



KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA



**PROVINCIAL STANDARDISED
ASSESSMENT**

GRADE 12

MATHEMATICS P1

JUNE 2026

MARKS: 150

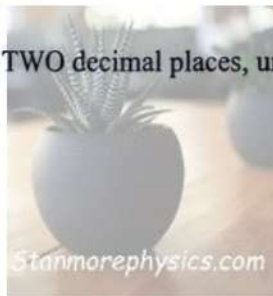
TIME: 3 hours

This question paper consists of 10 pages and an information sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 11 questions.
2. Answer ALL the questions in the ANSWER BOOK provided.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining your answers.
5. Answers only will NOT necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. If necessary, round off answers correct to TWO decimal places, unless stated otherwise.
9. Write neatly and legibly.



QUESTION 1

1.1 Solve for x :

1.1.1 $x^2 - 5x - 24 = 0$ (3)

1.1.2 $4x(x+3) = 13$ (correct to TWO decimal places). (4)

1.1.3 $22x - 121 < x^2$ (4)

1.1.4 $\sqrt{5+x} = \sqrt{x+1}$ (4)

1.2 Solve simultaneously for x and y :

$2^{x-y} = 8$

$x^2 - xy = 2y^2 + 7$ (6)

1.3 It is given that $P^{\frac{1}{x}} = 2$, $P^{\frac{1}{y}} = 3$ and $P^{\frac{1}{z}} = 6$.

Prove that $z = \frac{xy}{x+y}$.

(3)

[24]

QUESTION 2

2.1 Given the sequence: $1 ; -3 ; x ; \dots$
Write down the value of x if the sequence is.....

2.1.1 arithmetic. (1)

2.1.2 geometric. (1)

2.2 Given a geometric sequence: $\frac{1}{64} ; \frac{1}{128} ; \frac{1}{256} ; \dots$ 2.2.1 Determine the general term, T_n , of the sequence. (2)2.2.2 Which term of the sequence is equal to $\frac{1}{8192}$? (3)2.2.3 Explain why the series $\frac{1}{64} + \frac{1}{128} + \frac{1}{256} + \dots$ is convergent. (1)

[8]

QUESTION 3

3.1 Consider the quadratic number pattern: $-233 ; -191 ; -153 ; -119 ; \dots$

3.1.1 Determine the values of the 5th and the 6th terms of the sequence. (2)

3.1.2 Determine the general term, T_n , of the sequence. (4)

3.1.3 Calculate the maximum value for a term of this sequence. (4)

3.2 Given $\sum_{k=p}^{18} (7k+5) = 1230$

3.2.1 Write down the first and the last terms of the series. (2)

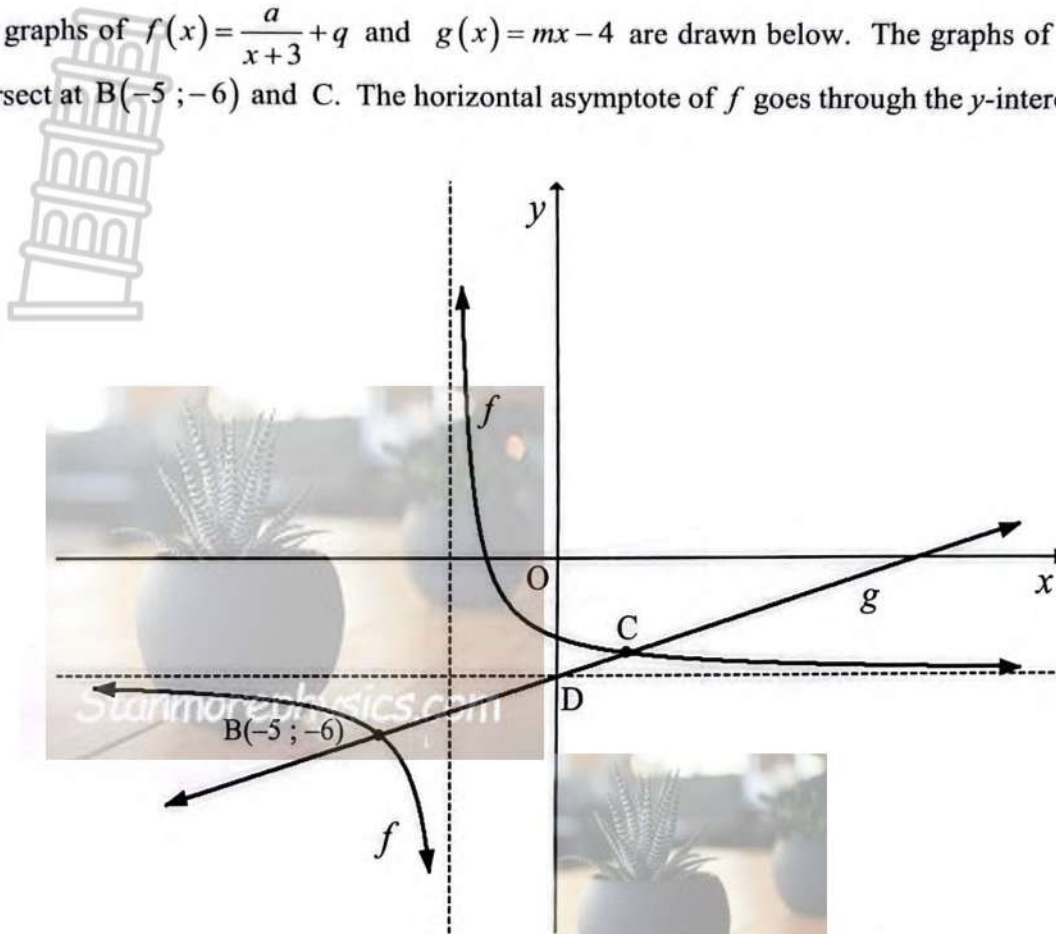
3.2.2 Hence, or otherwise, determine the value of p . (5)

[17]



QUESTION 4

The graphs of $f(x) = \frac{a}{x+3} + q$ and $g(x) = mx - 4$ are drawn below. The graphs of f and g intersect at $B(-5; -6)$ and C . The horizontal asymptote of f goes through the y -intercept of g .

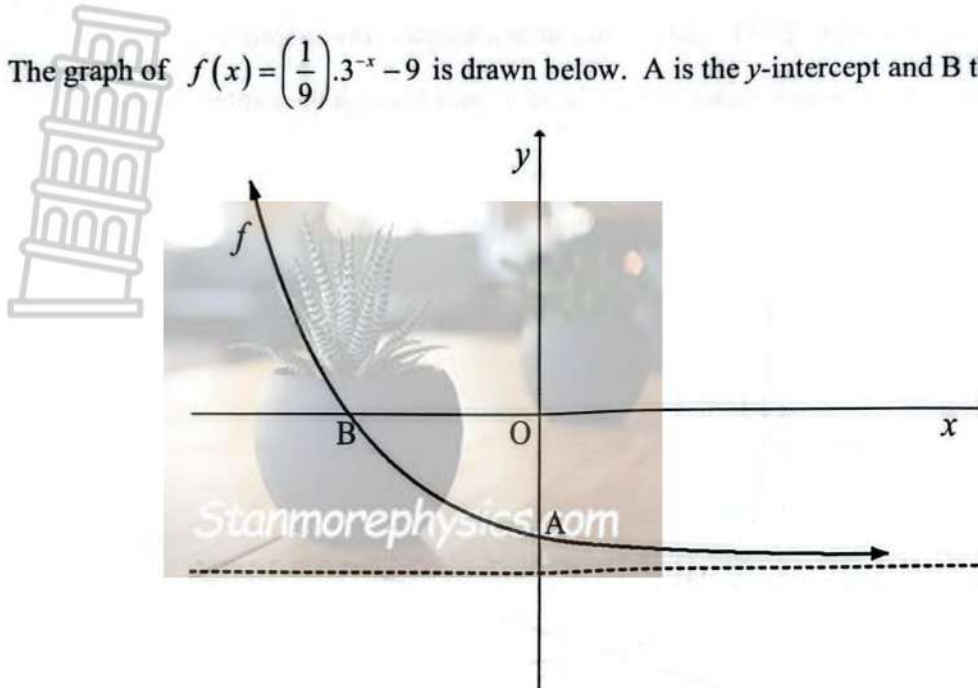


- 4.1 Write down the equations of the asymptotes of f . (2)
- 4.2 Determine the values of a and m . (4)
- 4.3 Determine the x -coordinate of C . (3)
- 4.4 For which values of x will $f(x-3) - g(x-3) \geq 0$? (3)

[12]

QUESTION 5

The graph of $f(x) = \left(\frac{1}{9}\right) \cdot 3^{-x} - 9$ is drawn below. A is the y -intercept and B the x -intercept.

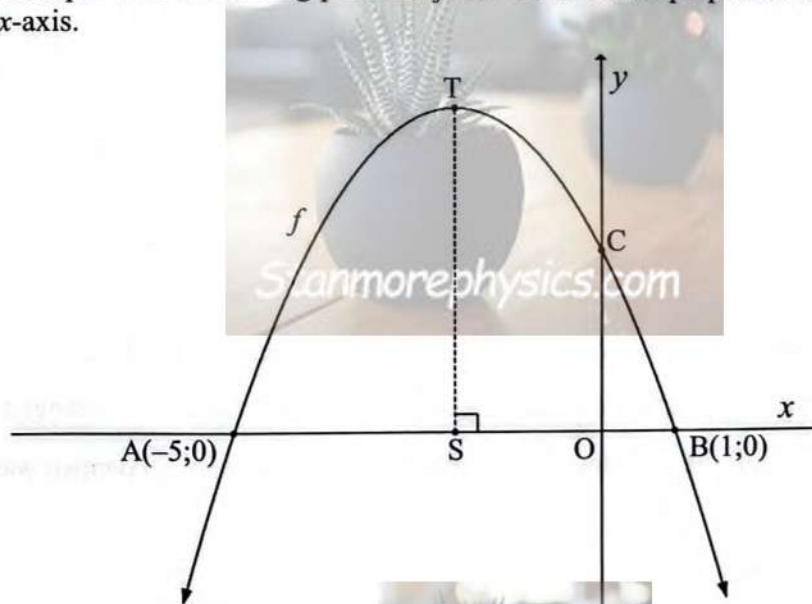


- 5.1 Write down the range of f . (1)
- 5.2 Determine the coordinates of A and B. (4)
- 5.3 f is translated to become $g(x) = \left(\frac{1}{3}\right)^x$. Describe the translation. (3)
- 5.4 Determine the equation of g^{-1} , the inverse of g , in the form of $y = \dots$ (2)
- 5.5 Draw a sketch graph of g^{-1} , indicating any intercepts with the axes. (2)
- 5.6 Determine the values of x for which $-2 \leq g^{-1}(x) \leq 0$. (3)

[15]

QUESTION 6

The graph of $f(x) = -2x^2 - 8x + 10$ is drawn below. $A(-5;0)$ and $B(1;0)$ are the x -intercepts and C the y -intercept. T is the turning point of f and TS is drawn perpendicular to the x -axis, with S on the x -axis.



6.1 Calculate the length of:

6.1.1 AB

(1)

6.1.2 OC

(1)

6.1.3 TS

(3)

6.2 Solve for k if $f(x) + k = 0$ has 2 real roots with the same sign.

(3)

6.3 For which value(s) of x will $f(x+t) = f(x-t)$ for all values of t ?

(1)

[9]

QUESTION 7

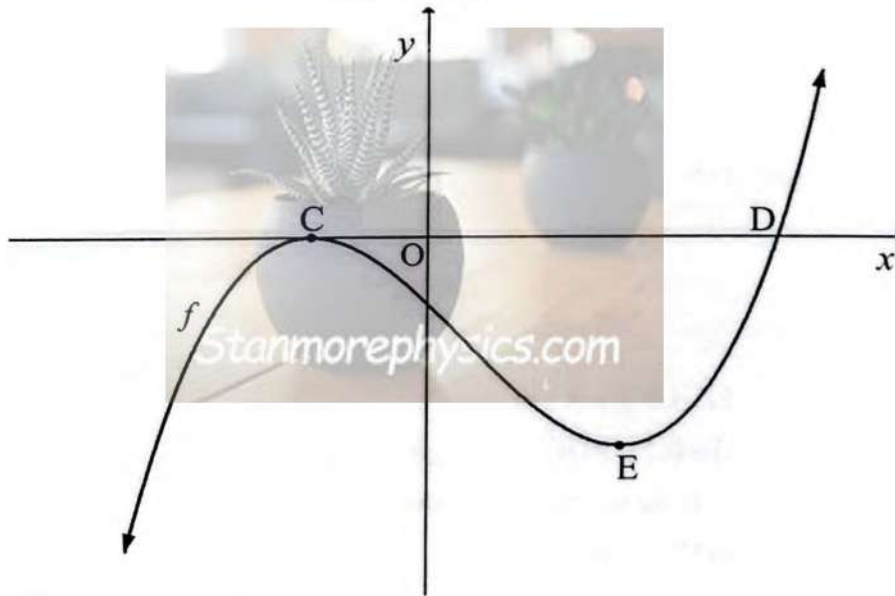
- 7.1 Convert an interest rate of 8,5% p.a., compounded quarterly, to an effective interest rate. (3)
- 7.2 Jaden bought a car for R380 000. Depreciating at an interest rate of k % p.a. on a reducing balance, the book value of the car was R124 518,50 after 5 years.
- 7.2.1 Calculate the value of k . (3)
- 7.2.2 Use the grid provided in the ANSWER BOOK to draw a sketch graph representing the depreciation of the car. (1)
- 7.2.3 After how many years will the book value of the car be R0? (1)
- 7.3 Mrs Zwane deposited R5000 into a bank account at an interest rate of 7,25% p.a., compounded monthly. After $2\frac{1}{2}$ years of investment, the interest rate changed to 8% p.a. How much will the investment be worth 7 years after the initial deposit was made? (4)
- [12]**

QUESTION 8

- 8.1 Determine $f'(x)$ from first principles if $f(x) = \frac{4}{x}$. (5)
- 8.2 Determine the following:
- 8.2.1 $\frac{dy}{dx}$ if $y = x^2(6x^3 - 7)$ (3)
- 8.2.2 $D_x\left(\frac{3}{2x^4} + 5\sqrt{x^3}\right)$ (4)
- 8.3 Determine the value of t if the line $y = -2x + t$ is a tangent to the curve $f(x) = 6 + 4x - x^2$. (5)
- [17]**

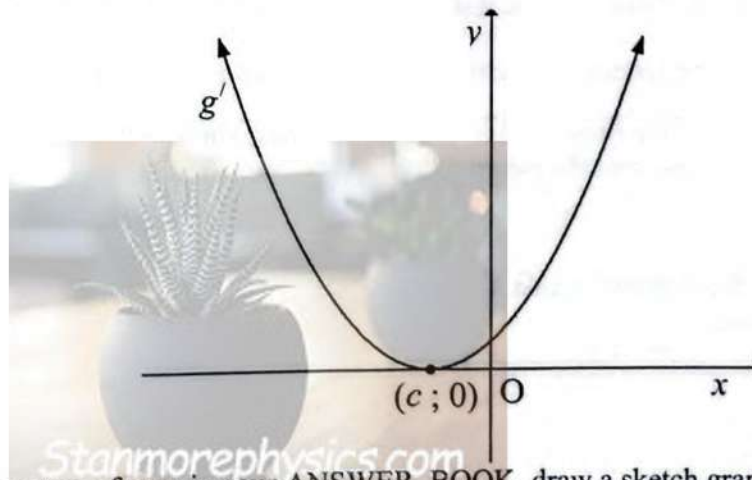
QUESTION 9

9.1 The graph of $f(x) = x^3 - x^2 - 5x - 3$ is sketched below. The x -intercepts of f are at C and D. C and E are the turning points of f .



- 9.1.1 Calculate $f(-1)$. (1)
- 9.1.2 Determine the x -coordinate of D. (3)
- 9.1.3 Determine the x -coordinate of E. (4)
- 9.1.4 For which values of x will:
 - (a) f be concave up? (3)
 - (b) $f'(x) \cdot f(x) < 0$? (3)

9.2 The graph of g' is sketched below. g' is a parabola that touches the x -axis at $(c; 0)$.



On the system of axes in your ANSWER BOOK, draw a sketch graph of g .
No coordinates of points on the graph or intercepts with the axes need to be shown.

(2)
[16]

QUESTION 10

A ball is thrown into the air and its height, h , above the ground after t seconds is given by $h(t) = -5t^2 + 22t + 4$ metres.

- 10.1 Write down the initial height of the ball. (1)
- 10.2 Determine the maximum height of the of the ball above the ground. (4)
- 10.3 Determine the rate of change in velocity of the ball at any given time. (2)

[7]

QUESTION 11

11.1 For events A, B and C it is given that:

- $P(A) = 0,2$, $P(B) = 0,6$ and $P(C) = 0,7$
- A and B are mutually exclusive
- A and C are independent

11.1.1 What is the probability that A and B will occur simultaneously? (1)

11.1.2 Calculate $P(A \text{ or } C)$. (3)

11.2 A survey was done among 45 grade 12 learners in Success High School on their favourite games. The results are given below:

- 22 learners like Chess
- 24 learners like Morabaraba
- 18 learners like Drie stokkies
- 5 learners like all the games
- 3 learners like only Chess
- 38 learners like at least one of the games
- 11 learners like Drie stokkies and Chess

11.2.1 Determine the number of learners who do not like any of these games. (1)

11.2.2 If x learners like Morabaraba and Drie stokkies, but not Chess, draw a Venn diagram to represent the information given above. (4)

11.2.3 Solve for x . (2)

11.2.4 What is the probability that a learner chosen at random likes exactly two of these games? (2)

[13]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

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

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

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

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

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

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

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

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

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

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

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

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

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

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

$$y = mx + c$$

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

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

$$m = \tan \theta$$

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

In ΔABC :

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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MARKING GUIDELINES

**STANDARISED PROVINCIAL
ASSESSMENT**

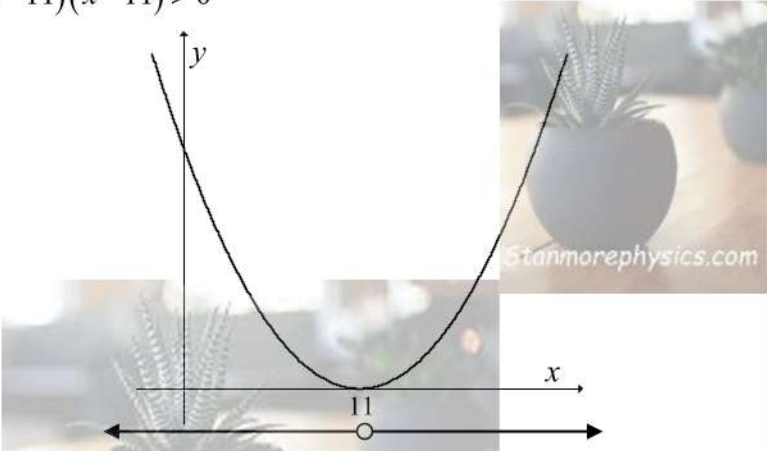
Stanmorephysics.com

GRADE 12

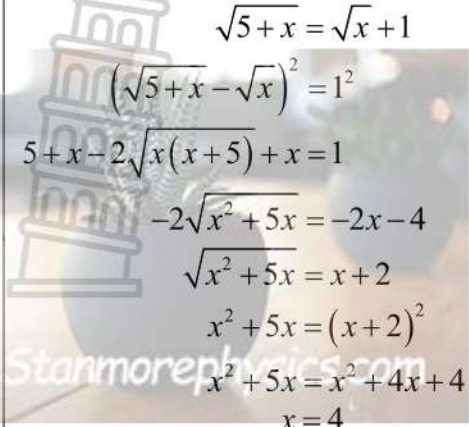

MARKS: 150

These marking guidelines consist of 14 pages.

QUESTION 1

<p>1.1.1</p>	$x^2 - 5x - 24 = 0$ $(x+3)(x-8) = 0$ $x = -3 \text{ or } x = 8$	<p>✓ A factors ✓ CA ✓CA answers</p> <p style="text-align: right;">(3)</p>
<p>1.1.2</p>	$4x(x+3) = 13$ $4x^2 + 12x - 13 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(12) \pm \sqrt{(12)^2 - 4(4)(-13)}}{2(4)}$ $x = -3,85 \text{ or } x = 0,85$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> Penalty of 1 for incorrect rounding in this question only </div>	<p>✓ A standard form</p> <p>✓ CA substitution</p> <p>✓ CA ✓CA answers</p> <p style="text-align: right;">(4)</p>
<p>1.1.3</p>	$22x - 121 < x^2$ $x^2 - 22x + 121 > 0$ $(x-11)(x-11) > 0$  <p> $x < 11 \text{ or } x > 11$ OR $x \in \mathbb{R}; x \neq 11$ OR </p> <p> $x \in (-\infty; 11) \text{ or } x \in (11; \infty)$ </p>	<p>✓ A $x^2 - 22x + 121 > 0$</p> <p>✓ CA factors Stanmorephysics.com</p> <p>✓ ✓ CA CA answers</p> <p style="text-align: right;">(4)</p>
<p>1.1.4</p>	$\sqrt{5+x} = \sqrt{x+1}$ $(\sqrt{5+x})^2 = (\sqrt{x+1})^2$ $5+x = x+2\sqrt{x}+1$ $\sqrt{x} = 2$ $x = 4$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> B/D if written $(\sqrt{5+x})^2 = (\sqrt{x})^2 + 1^2$ </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> CA for answer: Conditional upon the obtained answer being rejected. </div> <p>OR</p>	<p>✓ A squaring both sides</p> <p>✓ A simplification</p> <p>✓ CA isolating the surd</p> <p>✓ CA answer</p> <p>OR</p> <p style="text-align: right;">(4)</p>

GRADE 12
Marking Guidelines

	 $\sqrt{5+x} = \sqrt{x} + 1$ $(\sqrt{5+x} - \sqrt{x})^2 = 1^2$ $5+x - 2\sqrt{x(x+5)} + x = 1$ $-2\sqrt{x^2+5x} = -2x-4$ $\sqrt{x^2+5x} = x+2$ $x^2+5x = (x+2)^2$ $x^2+5x = x^2+4x+4$ $x = 4$	<p>✓A squaring both sides ✓A simplification</p> <p>✓CA isolating the surd</p> <p>✓CA answer</p> <p>(4)</p>
1.2	 $2^{x-y} = 8$ $2^{x-y} = 2^3$ $x-y = 3$ $x = 3+y$ $x^2 - xy = 2y^2 + 7$ $(3+y)^2 - y(3+y) = 2y^2 + 7$ $2y^2 - 3y - 2 = 0$ $(2y+1)(y-2) = 0$ $y = -\frac{1}{2} \text{ or } y = 2$ $x = 3 - \frac{1}{2} \text{ or } x = 3 + 2$ $x = \frac{5}{2} \text{ or } x = 5$ <p>OR</p> $2^{x-y} = 8$ $2^{x-y} = 2^3$ $x-y = 3$ $y = x-3$ $x^2 - xy = 2y^2 + 7$ $x^2 - x(x-3) = 2(x-3)^2 + 7$ $2x^2 - 15x + 25 = 0$ $(2x-5)(x-5) = 0$ $x = \frac{5}{2} \text{ or } x = 5$ $y = \frac{5}{2} - 3 \text{ or } y = 5 - 3$ $y = -\frac{1}{2} \text{ or } y = 2$	<p>✓A writing 8 as power of 2</p> <p>✓CA making x subject of the formula</p> <p>✓CA substitution ✓CA standard form</p> <p>✓CA y-values</p> <p>✓CA x-values</p> <p>(6)</p> <p>OR</p> <p>✓A writing 8 as power of 2</p> <p>✓CA making y the subject of the formula</p> <p>✓CA substitution</p> <p>✓CA factors</p> <p>✓CA x-values</p> <p>✓CA y-values</p> <p>(6)</p>

1.3	$2 \times 3 = 6$ $P^x \times P^y = P^z$ $P^{x+y} = P^z$ $\therefore \frac{1}{x} + \frac{1}{y} = \frac{1}{z}$ $\frac{y+x}{xy} = \frac{1}{z}$ $z = \frac{xy}{y+x}$	$\checkmark A \quad P^x \times P^y = P^z$ $\checkmark A \quad \text{adding exponents}$ $\checkmark A \quad \frac{y+x}{xy} = \frac{1}{z}$ <p style="text-align: right;">(3)</p>
		[24]

QUESTION 2

2.1.1	$x = -7$	$\checkmark A$ answer (1)
2.1.2	$x = 9$	$\checkmark A$ answer (1)
2.2.1	$r = \frac{T_2}{T_1} = \frac{1}{128} \div \frac{1}{64} = \frac{1}{2}$ $T_n = ar^{n-1}$ $= \frac{1}{64} \left(\frac{1}{2}\right)^{n-1}$	$\checkmark A$ value of r $\checkmark CA$ answer (2)
2.2.2	$\frac{1}{64} \left(\frac{1}{2}\right)^{n-1} = \frac{1}{8192}$ $\left(\frac{1}{2}\right)^{n-1} = \frac{1}{128}$ $\left(\frac{1}{2}\right)^{n-1} = \left(\frac{1}{2}\right)^7$ $n = 8$ OR $\frac{1}{64} \left(\frac{1}{2}\right)^{n-1} = \frac{1}{8192}$ $\left(\frac{1}{2}\right)^{n-1} = \frac{1}{128}$ $2^{-n+1} = 2^{-7}$ $-n+1 = -7$ $n = 8$	$\checkmark CA$ equating Stanmorephysics.com $\checkmark CA$ LHS and RHS as powers of $\frac{1}{2}$ $\checkmark CA$ answer (3) OR $\checkmark CA$ equating $\checkmark CA$ LHS and RHS as powers of 2 $\checkmark CA$ answer (3)

2.2.3	$r = \frac{1}{2}$ $\therefore -1 < r < 1$ <p>OR</p> <p>Because $-1 < \frac{1}{2} < 1$</p>	<p>✓ A reason (1)</p> <p>OR</p> <p>✓ A reason (1)</p> <p>[8]</p>
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QUESTION 3

3.1.1	$T_5 = -89$ $T_6 = -63$	<p>✓ A answer</p> <p>✓ A answer (2)</p>
3.1.2	$2a = -4$ $a = -2$ $3a + b = 42$ $3(-2) + b = 42$ $b = 48$ $a + b + c = -233$ $-2 + 48 + c = -233$ $c = -279$ $T_n = -2n^2 + 48n - 279$	<p>✓ A value of a</p> <p>✓ CA value of b</p> <p>✓ CA value of c</p> <p>✓ CA answer (4)</p>
3.1.3	<p>Maximum when $n = \frac{-b}{2a}$;</p> $= \frac{-(48)}{2(-2)}$ $n = 12$ $T_{12} = -2(12)^2 + 48(12) - 279$ $= 9$ <p>OR</p> <p>Maximum when $T_n' = 0$</p> $-4n + 48 = 0$ $n = 12$ $T_{12} = -2(12)^2 + 48(12) - 279$ $= 9$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>If n is not a natural number: Maximum: $2/4$</p> </div> <p>OR</p>	<p>✓ CA substitution</p> <p>✓ CA value of n</p> <p>✓ CA substitution</p> <p>✓ CA answer (4)</p> <p>OR</p> <p>✓ CA substitution in $T_n' = 0$</p> <p>✓ CA value of n</p> <p>✓ CA substitution</p> <p>✓ CA answer (4)</p> <p>OR</p>


GRADE 12
Marking Guidelines

	$T_n = -2n^2 + 48n - 279$ $= -2(n^2 - 24n) - 279$ $= -2(n^2 - 24n + 144) - 279 + 288$ $= -2(n - 12)^2 + 9$ <p>∴ Maximum value of sequence = 9</p>	<p>✓CA ✓CA completion of the square ✓CA format $a(n + p)^2 + q$ ✓CA answer</p> <p>(4)</p>
3.2.1	$a = 7p + 5$ $l = 7(18) + 5 = 131$	<p>✓A value of a ✓A value of l</p> <p>(2)</p>
3.2.2	$n = 18 - p + 1 = 19 - p$ $S_n = \frac{n}{2}(a + l)$ $\frac{19 - p}{2}(7p + 5 + 131) = 1230$ $(19 - p)(7p + 136) = 2460$ $7p^2 + 3p - 124 = 0$ $p = \frac{-(3) \pm \sqrt{(3)^2 - 4(7)(-124)}}{2(7)}$ $p = 4 \text{ or } p \neq -4, 43$ <p>OR</p> $n = 18 - p + 1 = 19 - p$ $S_n = \frac{n}{2}[2a + (n - 1)d]$ $\frac{19 - p}{2}[2(7p + 5) + (19 - p - 1) \times 7] = 1230$ $(19 - p)(7p + 136) = 2460$ $7p^2 + 3p - 124 = 0$ $p = \frac{-(3) \pm \sqrt{(3)^2 - 4(7)(-124)}}{2(7)}$ $p = 4 \text{ or } p \neq -4, 43$	<p>✓A value of n</p> <p>✓CA substitution</p> <p>✓CA standard form</p> <p>✓CA factors or formula</p> <p>✓CA answer with rejection</p> <p>(5)</p> <p>OR</p> <p>✓A value of n</p> <p>✓A substitution</p> <p>✓CA standard form</p> <p>✓CA factors or formula</p> <p>✓CA answer with rejection</p> <p>(5)</p>
<p>[17]</p>		

QUESTION 4

4.1	$x = -3$ $y = -4$	✓A $x = -3$ ✓A $y = -4$ (2)
4.2	$f(x) = \frac{a}{x+3} - 4$ Subst. $(-5; -6)$: $\frac{a}{-5+3} - 4 = -6$ $\frac{a}{-2} = -2$ $a = 4$ $g(x) = mx - 4$ Subst. $(-5; -6)$: $m(-5) - 4 = -6$ OR $m = \frac{-4 - (-6)}{0 - (-5)}$ $m = \frac{2}{5}$ OR $m = \frac{2}{5}$	✓A substituting $(-5; -6)$ in f ✓CA value of a ✓A substitution ✓A value of m (4)
4.3	$\frac{4}{x+3} - 4 = \frac{2}{5}x - 4$ $\frac{4}{x+3} = \frac{2}{5}x$ $2x^2 + 6x = 20$ $x^2 + 3x - 10 = 0$ $(x+5)(x-2) = 0$ $x \neq -5 \text{ or } x = 2$	✓CA equating f and g ✓CA standard form ✓CA value of x (3)
4.4	$x \leq -2 \text{ or } 0 < x \leq 5$ OR $x \in (-\infty; -2] \text{ or } x \in (0; 5]$	✓A $x \leq -2$ ✓CA ✓CA $0 < x \leq 5$ OR ✓A $x \in (-\infty; -2]$ ✓CA ✓CA $x \in (0; 5]$ (3)
		[12]

QUESTION 5

5.1	$y > -9$ OR $y \in (-9; \infty)$	✓A answer (1)
5.2	<p>At A, $x=0$, $\therefore y = \frac{1}{9}(3)^0 - 9$</p> $= \frac{-80}{9}$ <p>A $(0; -\frac{80}{9})$ OR A $(0; -8,89)$</p> <p>At B, $y=0$, $\therefore \frac{1}{9}(3)^{-x} - 9 = 0$</p> $3^{-x} = 81$ $x = -4$ <p>B $(-4; 0)$</p>	✓A substitute $x=0$ ✓A coordinates of A ✓A substitute $f(x)=0$ ✓A coordinates of B (4)
5.3	$\frac{1}{9}\left(\frac{1}{3}\right)^x - 9 = \left(\frac{1}{3}\right)^2 \left(\frac{1}{3}\right)^x - 9 = \left(\frac{1}{3}\right)^{x+2} - 9$ <p>Translation from $\left(\frac{1}{3}\right)^{x+2} - 9$ to $\left(\frac{1}{3}\right)^x$:</p> <p>2 units to the right and 9 units up</p>	 ✓A 2 units Stanmorephysics.com ✓A to the right ✓A 9 units up (3)
5.4	$g^{-1}(x): x = \left(\frac{1}{3}\right)^y$ $\therefore y = \log_{\frac{1}{3}} x$ <p>OR</p> $g^{-1}(x): x = 3^{-y}$ $\therefore -y = \log_3 x$ $y = -\log_3 x$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> Answer only: Full marks </div>	✓A $x = \left(\frac{1}{3}\right)^y$ ✓A answer (2) <p>OR</p> ✓A $x = 3^{-y}$ ✓A answer (2)

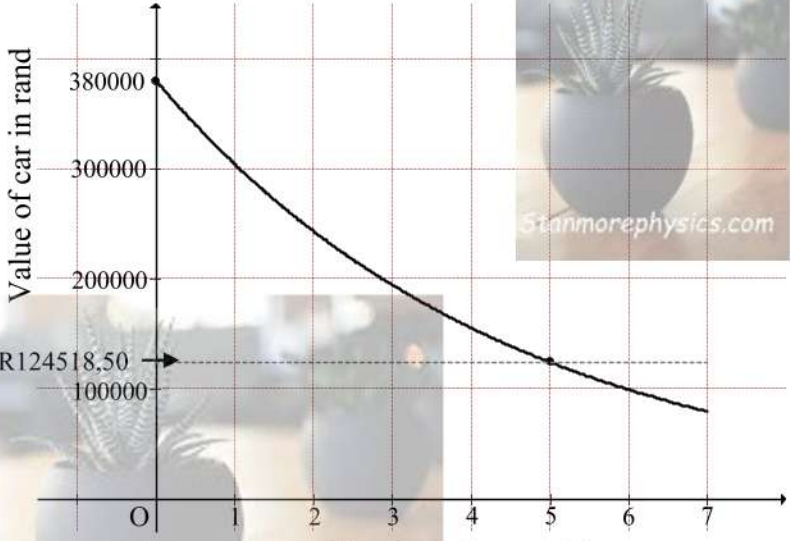
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5.5		<p>✓A shape ✓A x-intercept</p> <p style="text-align: right;">(2)</p>
5.6	$g^{-1}(x) = -2$ $\log_{\frac{1}{3}} x = -2$ $x = \left(\frac{1}{3}\right)^{-2}$ $= 9$ $1 \leq x \leq 9 \text{ OR } x \in [1; 9]$	<p>✓CA $x=9$ ✓✓A CA answer</p> <p style="text-align: right;">(3)</p>
[15]		

QUESTION 6

6.1.1	$AB = 1 - (-5) = 6 \text{ units}$	<p>✓A answer</p> <p style="text-align: right;">(1)</p>
6.1.2	$OC = 10 \text{ units}$	<p>✓A answer</p> <p style="text-align: right;">(1)</p>
6.1.3	$x = \frac{-b}{2a}$ $= \frac{-(-8)}{2(-2)} \text{ OR } x = \frac{-5+1}{2} \text{ OR } f'(x) = -4x - 8 = 0$ $= -2 \qquad \qquad = -2 \qquad \qquad \therefore x = -2$ $y_c = -2(-2)^2 - 8(-2) + 10$ $= 18$ $\therefore \text{TS} = 18 \text{ units}$	<p>✓A method ✓CA x-value ✓CA answer</p> <p style="text-align: right;">(3)</p>
6.2	$f(x) = -k$ $10 < -k < 18$ $-18 < k < -10$	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> Answer only: Full marks </div> <p>✓CA $10 < -k < 18$ ✓CA ✓CA $-18 < k < -10$</p> <p style="text-align: right;">(3)</p>
6.3	$x = -2$	<p>✓CA answer</p> <p style="text-align: right;">(1)</p>
[9]		

QUESTION 7

7.1	$1+i_e = \left(1 + \frac{i_N}{m}\right)^m$ $1+i_e = \left(1 + \frac{0,085}{4}\right)^4$ $i_e = 0,0877479\dots$ <p>Effective interest rate = 8,77%p.a.</p>	✓ A formula ✓ A substitution ✓ CA answer (3)
7.2.1	$A = P(1-i)^n$ $124\,518,50 = 380\,000(1-i)^5$ $1-i = \sqrt[5]{\frac{124\,518,50}{380\,000}}$ $i = 0,20$ <p>20%p.a. ∴ k = 20</p>	✓ A substitution ✓ CA simplification ✓ CA answer (3)
7.2.2		✓ A shape (1)
7.2.3	<p>The book value will never reach zero.</p>	✓ A answer (1)
7.3	$A = 5\,000 \left(1 + \frac{0,0725}{12}\right)^{2,5 \times 12} (1 + 0,08)^{4,5}$ $A = R8\,469,46$	✓ A $i = \frac{0,0725}{12}$ and $n = 2,5 \times 12$ ✓ A $5000 \left(1 + \frac{0,0725}{12}\right)^{2,5 \times 12}$ ✓ A $\times (1 + 0,08)^{4,5}$ ✓ CA answer (4)

QUESTION 8

<p>8.1</p>	$f(x+h) = \frac{4}{x+h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \left[\left(\frac{4}{x+h} - \frac{4}{x} \right) \div h \right]$ $= \lim_{h \rightarrow 0} \left[\frac{4x - 4(x+h)}{x(x+h)} \times \frac{1}{h} \right]$ $= \lim_{h \rightarrow 0} \left[\frac{-4h}{x^2 + xh} \times \frac{1}{h} \right]$ $= \lim_{h \rightarrow 0} \left(\frac{-4}{x^2 + xh} \right)$ $= -\frac{4}{x^2}$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> Penalise once for notation, only in 8.1. </div>	<p>✓A expression for $f(x+h)$</p> <p>✓CA substitution</p> <p>✓CA $\frac{4x - 4(x+h)}{x(x+h)}$</p> <p>✓CA simplification</p> <p>✓CA answer</p> <p style="text-align: right;">(5)</p>
<p>8.2.1</p>	$y = x^2(6x^3 - 7)$ $y = 6x^5 - 7x^2$ $\frac{dy}{dx} = 30x^4 - 14x$	<p>A ✓ $y = 6x^5 - 7x^2$</p> <p>✓CA $30x^4$ ✓CA $-14x$</p> <p style="text-align: right;">(3)</p>
<p>8.2.2</p>	$D_x \left(\frac{3}{2x^4} + 5\sqrt{x^3} \right)$ $= D_x \left(\frac{3}{2}x^{-4} + 5x^{\frac{3}{2}} \right)$ $= -6x^{-5} + \frac{15}{2}x^{\frac{1}{2}}$	<p>✓A $\frac{3}{2}x^{-4}$ ✓A $+5x^{\frac{3}{2}}$</p> <p>✓CA $-6x^{-5}$ ✓CA $+\frac{15}{2}x^{\frac{1}{2}}$</p> <p style="text-align: right;">(4)</p>
<p>8.3</p>	$f'(x) = 4 - 2x$ $m_{\text{line}} = -2 = 4 - 2x$ $2x = 4 + 2$ $x = 3$ $f(3) = 6 + 4(3) - (3)^2 = 9$ <p>Contact point between line and f: (3;9)</p> <p>Substitute in $y = -2x + t$:</p> $9 = -2(3) + t$ $t = 9 + 6 = 15$ <p>OR</p>	<p>✓A $f'(x) = 4 - 2x$</p> <p>✓CA $4 - 2x = -2$</p> <p>✓CA x-value of contact point</p> <p>✓CA y-value of contact point</p> <p>✓CA answer</p> <p style="text-align: right;">(5)</p> <p>OR</p>

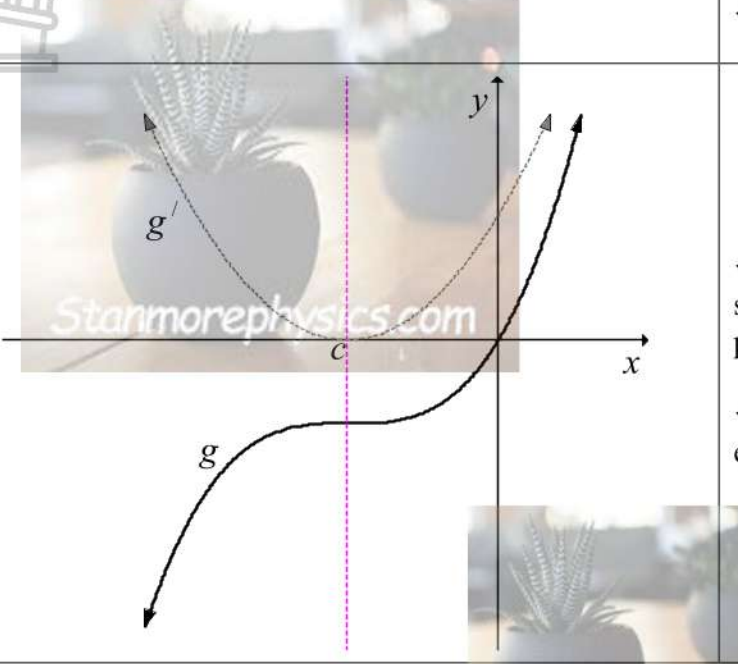
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$6 + 4x - x^2 = -2x + t$ $-x^2 + 6x + 6 - t = 0$ <p>For the line to be a tangent, roots must be equal:</p> $b^2 - 4ac = 0$ $\therefore 6^2 - 4(-1)(6 - t) = 0$ $-4t = -60$ $t = 15$	✓A equating ✓A standard form ✓A $b^2 - 4ac = 0$ ✓CA substitution ✓CA answer (5)
[17]	

QUESTION 9

9.1.1	$f(-1) = (-1)^3 - (-1)^2 - 5(-1) - 3 = 0$	✓A answer (1)
9.1.2	<p>$(x+1)$ is a factor of f.</p> <p>For x-intercepts:</p> $f(x) = x^3 - x^2 - 5x - 3 = 0$ $\therefore (x+1)(x^2 - 2x - 3) = 0$ $(x+1)(x+1)(x-3) = 0$ $x = -1 \text{ or } x = 3$ <p>x-coordinate of D = 3</p>	✓A $(x+1)(x^2 - 2x - 3) = 0$ ✓CA $(x+1)(x+1)(x-3) = 0$ ✓CA answer (3)
9.1.3	$f'(x) = 3x^2 - 2x - 5$ <p>At the turning points:</p> $3x^2 - 2x - 5 = 0$ $\therefore (3x-5)(x+1) = 0$ $x = -1 \text{ or } x = \frac{5}{3}$ <p>x-coordinate of E = $\frac{5}{3}$</p>	✓A derivative of f ✓CA equating derivative to zero ✓CA factors ✓CA answer (4)
9.1.4(a)	<p>At the point of inflection: $x = \frac{-1 + \frac{5}{3}}{2}$</p> $= \frac{1}{3}$ <p>Concave up for $x > \frac{1}{3}$ OR $x \in \left(\frac{1}{3}; \infty\right)$</p> <p>OR</p> <p>At the point of inflection: $f''(x) = 6x - 2 = 0$</p> $\therefore x = \frac{1}{3}$ <p>Concave up for $x > \frac{1}{3}$ OR $x \in \left(\frac{1}{3}; \infty\right)$</p>	✓CA $x = \frac{-1 + \frac{5}{3}}{2}$ ✓CA x -value of point of inflection ✓CA answer (3) OR ✓CA $f''(x) = 6x - 2 = 0$ ✓CA x -value of point of inflection ✓CA answer (3)

GRADE 12
Marking Guidelines

<p>9.1.4(b)</p>	<p>$x < -1$ or $\frac{5}{3} < x < 3$</p> <p>OR</p> <p>$x \in (-\infty; -1)$ or $x \in (\frac{5}{3}; 3)$</p>	<p>✓CA $x < -1$</p> <p>✓✓CA CA $\frac{5}{3} < x < 3$ (3)</p> <p>OR</p> <p>✓CA $x \in (-\infty; -1)$</p> <p>✓✓CA CA $(\frac{5}{3}; 3)$ (3)</p>
<p>9.2</p>		<p>✓A shape: a graph with one stationary point, and no turning points</p> <p>✓A an increasing graph for all x, except the stationary point</p> <p>(2)</p>

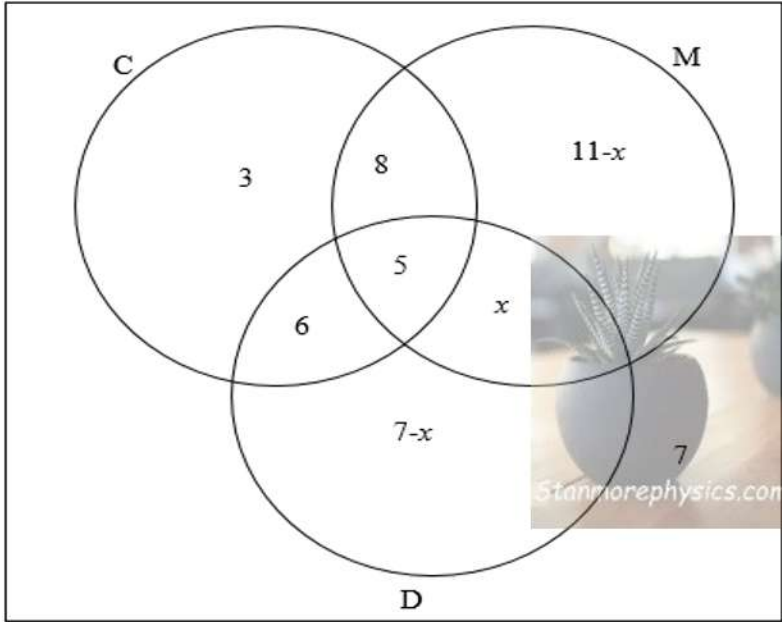
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QUESTION 10

<p>10.1</p>	<p>$h(0) = 4\text{m}$</p>	<p>✓A answer (1)</p>
<p>10.2</p>	<p>At the max. height: $h'(t) = 0$</p> $-10t + 22 = 0$ $t = 2, 2\text{s}$ $h(2, 2) = -5(2, 2)^2 + 22(2, 2) + 4$ $= 28, 2\text{m}$ <p>OR</p> <p>Maximum height will be at the turning point:</p> $t = \frac{-b}{2a} = \frac{-22}{2(-5)}$ $= 2, 2\text{s}$ $h(2, 2) = -5(2, 2)^2 + 22(2, 2) + 4$ $= 28, 2\text{m}$	<p>✓A $-10t + 22 = 0$</p> <p>✓CA value of t</p> <p>✓CA $-5(2, 2)^2 + 22(2, 2) + 4$</p> <p>✓CA answer (4)</p> <p>OR</p> <p>✓A substitution</p> <p>✓CA value of t</p> <p>✓CA $-5(2, 2)^2 + 22(2, 2) + 4$</p> <p>✓CA answer (4)</p>
<p>10.3</p>	<p>$h''(t) = -10 \text{ m/s}^2$</p>	<p>✓✓CA CA answer (2)</p>

[7]

QUESTION 11

11.1.1	$P(A \text{ and } B) = 0$	✓ A answer (1)
11.1.2	$P(A \text{ and } C) = 0,2 \times 0,7$ $P(A \text{ or } C) = P(A) + P(C) - P(A \text{ and } C)$ $= 0,2 + 0,7 - (0,2 \times 0,7)$ $= 0,76$	✓ A $P(A \text{ and } C) = 0,2 \times 0,7$ ✓ CA substitution ✓ CA answer (3)
11.2.1	7	✓ A answer (1)
11.2.2	$n(S) = 45$ 	✓ A 5 and x ✓ CA 6 and $(7 - x)$ ✓ CA 3 and 8 ✓ CA $(11 - x)$ and 7 If $x = 2$ has been substituted into the Venn diagram, still award the marks. (4)
11.2.3	$22 + (7 - x) + (11 - x) + x + 7 = 45$ $x = 2$	✓ CA setting up equation ✓ CA answer (2)
11.2.4	$P(\text{likes exactly 2 games}) = \frac{2 + 8 + 6}{45}$ $= \frac{16}{45} = 0,36$	✓ CA $P = \frac{2 + 8 + 6}{45}$ ✓ CA answer (2)
[13]		

TOTAL: 150