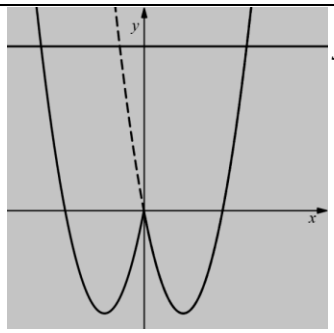
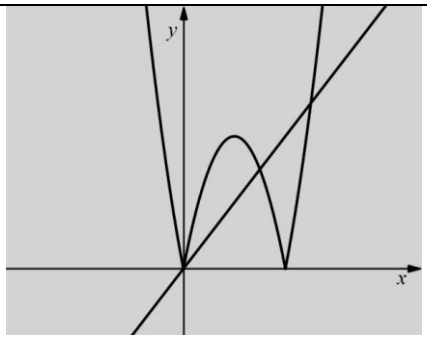
Question Number	Scheme	Marks
3 (a)	 $y = 48$ Graphical interpretation of $\mathrm{f}(\lvert x \rvert) = 48$	
	One of $8, -8$	B1
	Attempts to solve an appropriate equation E.g. $2x^2 - 10x = 48 \Rightarrow x^2 - 5x - 24 = 0 \Rightarrow (x \pm 8)(x \pm 3) = 0 \Rightarrow x = ...$	M1
	$x = 8, -8$ with no additional values	A1
		(3)
(b)	 $y = \frac{5}{2}x$ Graphical interpretation of $\lvert \mathrm{f}(x) \rvert \ldots \frac{5}{2}x$	
	Attempts to solve $2x^2 - 10x = \frac{5}{2}x \Rightarrow 4x^2 - 25x = 0 \Rightarrow x = \frac{25}{4}$ OR attempts to solve (o.e.) $10x - 2x^2 = \frac{5}{2}x \Rightarrow 4x^2 - 15x = 0 \Rightarrow x = \frac{15}{4}$	M1
	Attempts to solve $2x^2 - 10x = \frac{5}{2}x \Rightarrow 4x^2 - 25x = 0 \Rightarrow x = \frac{25}{4}$ AND attempts to solve (o.e.) $10x - 2x^2 = \frac{5}{2}x \Rightarrow 4x^2 - 15x = 0 \Rightarrow x = \frac{15}{4}$	dM1
	Achieves both critical values $x = \frac{15}{4}$, $x = \frac{25}{4}$	A1
	Correct set of values $x \,,, \frac{15}{4}$ or $x \ldots \frac{25}{4}$	A1
		(4)
		Total 7

This question demands that some working should be shown

(a) This part is now being marked B1 M1 A1 instead of M1 A1 A1

B1: Correctly obtains 8 or -8 as a solution (for x) . Condone solution appearing as $\lvert x \rvert = 8$

M1: Attempts to solve $\mathrm{f}(\lvert x \rvert) = 48$ via an appropriate method including a calculator, factors or formula

So, look for a correct equation followed by an attempt to solve.

The equation must be given in the form of a correct 3TQ, but not necessarily collected on one side of the = sign. Solving is allowed by all methods including via a calculator.

All the following score this M mark

Example 1:

$2x^2-10x=48$ o.e $\Rightarrow x=8,(-3)$ …only the 8 is required

Example 2:

$2x^2-10x=48$ o.e $\Rightarrow x^2-5x-24=0\Rightarrow (x-8)(x+3)=0\Rightarrow x=...$

Example 3:

$2|x|^2-10|x|-48=0$ or $|x|^2-5|x|-24=0$ leading to $|x|$ or $x=8,(-3)$

Example 4:

$$2x^2+10x-48=0 \Rightarrow x=\frac{-10\pm\sqrt{100-4(2)(-48)}}{2(2)}=...$$

Example 5:

$2x^2+10x=48$ o.e $\Rightarrow x=-8,(3)$ …only the −8 is required

A1 $x=8,-8$ with no additional values unless they have been rejected

(b)

M1: Attempts to solve a correct equation or inequality, leading to a non-zero value for *x*.

The method **must be shown** with the terms being collected as a minimum response

Look for $2x^2-10x=\frac{5}{2}x\Rightarrow ax^2\pm bx=0\Rightarrow x=c,\ c\neq 0$. Allow with the = as any inequality including <

OR $-2x^2+10x=\frac{5}{2}x\Rightarrow ax^2\pm bx=0\Rightarrow x=c,\ c\neq 0$. Allow with the = as any inequality including <

You may see as an alternative to the 2nd equation/inequality $2x^2-10x=-\frac{5}{2}x\Rightarrow ax^2\pm bx=0\Rightarrow x=c,\ c\neq 0$

It is acceptable to divide through by *x*, so $2x^2-10x=\frac{5}{2}x\Rightarrow 2x-10=\frac{5}{2}\Rightarrow 2x=\frac{25}{2}\Rightarrow x=6.25$

dM1: Attempts to solve BOTH correct equations or inequations leading to two non-zero values for *x*

Allow even if there are extra equations solved.

A1: Achieves both critical values $x=\frac{15}{4}$ and $x=\frac{25}{4}$ and no other values apart from 0 (and perhaps 5) following both equations or inequalities. Allow with incorrect inequalities $x\ldots\frac{15}{4}$ and $x\,,,\,\frac{25}{4}$, you are looking for the critical values only

A1: Correct range in allowable form. E.g. $x,,\ \frac{15}{4}$ or $x\ldots\frac{25}{4}$, $\left(-\infty,\frac{15}{4}\right]\cup\left[\frac{25}{4},\infty\right)$ but condone $x,,\ \frac{15}{4}, x\ldots\frac{25}{4}$

Do NOT incorrect forms such as $x,,\ \frac{15}{4}$ and $x\ldots\frac{25}{4}$, $\left(-\infty,\frac{15}{4}\right]\cap\left[\frac{25}{4},\infty\right)$, $\frac{25}{4},, x,,\ \frac{15}{4}$

The two aspects must be brought together on a single line. Mark their final answer

Alt Method: You may see attempts via squaring. It can be marked using the above guidelines

$$\left(2x^2-10x\right)^2=\left(\frac{5}{2}x\right)^2\Rightarrow x^2\left(16x^2-160x+375\right)=0\Rightarrow x^2(4x-15)(4x-25)=0$$

Question Number	Scheme	Marks
4 (a)	$\log_{10} N = 2 \Rightarrow N = 100$	B1
		(1)
(b)	$\log_{10} N = 0.35t + 2 \Rightarrow N = 10^{0.35t+2}$	M1
	$\Rightarrow N = 10^{0.35t} \times 10^{2}$	dM1
	$\Rightarrow N = 100 \times 2.24^{t}$	A1
		(3)
(c)	Rate of growth at 5 hours is $\frac{dN}{dt} = 100 \times \ln 2.24 \times 2.24^{5}$	M1
	Allow an answer in the range 4530 to 4550 (bacteria per hour)	A1
		(2)
		Total 6

(a)

B1: For 100 Do not accept just 10^2 and cannot be awarded from 100 in part (b)

(b) **The demand of the question is 'show that', not just find values of *a* and *b***

Method 1: starting with $\log_{10} N = 0.35t + 2$

M1: Undoes the log. E.g. $\log_{10} N = 0.35t + 2 \Rightarrow N = 10^{0.35t+2}$

Give BOD for those who go from $\log_{10} N = 0.35t + 2$ straight to $N = 10^{0.35t} \times 10^{2}$

dM1: And follows with a correct application of the index law.

Look for $\log_{10} N = 0.35t + 2 \Rightarrow N = 10^{0.35t+2} = 10^{0.35t} \times 10^{2}$ o.e such as $10^{0.35t} \times 100$

But BOD for $\log_{10} N = 0.35t + 2 \Rightarrow N = 10^{0.35t} \times 10^{2}$ o.e. such as $10^{0.35t} \times 100$

And BOD for $\log_{10} N = 0.35t + 2 \Rightarrow N = 10^{0.35t+2} \Rightarrow N = 100 \times 2.24^{t}$

A1: CSO $N = 100 \times 2.24^{t}$ with no errors following M1, dM1. Allow awrt 2.24

Condone $a = 100, b = 2.24$ following the award of M1 dM1

You should expect to see at least one correct line of working and no errors

Method 2: starting with $N = ab^{t}$

M1: Takes logs of both sides and applies one correct rule. E.g $N = ab^{t} \Rightarrow \log N = \log a + \log b^{t}$

Give BOD for those who write $N = ab^{t}$ followed by $\log N = \log a + t \log b$

dM1: And follows with $\log N = \log a + t \log b$ before setting

$\log a = 2$ and $\log b = 0.35$ and proceeding to values for *a* and *b*

A1: Fully shows and produces correct values following M1, dM1

CSO $N = 100 \times 2.24^{t}$ with no errors. Allow awrt 2.24

Condone $a = 100, b = 2.24$ following the award of M1 dM1

You should expect to see at least one correct line of working and no errors