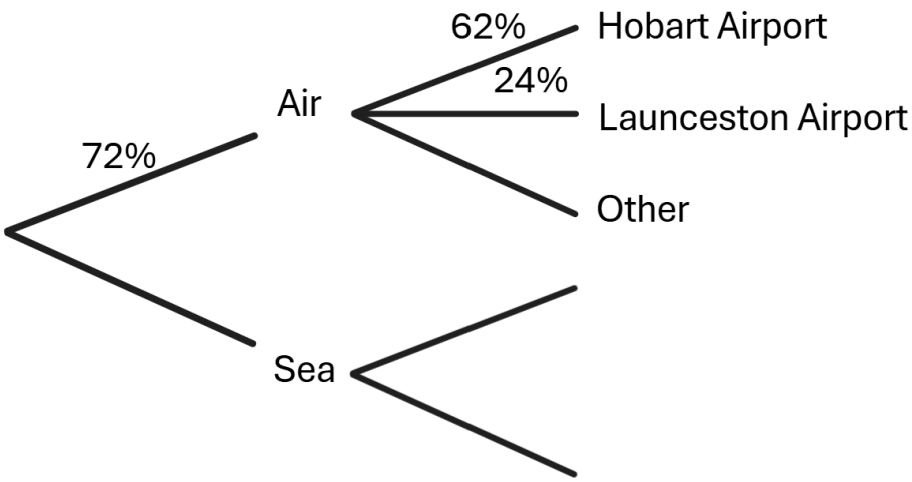

Figure 17

End of Exam

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