



**GAUTENG PROVINCE**

EDUCATION  
REPUBLIC OF SOUTH AFRICA

# PREPARATORY EXAM

## 2026

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**MATHEMATICS PAPER 1 (10611)**

27 pages

**PREPARATORY EXAMINATION  
2026**

|                   |                            |   |   |   |   |   |   |   |              |  |    |  |       |
|-------------------|----------------------------|---|---|---|---|---|---|---|--------------|--|----|--|-------|
| NAME OF SCHOOL:   |                            |   |   |   |   |   |   |   |              |  |    |  |       |
| CANDIDATE'S NAME: |                            |   |   |   |   |   |   |   |              |  |    |  |       |
| DATE:             | D                          | D | M | M | 2 | 0 | 2 | 6 | BOOK NUMBER  |  | OF |  | BOOKS |
| TEACHER:          |                            |   |   |   |   |   |   |   | PAPER NUMBER |  | 1  |  |       |
| SUBJECT:          | <b>MATHEMATICS (10611)</b> |   |   |   |   |   |   |   |              |  |    |  |       |

**ANSWER ALL THE QUESTIONS IN THE QUESTION PAPER.**

|          | MARKER |  |  |                   | MODERATOR(S) |  |  |                      |  |  |
|----------|--------|--|--|-------------------|--------------|--|--|----------------------|--|--|
| QUESTION | MARKS  |  |  | MARKER'S INITIALS | MARKS        |  |  | MODERATORS' INITIALS |  |  |
| 1        | 0      |  |  |                   | 0            |  |  |                      |  |  |
| 2        | 0      |  |  |                   | 0            |  |  |                      |  |  |
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| 6        | 0      |  |  |                   | 0            |  |  |                      |  |  |
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| 8        | 0      |  |  |                   | 0            |  |  |                      |  |  |
| 9        | 0      |  |  |                   | 0            |  |  |                      |  |  |
| 10       | 0      |  |  |                   | 0            |  |  |                      |  |  |
| 11       | 0      |  |  |                   | 0            |  |  |                      |  |  |
|          |        |  |  | TOTAL             |              |  |  |                      |  |  |

**TIME: 3 hours****MARKS: 150****26 pages + 1 information sheet**

**INSTRUCTIONS AND INFORMATION**

Read the following instructions carefully before answering the questions.

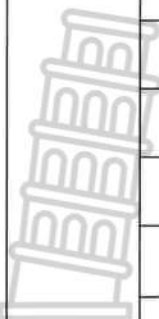
1. This question paper consists of 11 questions. Answer ALL the questions in the spaces provided for answers.
2. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.
3. Answers only will NOT necessarily be awarded full marks.
4. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
5. If necessary, round-off answers to TWO decimal places, unless stated otherwise.
6. Diagrams are NOT necessarily drawn to scale.
7. An INFORMATION SHEET with formulae is included at the end of the question paper.
8. No pages may be torn from the question paper.
9. Candidates may not retain a question paper or remove it from the examination room. Question papers must be returned to the invigilator at the end of the examination session.
10. Answers must be written in black/blue ink as distinctly as possible. DO NOT write in the margins.
11. Indicate the questions you have answered by drawing a circle around the relevant numbers on the front cover of the question paper where marks are to be recorded.
12. Draw a neat line through any work/rough work that must NOT be marked.
13. In the event that you use the additional space provided:
  - 13.1 Write down the number of the question.
  - 13.2 Leave a line open and rule off after your answer.
14. Write neatly and legibly.

QUESTION 1

|       |                                                    |     |
|-------|----------------------------------------------------|-----|
| 1.1   | Solve for $x$ :                                    |     |
| 1.1.1 | $3x^2 - x + 2 = x + 2$                             |     |
|       |                                                    | (3) |
|       |                                                    |     |
|       |                                                    |     |
|       |                                                    |     |
|       |                                                    |     |
| 1.1.2 | $7x^2 - x - 2 = 0$ (Correct to TWO decimal places) |     |
|       |                                                    | (3) |
|       |                                                    |     |
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|       |                                                    |     |
| 1.1.3 | $\left(\frac{x}{2}\right)^2 - 5x + 24 \leq 0$      |     |
|       |                                                    | (5) |
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1.1.4

$$2^{-x+2} - 2^{-x} = 48$$



(3)

1.2

Solve for  $x$  and  $y$  simultaneously:

$$\sqrt{2x+1} - 2 = y \text{ and } x = 4y$$

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(6)

|       |                                                                                                                                                                  |     |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1.3   | <p>Given the quadratic equation <math>ax^2 + bx + c = 0</math> with solutions:</p> <p><math>x = 7</math> and <math>x = \frac{5 - \sqrt{25 + 56a}}{2a}</math></p> |     |
| 1.3.1 | <p>Determine the values of <math>a</math>, <math>b</math> and <math>c</math>.</p>                                                                                |     |
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|       |                                                                                                                                                                  | (5) |
| 1.3.2 | <p>Hence determine the other solution to the quadratic equation.</p>                                                                                             |     |
|       |                                                                                                                                                                  |     |
|       |                                                                                                                                                                  |     |
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|       |                                                                                                                                                                  | (1) |

[26]

## QUESTION 2

Given the number pattern:  $7\sin 30^\circ$  ; 7 ;  $23\sin 30^\circ$  ; 17 ; ...

2.1 Show that the pattern is quadratic.

(3)

2.2 The  $n^{\text{th}}$  term of the number pattern can be written as  $T_n = \frac{1}{2}n^2 + pn + q$ .  
Show that  $p = 2$  and  $q = 1$ .

(2)

2.3 Determine which term of the sequence will have a value of 49.

(4)

|     |                                                                                                                                                       |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.4 | A Grade 12 learner claims that the minimum value of this pattern can be obtained by determining the turning point of the relevant quadratic function. |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------|

By using a valid calculation, explain why this learner is incorrect.

A small potted plant, possibly a succulent, sits on a wooden surface. The background is blurred, showing what appears to be a kitchen or indoor setting. The website address 'stanmorephysics.com' is visible at the bottom of the image.

(3)

[12]

### ADDITIONAL SPACE

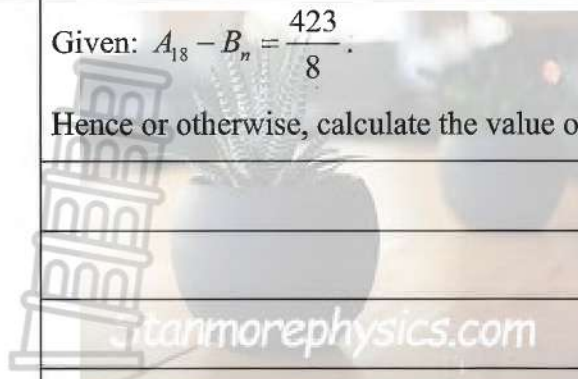
## QUESTION 3

|       |                                                                                                                                                               |     |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 3.1   | The first three terms of an infinite series are given by: $3 + 2x + \frac{4}{3}x^2 + \dots$                                                                   |     |
| 3.1.1 | Determine the value(s) of $x$ for which the series is convergent.                                                                                             |     |
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|       |                                                                                                                                                               | (3) |
| 3.1.2 | If $x = \frac{1}{2}$ , determine $S_{\infty}$ .                                                                                                               |     |
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|       |                                                                                                                                                               | (3) |
| 3.2   | Two different series, A and B are given as follows:<br>$A_m = \sum_{p=1}^m (7p - 22) \quad \text{and} \quad B_n = \sum_{k=1}^n 24 \left(\frac{3}{2}\right)^k$ |     |
| 3.2.1 | Show that $B_n = 72 \left[ \left(\frac{3}{2}\right)^n - 1 \right]$ .                                                                                          |     |
|       |                                                                                                                                                               |     |
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|       |                                                                                                                                                               | (3) |

3.2.2

Given:  $A_{18} - B_n = \frac{423}{8}$ .

Hence or otherwise, calculate the value of  $n$ .



(6)

[13]

**ADDITIONAL SPACE**

## QUESTION 4

Given  $f(x) = q - \frac{2}{x+p}$  with the following essential properties:

- $x \in \mathbb{R}; x \neq 2$
- $y \in \mathbb{R}; y \neq 3$
- $y = x + t$  is the equation for ONE of the axes of symmetry of  $f$ .

4.1 Write down the values of  $p$  and  $q$ .

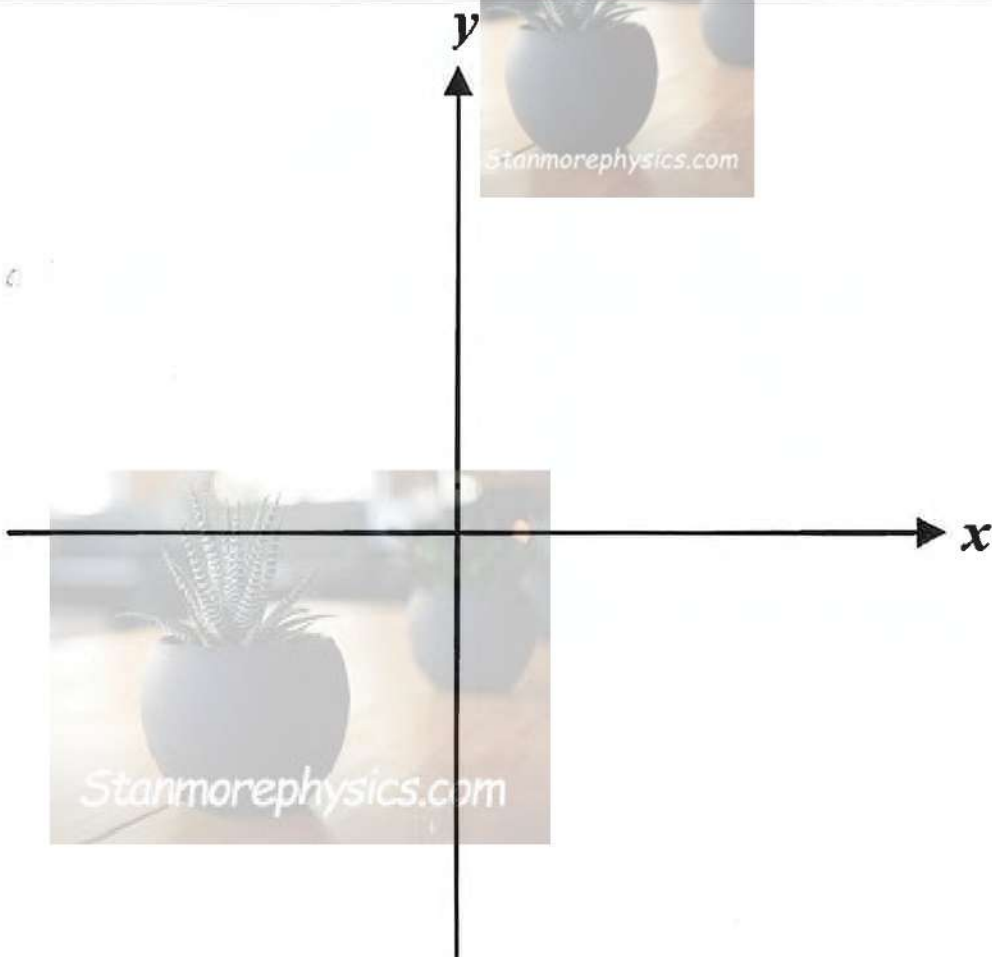
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4.2 Calculate the value of  $t$ .

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4.3  $f$  is translated 2 units to the left and 3 units upward to obtain  $h$ .  
Determine the equation of  $h^{-1}$ . Write your answer in the form  $y = \dots$

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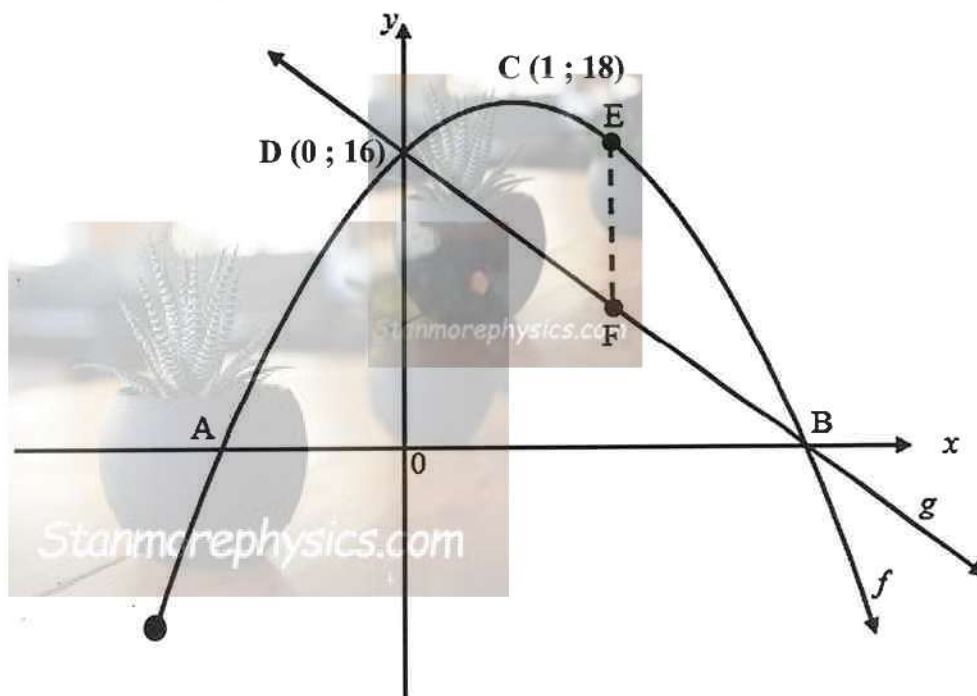
|                                                                                     |                                                                                                                                                          |     |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 4.4                                                                                 | Given: $g(x) = \log_2 x$                                                                                                                                 |     |
| 4.4.1                                                                               | Write down the equation of $g^{-1}$ in the form $y = \dots$                                                                                              |     |
|                                                                                     |                                                                                                                                                          |     |
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|                                                                                     |                                                                                                                                                          |     |
|                                                                                     |                                                                                                                                                          |     |
|                                                                                     |                                                                                                                                                          | (2) |
| 4.4.2                                                                               | Sketch the graphs of $g$ and $g^{-1}$ on the same set of axes.<br>Clearly indicate the intercepts with the axes, and ONE additional point on each graph. |     |
|  |                                                                                                                                                          |     |
|                                                                                     |                                                                                                                                                          | (4) |
| 4.4.3                                                                               | Write down the value(s) of $x$ for which $x.g(x) \leq 0$ .                                                                                               |     |
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|                                                                                     |                                                                                                                                                          | (2) |

[15]

## QUESTION 5

The graphs of  $f(x) = a(x+p)^2 + q$  for  $x \geq -4$  and  $g(x) = mx + c$  are sketched below.

- Points A and B are the  $x$ -intercepts of  $f$ .
- $C(1; 18)$  is the turning point of  $f$ .
- $D(0; 16)$  is a point of intersection of  $f$  and  $g$ .



5.1 Show that the equation of  $f$  can be written as  $f(x) = -2x^2 + 4x + 16$ .

(4)

5.2 Calculate the length of AB.

(2)

|       |                                                                                                                                            |     |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 5.3   | Determine the equation of $g$ in the form $g(x) = \dots$                                                                                   |     |
|       |                                                                                                                                            |     |
|       |                                                                                                                                            |     |
|       |                                                                                                                                            | (2) |
| 5.4   | For which value(s) of $x$ is:                                                                                                              |     |
| 5.4.1 | $f$ increasing?                                                                                                                            |     |
|       |                                                                                                                                            |     |
|       |                                                                                                                                            | (2) |
| 5.4.2 | $f(x) \cdot f'(x) < 0$ ?                                                                                                                   |     |
|       |                                                                                                                                            |     |
|       |                                                                                                                                            | (2) |
| 5.5   | E is a point on $f$ and F is a point on $g$ such that EF is a line drawn parallel to the $y$ -axis.<br>Determine the maximum length of EF. |     |
|       |                                                                                                                                            |     |
|       |                                                                                                                                            |     |
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|       |                                                                                                                                            | (5) |

[17]

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## QUESTION 6

- 6.1 The International Union for Conservation of Nature (ICUN) estimates that approximately 39 000 African lions remain in the wild in 2026. If the rate of population growth is estimated to average 18% p.a, in which year can the ICUN expect the African lion population to double?



(4)

- 6.2 Mrs Molefe, a Mathematics teacher, decides to invest in a retirement fund. She plans to retire in 20 years. She makes equal, monthly contributions of R3 200 into the fund which earns interest at 9,75% p.a. compounded monthly.

- 6.2.1 Determine how much Mrs Molefe will have in her retirement fund when she retires.

(3)

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 6.2.2 | If Mrs Molefe has R2 352 649,68 in her retirement fund when she retires, what percentage of the total investment is interest?                                                                                                                                                                                                                                                                                                                                                                       |     |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |
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|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | (3) |
| 6.2.3 | <p>After settling all her debt, Mrs Molefe plans to purchase a property valued at R1 200 000. She obtains a 20-year home loan (mortgage bond) from a bank at an interest rate of 11,37% p.a., compounded monthly. The loan is to be repaid in equal monthly instalments commencing one month after the loan is granted.</p> <p>Mrs Molefe can afford monthly repayments of R13 000 from the income generated by her investments. Determine whether she will be able to afford the new property.</p> |     |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |
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|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | (4) |

[14]

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|  | <b>ADDITIONAL SPACE</b> |  |
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QUESTION 7

|     |                                                                 |
|-----|-----------------------------------------------------------------|
| 7.1 | Determine $f'(x)$ from first principles if $f(x) = -x + 2x^2$ . |
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|     |                                                                 |
|     | (5)                                                             |
| 7.2 | Determine: $\frac{dy}{dx}$ if $y = 2x^3 - 6x^2 + 1$             |
|     |                                                                 |
|     |                                                                 |
|     | (2)                                                             |

7.3

Given:  $f(x) = \frac{\sqrt{x}}{x} - 9x$  and  $g(x) = -16x$

Determine:  $D_x \left[ f(x) + \frac{1}{2}g(x) \right]$

(5)

[12]

ADDITIONAL SPACE

QUESTION 8

Consider the function  $f(x) = x^3 - ax^2 + bx - 6$  where:

- The graph of  $f$  has a point of inflection at  $x = 2$  and;
- The gradient of  $f$  at  $x = -1$  is 26.

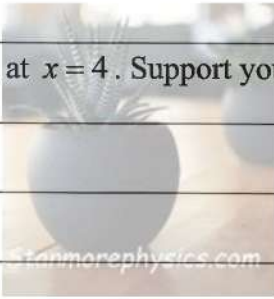
8.1 Show that  $a = 6$  and  $b = 11$ .

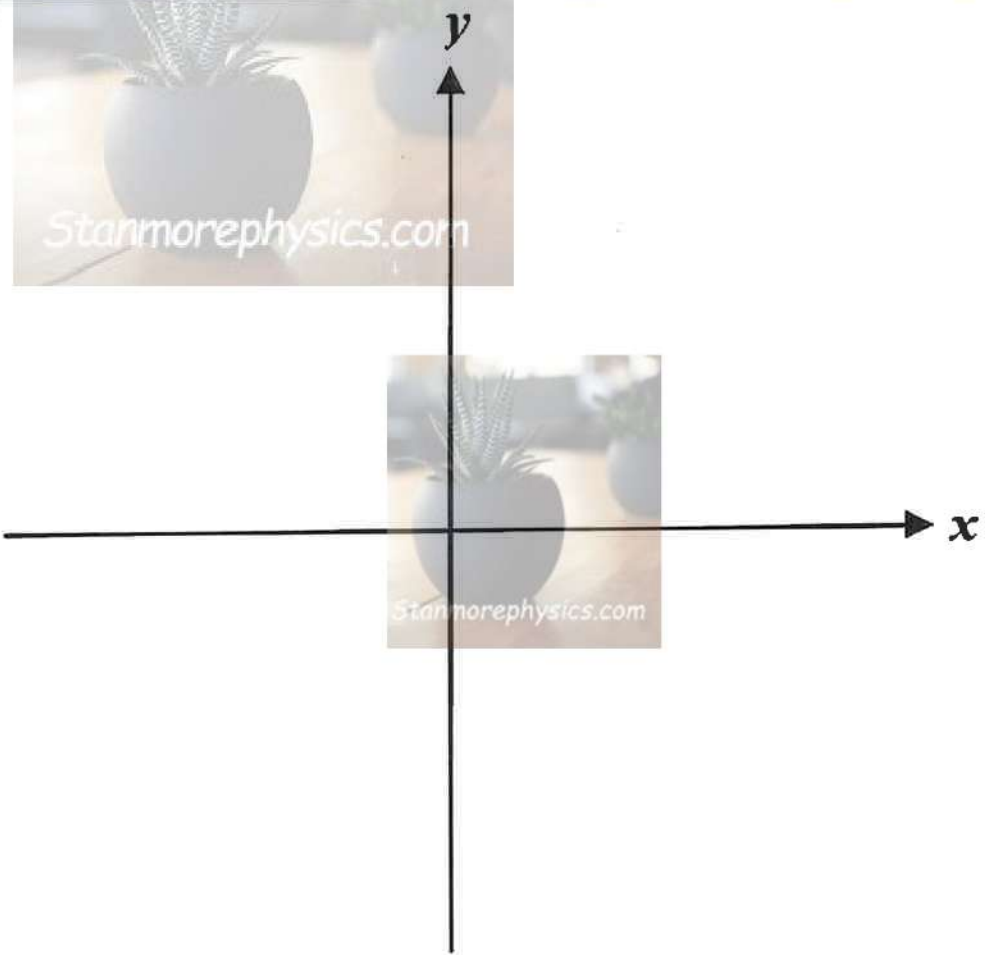


(4)

8.2 The graph of  $f$  passes through the  $x$ -axis at  $x = 1$ . Determine, showing ALL relevant calculations, the other  $x$ -intercepts of  $f$ .

(3)

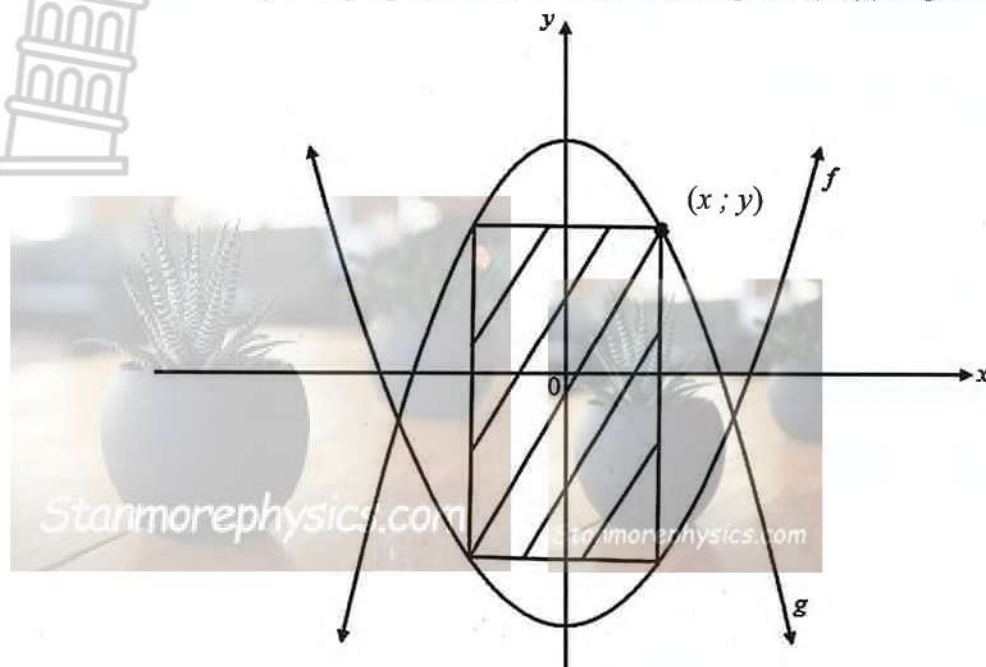
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|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 8.3 | <p>Determine the <math>x</math>-coordinate of the local maximum of <math>f</math>.</p>  <div style="border: 1px solid black; height: 150px; width: 100%;"></div>                              | (3) |
| 8.4 | <p>Describe the concavity of the function at <math>x = 4</math>. Support your answer with a valid calculation.</p>  <div style="border: 1px solid black; height: 100px; width: 100%;"></div> | (3) |

|     |                                                                                                                                                                                                                                                                               |     |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 8.5 | <p>Sketch the graph of <math>f</math>, clearly indicating ALL intercepts and turning points. (It is NOT necessary to determine the <math>y</math>-coordinates of the turning points).</p>  | (3) |
| 8.6 | <p>A tangent to <math>f</math> is drawn at the <math>y</math>-intercept of the function. Determine the equation of the tangent.</p> <hr/> <hr/> <hr/> <hr/>                                                                                                                   | (2) |

[18]

**QUESTION 9**

$f(x) = \frac{1}{2}x^2 - 6$  and  $g(x) = -x^2 + 12$  enclose a rectangle, as shown in the diagram below. The vertical sides of the rectangle lie perpendicular to the  $x$ -axis. A point  $(x; y)$  is given on  $g$ .



|     |                                                                  |     |
|-----|------------------------------------------------------------------|-----|
| 9.1 | Determine the dimensions of the rectangle in terms of $x$ .      | (3) |
|     |                                                                  |     |
|     |                                                                  |     |
|     |                                                                  |     |
| 9.2 | Hence or otherwise, determine the maximum area of the rectangle. | (5) |
|     |                                                                  |     |
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[8]

P.T.O.

**QUESTION 10**

Three events A, B and C are given such that:

- B and C are independent.
- A and C are mutually exclusive.
- $P(A) = 0,3$
- $P(B) = 0,4$
- $P(C) = 0,2$
- $P(A \text{ and } B) = 0,12$

10.1 Calculate the probability of the following:

10.1.1 Both A and C occur simultaneously.

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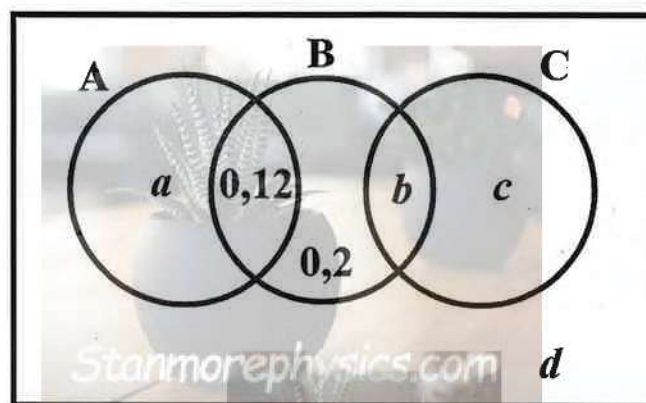
(1)

10.1.2 Both B and C occur simultaneously.

(2)

10.2

Using the Venn Diagram given below, determine values for  $a$ ,  $b$ ,  $c$  and  $d$ .



(4)

[7]

ADDITIONAL SPACE

**QUESTION 11**

9 members of a school's Representative Council of Learners (RCL) are seated in the front row for the school's photographs.

11.1 Determine the number of ways in which the 9 RCL members can be arranged?

(2)

11.2 The following office bearers/portfolio managers are present at the school's photo session:

- President (P)
- Deputy President (DP)
- Secretary (S) and
- Public Relations Officer (PRO)

11.2.1 Calculate the probability that the President, Deputy President and Secretary will be seated next to each other.

(3)

11.2.2 If the Secretary and Public Relations Officer may NOT sit together, in how many different ways can the RCL members be seated?

(3)

[8]

**TOTAL: 150**

**P.T.O.**

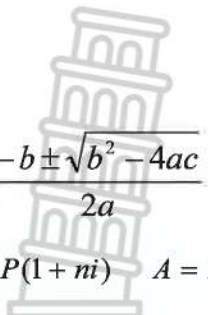
ADDITIONAL SPACE





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## INFORMATION SHEET



$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P(1 + ni) \quad A = P(1 - ni)$$

$$T_n = a + (n-1)d$$

$$S_n = \frac{a(r^n - 1)}{r - 1}; \quad r \neq 1$$

$$F = \frac{x[(1+i)^n - 1]}{i}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$y - y_1 = m(x - x_1)$$

$$(x - a)^2 + (y - b)^2 = r^2$$

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

$$\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$$

$$\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$$

$$\cos 2\alpha = \begin{cases} \cos^2 \alpha - \sin^2 \alpha \\ 1 - 2\sin^2 \alpha \\ 2\cos^2 \alpha - 1 \end{cases}$$

$$\bar{x} = \frac{\sum x}{n}$$

$$P(A) = \frac{n(A)}{n(S)}$$

$$\hat{y} = a + bx$$

$$A = P(1 - i)^n$$

$$S_n = \frac{n}{2}[2a + (n-1)d]$$

$$S_\infty = \frac{a}{1 - r}; \quad -1 < r < 1$$

$$P = \frac{x[1 - (1+i)^{-n}]}{i}$$

$$M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\text{In } \triangle ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\text{area } \triangle ABC = \frac{1}{2} ab \sin C$$

$$\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cos \beta + \sin \alpha \sin \beta$$

$$\sin 2\alpha = 2 \sin \alpha \cos \alpha$$

$$\sigma^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}$$

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

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

$$A = P(1 + i)^n$$

$$T_n = ar^{n-1}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$$y = mx + c$$

$$m = \tan \theta$$



# **PREPARATORY EXAM**

**2026**

**MARKING GUIDELINES**

**MATHEMATICS PAPER 1 (10611)**

22 pages

**NOTE:**

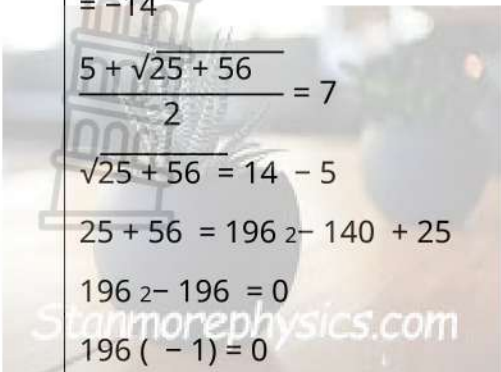
- If a candidate answers a question TWICE, mark only the *FIRST* attempt.
- If a candidate DEADLINES the answer to a question and does not redo it, mark the deadline attempt.
- Consistent accuracy (SA) is applied in ALL aspects of the marking guidelines.
- Assuming values/answers to solve a problem is UNACCEPTABLE.
- (A) – refers to an accuracy point.



## QUESTION 1

|       |                                                                                                                                                                                                                                  |                                                                                                                                                        |     |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1.1.1 | $3x^2 - x + 2 = x + 2$<br>$3x^2 - 2x = 0$<br>$x(3x - 2) = 0$<br>$x = 0$ or $x = \frac{2}{3}$                                                                                                                                     | ✓ standard form<br>✓ factors<br>✓ both answers                                                                                                         | (3) |
| 1.1.2 | $7x^2 - x - 2 = 0$<br>$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(7)(-2)}}{2(7)}$<br>$x = 0.61$ or $x = -0.47$<br><b>NOTE: Penalize one point for incorrect rounding in this question.</b>                                             | ✓ correct substitution<br>✓ answer<br>✓ answer                                                                                                         | (3) |
| 1.1.3 | $\left(\frac{x}{2}\right)^2 - 5 + 24 \leq 0$<br>$\frac{x^2}{4} - 5 + 24 \leq 0$<br>$x^2 - 20 + 96 \leq 0$<br>$(x - 8)(x - 12) \leq 0$<br>$8 \leq x \leq 12$                                                                      | ✓ square fraction<br>✓ standard form<br>✓ critical values<br>✓ ✓ answer (combination point)                                                            | (5) |
| 1.1.4 | $2^{-x+2} - 2^{-x} = 48$<br>$2^{-x}(2^2 - 1) = 48$<br>$2^{-x} = 16$<br>$2^{-x} = 2^4$<br>$x = -4$<br><b>OR</b><br>$2^{-x} = 2^4$<br>$4 - x = 48$<br>$3 = 48$<br>$= 16$<br>$\therefore 2^{-x} = 16$<br>$2^{-x} = 2^4$<br>$x = -4$ | ✓ factorize GGF<br>✓ simplified to equal bases<br>✓ answer for x<br>✓ set up comparison according to.<br>✓ simplified to equal bases<br>✓ answer for x | (3) |

4

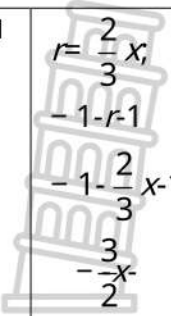
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                    |     |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|       | $= -5$<br>$-4 = 56$<br>$= -14$<br> $\frac{5 + \sqrt{25 + 56}}{2} = 7$ $\sqrt{25 + 56} = 14 - 5$ $25 + 56 = 196 - 140 + 25$ $196 - 196 = 0$ $196(-1) = 0$<br>$\neq 0 \text{ or } = 1$<br><b>OR</b><br>$ax^2 + bx + c = 0$<br>$49a + 7b + c = 0 \dots (1)$<br>$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $-b = 5$<br>$b = -5$<br>$b^2 - 4ac = 25 + 56a$<br>$(5)^2 - 4ac = 25 + 56a$<br>$-4ac = 56a$<br>$c = -14$<br>from (1)<br>$49a - 49 = 0$<br>$a = 1$<br><b>OR</b><br>$b = -5$<br>$-4ac = 56a$<br>$c = -14$<br>$0 = a(7)^2 - 5(7) - 14$<br>$49a - 35 - 14 = 0$<br>$a = 1$ | $\checkmark = -5$<br>$\checkmark$ drafting of comparison<br>$\checkmark$ value for $c$<br><br>$\checkmark$ substitution<br><br>$\checkmark$ value for $a$<br><br>$\checkmark$ drafting of comparison<br>$\checkmark = -5$<br>$\checkmark$ substitution<br>$\checkmark$ value for $c$<br>$\checkmark$ value for $a$ |     |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                    | (5) |
| 1.3.2 | $x = -2$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | $\checkmark$ answer                                                                                                                                                                                                                                                                                                | (1) |

## QUESTION 2

|     |                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                     |     |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----|
| 2.1 | <p>7 sentence 30- ; 7; 23syn 30- ; 17...</p> $\frac{7}{2}; 7; \frac{23}{2}; 17$ $\frac{7}{2} \quad \frac{9}{2} \quad \frac{11}{2}$ $1 \quad 1$ <p>2<sup>nd</sup> Differences = 1<br/>the pattern is square</p>                                                                                                                                                                               | <p>✓ row</p> <p>✓ first differences</p> <p>✓ 2<sup>nd</sup> differences</p>                         | (3) |
| 2.2 | <p> <math>3a+b = \frac{7}{2}</math><br/> <math>3\frac{-1}{-2} + b = \frac{7}{2}</math><br/> <math>b=2</math><br/> <math>p=2</math><br/> <math>a+b+c = \frac{7}{2}</math><br/> <math>\frac{1}{2} + 2 + c = \frac{7}{2}</math><br/> <math>c=1</math><br/> <math>q=1</math> </p> <p><b>NOTE: FULL MARKS if in terms of <i>b</i> and <i>c</i> left.</b></p> <p><b>Answer only, NO MARKS.</b></p> | <p>✓ substitution</p> <p>✓ substitution</p>                                                         | (2) |
| 2.3 | <p> <math>49 = \frac{1}{2}a^2 + 2a + 1</math><br/> <math>0 = a^2 + 4a - 96</math><br/> <math>0 = (a+12)(a-8)</math><br/> <math>-12 \text{ or } a=8</math> </p>                                                                                                                                                                                                                               | <p>✓ equate to 49</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ both answers with rejection.</p> | (4) |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 2.4 | <p> <math>x = \frac{-2}{-1 \pm \sqrt{2^2 - 2}}</math><br/> <math>x = -2</math><br/>           The minimum value of the function occurs where, <math>x = -2</math>, but <math>a = -2</math> since <math>a &lt; 4</math>. OR<br/> <math>y = \frac{1}{2}x^2 + 2x + 1</math><br/> <math>\frac{dy}{dx} = x + 2</math><br/> <math>0 = x + 2</math><br/> <math>x = -2</math><br/>           The minimum value of the function occurs where, <math>x = -2</math>, but <math>a = -2</math> since <math>a &lt; 4</math>.<br/> <b>OR</b><br/>           A valid explanation is as follows:<br/>           The learner is wrong because a number sequence proposal and therefore only positive integers can be.<br/>           The turning point of the quadratic function gives the minimum value of the function for all real values of , but not necessarily the minimum term of the pattern.<br/>           Therefore, the minimum value of the pattern must be determined by the allowed values of to investigate.<br/>           Since the line from <math>n = 1</math> increases, the minimum term of the pattern is:<br/> <math display="block">T_1 = \frac{1}{2}(1)^2 + 2(1) + 1 = 3.5</math><br/>           The turning point of the function cannot therefore be used to determine the minimum term of the pattern, because the turning point is at an inadmissible value of prevent.<br/> <b>NOTE: The explanation must support</b><br/> <b>is determined by a valid calculation of the turning point of the quadratic function in question.</b><br/> <b>In the second option, the <math>n = 0</math> for the first point may be implied.</b> </p> | <p> <math>\checkmark</math> <math>x = \frac{-b}{2a}</math> calculation<br/> <math>\checkmark</math> value for <math>x</math><br/> <math>\checkmark</math> valid explanation<br/> <br/> <math>\checkmark</math> derivative = 0<br/> <math>\checkmark</math> value for <math>x</math><br/> <math>\checkmark</math> valid explanation<br/> <br/> <math>\checkmark</math> valid explanation<br/> <br/> <math>\checkmark</math> calculation of <math>T_1</math><br/> <br/> <math>\checkmark</math> valid explanation         </p> | (3) |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|

## QUESTION 3

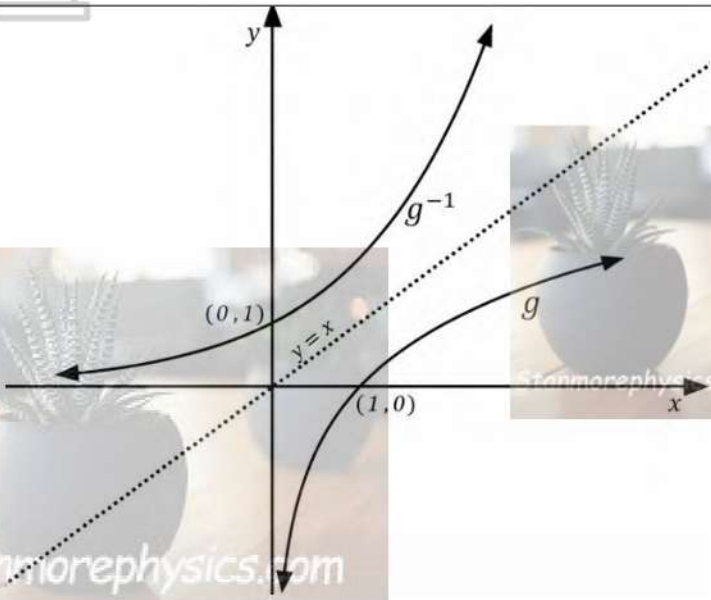
|       |                                                                                                                                                                                                                                                  |                                                                                                    |     |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-----|
| 3.1.1 |  $r = \frac{2}{3}x, \quad x=0$ $-1-r-1$ $-1-\frac{2}{3}x-1$ $-\frac{3}{2}x \quad \frac{3}{2}$ <p><b>NOTE:</b> <math>x=0</math> may be implied.</p>              | <p>✓ <math>r = \frac{2}{3}</math></p> <p>✓ answer (A)</p>                                          | (2) |
| 3.1.2 |  $3 + 1 + \frac{1}{3}$ $r = \frac{1}{3}$ $S = \frac{3}{1 - \frac{1}{3}}$ $S = \frac{9}{2}$ <p>OhOhFF</p> $S = \frac{3}{1 - \frac{2-1}{3-2}}$ $S = \frac{9}{2}$ | <p>✓ value for r</p> <p>✓ substitution</p> <p>✓ answer</p> <p>✓ ✓ substitution</p> <p>✓ answer</p> | (3) |

|       |                                                                                                                                                                                                                                                                                                      |                                                                                                                                                           |     |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 3.2.1 | $B_a = \sum_{k=1}^a 24 \cdot \frac{3^{-k}}{2}$ <p>36; 54; 81</p> $a=36 \quad r = \frac{3}{2}$ $S_n = \frac{36 \cdot \frac{3^{-a}}{2} - \frac{1}{2}}{\frac{3}{2} - 1}$ $S_n = 72 \cdot \frac{3^{-a}}{2} - \frac{1}{2}$ <p><b>NOTE:</b> answer only, 0 points</p>                                      | <p>✓ values for <math>a</math> and <math>r</math></p> <p>✓ substitution</p>                                                                               | (2) |
| 3.2.2 | $A_{18} - B_a = \frac{423}{8}$ <p>A: -15; -8; -1 <math>a</math></p> <p>= -15 <math>d=7</math></p> $S_{18} = \frac{18}{2} [2(-15) + (18-1)(7)]$ $S_{18} = 801$ $801 - \frac{3^{-a}}{2} - \frac{1}{2} = \frac{423}{8}$ $\frac{3^{-a}}{2} = \frac{729}{64}$ $\frac{3^{-a}}{2} = \frac{3^{-6}}{2}$ $a=6$ | <p>✓ values for <math>a</math> and <math>d</math></p> <p>✓ substitution</p> <p>✓ answer</p> <p>✓ substitution</p> <p>✓ simplification</p> <p>✓ answer</p> | (6) |

[13]

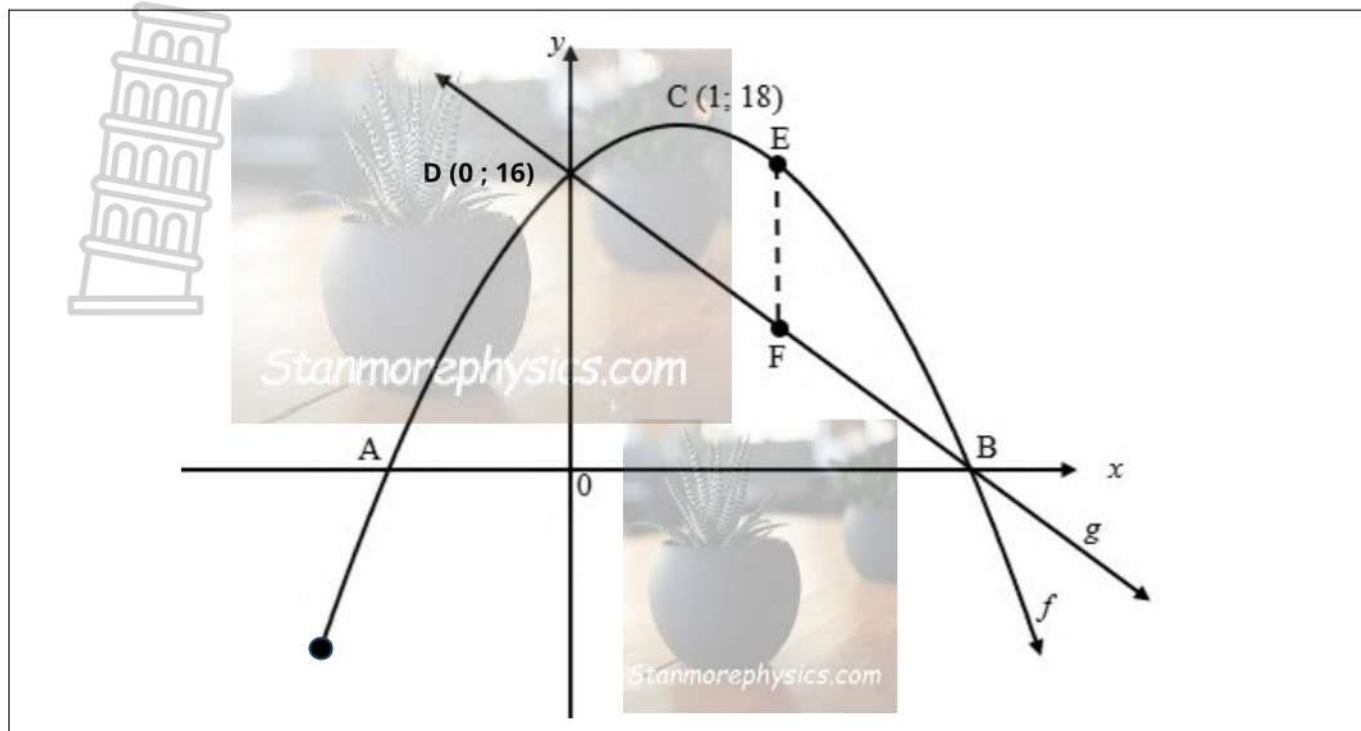
## QUESTION 4

|     |                                                                                                                                                                                         |                                                                                                            |     |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-----|
| 4.1 | $p = -2$<br>$q = 3$<br><b>NOTE: Answers may NOT be in terms of <math>x</math> and <math>y</math> is NOT given.</b>                                                                      | ✓ value for $p$<br>✓ value for $q$                                                                         | (2) |
| 4.2 | $y = x + t$<br>replace (2 ; 3) 3<br>$= 2 + t$<br>$t = 1$<br><b>OR</b><br>Axis of symmetry with positive slope<br>$= -2 + 3$<br>$= +1$<br>$= 1$<br><b>NOTE: Answer only, FULL MARKS.</b> | ✓ substitution in comparison<br>✓ value for $t$<br><br>✓ substitution in comparison<br><br>✓ value for $t$ | (2) |
| 4.3 | $y = \frac{-2}{x-2} + 3$<br>$h(x) = \frac{-2}{x} + 6$<br>$x-6 = \frac{-2}{y}$<br>$y = \frac{-2}{x-6}$                                                                                   | ✓ $\frac{-2}{x}$<br>✓ $+ 6$<br>✓ comparison of $h$                                                         | (3) |

|       |                                                                                                             |                                                                                                                                                                   |     |
|-------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 4.4.1 | $g(x) = \log_2$<br>$xyz = \log_2 x$<br>$x = \log_2 y$<br>$y = 2^x$<br><b>NOTE: Answer only, FULL MARKS.</b> | ✓ exchange of x and y<br>✓ answer                                                                                                                                 | (2) |
| 4.4.2 |                           | ✓ rising ( ) with asymptote $x=0$<br>✓ y-section of $g^{-1}$ and x-section of $g$<br>✓ rising -1( ) with asymptote $y=0$<br>✓ one additional point on both graphs | (4) |
| 4.4.3 | $0 < x < 1$<br><b>OR</b><br>$x \in (0;1]$                                                                   | ✓ ✓ answer (combination point)                                                                                                                                    | (2) |

**[15]**

## QUESTION 5



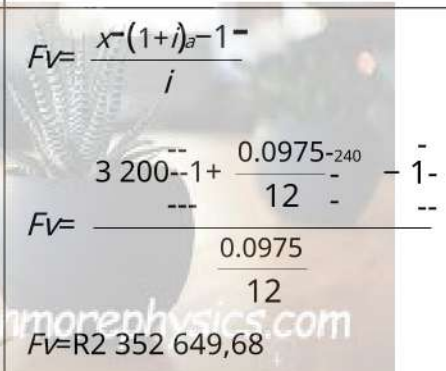
|     |                                                                                                                                                                                                          |                                                                                                    |     |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-----|
| 5.1 | $f(x) = a(x-1)^2 + 18$<br>$16 = a(0-1)^2 + 18$<br>$16 = a + 18$<br>$a = -2$<br><br>$f(x) = -2(x-1)^2 + 18$<br>$f(x) = -2(x^2 - 2x + 1) + 18$<br>$f(x) = -2x^2 + 4x - 2 + 18$<br>$f(x) = -2x^2 + 4x + 16$ | ✓ subst (1;18)<br>✓ subst (0;16)<br><br>✓ value for $a$<br><br>✓ simplification of square two-term | (4) |
| 5.2 | $f(x) = -2x^2 + 4x + 16$<br>$0 = -2x^2 + 4x + 16$<br>$0 = -2(x^2 - 2x - 8)$<br>$0 = -2(x+2)(x-4)$<br>$x = -2$ or $x = 4$<br><br>$AB = 6$ units                                                           | ✓ $f(x) = 0$<br><br>✓ answer                                                                       | (2) |

|       |                                                                                                                               |                                  |     |
|-------|-------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----|
| 5.3   | $m = \frac{16 - 0}{0 - 4}$ $m = -4$ $g(x) = -4x + 16$ <p><b>OR</b></p> $y = mx + 16$ $0 = 4m + 16$ $m = -4$ $g(x) = -4x + 16$ | ✓ gradient<br>✓ answer           |     |
| 5.4.1 | $-4 \leq x \leq 1$<br><b>OR</b><br>$x \in [-4; 1]$<br><b>Accept</b> $-4 \leq x \leq 1$ or $x \in [-4; 1]$                     | ✓ ✓ answer                       | (2) |
| 5.4.2 | $1 < x < 4$ or $-4 < x < -2$<br><b>OR</b><br>$x \in (1; 4)$ or $x \in [-4; -2)$                                               | ✓ $1 < x < 4$<br>✓ $-4 < x < -2$ | (2) |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 5.5 | $f(x) - g(x)$ $= -2x^2 + 4x + 16 - (-4x + 16) = -$ $2x^2 + 8x$ $EF_{MAX} \text{ Derivative} = 0$ $-4x + 8 = 0$ $4x = 8$ $x = 2$ $-2(2)^2 + 8(2)$ $= 8 \text{ units}$ <p><b>OR OR</b></p> $f(x) - g(x)$ $= -2x^2 + 4x + 16 - (-4x + 16) = -$ $2x^2 + 8x$ $x = \frac{-b}{2a} = \frac{-8}{2(-2)}$ $x = 2$ $-2(2)^2 + 8(2)$ $= 8 \text{ units}$ <p><b>OR OR</b></p> $f(x) - g(x)$ $= -2x^2 + 4x + 16 - (-4x + 16) = -$ $2x^2 + 8x$ $-2(x^2 - 4x + 2) =$ $-2(x-2)^2 + 2(2)^2$ $= -2(x-2)^2 + 8$ $8 \text{ units}$ | $\checkmark EF = f(x) - g(x)$ $\checkmark \text{ answer in terms of } x$<br>$\checkmark \text{ derivative} = 0$ $\checkmark \text{ value for } x$ $\checkmark \text{ answer}$<br>$\checkmark EF = f(x) - g(x)$ $\checkmark \text{ answer in terms of } x$<br>$\checkmark \text{ noun in } \frac{-b}{2a}$ $\checkmark \text{ value for } x$ $\checkmark \text{ answer}$<br>$\checkmark EF = f(x) - g(x)$ $\checkmark \text{ answer in terms of } x$<br>$\checkmark \text{ complete square}$ $\checkmark \text{ simplify expression}$ $\checkmark \text{ answer}$ | (5) |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|

[17]

## QUESTION 6

|       |                                                                                                                                                                                                                                                                                                                           |                                                                                             |     |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-----|
| 6.1   | $A = P(1+i)^a$<br>$78\,000 = 39\,000(1 + 0.18)^a$<br>$2 = (1 + 0.18)^a$<br>$\log_{(1+0.18)} 2 = a$<br>$n = 4,187$ years<br>year 2031                                                                                                                                                                                      | ✓ substitution<br><br>✓ use of logs<br>✓ value for $a$<br>✓ answer                          | (4) |
| 6.2.1 |                                                                                                                                                        | ✓ value for $i$ and $a$<br>✓ substitution in correct formula<br><br>✓ R2 352 649,68         | (3) |
| 6.2.2 | $240 \times R3\,200 = R768\,000$<br>$\frac{768\,000}{2\,352\,649,68} \times 100$ $= 32.64\%$<br>67.36% of the total investment is interest.<br><br><b>OR</b><br><br>$240 \times R3\,200 = R768\,000$<br>$R2\,352\,649,68 - R768\,000 = R1\,584\,649,68$<br>$\frac{1\,584\,649,68}{2\,352\,649,68} \times 100$ $= 67.36\%$ | ✓ R768 000<br><br>✓ 32.64%<br>✓ 67.36%<br><br>✓ R768 000<br>✓ R1 584 649,68<br><br>✓ 67.36% | (3) |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                              |     |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 6.2.3 | <p> <math display="block">Pvt. = \frac{x(1 - (1 + i)^{-a})}{i}</math> <math display="block">1\,200\,000 = \frac{x(1 - (1 + \frac{0.1137}{12})^{-240})}{\frac{0.1137}{12}}</math> <math display="block">x = R12\,689,84</math> </p> <p>Yes, she will be able to afford to buy the property.</p> <p>OR</p> <p> <math display="block">Pvt. = \frac{x(1 - (1 + i)^{-a})}{i}</math> <math display="block">= \frac{13\,000(1 - (1 + \frac{0.1137}{12})^{-240})}{\frac{0.1137}{12}}</math> <math display="block">= 1229330.40</math> </p> <p>Yes, she will be able to afford to buy the property.</p> | <p>✓ values for <math>i</math> and <math>a</math></p> <p>✓ substitution in correct formula</p> <p>✓ R12 689,84</p> <p>✓ deduction</p> <p>✓ values for <math>i</math> and <math>a</math></p> <p>✓ substitution in correct formula</p> <p>✓ R1229330.40</p> <p>✓ deduction</p> | (4) |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|

[14]

## QUESTION 7

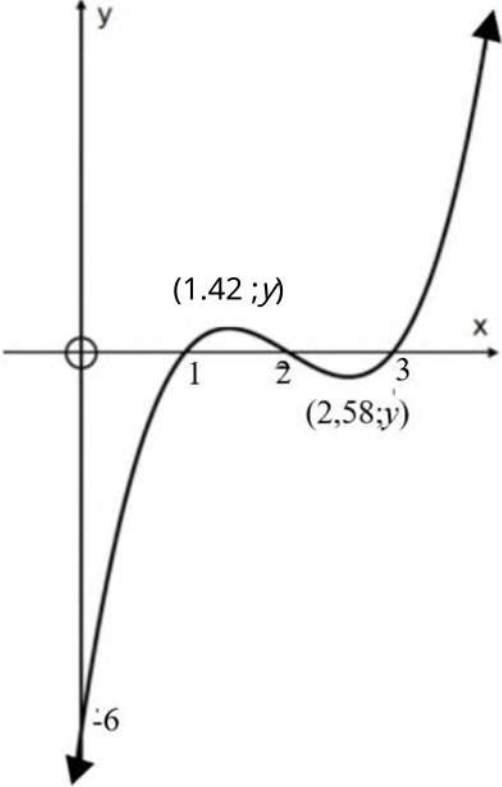
|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                     |     |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 7.1 | $f(x) = -x + 2x^2$ $f(x+h) = -(x+h) + 2(x+h)^2$ $f(x+h) = -x-h+2(x^2+2xh+h^2)$ $f(x+h) = -x-h+2x^2+4xh+2h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-x-h+2x^2+4xh+2h^2 - (-x+2x^2)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-x-h+2x^2+4xh+2h^2+x-2x^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-h+4xh+2h^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(-1+4x+2h)}{h}$ $f'(x) = \lim_{h \rightarrow 0} (-1+4x+2h)$ $f'(x) = -1+4x$ <p><b>OR</b></p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-(x+h) + 2(x+h)^2 - (-x+2x^2)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-x-h+2x^2+4xh+2h^2 - (-x+2x^2)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-x-h+2x^2+4xh+2h^2+x-2x^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-h+4xh+2h^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(-1+4x+2h)}{h}$ $f'(x) = \lim_{h \rightarrow 0} (-1+4x+2h)$ $f'(x) = -1+4x$ <p><b>NOTE: Penalize ONE point for incorrect notation in this question.</b></p> | <p>✓ <math>f(x+h)</math></p> <p>✓ substitution</p> <p>✓ simplification</p> <p>✓ factorization</p> <p>✓ answer</p> <p>✓ substitution</p> <p>✓ <math>f(x+h)</math></p> <p>✓ simplification</p> <p>✓ factorization</p> <p>✓ answer</p> | (5) |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|

|     |                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                             |     |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 7.2 | $y = 2x^3 - 6x^2 + 1$<br>$\frac{d}{dx} = 6x^2 - 12x$                                                                                                                                                                                               | ✓ $6x^2$<br>✓ $-12x$                                                                                                                                                                                                                        | (2) |
| 7.3 | $f(x) = \frac{\sqrt{x}}{x} - 9x$ $g(x) = -16x$<br>$D_x f(x) + \frac{1}{2} g(x)$<br>$D_x \frac{\sqrt{x}}{x} - 9x + \frac{1}{2}(-16x)$<br>$D_x x^{-\frac{1}{2}} - 9x - 8x$<br>$D_x x^{-\frac{1}{2}} - 17x$<br>$= -\frac{1}{2}x^{-\frac{3}{2}} - 17x$ |  ✓ substitution<br>✓ $-\frac{1}{2}$<br>✓ $-17$<br>✓ first term correctly differentiated if exponent is negative<br>✓ second term correctly differentiated | (5) |

[12]

## QUESTION 8

|     |                                                                                                                                                                                                           |                                                                                                              |     |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-----|
| 8.1 | $f(x) = x^3 - ax^2 + bx - 6$ $f'(x)$<br>$= 3x^2 - 2ax + b$<br>$= 6x - 2a$ $f'(2) = 6(2) - 2a$<br>$= 0$ $12 = 2a$<br>$a = 6$<br>$f(x) = 3x^2 - 2(-6)x + b - 6$<br>$= 3(-1)^2 + 12(-1) + b - 6$<br>$b = 11$ | ✓ $f'(x)$<br>✓ $f'(x) = 0$ the 0 can be implied<br>✓ substitution of $x = 2$<br>✓ subst $(-1; 26)$ in $f(x)$ | (4) |
| 8.2 | $f(x) = x^3 - 6x^2 + 11x - 6$ $f(x)$<br>$= (x-1)(x^2 - 5x + 6)$ $f(x) = (x-1)(x-2)(x-3)$ $x=1$ or $x=2$ or $x=3$<br><b>Accept any method</b>                                                              | ✓ trinomial<br>✓ factors<br>✓ both other $x$ -values                                                         | (3) |

|     |                                                                                                                                                                                                              |                                                                                                                                                  |     |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 8.3 | $f(x) = x^3 - 6x^2 + 11x - 6$<br>$f'(x) = 3x^2 - 12x + 11$<br>$0 = 3x^2 - 12x + 11$<br>$x = \frac{-(-12) \pm \sqrt{(-12)^2 - 4(3)(11)}}{2(3)}$<br>$x = \frac{6 \pm \sqrt{3}}{3}$<br>$x = 2.58$ or $x = 1.42$ | <ul style="list-style-type: none"> <li>✓ derivative = 0</li> <li>✓ substitution in quadratic formula</li> <li>✓ answer with selection</li> </ul> | (3) |
| 8.4 | $f''(x) = 6x - 12$<br>$f''(4) = 6(4) - 12$<br>$f''(4) = 12$<br>$f''(x) > 0$ - concave up                                                                                                                     | <ul style="list-style-type: none"> <li>✓ noun <math>x=4</math> in <math>f''( )</math></li> <li>✓ answer</li> <li>✓ interpretation</li> </ul>     | (3) |
| 8.5 |                                                                                                                            | <ul style="list-style-type: none"> <li>✓ form</li> <li>✓ all intersections</li> <li>✓ both turning points</li> </ul>                             | (3) |
| 8.6 | $f(x) = 3x^2 - 6x + 11$<br>$f'(0) = 11$<br>$y = 11x - 6$                                                                                                                                                     | <ul style="list-style-type: none"> <li>✓ <math>m=11</math></li> <li>✓ answer</li> </ul>                                                          | (2) |

## QUESTION 9

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                  |     |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 9.1 | <p>Horizontal length = <math>2x</math></p> <p>Vertical length</p> $= g(x) - f(x)$ $= -x^2 + 12 - \left(-\frac{1}{2}x^2 - 6\right)$ $= -\frac{3}{2}x^2 + 18$                                                                                                                                                                                                                                                                                            | <p>✓ horizontal length = <math>2x</math></p> <p>✓ <math>g(x) - f(x)</math></p> <p>✓ <math>= -\frac{3}{2}x^2 + 18</math></p>                      | (3) |
| 9.2 | <p><math>A(x) = 2x - \frac{3}{2}x^2 + 18</math></p> <p><math>A(x) = -3x^2 + 36x</math></p> <p><math>A'(x) = -9x + 36</math></p> <p><math>x^2 - 36 = 0</math></p> <p><math>9(x^2 - 4) = 0</math></p> <p><math>(x-2)(x+2) = 0</math></p> <p><math>x=2</math> or <math>x=-2</math></p> <p><math>A(2) = -3(2)^2 + 36(2)</math></p> <p><math>A=48</math> units<sup>2</sup></p> <p><b>NOTE: derivative = 0 Must be indicated and may not be implied.</b></p> | <p>✓ expression setting</p> <p>✓ simplification of expression</p> <p>✓ derivative = 0</p> <p>✓ both values of <math>x</math></p> <p>✓ answer</p> | (5) |

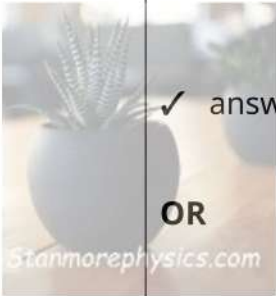
[8]

## QUESTION 10

|        |                                                                                                                                                         |                                                                      |     |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|-----|
| 10.1.1 | $(\quad) = 0$                                                                                                                                           | ✓ answer                                                             | (1) |
| 10.1.2 | $P(B \text{ and } C) = P(B) - P(C) \quad P(B \text{ and } C) = 0.4 - 0.2$<br>$P(B \text{ and } C) = 0.08 \text{ or } \frac{2}{25}$                      | ✓ $0.4 \times 0.2$<br>✓ answer                                       | (2) |
|        |                                                                                                                                                         |                                                                      |     |
| 10.2   | $a = 0.18 \text{ or } \frac{9}{50}$<br>$b = 0.08 \text{ or } \frac{2}{25}$<br>$c = 0.12 \text{ or } \frac{3}{25}$<br>$d = 0.3 \text{ or } \frac{3}{10}$ | ✓ value of $a$<br>✓ value of $b$<br>✓ value of $c$<br>✓ value of $d$ | (4) |

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## QUESTION 11

|        |                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                               |     |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 11.1   | $9!$<br>$= 362,880$                                                                                                                                                                                                                                                                              | ✓ $9!$<br>✓ answer ( $9!$ or 362 880)                                                                                                                                                                                         | (2) |
| 11.2.1 | $3! - 7!$<br>$= 30\,240$<br>$P(\text{together}) = \frac{3! - 7!}{9!}$<br>$P(\text{together}) = \frac{30\,240}{362,880}$<br>$P(\text{together}) = \frac{1}{12}$<br><b>OR</b><br>$3! - 11!$<br>$= 239500800$<br>$P(\text{together}) = \frac{3! - 11!}{13!}$<br>$P(\text{together}) = \frac{1}{26}$ |  ✓ $3! - 7!$<br>✓ method (divide by $9!$ )<br>✓ answer<br><b>OR</b><br>✓ $3! - 11!$ or 239500800<br>✓ method (divide by $13!$ )<br>✓ answer | (3) |
| 11.2.2 | Total! – together!<br>$= 9! - (2! \times 8!)$<br>$= 282\,240$<br><b>OR</b><br>Total! – together!<br>$= 13! - (2! \times 10!)$<br>$= 62\,197\,632\,000$                                                                                                                                           | ✓ method<br>✓ $2! \times 8!$<br>✓ answer<br><br>✓ method<br>✓ $2! \times 10!$<br>✓ answer                                                                                                                                     | (3) |

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TOTAL: 150