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KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

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MATHEMATICS P1

JUNE EXAMINATION

2025

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MARKS: 150

TIME: 3 hours

This question paper consists of 12 pages and an information sheet.

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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.
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. If necessary, round off answers correct to TWO decimal places, unless stated otherwise.
8. Write neatly and legibly.

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QUESTION 1

1.1 Solve for x:

1.1.1 $(x+3)(2-5x)=0$ (2)

1.1.2 $7x^2+5x-8=0$ (correct to TWO decimal places) (3)

1.1.3 $\frac{7}{x^2-2x-8}>0$ (4)

1.1.4 $3^{x+2}=42-5.3^x$ (3)

1.1.5 $x-\sqrt{5x-1}=5$ (5)

1.2 Solve for x and y simultaneously:

$x-y=3$

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

1.3 Prove that the roots of $2x^2+px-p^2=0$ are rational for all rational values of p. (3)

[26]

QUESTION 2

2.1 Given the arithmetic series: $6+1\ -4\ -9\ .\ .\ .\ .\ .$

2.1.1 Write down the value of the next term of the arithmetic series. (1)

2.1.2 Calculate: $6+1\ -4\ -9\ .\ .\ .\ .\ .\ .\ .\ -239$ (5)

2.2 Consider a quadratic pattern: $-9\ ;\ -5\ ;\ x\ ;\ 15\ ;\ ...$

2.2.1 Calculate the value of x. (3)

2.2.2 If the value of $x=3$, determine the n^{th} term of the number pattern. (4)

2.2.3 Explain why all the terms of this quadratic pattern are odd numbers. (2)

[15]

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QUESTION 3

3.1 Given: $\sum_{k=1}^{\infty} 4.p^{1-k} = 6$

3.1.1 Calculate the value of p. (4)

3.1.2 Hence, write down the first three terms of the series. (1)

3.2 On a particular day, a grade 12 learner from Dinaledi High School watched a video about number patterns on YouTube.

- At 1 p.m. he shared the link for the video with 5 of his friends.
- At 2 p.m. each of these 5 friends shared the link with 5 other friends.
- Then at 3 p.m., each of those 5 friends shared it again with 5 different people.

If this pattern continues in the same way:

3.2.1 Determine how many people will receive the link at exactly 4 p.m. (2)

3.2.2 Determine the total number of people who would have received the link by 11 p.m. (3)

[10]

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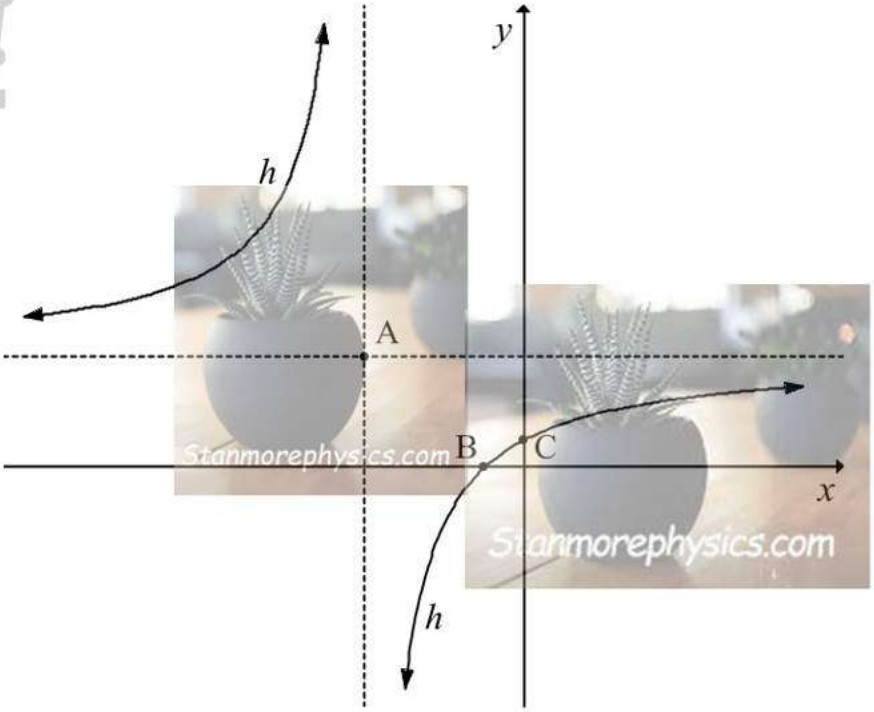
QUESTION 4

The sketch below shows the graph of $h(x)=\frac{-9}{x+4}+3$. The asymptotes of h intersect at A.
The graph h intersects the x-axis and y-axis at B and C respectively.



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4.1 Write down the coordinates of A. (1)

4.2 Calculate the coordinates of B. (2)

4.3 Calculate the coordinates of C. (2)

4.4 Describe the translation from h to $j(x)=\frac{-9}{x}$. (2)

4.5 Determine the coordinates of the points on j that are closest to the origin. (4)

[11]

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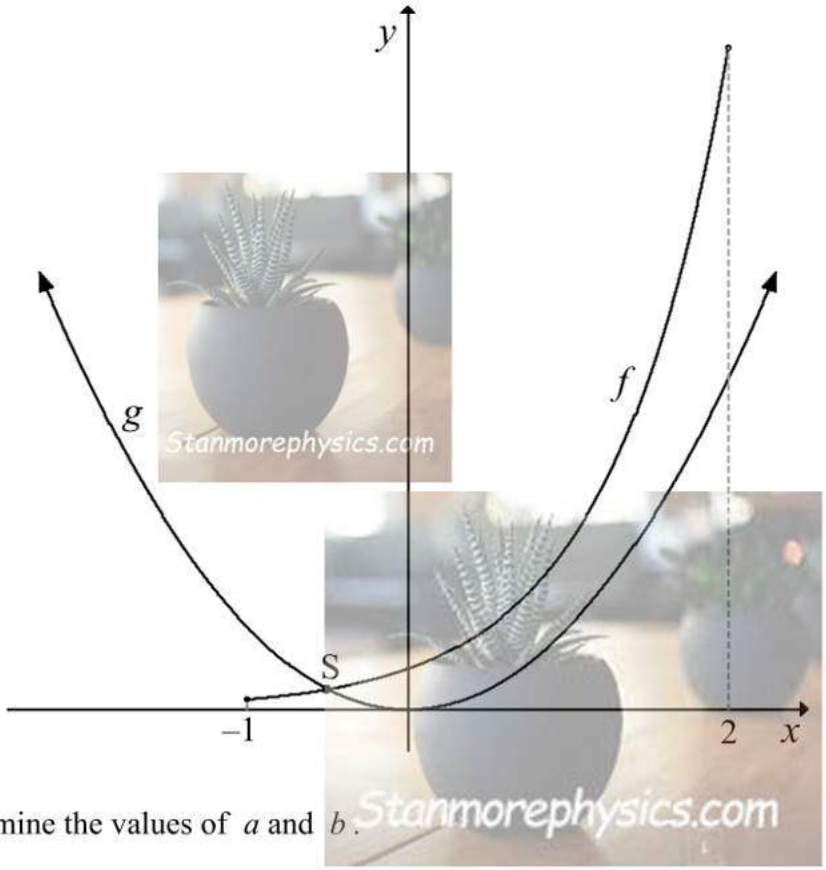
QUESTION 5

The diagram below shows the graphs of $f(x)=a^x$, for $x\in[-1\ ;\ 2]$, and $g(x)=bx^2$.

$S\left(-\frac{1}{2}\ ;\ \frac{1}{2}\right)$ is a point of intersection of f and g.



5.1 Determine the values of a and b. (4)

5.2 Draw a sketch graph of the inverse of g. Indicate the coordinates of one point on the graph. (2)

5.3 Is the inverse of g a function? (1)

5.4 Determine the equation of f^{-1} in the form of $y=.....$
Also state the restriction on the domain. (4)

5.5 If $x<0$, write down the values of x for which $f(x)>g(x)$. (2)

[13]

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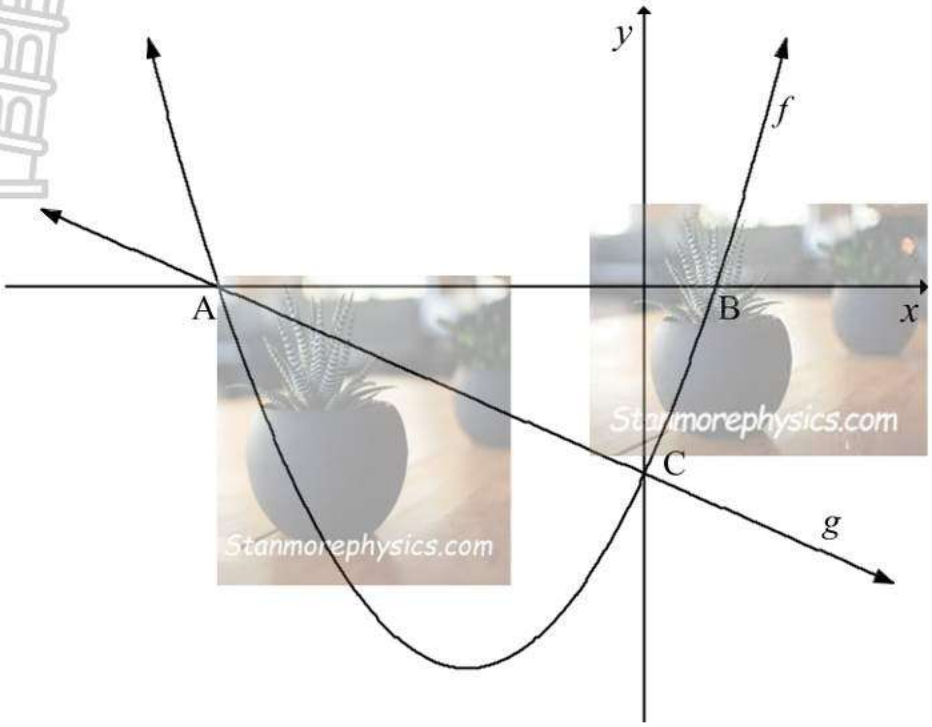
QUESTION 6

The graphs of $f(x)=x^2+5x-6$ and $g(x)=mx+c$ are drawn below.
A and B are the x-intercepts of f and C, the y-intercept. g passes through A and C.



6.1 Calculate the coordinates of A and B. (3)

6.2 Determine the equation of g. (3)

6.3 If $h(x)=f(x)+k$, determine the values of k for which g and h will not intersect. (5)

[11]

QUESTION 7

7.1 Nelisiwe received her yearly bonus and decided to invest the full amount.

- Bank A offers an interest rate of 8,5% p.a., compounded half-yearly.
- Bank B also offers an interest rate of 8,5% p.a., but compounded monthly.

7.1.1 With which bank should she invest? Give a reason for your answer. (2)

7.1.2 Convert 8,5% p.a. compounded monthly to an effective interest rate. (3)

7.2 Calculate the price at which Bongiwe bought her car if its depreciated value after three years is R230 476,05. Depreciation is calculated at a rate of 13% p.a., using the reducing balance method. (2)

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7.3 Andries deposited R x into a savings account with an interest rate of 8,7% p.a. compounded quarterly.

- 3½ years after the initial deposit, the interest rate charged changed to 9,2% p.a., compounded monthly.
- 4 years after the initial deposit, he withdrew R1 750.
- His pay-out amount after 6 years of investment is R8 944,97.

Calculate x. (5)

[12]

QUESTION 8

8.1 Given: $f(x) = -7x^2 - 3$

8.1.1 Determine $f'(x)$ from first principles. (5)

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8.1.2 Calculate the gradient of the tangent to f at $x = -\frac{1}{2}$. (2)

8.2 Determine:

8.2.1 $\frac{dy}{dx}$ if $y = 3x(x^2 - 2)$ (3)

8.2.2 $D_x\left[\frac{\sqrt[3]{x^2} - 8x}{x}\right]$ (3)

[13]

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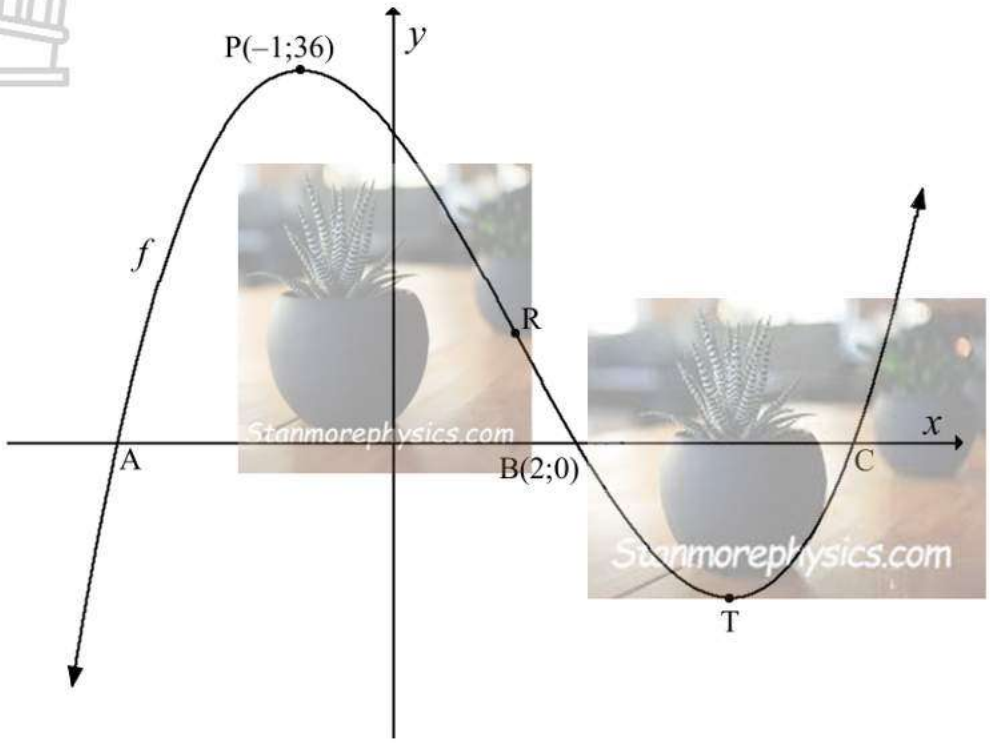
QUESTION 9

The diagram below shows the graph of $f(x)=x^3+px^2+qx+30$.
A, $B(2;0)$ and C are the x-intercepts of f, and $P(-1;36)$ and T are the turning points.
R is the point of inflection.



9.1 Show that $p=-4$ and $q=-11$. (5)

9.2 Calculate the coordinates of point T. (4)

9.3 Determine the length of AC. (4)

9.4 Determine the x-coordinate of point R. (2)

9.5 For which values of x is:

9.5.1 $f'(x)>0$ (2)

9.5.2 $\frac{f''(x)}{x}<0$ (2)

[19]

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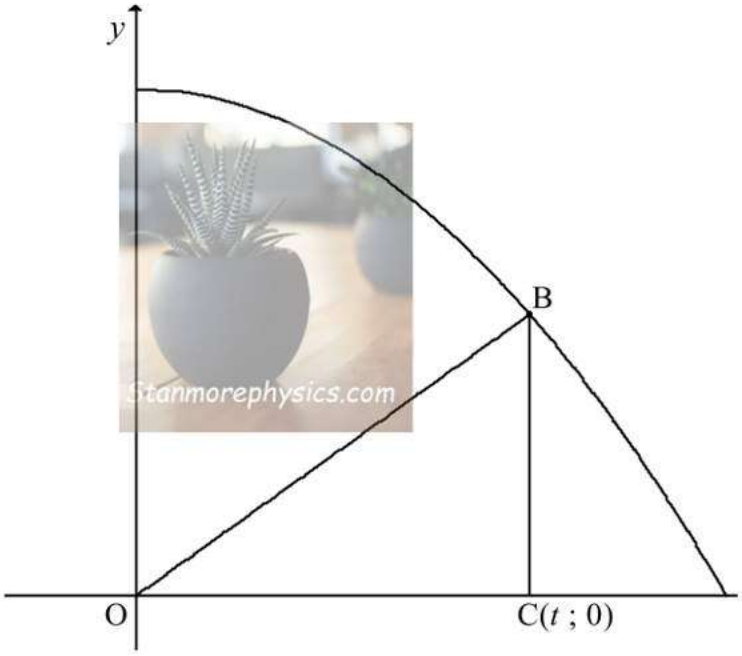
QUESTION 10

The diagram shows the graph of the parabola with equation $f(x)=9-\frac{x^2}{9};\ x\in[0\ ;\ 9]$.

BC is a line parallel to the *y*-axis, with $C(t;0)$ a point on the *x*-axis and B on the graph of *f*.
OB is drawn.



10.1 Write down the coordinates of B in terms of *t*. (2)

10.2 Show that the area of ΔOBC can be given by: $A(t)=\frac{9}{2}t-\frac{t^3}{18}$. (2)

10.3 Determine the maximum area of ΔOBC. (5)

[9]

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QUESTION 11

11.1 A bag of balls contains 7 green balls and 5 yellow balls. Sihle randomly selects two balls from the bag, one at a time, and without replacing the first one.

11.1.1 Draw a tree diagram to illustrate all possible outcomes. (3)

11.1.2 Determine the probability that she selects one yellow and one green ball, in any order. (3)

11.2 A smoke detector system in a large warehouse uses two devices: A and B.
If smoke is present, the probability that it will be detected by device A is 0,71.
The probability that it will be detected by device B is 0,83, and the probability that it will be detected by both devices is 0,58.

11.2.1 Are the two events, namely that device A will detect the smoke and that device B will detect the smoke, mutually exclusive?
Give a reason for your answer. (2)

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11.2.2 If smoke is present, what is the probability that it will **not** be detected? (3)

[11]

TOTAL: 150

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INFORMATION SHEET: MATHEMATICS

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

$$A = P(1+ni) \qquad A = P(1-ni) \qquad A = P(1-i)^n \qquad A = P(1+i)^n$$

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

$$T_n = ar^{n-1} \qquad S_n = \frac{a\left(r^n - 1\right)}{r-1} \;;\; r \neq 1 \qquad S_\infty = \frac{a}{1-r} \;;\; -1 < r < 1$$

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

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

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad \text{M}\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c \qquad y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1} \qquad m = \tan\theta$$

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

In ΔABC:

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

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

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

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

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

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

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

$$\text{P(A)} = \frac{n(\text{A})}{n(\text{S})} \qquad \text{P(A or B)} = \text{P(A)} + \text{P(B)} - \text{P(A and B)}$$

$$\hat{y} = a + bx \qquad b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$$

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MATHEMATICS P1

JUNE 2025

MARKING GUIDELINES

NATIONAL SENIOR CERTIFICATE

GRADE 12

MARKS: 150

These marking guidelines consist of 15 pages.

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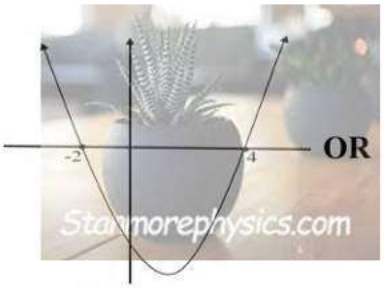
GRADE 12
Marking Guidelines

QUESTION 1

1.1.1	$x=-3$ or $x=\frac{2}{5}$	✓A answer ✓A answer (2)
1.1.2	$7x^2+5x-8=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-(5)\pm\sqrt{(5)^2-4(7)(-8)}}{2(7)}$ $x=-1,48$ or $x=0,77$ Penalise for incorrect rounding only in this sub-question.	✓A substitution into formula ✓CA answer ✓CA answer (3)
1.1.3	$\frac{7}{x^2-2x-8}>0$ $\therefore x^2-2x-8>0$ $(x-4)(x+2)>0$  OR  $x<-2$ or $x>4$	✓A $x^2-2x-8>0$ ✓A critical values ✓✓CA answer (4)
1.1.4	$3^{x+2}=42-5.3^x$ $3^x.3^2+5.3^x=42$ $3^x(9+5)=42$ $3^x=3^1$ $x=1$	✓A splitting exponents ✓CA factorising ✓CA answer (3)
1.1.5	$-\sqrt{5x-1}=5-x$ $\left(-\sqrt{5x-1}\right)^2=(5-x)^2$ $5x-1=25-10x+x^2$ $x^2-15x+26=0$ $(x-2)(x-13)=0$ $x\neq 2$ or $x=13$	✓A isolating the surd ✓CA squaring both sides ✓CA standard form ✓CA rejecting $x=2$ ✓CA answer $x=13$ (5)

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1.2	$x = 3 + y$ $(3+y)^2 - y(3+y) = 2y^2 + 7$ $9 + 6y + y^2 - 3y - y^2 - 2y^2 - 7 = 0$ $2y^2 - 3y - 2 = 0$ $(2y+1)(y-2) = 0$ $y = -\frac{1}{2}$ or $y = 2$ $x = 3 + \left(-\frac{1}{2}\right)$ or $x = 3 + 2$ $x = \frac{5}{2}$ or $x = 5$ **OR** $y = x - 3$ $x^2 - x(x-3) = 2(x-3)^2 + 7$ $x^2 - x^2 + 3x - 2x^2 + 12x - 18 - 7 = 0$ $2x^2 - 15x + 25 = 0$ $(2x-5)(x-5) = 0$ $x = \frac{5}{2}$ or $x = 5$ $y = \frac{5}{2} - 3$ or $y = 5 - 3$ $y = -\frac{1}{2}$ or $y = 2$	✓A making x the subject of the formula ✓CA substitution ✓CA standard form ✓CA factors ✓CA y-values ✓CA x-values (6) **OR** ✓A making y the subject of the formula ✓CA substitution ✓CA standard form ✓CA factors ✓CA x-values ✓CA y-values (6)
1.3	$2x^2 + px - p^2 = 0$ $\Delta = b^2 - 4ac$ $= (p)^2 - 4(2)(-p^2)$ $= p^2 + 8p^2$ $= 9p^2$ $= (3p)^2$ $\therefore$ The roots are rational **OR**	✓A substitution into $b^2 - 4ac$ ✓CA $9p^2$ ✓CA $(3p)^2$ [showing that Δ is a perfect square] (3) **OR**

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	$2x^2+px-p^2=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-(p)\pm\sqrt{(p)^2-4(2)(-p^2)}}{2(2)}$ $=\frac{-p\pm\sqrt{9p^2}}{4}$ $=\frac{-p\pm3p}{4}$ $=\frac{p}{2}$ *or* $-p$ $\therefore$ The roots are rational	✓A substitution into quadratic formula ✓CA $\frac{-p\pm\sqrt{9p^2}}{4}$ ✓CA $\frac{-p\pm3p}{4}$ (3)
		[26]

QUESTION 2

2.1.1	$T_5=-14$	✓A answer (1)
2.1.2	$T_n=a+(n-1)d$ $6+(n-1)(-5)=-239$ $6-5n+5=-239$ $5n=250$ $n=50$ $S_n=\frac{n}{2}[a+l]$ OR $S_n=\frac{n}{2}[2a+(n-1)d]$ $S_{50}=\frac{50}{2}[6+(-239)]$ $S_{50}=\frac{50}{2}[2(6)+(50-1)(-5)]$ $=-5825$ $S_{50}=25[-233]$ $=-5825$	✓A substitution in T_n ✓CA equating T_n to -239 ✓CA value of n ✓CA substitution in S_n ✓CA answer (5)
2.2.1	-9 $\quad -5$ $\quad x$ $\quad 15$ 4 $\quad x+5$ $\quad 15-x$ $x+5-4=15-x-(x+5)$ $3x=9$ $x=3$	✓A 1st differences: 4; $x+5$; $15-x$ ✓CA $x+5-4=15-x-(x+5)$ ✓CA answer (3)

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2.2.2	1st differences: 4; 8; 12 2nd difference $=4=2a$ $\therefore a=2$ $3a+b=4$ $3(2)+b=4$ $b=-2$ $a+b+c=-9$ $2-2+c=-9$ $c=-9$ $T_n=2n^2-2n-9$	✓A $a=2$ ✓CA $b=-2$ ✓CA $c=-9$ ✓ CA $T_n=2n^2-2n-9$ (4)
2.2.3	$T_n=2n^2-2n-9=2(n^2-n-4)-1$ $2(n^2-n-4)$ is **even** An even number minus 1 is an odd number **OR** $T_n=2n^2-2n-9=2(n^2-n)-9$ $2(n^2-n)$ is even; 9 is odd. An even number minus an odd number is an odd number	✓CA $T_n=2(n^2-n-4)-1$ ✓CA conclusion (2) **OR** ✓CA $T_n=2(n^2-n)-9$ ✓CA conclusion (2)
		[15]

QUESTION 3

3.1.1	$4+4.p^{-1}+4.p^{-2}+\ldots=6$ $4+\frac{4}{p}+\frac{4}{p^2}+\ldots=6$ $\therefore r=\frac{1}{p}$ $S_\infty=\frac{a}{1-r}$ $\therefore \frac{4}{1-\frac{1}{p}}=6$ $4=6\left(1-\frac{1}{p}\right)$ $4=6-\frac{6}{p}$ $\frac{6}{p}=2$ $p=3$	✓A $r=\frac{1}{p}$ ✓CA substitution in S_∞ ✓CA simplification ✓CA answer (4)

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3.1.2	$4;\ 4.3^{-1};\ 4.3^{-2}$ **OR** $4;\ \frac{4}{3};\ \frac{4}{3^2}$ **OR** $4;\ \frac{4}{3};\ \frac{4}{9}$	✓CA answer (1)
3.2.1	$5^4 = 625$ Answer only: Full marks.	✓A 5^4 ✓A 625 (2)
3.2.2	$5^1 + 5^2 + 5^3 + ... + 5^{11}$ $S_n = \frac{a(r^n - 1)}{r - 1}$ $S_{11} = \frac{5(5^{11} - 1)}{5 - 1}$ $= 61\ 035\ 155$	✓A $r = 5$ ✓A substituting $n = 11$ into S_n formula ✓CA answer (3)
		[10]

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QUESTION 4

4.1	$A(-4;3)$	✓A answer (1)
4.2	For x-intercept, let $y = 0$: $0 = \frac{-9}{x+4} + 3$ $-3 = \frac{-9}{x+4}$ $x + 4 = 3$ $x = -1$ $B(-1\ ;\ 0)$	✓A substitute $y = 0$ ✓A answer (2)
4.3	For y-intercept, let $x = 0$: $y = \frac{-9}{0+4} + 3$ $y = \frac{3}{4}$ $C\left(0\ ;\ \frac{3}{4}\right)$	✓A substitute $x = 0$ ✓A answer (2)
4.4	Translate h 4 units to the right, and 3 units down.	✓A 4 units to the right ✓A 3 units down (2)

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4.5	The points of intersection between j and the axis of symmetry of j, i.e. between $y=\frac{-9}{x}$ and $y=-x$: $\frac{-9}{x}=-x$ $x^2=9$ $x=3$ or $x=-3$ $y=-3$ or $y=3$ The points are $(3\,;-3)$ and $(-3\,;3)$ OR Distance between origin and any point on the graph $=\sqrt{(0-x)^2+\left(0-\left(\frac{9}{x}\right)\right)^2}$ $=\sqrt{x^2+\frac{81}{x^2}}$ For a minimum distance, $\frac{d}{dx}\left(x^2+\frac{81}{x^2}\right)=0$ $2x-162x^{-3}=0$ $2x^4=162$ $x^4=81$ $x=3$ or $x=-3$ Therefore, the points on j closest to the origin are: $(3\,;-3)$ and $(-3\,;3)$.	✓A points of intersection ✓A $\frac{-9}{x}=-x$ ✓A $(3\,;-3)$ ✓A $(-3\,;3)$ (4) OR ✓A $\sqrt{(0-x)^2+\left(0-\left(\frac{9}{x}\right)\right)^2}$ ✓A $\frac{d}{dx}\left(x^2+\frac{81}{x^2}\right)=0$ ✓A $(3\,;-3)$ ✓A $(-3\,;3)$ (4)
		[11]

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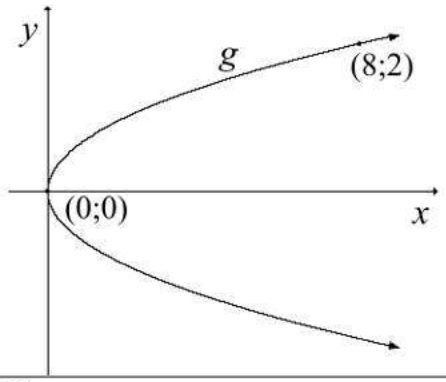
QUESTION 5

5.1	Substitute $\left(-\frac{1}{2}\ ;\ \frac{1}{2}\right)$ in $f(x)=a^x$: $a^{-\frac{1}{2}}=\left(\frac{1}{2}\right)$ $\frac{1}{\sqrt{a}}=\frac{1}{2}$ $\therefore \sqrt{a}=2$ $a=4$ Substitute $\left(-\frac{1}{2}\ ;\ \frac{1}{2}\right)$ in $g(x)=bx^2$: $\frac{1}{2}=b\left(-\frac{1}{2}\right)^2$ $\frac{1}{2}=\frac{1}{4}b$ $\therefore b=2$	✓A substitution ✓A value of a ✓A substitution ✓A value of b (4)
5.2		✓A shape ✓A coordinates of any point on the graph, e.g. $(0;0)$, $(8;2)$, $(2;1)$, $(8;-2)$, $(2;-1)$. (2)
5.3	No .	✓A answer (1)
5.4	$f(x)=4^x$ or $y=4^x$ Inverse: $x=4^y$ $y=\log_4 x$ domain of inverse = range of function Therefore: $y=\log_4 x,\ x\in\left[\frac{1}{4};16\right]$	✓CA $x=4^y$ (swopping x and y) ✓CA $y=\log_4 x$ ✓CA ✓CA $x\in\left[\frac{1}{4};16\right]$ (4)
5.5	$-\frac{1}{2}<x<0$	✓A ✓A answer (2)
		[13]

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QUESTION 6

6.1	$x^2+5x-6=0$ $(x+6)(x-1)=0$ $x=-6$ or $x=1$ $A(-6;0)$; $B(1;0)$ If A and B are not mentioned, max. 2/3	✓A factors ✓CA answer ✓CA answer (3)
6.2	$C(0;-6)$ $m=\frac{-6-0}{0+6}$ $=-1$ $y=-x-6$	✓A $C(0;-6)$ ✓CA $m=-1$ ✓CA answer (3)
6.3	The x-values of the points of intersection are the roots of: $g(x)=f(x)+k$ $-x-6=x^2+5x-6+k$ $x^2+6x+k=0$ If there are no points of intersection, the equation will have no real roots, i.e.: $b^2-4ac<0$ $6^2-4(1)(k)<0$ $-4k<-36$ $\therefore k>9$ **OR** f is translated upwards until there are no points of intersection between f and h. Just before they do not intersect any more, h will be a tangent to f. Calculating the value of k when h will be a tangent to f: $m_g=h'(x)$ $\therefore -1=2x+5$ $x=-3$ $g(-3)=-(-3)-6=-3$ $\therefore$ The contact point will be: $(-3;-3)$. $f(-3)=(-3)^2+5(-3)-6=-12$ From -12 to -3 indicates an upward translation of 9 units. $\therefore$ For g and h not to intersect, it means that f has to be translated upwards by **more than 9 units**. $\therefore k>9$	✓CA $-x-6=x^2+5x-6+k$ ✓CA standard form ✓A $b^2-4ac<0$ ✓CA substitution ✓CA answer (5) **OR** ✓CA $-1=2x+5$ ✓CA $x=-3$ ✓CA calculating $g(-3)$ ✓CA calculating $f(-3)$ ✓CA answer (5)
		[11]

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QUESTION 7

7.1.1	Bank B. Because interest is compounded more frequently, she will get more interest from Bank B. If the candidate calculated amounts of money from the two banks, and then conclude correctly **OR** If the candidate calculates effective interest rates and then conclude correctly AWARD THE MARKS	✓A Bank B ✓A more interest (2)
7.1.2	$1+i_e=\left(1+\frac{i_N}{m}\right)^m$ $i_e=\left(1+\frac{0,085}{12}\right)^{12}-1$ $i_e=8,84\%$ p.a.	✓A formula ✓A substitution ✓CA answer (3)
7.2	$A=P(1-i)^n$ $230\ 476,05=P(1-0,13)^3$ $P=\frac{230\ 476,05}{(1-0,13)^3}$ $P=R\ 350\ 000$	✓A substitution ✓CA answer (2)
7.3	$8\ 944,97=x\left(1+\frac{0,087}{4}\right)^{14}\left(1+\frac{0,092}{12}\right)^{30}-1\ 750\left(1+\frac{0,092}{12}\right)^{24}$ $x\left(1+\frac{0,087}{4}\right)^{14}\left(1+\frac{0,092}{12}\right)^{30}=8\ 944,97+1\ 750\left(1+\frac{0,092}{12}\right)^{24}$ $x=R6\ 500$ **OR**	✓A $x\left(1+\frac{0,087}{4}\right)^{14}$ ✓A $\times\left(1+\frac{0,092}{12}\right)^{30}$ ✓A $-1\ 750\left(1+\frac{0,12}{12}\right)^{24}$ ✓CA equated to R8944,97 ✓CA answer (5) **OR**

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	Amount after 3½ years $= x\left(1+\frac{0,087}{4}\right)^{14} = 1,351528006x$	✓A $x\left(1+\frac{0,087}{4}\right)^{14}$
	Six months interest added: $1,351528006x\left(1+\frac{0,092}{12}\right)^{6}$	✓A $\times\left(1+\frac{0,092}{12}\right)^{6}$
	Withdrawal of R1750: $1,414902142x-1750$	
	Two more years' interest added: $(1,414902142x-1750)\left(1+\frac{0,092}{12}\right)^{24}$	✓A $-1\ 750\left(1+\frac{0,12}{12}\right)^{24}$
	$(1,414902142x-1750)(1,201172602)=8944,97$	✓CA equated to R8944,97
	$1,699541693x-2102,05=8944,97$	
	$x=$ R6 500	✓CA answer (5)
		[12]

QUESTION 8

Penalise once only for incorrect notation in this question.

8.1.1	$f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{-7(x+h)^2-3-(-7x^2-3)}{h}$ $=\lim_{h\to 0}\frac{-7x^2-14xh-7h^2-3-(-7x^2-3)}{h}$ $=\lim_{h\to 0}\frac{-14xh-7h^2}{h}$ $=\lim_{h\to 0}\frac{h(-14x-7h)}{h}$ $=\lim_{h\to 0}(-14x-7h)$ $=-14x$	✓A substitution into the formula ✓CA $f(x+h)=-7x^2-14xh-7h^2-3$ ✓CA simplification ✓CA factors ✓CA answer (5)
8.1.2	gradient of tangent at $x=-\frac{1}{2}$ $=f'\left(-\frac{1}{2}\right)$ $=-14\left(-\frac{1}{2}\right)$ $=7$	✓CA $-14\left(-\frac{1}{2}\right)$ ✓CA answer (2)
8.2.1	$y=3x(x^2-2)$ $=3x^3-6x$ $\frac{dy}{dx}=9x^2-6$	✓A $3x^3-6x$ ✓CA $9x^2$ CA ✓-6 (3)

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8.2.2	$D_x\left[\frac{\sqrt[3]{x^2}-8x}{x}\right]$ $=D_x\left[\frac{x^{\frac{2}{3}}-8x}{x}\right]$ $=D_x\left[x^{-\frac{1}{3}}-8\right]$ $=-\frac{1}{3}x^{-\frac{4}{3}}$	✓A $x^{\frac{2}{3}}$ ✓CA $D_x\left[x^{-\frac{1}{3}}-8\right]$ ✓CA answer (3)
		[13]

QUESTION 9

9.1	$f(x)=x^3+px^2+qx+30$ $f'(x)=3x^2+2px+q=0$ $f'(-1)=3(-1)^2+2p(-1)+q=0$ $q=2p-3.....\rightarrow(1)$ $f(-1)=(-1)^3+p(-1)^2+q(-1)+30=36$ $p-q=7.....\rightarrow(2)$ Substitute (1) into (2) $p-(2p-3)=7$ $p=-4$ $q=2(-4)-3$ $q=-11$ **OR** $f(2)=(2)^3+p(2)^2+q(2)+30=0$ $p-q=7.....\rightarrow(1)$ $f(-1)=(-1)^3+p(-1)^2+q(-1)+30=36$ $2p+q=-19$ $q=-2p-19.....\rightarrow(2)$ substitute (2) into (1): $p-(-2p-19)=7$ $p=-4$ $q=-11$	✓A derivative ✓A $f'(-1)=0$ ✓A $q=2p-3$ ✓A $p-q=7$ ✓A solving simultaneously (5) **OR** ✓A substitute in $f(2)=0$ ✓A $p-q=7$ ✓A substitute in $f(-1)=36$ ✓A $2p+q=-19$ ✓A solving simultaneously (5)

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9.2	$f'(x)=3x^2-8x-11=0$ $(3x-11)(x+1)=0$ $x=\frac{11}{3}$ or $x\neq -1$ $f\left(\frac{11}{3}\right)=\left(\frac{11}{3}\right)^3-4\left(\frac{11}{3}\right)^2-11\left(\frac{11}{3}\right)+30=-\frac{400}{27}=-57,14$ $\therefore \text{T}\left(\frac{11}{3};-\frac{400}{27}\right)=\text{T}\left(\frac{11}{3};-57,14\right)$	✓A $f'(x)=3x^2-8x-11=0$ ✓CA factors ✓CA $x=\frac{11}{3}$ only ✓CA $f\left(\frac{11}{3}\right)=-\frac{400}{27}=-57,14$ (4)
9.3	For x-intercepts, let $y=0$: $x^3-4x^2-11x+30=0$ $(x-2)(x^2-2x-15)=0$ $(x-2)(x-5)(x+3)=0$ $x=2$ or $x=5$ or $x=-3$ Length of AC $=8$ units	✓A $(x-2)$ ✓A $(x^2-2x-15)$ ✓CA x-values ✓CA answer (4)
9.4	$f''(x)=6x-8=0$ $\therefore x_R=\frac{4}{3}$ **OR** $x_R=\frac{-1+\frac{11}{3}}{2}$ $=\frac{4}{3}$	✓A $f''(x)=6x-8=0$ ✓CA answer (2) **OR** ✓A using midpoint formula ✓CA answer (2)
9.5.1	$x<-1$ or $x>\frac{11}{3}$ **OR** $x\in(-\infty\ ;\ -1)$ or $x\in\left(\frac{11}{3}\ ;\ \infty\right)$	✓A✓CA answer **OR** ✓A✓CA answer (2)
9.5.2	$0<x<\frac{4}{3}$ **OR** $x\in\left(0;\frac{4}{3}\right)$	✓A✓CA answer **OR** ✓A✓CA answer (2)
		[19]

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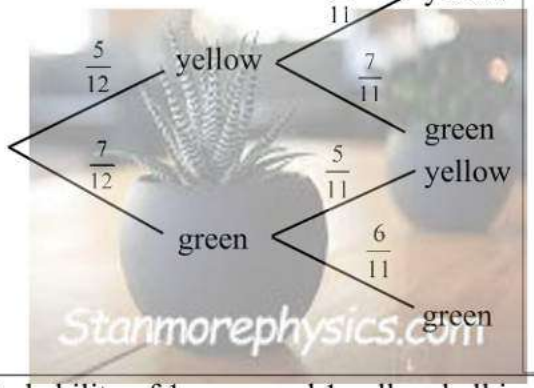
QUESTION 10

10.1	B$\left(t\ ;\ 9-\frac{t^2}{9}\right)$	✓A t ✓A $9-\frac{t^2}{9}$ (2)
10.2	Area $=\frac{1}{2}bh$ $A(t)=\frac{1}{2}t\left(9-\frac{t^2}{9}\right)$ $=\frac{9}{2}t-\frac{t^3}{18}$	✓A $\frac{1}{2}bh$ ✓A $\frac{1}{2}t\left(9-\frac{t^2}{9}\right)$ (2)
10.3	For a maximum: $A'(t)=0$ $\frac{9}{2}-\frac{1}{6}t^2=0$ $t^2=27$ $t=5,2$ units $A(5,2)=\frac{9}{2}(5,2)-\frac{(5,2)^3}{18}$ $=15,59$	✓A $A'(t)=0$ ✓A $A'(t)=\frac{9}{2}-\frac{1}{6}t^2$ ✓CA value of t ✓CA substitution ✓CA answer (5)
		[9]

QUESTION 11

11.1.1	 **Combined Outcomes**: yellow; yellow yellow; green green; yellow green; green	✓A first branch ✓A second branch ✓A probability values on diagram (3)
11.1.2	Probability of 1 green and 1 yellow ball in any order $=\frac{5}{12}\times\frac{7}{11}+\frac{7}{12}\times\frac{5}{11}$ $=\frac{70}{132}=\frac{35}{66}=0,53$	✓CA $\frac{5}{12}\times\frac{7}{11}$ ✓CA $+\frac{7}{12}\times\frac{5}{11}$ ✓CA answer (3)

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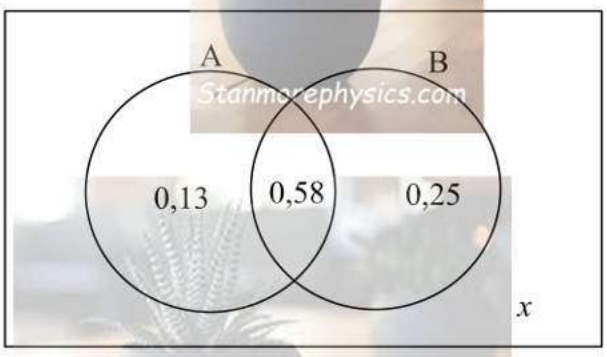
11.2.1	No, because $P(A \text{ and } B) \neq 0$	✓A No ✓A $P(A \text{ and } B) \neq 0$ (2)
11.2.2	$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $= 0,71 + 0,83 - 0,58$ $= 0,96$ Probability that smoke is not detected $= P[\text{not}(A \text{ or } B)]$ $= 1 - P(A \text{ or } B)$ $= 1 - 0,96$ $= 0,04$ **OR**  $P(A \text{ or } B) = 0,13 + 0,58 + 0,25$ $= 0,96$ $\therefore P[\text{not}(A \text{ or } B)] = 1 - 0,96$ $= 0,04$	✓A $0,71 + 0,83 - 0,58$ ✓A $0,96$ ✓CA answer (3) **OR** ✓A Venn diagram with probability values ✓A $P(A \text{ or } B)$ ✓CA answer (3)
		[11]

TOTAL: 150

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