PLC COMMON PAPER

JOHANNESBURG EAST DISTRICT

GRADE 11

MATHEMATICS P1

JUNE 2026

TIME: 2 hours

MARKS: 100

This question paper consists of 7 pages including the cover page

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

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

QUESTION 1

1.1 Simplify the following expressions, WITHOUT using a calculator

1.1.1 $\left(\frac{16}{x^{-4}}\right)^{\frac{3}{4}}$ (3)

1.1.2 $(\sqrt{8x}-\sqrt{12x})(\sqrt{8x}+\sqrt{12x})$ (3)

1.1.3 $\frac{2^{2n-4}\cdot 8^{5-2n}}{16^{3-n}}$ (4)

1.2

Given: $m+\frac{64}{m}=16$

1.2.1 Solve for m. (3)

1.2.2 Hence, solve for x: $2^x+2^{6-x}=16$ (3)

1.3 Given that $2^x=3$, determine the value of 8^{x+1} (3)

[19]

QUESTION 2

2.1 Solve for x:

2.1.1 $x(3+x)=0$ (2)

2.1.2 $3x^2+8x+2=0$ (correct to TWO decimal places) (3)

2.1.3 $-x^2+2x+15<0$ (4)

2.1.4 $\sqrt{2(1-x)}=x-1$ (4)

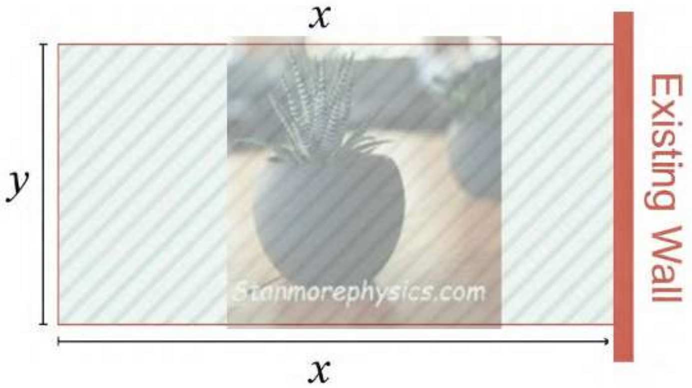
2.2 Solve for x and y simultaneously: (5)

$y - 2 = 2(x - 1)^2$ and $y - x = 2$

2.3 For which value(s) of m will the equation $x^2 + mx + 4 = 3x$ have non-real roots? (5)

2.4 A farmer wants to build a rectangular garden against an existing straight wall, as shown in the diagram.

The farmer has **12m** of mesh fencing available.



2.4.1 Write an equation in terms of x and y representing the total length of fencing used.

Hence show that:

$$2x + y = 12$$ (1)

2.4.2 Hence, show that the area, A, can be written as:

$A = 12x - 2x^2$ (3)

2.4.3 Determine the **maximum possible area** of the garden. (4)

[31]

QUESTION 3

Given: $f(x) = 2 - \frac{1}{x-3}$

3.1 Write down the equations of the asymptotes of *f*. (2)

3.2 Write down the domain of *f*. (1)

3.3 Determine the coordinates of the *x*-intercept of *f*. (2)

3.4 Calculate the coordinates of the *y*-intercept of *f*. (2)

3.5 Sketch the graph of *f* in your ANSWER BOOK clearly indicating ALL asymptotes and intercepts with the axes. (3)

3.6 Determine the value(s) of *x* for which $f(x) \leq 0$. (2)

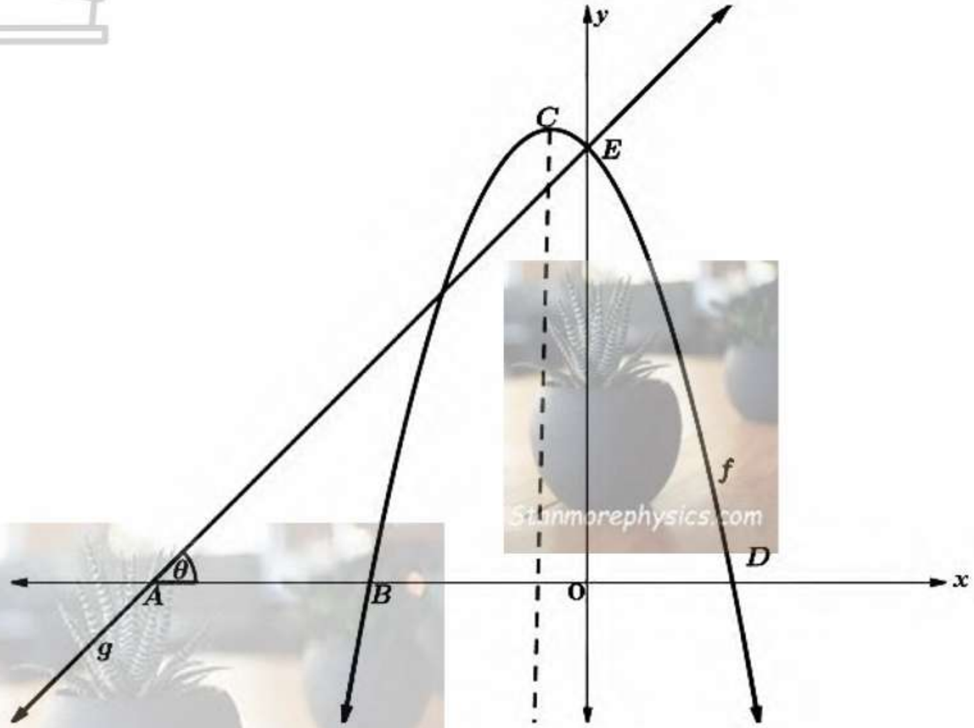
3.7 ONE of the axes of symmetry of *f* is an increasing function. Determine the equation of this axis of symmetry. (3)

[15]

QUESTION 4

The diagram below shows the graph of $f(x) = -x^2 - x + 6$. The parabola cuts the $x - axis$ at B and D and the $y - axis$ at E. C is the turning point of *f*.

The straight-line graph g has an angle of inclination of θ and cuts the *x-axis* and *y-axis* at A and E respectively.



4.1	Determine the coordinates of B and D.	(4)
4.2	Write down the equation of the axis of symmetry of *f*.	(2)
4.3	Determine the range of *f*.	(3)
4.4	Given that $\theta = 45°$. Write down the equation of *g* in the form $g(x) = mx + c$	(3)
4.5	Determine the equation of *h*, if *h* is the reflection of *f* about the *x-axis* and then translated 3 units to the right. Leave your answer in the form $h(x) = a(x + p)^2 + q$	(3)
4.6	Write down the values of *x* for which $x \cdot g(x) < 0$	(2)
4.7	For which value(s) of *k* will $f(x) = k$ have 2 distinct negative real roots?	(2)
4.8	If $f(p) = f(r) = 4$, calculate the value of $p - r \ if \ r < 0$	(4)

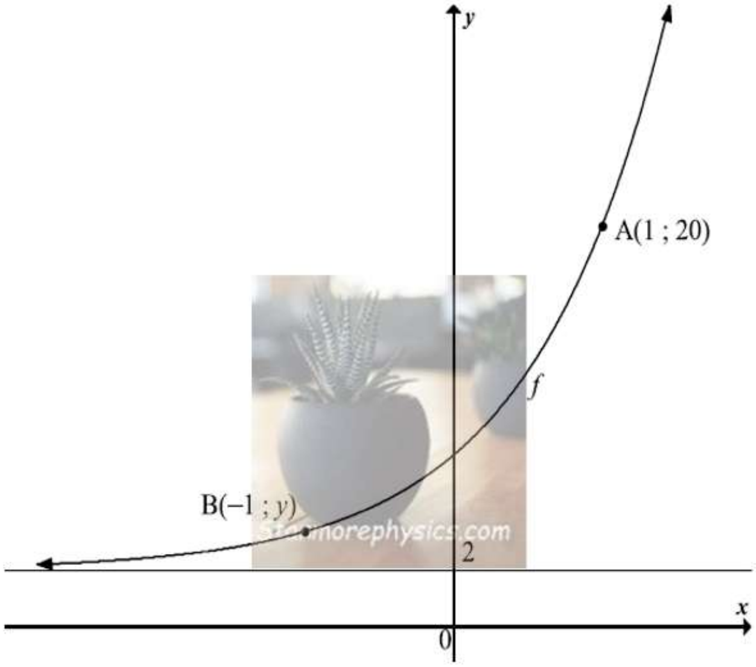
[23]

QUESTION 5

The sketch below is the graph of $f(x) = 2 \cdot b^{x+1} + q$.

The graph of *f* passes through the points $A(1; 20)$ and $B(-1; y)$.

The line $y = 2$ is an asymptote of *f*.



5.1 Show that $b = 3$ and $q = 2$ (3)

5.2 Calculate the $y - coordinate$ of the point B. (2)

5.3 Determine the average gradient of the curve between the points A and B. (2)

5.4 A new function *h* is obtained when *f* is reflected about its asymptote.

Determine the equation of *h*. (2)

5.5 The function of $g(x) = b^x + q$ has the following properties:

- $q > 0$
- $0 < b < 1$

Draw a neat sketch of *g*. Indicate clearly on your sketch the asymptote and the *y*-intercept. (3)

[12]

TOTAL: 100

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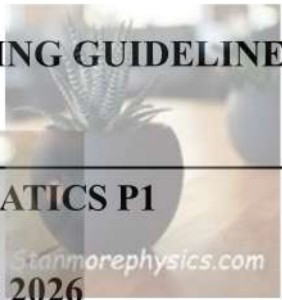


MARKING GUIDELINE

MATHEMATICS P1

JUNE 2026

MARKS: 100

This marking guideline consists of 11 pages including the cover page.

NOTES:

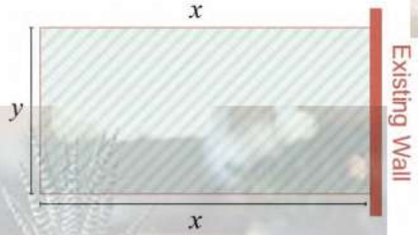
- If a candidate answers a question TWICE, only mark the FIRST attempt.
- If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed-out version.
- Consistent accuracy applies in ALL aspects of the marking guidelines. Stop marking at the second calculation error.
- Assuming answers/values to solve a problem is NOT acceptable.

QUESTION 1		
1.1.1	$\left(\frac{16}{x^{-4}}\right)^{\frac{3}{4}}$ $= (16x^4)^{\frac{3}{4}}$ $= (2^4x^4)^{\frac{3}{4}}$ $= (2x)^3$ $= 8x^3$ OR $= \left(\sqrt[4]{16x^4}\right)^3$ $= (2x)^3$ $= 8x^3$	✓ $(16x^4)^{\frac{3}{4}}$ ✓2^4 ✓ answer **OR** ✓ $\left(\sqrt[4]{16x^4}\right)^3$ ✓$(2x)^3$ ✓ answer **(3)**
1.1.2	$\left(\sqrt{8x}-\sqrt{12x}\right)\left(\sqrt{8x}+\sqrt{12x}\right)$ $= \left(\sqrt{8x}\right)^2 - \left(\sqrt{12x}\right)^2$ $= 8x - 12x$ $= -4x$ **OR** $\left(\sqrt{8x}-\sqrt{12x}\right)\left(\sqrt{8x}+\sqrt{12x}\right)$ $= 8x - 12x$ $= -4x$	✓ applying $a^2 - b^2$ *correctly* ✓ correct squaring ✓ answer **(3)** **OR** ✓$8x$ ✓$-12x$ ✓$-4x$

1.1.3	$\frac{2^{2n-4}\cdot 8^{5-2n}}{16^{3-n}}$ $=\frac{2^{2n-4}\cdot 2^{3(5-2n)}}{2^{4(3-n)}}$ $=\frac{2^{2n-4}\cdot 2^{15-6n}}{2^{12-4n}}$ $=\frac{2^{-4n+11}}{2^{12-4n}}$ $=2^{-4n+4n+11-12}$ $=2^{-1} or \ \frac{1}{2}$	✓ 2^3 ✓ 2^{12-4n} ✓ $2^{-4n+4n+11-12}$ ✓ answer **(4)**
1.2.1	$m+\frac{64}{m}=16$ $m^2+64=16m$ $m^2-16m+64=0$ $(m-8)^2=0$ $m=8$	✓ standard form ✓ factors ✓ answer **(3)**
1.2.2	$2^x+2^{6-x}=16$ $2^x+\frac{64}{2^x}=16$ $2^x=8$ (from 1.2.1) $2^x=2^3$ $x=3$	✓ $\frac{64}{2^x}$ ✓ $2^x=8$ ✓ answer **(3)**
1.3	Given $2^x=3$ 8^{x+1} $=(2^3)^{x+1}$ $=2^{3x+3}$ $=(2^x)^3\cdot 2^3$ $=(3)^3\cdot 8$ $=27\cdot 8$ $=216$	✓ applying the law $(a^m)^n=a^{m\cdot n}$ ✓ sub $2^x=3$ ✓ answer **(3)**
		[19]

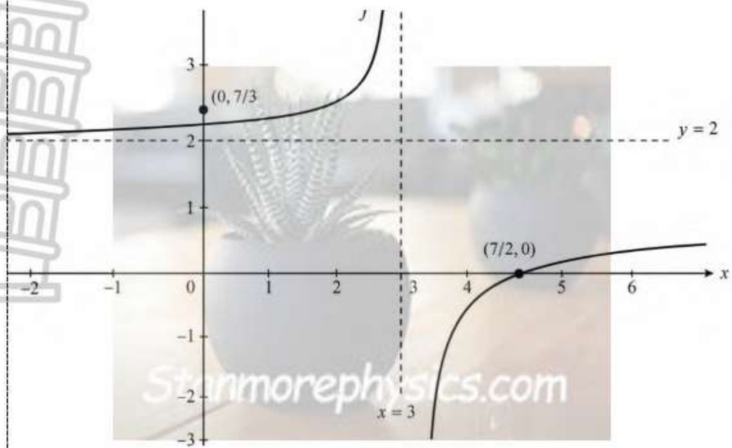
QUESTION 2		
2.1.1	$x(3+x)=0$ $x=0 \ or \ x=-3$	✓ $x=0$ ✓ $x=-3$ **(2)**
2.1.2	$3x^2+8x+2=0$ $=\frac{-8\pm\sqrt{8^2-4(3)(2)}}{2(3)}$ $x=-2{,}39 \ or \ x=-0{,}28$	✓ substitution into correct formula ✓$-2{,}39$ ✓ $-0{,}28$ **(3)**
2.1.3	$-x^2+2x+15<0$ $x^2-2x-15>0$ $(x-5)(x+3)>0$ $C.Vs \ are$: $x=5 \ or \ x=-3$ $\therefore x<-3 \ or \ x>5$ OR/OF $(-\infty;-3) or (5;\infty)$	✓ standard form ✓ critical values ✓ $x<-3$ ✓ $x>5$ **(4)**
2.1.4	$\sqrt{2(1-x)}=x-1$ $\left(\sqrt{2(1-x)}\right)^2=(x-1)^2$ $2(1-x)=x^2-2x+1$ $2-2x=x^2-2x+1$ $x^2-1=0$ $(x-1)(x+1)=0$ $x=1 \ or \ x\neq-1$	✓ squaring both sides ✓ simplification ✓ standard form ✓ Answer with selection **(4)**
2.2.	$y-2=2(x-1)^2$ and $y-x=2$ $y=2+x \ldots\ldots\ldots\ldots\ldots (3)$ Sub eq(3) into eq(1): $2+x-2=2(x-1)^2$ $x=2x^2-4x+2$ $2x^2-5x+2=0$ $(2x-1)(x-2)=0$ $x=\frac{1}{2} \ or \ x=2$	✓ equation 3 ✓ substitution ✓ standard form ✓ x-values

	Sub *x*-values into eq(3):	
	$y = 2 + \frac{1}{2}$ or $y = 2 + 2$	
	$y = \frac{5}{2}$ or $y = 4$	✓*y*-values
	OR	**OR**
	$y - 2 = 2(x-1)^2$ and $y - x = 2$	
	$y - 2 = x$ ……………(3)	✓ equation 3
	Sub eq(3) into eq(1):	
	$y - 2 = 2(y - 2 - 1)^2$	✓ substitution
	$y - 2 = 2y^2 - 12y + 18$	
	$2y^2 - 13y + 20 = 0$	✓ standard form
	$(2y - 5)(y - 4) = 0$	
	$y = \frac{5}{2}$ or $y = 4$	✓*y*-values
	Sub *x*-values into eq(3):	
	$x = \frac{5}{2} - 2$ or $y = 4 - 2$	
	$x = \frac{1}{2}$ or $x = 2$	✓*x*-values
	OR	**OR**
	$y - 2 = 2(x-1)^2$ and $y - x = 2$	✓ equation 3
	$y = 2(x-1)^2 + 2$ …………(3)	
	Sub eq(3) into eq(1):	✓ substitution
	$2(x-1)^2 + 2 - \mathrm{x} = 2$	
	$2x^2 - 4x + 2 + 2 - x = 2$	✓ standard form
	$2x^2 - 5x + 2 = 0$	
	$(2x - 1)(x - 2) = 0$	✓*x*-values
	$x = \frac{1}{2}$ or $x = 2$	
	Sub *x*-values into eq(3):	
	$y = 2 + \frac{1}{2}$ or $y = 2 + 2$	
	$y = \frac{5}{2}$ or $y = 4$	✓*y*-values **(5)**

2.3	$x^2 + mx + 4 = 3x$ $x^2 + mx - 3x + 4 = 0$ $x^2 + x(m-3) + 4 = 0$ $b^2 - 4ac < 0$ $(m-3)^2 - 4(1)(4) < 0$ $m^2 - 6m + 9 - 16 < 0$ $m^2 - 6m - 7 < 0$ $(m-7)(m+1) < 0$ C.Vs are: $m = 7\ or\ m = -1$ $\therefore\ -1 < m < 7$	✓ standard form ✓ $\Delta < 0$ ✓ simplification of Δ ✓ critical values ✓ answer **(5)**
2.4		
2.4.1	$x + y + x = 12$ $2x + y = 12$	✓ $x + y + x = 12$ **(1)**
2.4.2	$A = l \times b$ $A = x \times y$ $but\ y = 12 - 2x$ $\therefore A = x(12 - 2x)$ $A = 12x - 2x^2$	✓ expression for area ✓ making y the subject ✓ substituting **(3)**
2.4.3	$A(x) = 12x - 2x^2$ $x = \frac{-12}{2(-2)}$ $x = 3$ $A(x) = 12(3) - 2(3)^2$ $\therefore\ the\ maximum\ possible\ area = 18\ units^2$	✓ sub ✓ x-coordinate of T.P. ✓ sub ✓ answer

	OR $A(x) = -2x^2 + 12x$ $A(x) = -2(x^2 - 6x)$ $A(x) = -2(x^2 - 6x + 9 - 9)$ $A(x) = -2[(x-3)^2 - 9]$ $A(x) = -2(x-3)^2 + 18$ $\therefore T.P\ (3; 18)$ $\therefore maximum\ \ area\ is\ 18\ units^2\ when\ x = 3$	✓ factoring out *-2* ✓ completing the square ✓ simplified vertex form ✓ answer **(4)**
		[31]

QUESTION 3		
3.1	$f(x) = \frac{-1}{x-3} + 2$ $x = 3$ $y = 2$	✓ $x = 3$ ✓ $y = 2$ **(2)**
3.2	$x \neq 3; x \epsilon \mathbb{R}$	✓ answer **(1)**
3.3	$0 = 2 - \frac{1}{x-3}$ $-2 = \frac{-1}{x-3}$ $-2(x-3) = -1$ $2x + 6 = -1$ $x = {}^7/_2$ $\therefore \left(\frac{7}{2}; 0\right)$	✓ *y=0* ✓ answer **(2)**
3.4	$y = 2 - \frac{1}{0-3}$ $y = {}^7/_3$ $\therefore \left(0; \frac{7}{3}\right)$	✓ *x=0* ✓ answer **(2)**

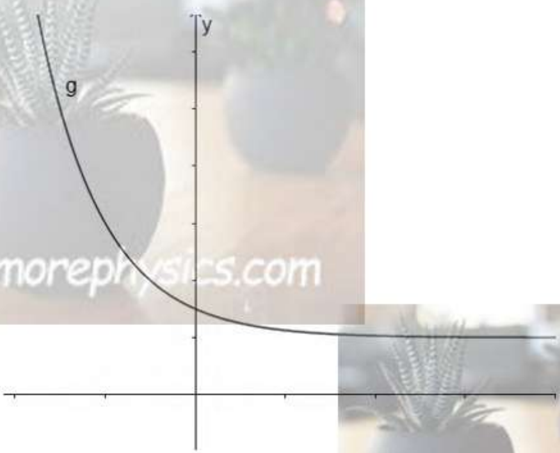
3.5		✓ asymptotes ✓ shape ✓ intercepts **(3)**
3.6	$3 < x < {}^{7}/_{2}$ **OR** $x \in \left(3; \frac{7}{2}\right)$	✓✓ answer **(2)**
3.7	$y = x + c \quad sub(3;2)$ $2 = 3 + c$ $y = x - 1$	✓ positive gradient ✓ sub into correct equation ✓ answer **(3)**
		[15]

QUESTION 4		
4.1	$0 = -x^2 - x + 6$ $x^2 + x - 6 = 0$ $(x+3)(x-2) = 0$ $x = -3 \text{ or } x = 2$ $\therefore B(-3;0)$ and $D(2;0)$	✓ $y = 0$ ✓ factors ✓ B coordinates ✓ D coordinates **(4)**
4.2	$x = \frac{-b}{2a}$ $x = \frac{-(-1)}{2(-1)}$ $x = -\frac{1}{2}$ **OR** $x = \frac{x_{1+}x_2}{2}$ $= \frac{(-3)+(2)}{2}$ $= -\frac{1}{2}$	✓ method ✓ answer OR ✓ method ✓ answer **(2)**

4.3	$f(-\frac{1}{2})$ $= -\left(-\frac{1}{2}\right)^2 - \left(-\frac{1}{2}\right) + 6$ $= 6\frac{1}{4}$ **Answer only full marks** $TP\left(-\frac{1}{2};\frac{25}{4}\right)$ Range $y \in (-\infty;\frac{25}{4}]$ **OR** $y \leq \frac{25}{4}$	✓ Subst ✓ $6\frac{1}{4}$ ✓ Answer **(3)**
4.4	$E(0;6)$ $tan45° = m_{AE}$ $m_{AE} = 1$ $g(x) = x + 6$	✓ coordinates of E ✓ gradient ✓ answer **(3)**
4.5	$f(x) = -\left(x+\frac{1}{2}\right)^2 + \frac{25}{4}$ $h(x) = \left(x+\frac{1}{2}-3\right)^2 - \frac{25}{4}$ $h(x) = \left(x-\frac{5}{2}\right)^2 - \frac{25}{4}$ OR $f(x) = -x^2 - x + 6$ $h(x) = x^2 + x - 6$ $h(x) = (x-3)^2 + (x-3) - 6$ $h(x) = x^2 - 5x$ $h(x) = \left(x-\frac{5}{2}\right)^2 - \frac{25}{4}$	✓ in T.P form ✓ $\left(x-\frac{5}{2}\right)^2$ ✓ $-\frac{25}{4}$ OR ✓ $(x-3)^2 + (x-3) - 6$ ✓ $\left(x-\frac{5}{2}\right)^2$ ✓ $-\frac{25}{4}$ **(3)**
4.6	$-6 < x < 0$ OR $x \in (-6;0)$	✓CVs ✓ notation **(2)**

4.7	$6 < k < {}^{25}/_{4}$	✓✓answer **(2)**
4.8	$r = -2$ *by* symmetry $p = 1$ $p - r = 3$ OR $-x^2 - x + 6 = 4$ $-x^2 - x + 2 = 0$ $x^2 + x - 2 = 0$ $(x+2)(x-1) = 0$ $x = -2$ *or* $x = 1$ $r = -2$ $p = 1$ $p - r = 3$	✓ $r = -2$ ✓✓ $p = 1$ ✓ answer **(4)**
		[23]

QUESTION 5		
5.1	$q = 2$ $f(x) = 2 \cdot b^{x+1} + 2$ *sub* $A(1;20)$ $20 = 2 \cdot b^{1+1} + 2$ $18 = 2 \cdot b^2$ $9 = b^2$ $b = 3$	✓ sub $q = 2$ ✓ sub $A(1;20)$ ✓ $9 = b^2$ **(3)**
5.2	$y = 2 \cdot 3^{x+1} + 2$ *sub* $B(-1;y)$ $y = 2 \cdot 3^{-1+1} + 2$ $y = 2 \cdot 1 + 2$ $y = 4$	✓ substitution ✓ answer **(2)**
5.3	$m = \dfrac{y_2 - y_1}{x_2 - x_1}$ $= \dfrac{20 - 4}{1 - (-1)}$ $= 8$	✓ substitution ✓ answer **(2)**
5.4	$h(x) = -2 \cdot 3^{x+1} + 2$ OR	✓✓ answer OR

	Reflected about the *x-axis* $= -2 \cdot 3^{x+1} - 2$ $\therefore reflecteed\ about\ the\ asymptote$ $h(x) = -2 \cdot 3^{x+1} - 2 + 4$ $= -2 \cdot 3^{x+1} + 2$	✓ reflection about *x*-axis ✓ answer **(2)**
5.5		✓ positive *y*-asymptote ✓ positive *y*-intercept ✓ *g* is decreasing above the asymptote **(3)**
		[12]