Objective: **Complete iGCSE questions on essential GDC skills.**

(c) **(i)** Calculate the mean time.

....

(ii) Calculate the mean number of objects.

....

5   In Kim's game a player looks at a fixed number of objects on a tray for a length of time, t
    The player is then tested to find how many objects they remember.

    The table shows the results for 10 players.

Time in seconds (t)	30	40	50	60	70	80	90	100	110	120
Number of objects (n)	8	10	15	12	16	20	18	23	19	25

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(d) (i)   Find the equation of the regression line.
          Give your answer in the form $n = mt + c$.

                                                    $n =$ ....

     (ii) Errol looks at the tray for 85 seconds.

           Use your equation to estimate the number of objects he remembers.

                                                    ....

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(c)	(i)	75	1	
	(ii)	16.6	1	
(d)	(i)	$0.168t + 3.96$	2	or $m = 0.1684$ to 0.1685, $c = 3.9$ **B1** for $n = mt + c$ with either m or **SC1** for $0.17t + 4[.0]$
	(ii)	18	1FT	**FT** from *their* equation with $t =$ rounded or truncated to nearest

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8 **(a)**
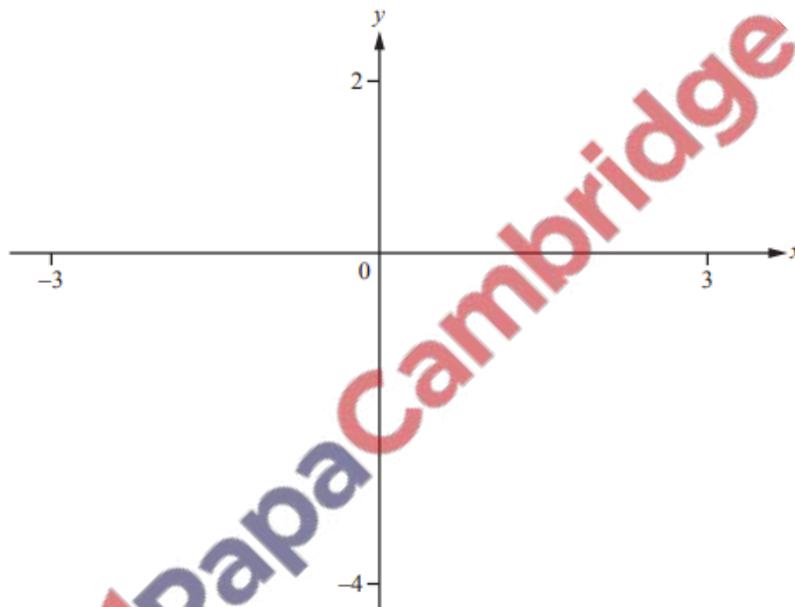
$$f(x) = \log(1 + 2x + x^2)$$

(i) On the diagram, sketch the graph of $y = f(x)$ for values of x between -3 and 3. [2]

(ii) Solve $f(x) = 0$.

$x =$ .... or $x =$ .... [2]

(iii) Write down the equation of the asymptote to the graph of $y = f(x)$.

.... [1]

(b) **(i)** On this diagram, sketch the graph of $y = 2\log(1+x)$ for values of x between -3 and 3.
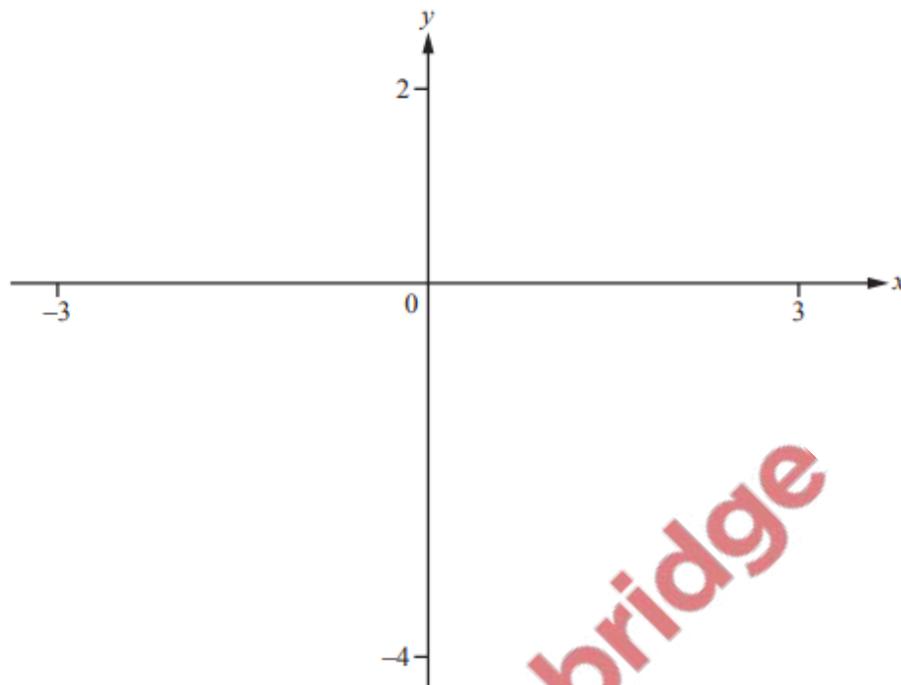
[2]

(ii) Describe a similarity between the graphs in **part (a)(i)** and **part (b)(i)**.

....

.... [1]

(iii) Explain the differences between the graphs in **part (a)(i)** and **part (b)(i)**.

....

.... [2]
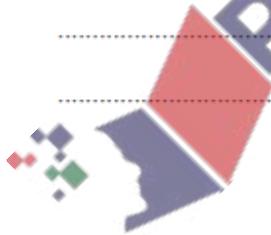
Question			Answer	Mark	Part Ma...
8	(a)	(i)	Correct sketch	2	**B1** RH branch through (0, 0) $x = a$ (–ve a) **B1** for LH branch symmetri... $x = a$ (–ve a)
		(ii)	-2 0	1 1	
		(iii)	$x = -1$	1	
	(b)	(i)	Correct sketch	2	**B1** for correct shape
		(ii)	Same right hand branch	1	
		(iii)	e.g. $\log(1 + 2x + x^2) = 2\log(1 + x)$ No log of a negative number	1 1	Independent
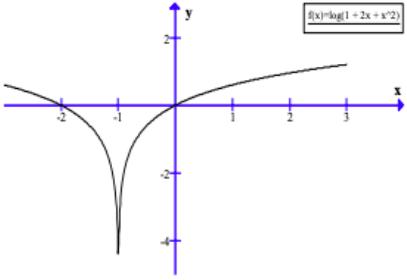
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6

$f(x) = \sin(x^2)$ where x^2 is in degrees.

(a) On the diagram, sketch the graph of $y = f(x)$ for $0 \leqslant x \leqslant 20$. [2]

(b) One solution of the equation $f(x) = 0$, for $0 \leqslant x \leqslant 20$ is $x = 0$.

Find the other two solutions.

$x =$ .... or $x =$ .... [2]

(c) Find the co-ordinates of the local maximum point.

(.......................... , ...) [2]
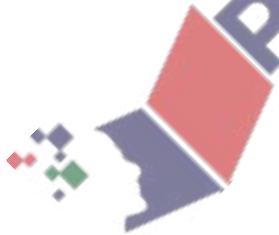
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(d) There is a local minimum point at $(0, 0)$.

Find the co-ordinates of the other local minimum point when $0 \leqslant x \leqslant 20$.

(......................... , ...

(e) Write down the range of f(x).

....

(f) By sketching another graph on the diagram, solve this equation.

$$\sin(x^2) = \frac{x^2}{20} - 1$$

$x =$ ....

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6	(a)	Correct sketch		
			2	**M1** for shape i.e. starting at or one maximum then one minim **A1** for two zeros to right of x = the left of $x = 20$
	(b)	13.4 or 13.41 to 13.42 19[.0] or 18.97…	1 1	
	(c)	(9.49, 1) or (9.486 to 9.487, 1)	**B1 B1**	
	(d)	(16.4, −1) or (16.43…, −1)	**B1 B1**	
	(e)	$-1 \leqslant$ f(x) $\leqslant 1$	1	
	(f)	Correct sketch of parabola shape from approximately $y = -1$ 5.48 or 5.477…	**B1** **B1**	

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8   The diagram shows the graph of $y = f(x)$ where $f(x) = \dfrac{x}{(x+2)(x-1)(x-2)}$.
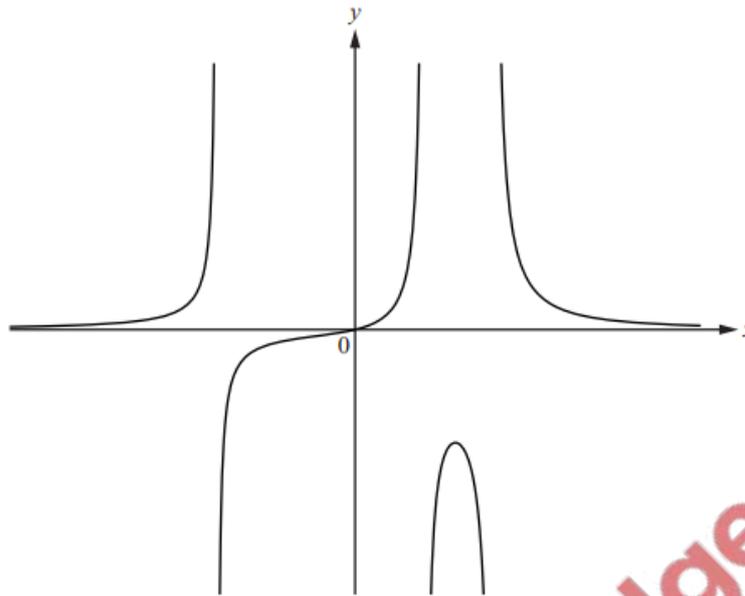
(a)   The equations of the asymptotes to the graph are $x = a, x = b, x = c$ and $y = d$.

Find the values of a, b, c and d.

$a =$ ....

$b =$ ....

$c =$ ....

$d =$ .... [4]

(b) $f(x) = k$ has only one solution, where k is an integer and $k \neq 0$.

Find the value of k.

$k =$ .... [1]

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(c)   Find the integer value of x such that $f(x) < 0$.

$x =$ ....

(d) $g(x) = x^2 - p$

On the diagram, sketch a possible graph of $y = g(x)$ so that $f(x) = g(x)$ has 5 solutions.

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8	(a)	$[a, b, c =]$ −2, 1, 2	1, 1, 1	In any order
		$[d =]$ 0	1	
	(b)	− 1	1	
	(c)	− 1	1	
	(d)	Parabola vertex downwards and vertex below x-axis	M1	
		Cuts given graph in 5 places	A1	

10 A company is testing a new drug.
Ten patients were examined and given a score before and after taking the drug.
A decrease in score represents an improvement.

The results are shown in the table.

Patient	A	B	C	D	E	F	G
Score before (x)	8	14	20	25	32	34	41
Score after (y)	3	4	16	15	20	27	34

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(b) Find

    (i) the mean score before taking the drug,

        ....

    (ii) the mean score after taking the drug.

        ....

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(c) (i) Find the equation of the regression line for y in terms of x.

$y =$ .... [2]

(ii) Estimate the score after taking the drug when the score before taking the drug was 30.

.... [1]

(iii) A patient has a score before taking the drug of 80.

Explain why using the line of regression is unlikely to be reliable in predicting the score of the patient after taking the drug.

....

.... [1]

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(b) **(i)**	32.7		1	
(ii)	23.6		1	
(c) **(i)**	$[y=]-5.57+0.892x$		2	**B1** for $-5.57 + kx$, or **B1** for $a + 0.8$ If 0 scored **SC1** for $-5.6 + 0.89x$
(ii)	21.2 or 21.19…		**1FT**	**FT** *their* (c)(i) using $x = 30$
(iii)	Outside range oe		1	

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11
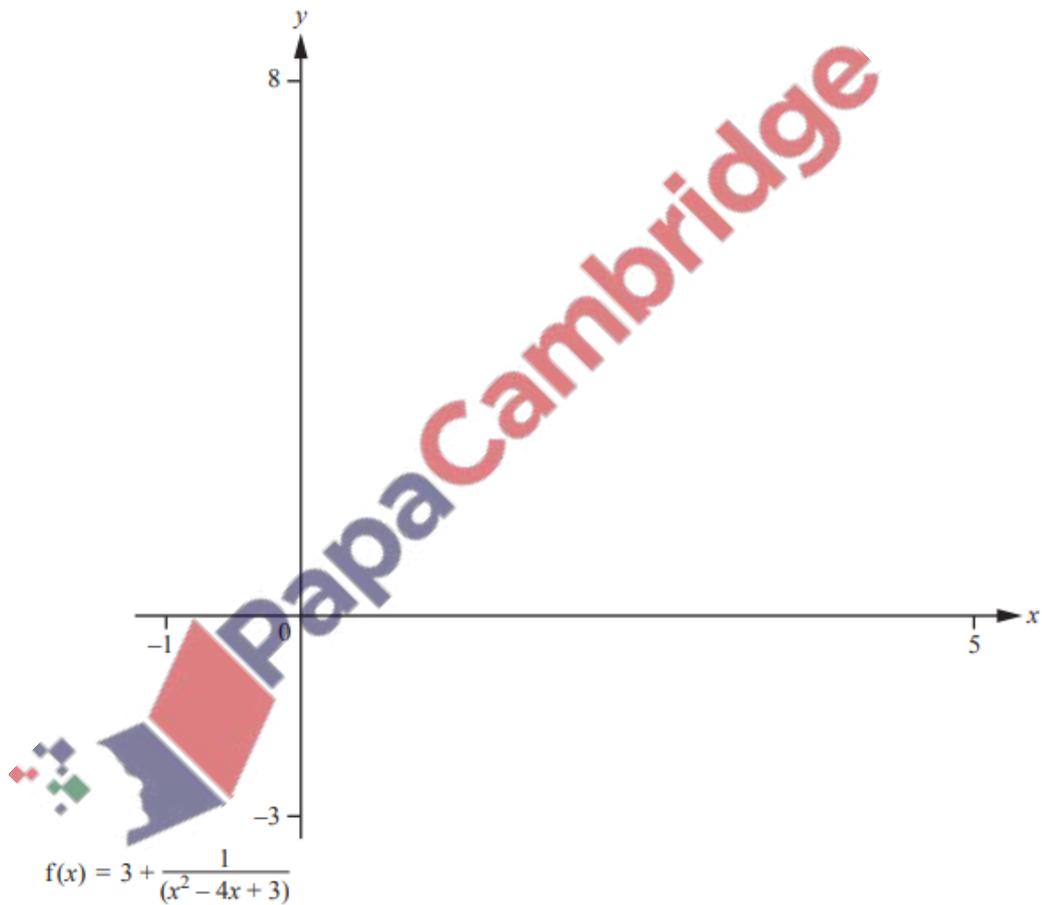
$$f(x) = 3 + \frac{1}{(x^2 - 4x + 3)}$$

(a) On the diagram, sketch the graph of $y = f(x)$ between $x = -1$ and $x = 5$.   [4]

(b) Write down the equations of the three asymptotes.

.........................., ..., ... [3]

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(c) Write down the co-ordinates of the local maximum point.

(.................... , ...

(d) The line $y = x$ intersects the curve $y = 3 + \dfrac{1}{(x^2 - 4x + 3)}$ three times.

Find the values of the x co-ordinates of these three points of intersection.

$x = $ .... , $x = $ .... , $x = $ ....

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Question	Answer	Mark	Part Marks
11 (a)	Correct sketch	4	**B1** Correct graph for $x > 3$ **B1** Correct graph for $x < 1$ **B1** Correct graph for $1 < x < 3$ **B1** Approximately correct intercepts
(b)	$x = 1$ $x = 3$ $y = 3$	1 1 1	
(c)	(2, 2)	1	
(d)	1.38, 2, 3.62	3	**B1** for each

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7
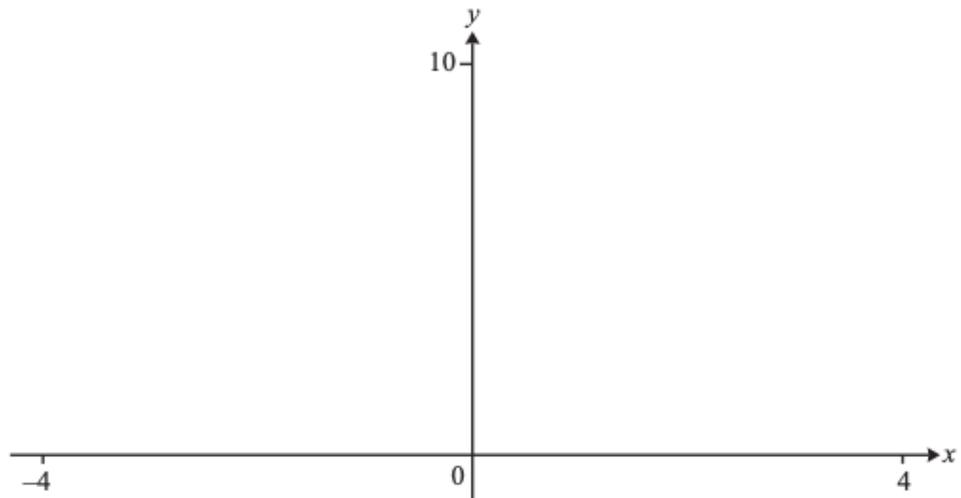
$$f(x) = \left|9 - x^2\right|$$

(a) On the diagram, sketch the graph of $y = f(x)$, for values of x between -4 and 4.

[4]

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(b) Solve $f(x) = 7$.

....

(c) The equation $\left|9 - x^2\right| = k$ has two solutions.

Find the range of values of k.

....

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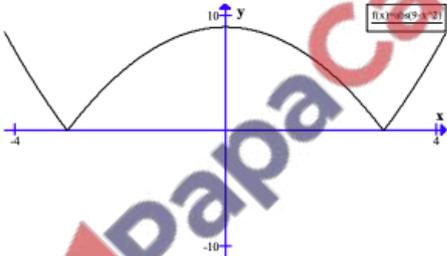
7(a)	Correct Graph	4	**B1** for maximum point on or close to y-... **B1** for correct shape between *their* -3 an... **B1** for mod graph
7(b)	$[x =] \pm 4, \pm \sqrt{2}$ or ± 1.41 or $\pm 1.414...$	2	**B1** for any 2 correct answers
7(c)	$k > 9$ $k = 0$	2	**B1** for each

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10

$$\text{f}(x) = 2\sin x + \cos x \qquad \text{for } 0° \leqslant x \leqslant 360°$$

$$\text{g}(x) = 2 - \log x \qquad \text{for } 0° \leqslant x \leqslant 360°$$

(a) On the diagram, sketch the graph of $y = \text{f}(x)$.

(b) On the same diagram, sketch the graph of $y = \text{g}(x)$.

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(c) Solve the equation.

$$2\sin x + \cos x = 2 - \log x$$

....
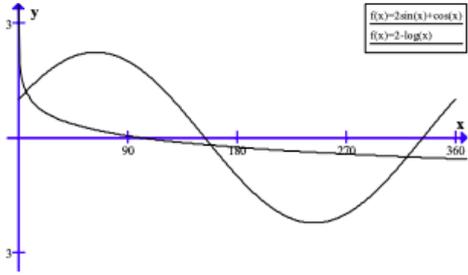
10(a)	Correct Graph	3	M1 for sine graph with one max and one A1 for x-intercepts at 150 and 330 (appro A1 for positive y-intercept
10(b)	Correct Graph with second intersection with other graph (if correct) below x-axis	2	M1 for correct shape
10(c)	6.18 or 6.175... 159 or 158.5 to 158.6 320 or 320.3 to 320.4	3	B1 for each

3 Two judges each give a mark out of ten for each dancer in a competition.
Their marks for ten dancers are shown in the table.

Mark from judge A (x)	4.0	4.6	5.2	6.2	8.8	6.8	7.0	7.4	8.0
Mark from judge B (y)	3.8	4.0	4.4	5.0	7.6	5.2	5.6	6.8	6.6

(c) **(i)** Find the equation of the regression line, in the form $y = mx + c$.

$y =$ ....

(ii) Judge A gives another dancer a mark of 6.4 .

Use your equation to estimate the mark judge B gives this dancer.

....

3(c)(i)	$y = 0.787x + 0.356$ final answer	**2**	0.7874 to 0.7875, 0.3555 to 0.3556 **B1** for one correct or for $y = 0.79x + 0.36$ final answer
3(c)(ii)	5.4[0]	**1**	**FT** from *their* (c)(i)

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8
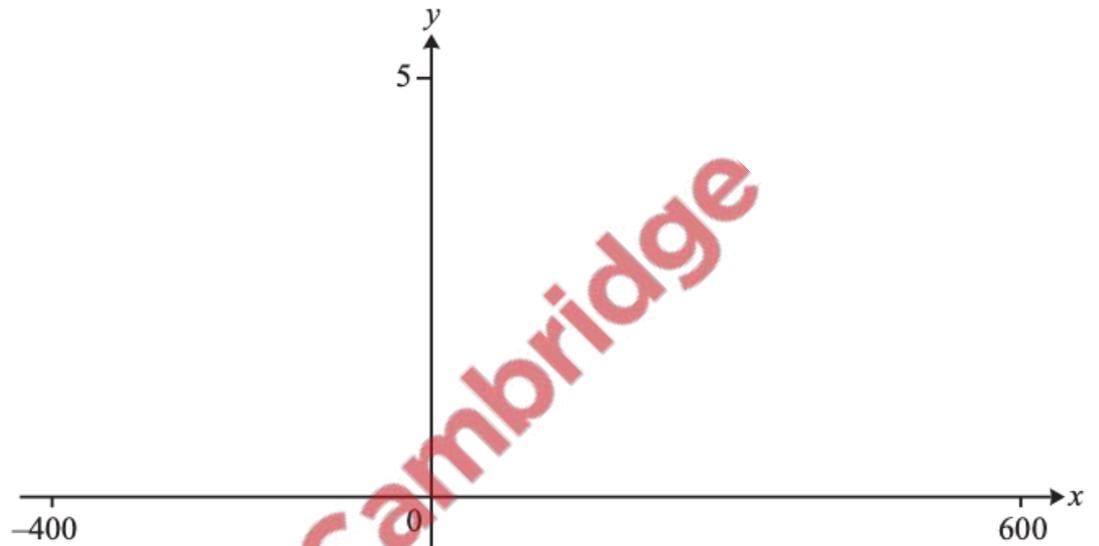
$f(x) = 3^{\sin x}$

(a) Sketch the graph of $y = f(x)$ for $-400° \leqslant x \leqslant 600°$.

(b) Find the x co-ordinates of the local maximum points of f(x) for $-400° \leqslant x \leqslant 600°$.

$x =$ .... or $x =$ .... or $x =$ ....

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(c) The point $(30, \sqrt{3})$ is on the graph.
The point $(a, \sqrt{3})$ is also on the graph where $600° < a < 900°$.

Find the two possible values of a.

$a =$ .... or $a =$ ....

(d) $g(x) = 3 - \dfrac{x}{100}$

Solve the inequality $g(x) > f(x)$.

....

8(a)	Correct sketch	3	With correct shape with two max on right and one on left, all above x-axis and reaso quality or **B2** for correct shape and all above x-ax or **B1** for correct shape
8(b)	−270, 90, 450	3	**B1** for each **SC2** for all correct but with y co-ords or **SC1** for two correct with y co-ords
8(c)	750, 870	2	**B1** for each
8(d)	$x < 54.7$	1	54.74 to 54.75
	$164 < x < 267$	2	163.5 to 163.6 , 266.6... **B1** for one inequality or **B1** for both values seen If 0 scored, **B1** for straight line with negat gradient crossing curve three times betwe $x = 0$ and $x = 400$. May be freehand.

(b) The table shows the average monthly temperature and the average monthly rainfall in Maser

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	No
Temperature ($t\,°C$)	21	21	19	15	11	8	8	11	15	17	19
Rainfall (r mm)	113	102	99	59	28	12	12	14	27	62	83

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(iii) Find the mean of these temperatures.

.... $°C$ [1]

(iv) Find the equation of the line of regression, giving r in terms of t.

$r = $ .... [2]

(v) On the diagram, sketch the graph of the regression line for $8 \leqslant t \leqslant 21$.
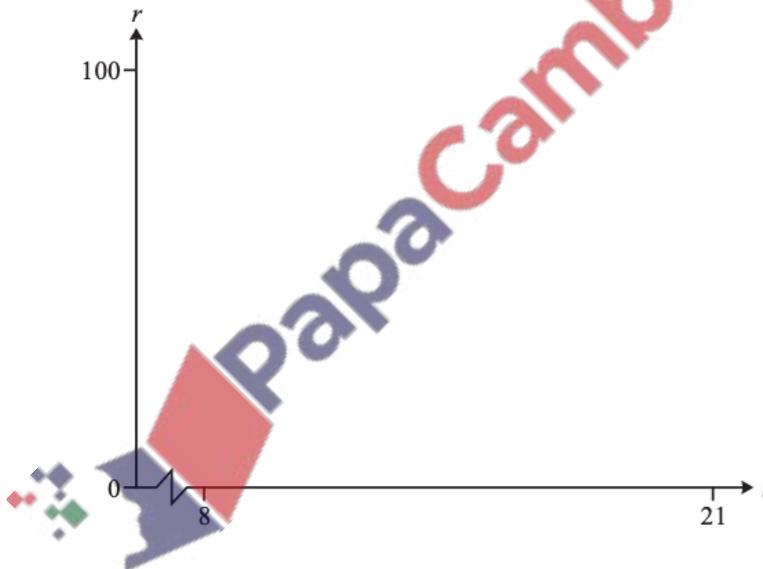
[2]

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3(b)(iii)	15.5	1	
3(b)(iv)	$7.32t - 55.3$	2	$(7.322$ to $7.323)t - (55.25…)$ **B1** for $7.32t + k$ or $kt - 55.3$ or **SC1** for $7.3t - 55$
3(b)(v)	Correct line (positive gradient and not below the x-axis)	2	**B1** for positive gradient

6

$f(x) = x - 5\log x$
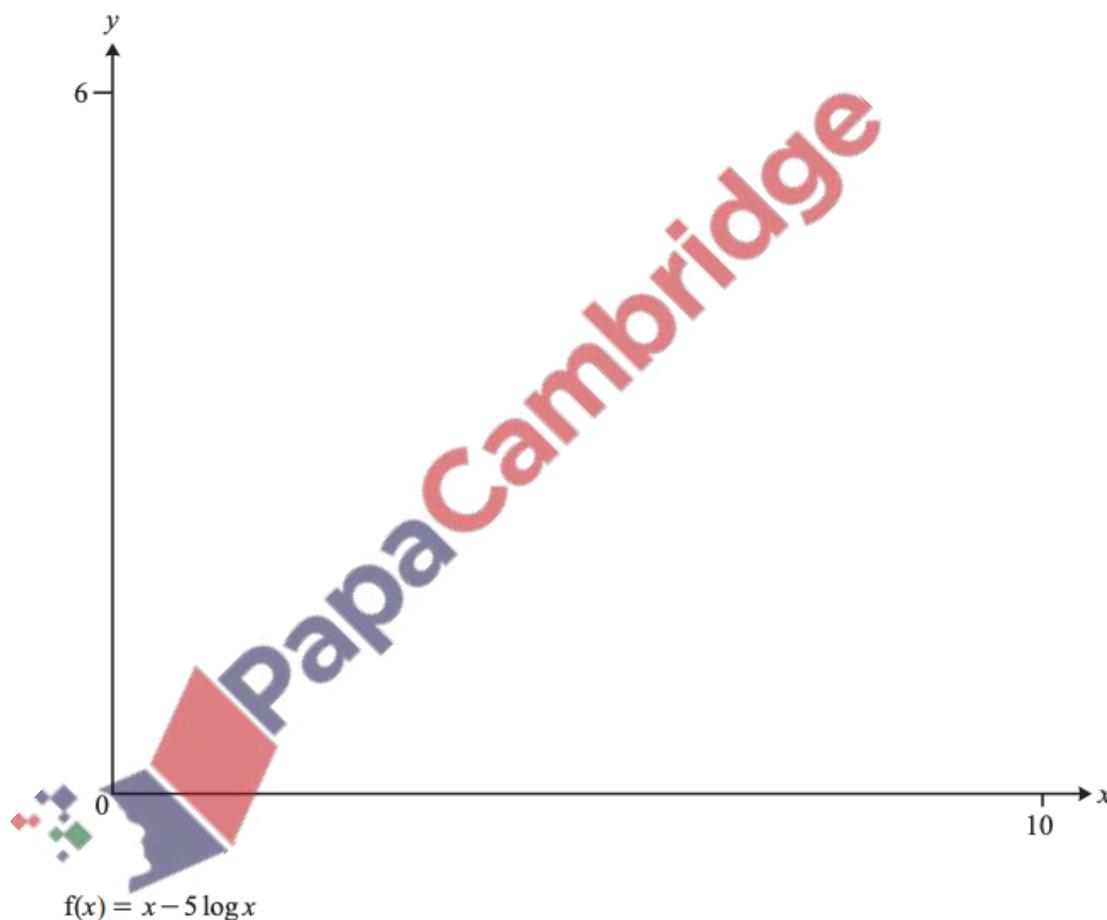
(a) On the diagram, sketch the graph of $y = f(x)$ for $0 < x \leqslant 10$. [2]

(b) Find the co-ordinates of the local minimum point.

(......................... , ...) [2]

(c) Find the range of f(x) for the domain $1 \leqslant x \leqslant 5$.

....

(d) Solve the equation f(x) = 2.

$x =$ .... or $x =$ ....

(e) Solve the inequality f(x) < 2.

....

(f) (i) Find f(0.001), f(0.00001) and f(0.0000001).

f(0.001) = ... , f(0.00001) = ... f(0.0000001) = ...

(ii) Complete the statement.

The y-axis is .... to the graph of $y =$ f(x).

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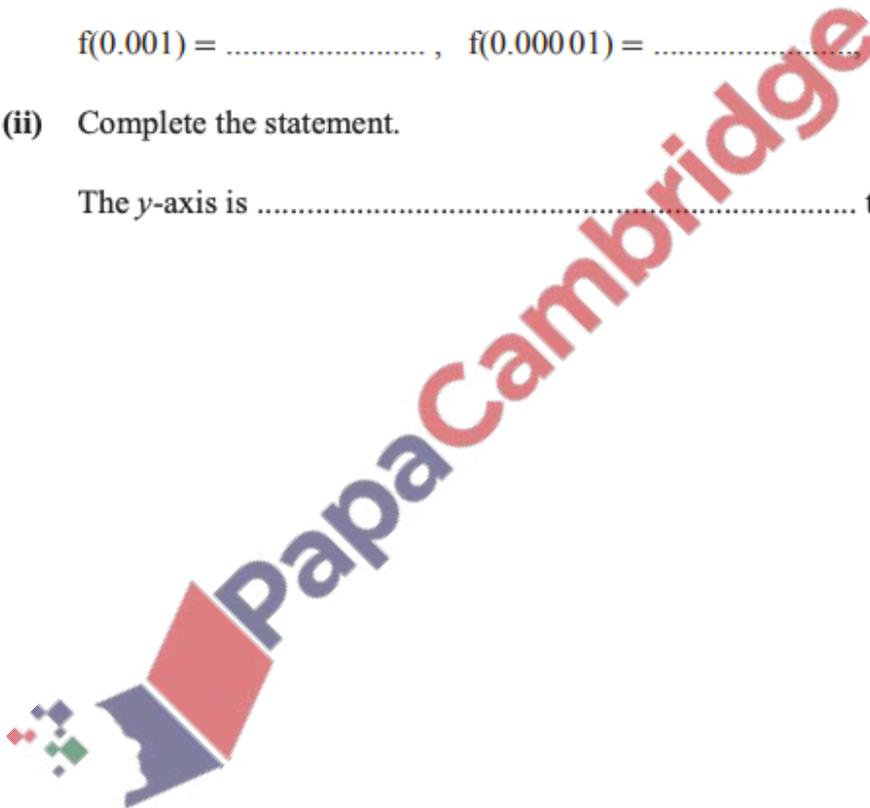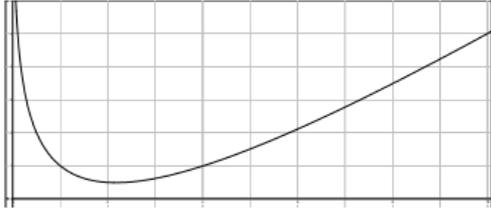
6(a)	Correct sketch	2	**B1** for correct shape
6(b)	(2.17, 0.488) or (2.171…, 0.4877…)	2	**B1** for each
6(c)	$0.488 \leqslant f(x) \leqslant 1.51$ or $0.4877... \leqslant f(x) \leqslant 1.505...$	2	**FT** *their* 0.488 **B1** for $0.488 \leqslant f(x)$ oe or $f(x) \leqslant 1.$
6(d)	0.502 or 0.5015… 5.83 or 5.827…	2	**B1** for each
6(e)	$0.502 < x < 5.83$ or $0.5015... < x < 5.827...$	1	**FT** *their* (d)
6(f)(i)	15.[0] or 15.00… 25.[0] or 25.00… 35. [0] or 35.00…	1	
6(f)(ii)	[an] asymptote oe	1	

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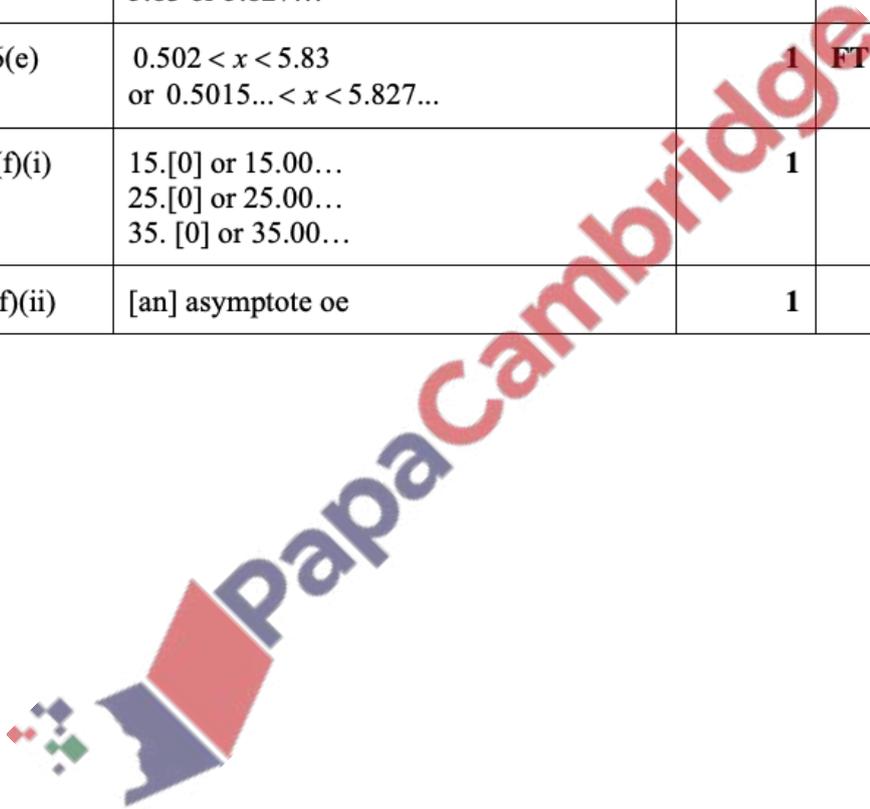
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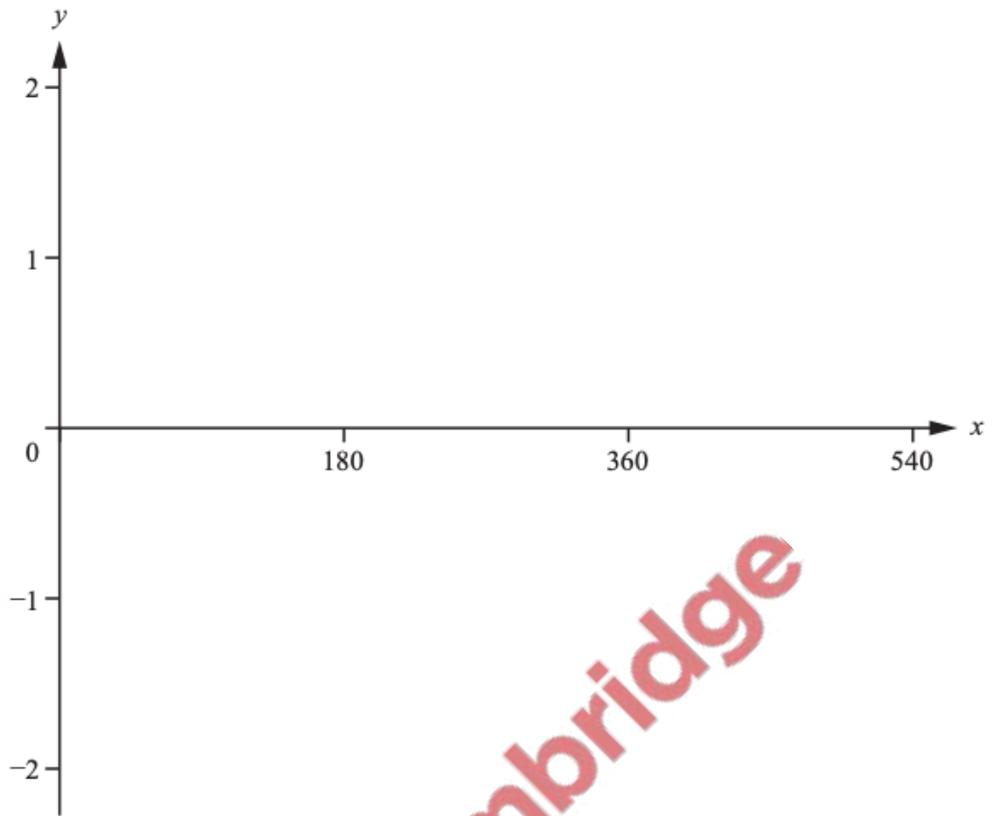
$f(x) = \sin x°$ $\qquad$ $g(x) = \log\left(\dfrac{1}{\sin x°}\right)$

(a) **(i)** On the diagram, sketch the graph of $\ y = f(x)\ $ for $0 \leqslant x \leqslant 540$. [2]

$\quad$ **(ii)** Write down the range of $f(x)$ for $0 \leqslant x \leqslant 540$.

.... [1]

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(b) **(i)** On the same diagram, sketch the graph of $y = g(x)$ for values of x between 0 and 5...

(ii) Give a reason why there are no values of g(x) for $180 \leqslant x \leqslant 360$.

....

(iii) Write down the co-ordinates of the minimum points on the graph of $y = g(x)$.

(................ , ...) and (................ , ...

(iv) Write down the equations of the four asymptotes to the graph of $y = g(x)$.

.... , ... , ... , ...

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(c) **(i)** $f(k) = g(k)$ and $0 \leqslant k \leqslant 90$.

Find the value of k.

$k =$ ....

(ii) Solve the inequality $f(x) > g(x)$ for values of x between 0 and 540.

....

(iii) j is an integer.

The equation $f(x) = j$ has no solutions.
The equation $g(x) = j$ has no solutions.

Write down a possible value of j.

$j =$ ....

Question	Answer	Marks	Partial Marks
5(a)(i)	Correct sketch	2	**B1** for sine graph with different amp and/or period but must go through ((or for correct sine graph but only on
5(a)(ii)	$-1 \leqslant \mathrm{f}(x) \leqslant 1$	1	
5(b)(i)	Correct sketch	2	i.e. Correct shape with 2 branches a axis and gap of at least 120 between branches and only slightly crossing axis. **B1** for 2 branches above x-axis but than 120 between the branches and slightly crossing either axis or one b correct
5(b)(ii)	logarithms of negative numbers do not exist oe	1	
5(b)(iii)	(90, 0), (450, 0)	2	**B1** for each
5(b)(iv)	$x = 0$, $x = 180$, $x = 360$, $x = 540$	2	**B1** for 2 or 3 correct
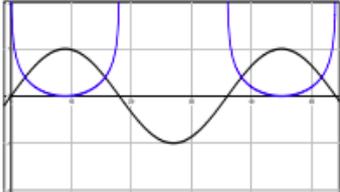
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Question	Answer	Marks	Partial Marks
5(c)(i)	23.5 or 23.51 to 23.52	1	
5(c)(ii)	$23.5 < x < 156.5$ $383.5 < x < 516.5$	2	**B1** for each Allow 23.51 to 23.52, 156.48 to 1 Allow 383.51 to 383.52, 516.48 to
5(c)(iii)	Any integer less than -1	1	

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2
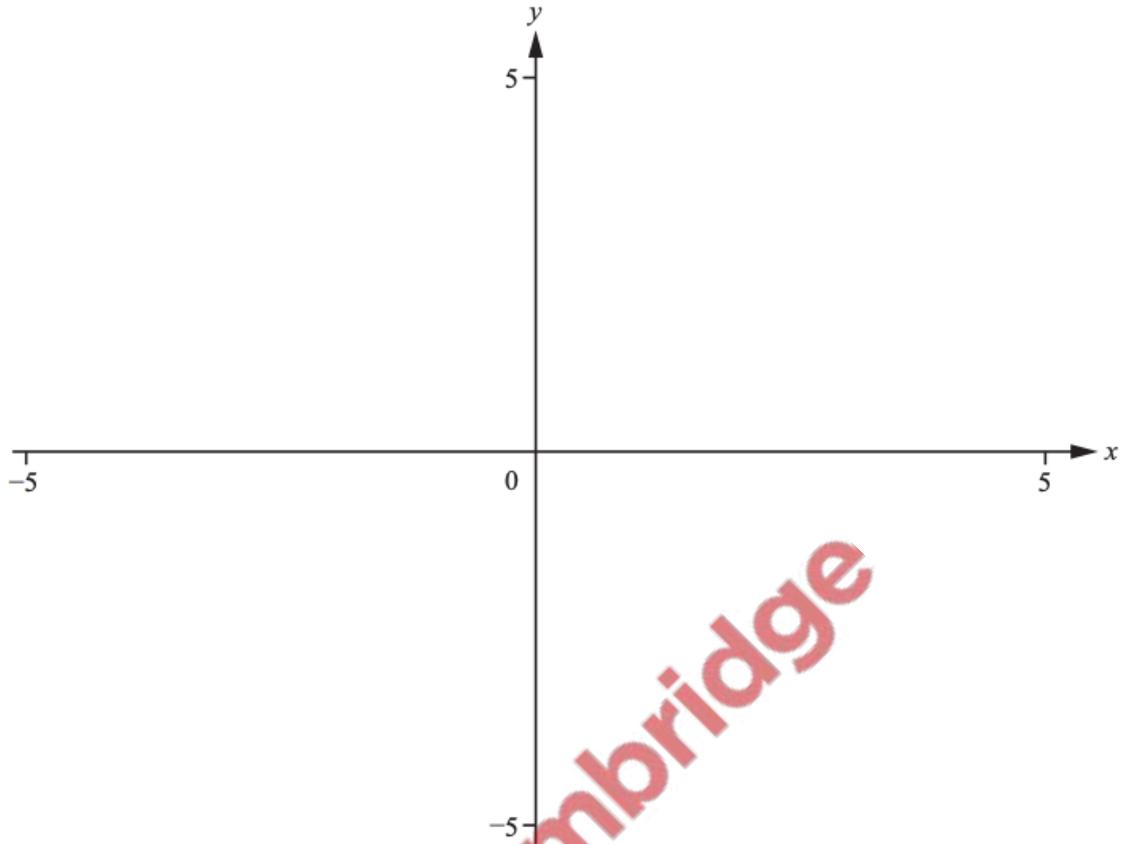
$$f(x) = 1 - \frac{x}{(x^2 - 9)}$$

(a) On the diagram, sketch the graph of $y = f(x)$, for values of x between -5 and 5. [3]

(b) Write down the equations of the three asymptotes.

.........................., ..., ... [3]

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(c) The line $y = x$ intersects the curve $y = 1 - \frac{x}{(x^2 - 9)}$ three times.

Find the values of the x co-ordinates of the points of intersection.

$x = $ .... or $x = $ .... or $x = $ ....

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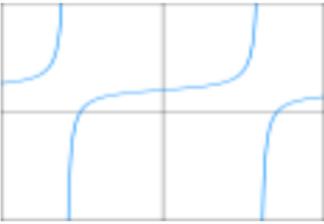
2(a)	Correct sketch	3	B1 for each branch
2(b)	$y = 1$, $x = 3$, $x = -3$	3	B1 for each
2(c)	−2.87 or −2.874 to −2.873 1.15 or 1.149 to 1.150 2.72 or 2.723 to 2.724	3	B1 for each If 0 scored SC1 for −2.9, 1.1 and 2.7

10 Wasim sprays different amounts of fertiliser on some seedlings.
He measures the amount, x millilitres, sprayed on each seedling.
A week later he measures the height, y centimetres, of each seedling.
His results are shown in the table.

Amount of fertiliser (x ml)	1	3	5	7	10	14	18	25	30	35	40
Height (y cm)	15.1	15.6	16.5	16.6	17	19.8	21	25.1	28.8	28.6	29.1

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(b) Find

(i) the mean amount of fertiliser,

....
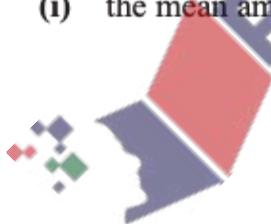
(ii) the mean height.

....

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(c) (i) Find the equation of the regression line in the form $y = mx + c$.

$$y = \text{.................................}$$

(ii) Use your answer to **part (c)(i)** to estimate the height of a seedling when the amount
is 20 ml.

....

(iii) Write down the units of m in the equation of the regression line, $y = mx + c$.

....

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10(b)(i)	17.1 or 17.09…	1	
10(b)(ii)	21.2	1	
10(c)(i)	$y = 14.2 + 0.411x$	2	**B1** for $14.2 + kx$ or $a + 0.411x$ If 0 scored, **SC1** for $14 + 0.41x$
10(c)(ii)	22.4 or 22.39 to 22.42	1	**FT** *their* **(c)(i)**
10(c)(iii)	cm/ml oe	1	

4 Hamid records the population density, p persons/km^2, in ten regions of the city in which he lives.
He also records the distance, d km, of each region from the city centre.
The results are shown in the table.

Region	A	B	C	D	E	F	G	H	I	J
Distance (d km)	0.8	1.7	3.1	4.1	3.5	2.8	4.6	3.7	1.9	5.1
Population density (p persons/km^2)	5600	4800	3600	4500	2800	3300	1100	2300	3900	800

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(c) (i) Calculate the equation of the regression line in the form $p = md + c$.

$$p = \text{...}$$

(ii) Use this equation to estimate the population density of a region 2.4 km from the city centre.

.... persons

(iii) Why would it not be sensible to use this equation to estimate the population density of a region 6.3 km from the city centre?

....

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Question	Answer	Marks	Partial Marks
4(c)(i)	$p = -967d + 6300$	2	or $(-967.4$ to $-967.3)d + 6297$ to 62... or **B1** for $-967d + k$ or $kd + 6300$
4(c)(ii)	3980 or 4000 or 3975 to 3980	1	FT
4(c)(iii)	[Too] far outside range of data oe	1	

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5
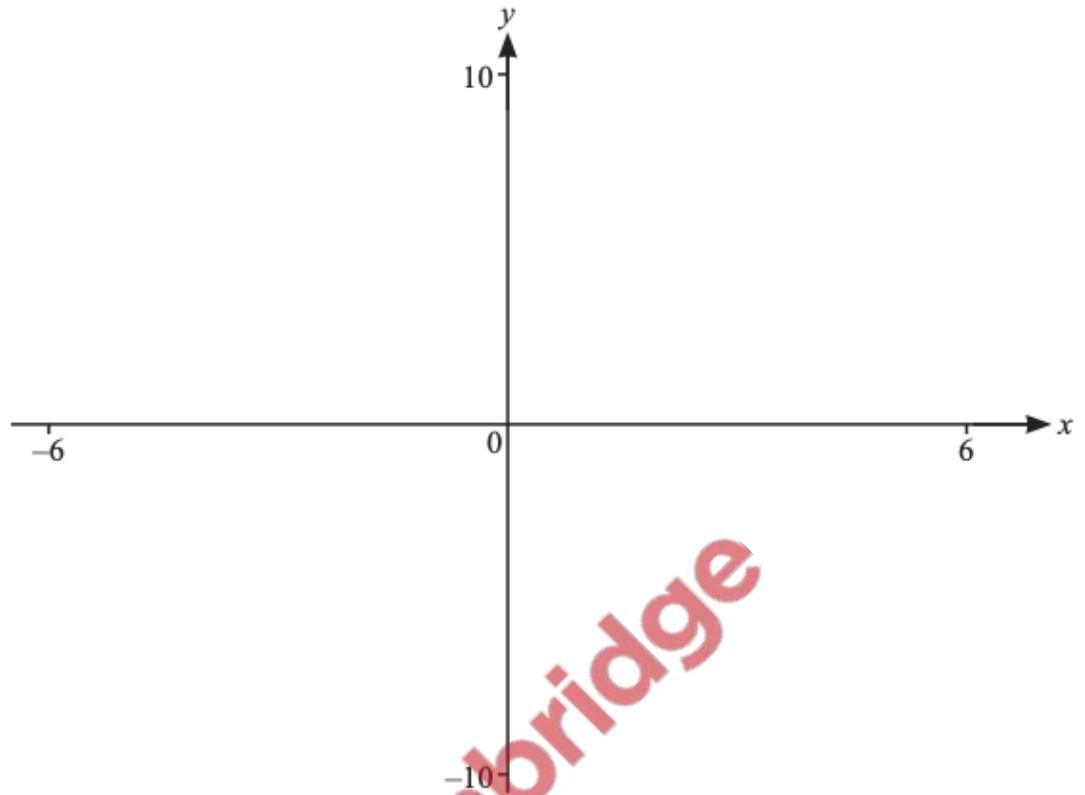
$$f(x) = \frac{(2x^2 - x + 5)}{(x^2 + x - 6)}$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -6 and 6.

(b) Find the co-ordinates of the local maximum.

(........................ , ...

(c) Find the equations of the three asymptotes to the graph of $y = f(x)$.

.... , ... , ...

(d) The equation $f(x) = k$ has no solutions.

Find the range of values of k.

....

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(e) $g(x) = |x+1|$

    (i) Solve $f(x) = g(x)$.

$x =$ .... or $x =$ ....

    (ii) Solve the inequality $f(x) > g(x)$.

....
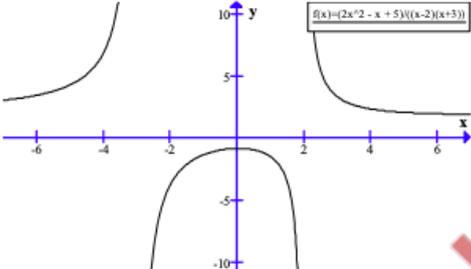
5(a)	Correct sketch	3	**B1** for each branch
5(b)	$(0.0295, -0.833)$	2	or $(0.02948$ to $0.02949, -0.8329...$ **B1** for each
5(c)	$x = -3, x = 2, y = 2$	3	**B1** for each
5(d)	$-0.833 < k \leqslant 2$	2	**FT** *their* **(b)** **B1** for each inequality
5(e)(i)	$-5.13, 2.81$	2	$-5.131..., 2.812$ to 2.813 **B1** for each
5(e)(ii)	$-5.13 < x < -3,$ $2 < x < 2.81$	2	$-5.131..., 2.812$ to 2.813 **B1** for each **FT** *their* **(c)** and **(e)(i)**

5 In Kim's game a player looks at a fixed number of objects on a tray for a length of time, *t*
The player is then tested to find how many objects they remember.

The table shows the results for 10 players.

Time in seconds (*t*)	30	40	50	60	70	80	90	100	110	120
Number of objects (*n*)	8	10	15	12	16	20	18	23	19	25