Question Number	Scheme	Marks
10. (a)	$2\log_y x + \dfrac{2\log_y y}{\log_y x} = 5$	M1
	For forming 3TQ $\quad 2(\log_y x)^2 + 2 = 5\log_y x$ oe	M1dA1
	$(2\log_y x - 1)(\log_y x - 2) = 0 \Rightarrow \log_y x = \dfrac{1}{2}, \Rightarrow \log_y x = 2$ *	M1ddA1 (5)
(b)	$\log_y x = \dfrac{1}{2} \Rightarrow x = y^{\frac{1}{2}}, \log_y x = 2 \Rightarrow x = y^2$	M1A1
	$xy = 27 \Rightarrow y^{\frac{1}{2}}.y = 27 \Rightarrow y^{\frac{3}{2}} = 27 \Rightarrow y = 9$ so $x = \sqrt{9} = 3$	M1dA1
	$xy = 27 \Rightarrow y^2.y = 27 \Rightarrow y^3 = 27 \Rightarrow y = 3$ so $x = 3^2 = 9$	M1dA1 (6)
	ALT	
	$\log_y xy = \log_y 27 \Rightarrow \log_y x + \log_y y = \log_y 27$	M1A1
	$\log_y x + 1 = \log_y 27 \Rightarrow 2 + 1 = \log_y 27$	
	$\Rightarrow 3 = \log_y 27 \Rightarrow y^3 = 27 \Rightarrow y = 3$	M1dA1
	$\Rightarrow 1 + \dfrac{1}{2} = \log_y 27 \Rightarrow y^{\frac{3}{2}} = 27 \Rightarrow y = 9$	M1dA1 (6) **(11)**
	$\Rightarrow y = 3, x = 9$, $\Rightarrow x = 3, \mathrm{y} = 9$	

Notes

(a)

M1 for using change of base formula for $2\log_x y = \dfrac{2\log_y y}{\log_y x}$

M1d for using their result above in an attempt to form 3TQ in $\log_y x$

A1 for correct 3TQ (allow a substitution for $\log_y x$)

M1dd for an attempt to solve their 3TQ. They must arrive at a solution for the award of this mark. This mark is dependent on both previous M marks being awarded.

A1 for the correct values of $\log_y x$ (Note: This is a show question)

(b)

M1 for converting at least one logarithm correctly to a power of y $y = x^{\frac{1}{2}}$ or $y = x^2$

A1 for both correct values $y = x^{\frac{1}{2}}$ and $y = x^2$

M1d for substituting either $y = x^2$ **or** $y = x^{\frac{1}{2}}$ into the equation $xy = 27$ and attempting to find a value for y or x.

A1 for either $y = 9, x = 3$ **OR** $x = 9, y = 3$

M1d for substituting both $y = x^2$ **and** $y = x^{\frac{1}{2}}$ into the equation $xy = 27$ and attempting to find a value for y or x.

A1 for both $x = 9, y = 3$ **AND** $y = 9, x = 3$

ALT

M1 for taking logs of both sides and using properties of logs to attempt to form the equation $\log_y x + \log_y y = \log_y 27$

A1 for the correct equation

M1d for using one of the values of $\log_y x$, and using the fact that $\log_y y = 1$ leading to $\log_y 27 =$ .....

A1 for either $y = 9, x = 3$ **OR** $x = 9, y = 3$

M1d for using the other value of $\log_y x$ to find the second value of y

A1 for both $x = 9, y = 3$ **AND** $y = 9, x = 3$

Question Number	Scheme	Marks
11 (a)	$4+3x-x^2=\frac{25}{4}-\left(x-\frac{3}{2}\right)^2$	M1A1 (2)
(b)	$\left(\frac{3}{2},\frac{25}{4}\right)$	B1ft (1)
(c)	$f'(x)=3-2x \Rightarrow f'(1)=3-2\times1=1$ $y=6$ $(y-6)=1(x-1) \Rightarrow (y=x+5)$	M1A1 B1 M1A1 (5)
(d)	$-1=3-2x \Rightarrow x=2$ $\{(y-6)=-1(x-2), \Rightarrow y=-x+8\}$ $\Rightarrow -x+8=x+5 \Rightarrow x=\frac{3}{2}, \Rightarrow y=\frac{13}{2} \Rightarrow (\frac{3}{2},\frac{13}{2})$	B1 M1A1 M1A1 (5)
(e)	$AB=\sqrt{(\frac{3}{2}--3)^2+(\frac{13}{2}-2)^2}=\frac{9\sqrt{2}}{2}$	M1A1 (2)
(f)	$\left\{AD=\sqrt{(\frac{3}{2}-8)^2+(\frac{13}{2}-0)^2}=\frac{13\sqrt{2}}{2}\right\}$ Area $=\frac{9\sqrt{2}}{2}\times\frac{13\sqrt{2}}{2}\times\frac{1}{2}=\frac{117}{4}$ units^2 **ALT** $\frac{1}{2}\begin{vmatrix}1.5 & -3 & 8 & 1.5\\ 6.5 & 2 & 0 & 6.5\end{vmatrix}=\frac{117}{4}$	M1A1ftA1 (3) {M1A1ftA1} **(18)**

Notes

(a)

M1 for attempting to complete the square (see General Guidance)

A1 for the correctly completed expression.

(b)

B1ft for the correct coordinates $\left(\frac{3}{2}, \frac{25}{4}\right)$ or accept $x = \frac{3}{2}, y = \frac{25}{4}$

(c)

M1 for an attempt at differentiating f (x) **AND** substituting $x = 1$ to find a value for the gradient

A1 for gradient = 1

B1 for $y = 6$

M1d for substituting $x = 1$, their y, and m into a correct formula for the equation of a straight line, or by using $y = mx + c$. Award the mark when they have found the value of c using their y and m.

A1 for the correct equation of the line as shown in any form

(d)

B1 for stating $x = 2$ when $m = -1$

Alternative for this mark

B1 they use the coordinate (8, 0) and find $m = -1$

M1 for substituting their x, y, and m into a correct formula for the equation of a straight line, or by using $y = mx + c$. Award the mark when they have found the value of c using their y, x and m.

A1 for the correct equation of the line as shown in any form

M1 for equating the lines to give a value of x or y and attempting to find a value for **BOTH** x and y

A1 for the correct coordinates or values

(e)

M1 for using formula or Pythagoras to find the length AB

A1 for $AB = \frac{9\sqrt{2}}{2}$ or any equivalent surd. For example, $\sqrt{\frac{162}{4}}$, $\frac{9}{\sqrt{2}}$

(f)

M1 for attempting to find the length AD

A1ft For using their values of AB and AD to find the area of the triangle ABD

A1 for the area of the triangle = 29.25 $(\text{units})^2$ oe

ALT

M1 using determinants correctly with(8,0), (−3,2) and their coordinates for the point A of the triangle

A1ft for their values in a correct calculation (either way around)

A1 for the area of the triangle = 29.25 $(\text{units})^2$ oe