

Question	Scheme	Marks	AOs
<b>16(a)</b>	Sets $2xy + \frac{\pi x^2}{2} = 250$	B1	2.1
	Obtain $y = \frac{250 - \frac{\pi x^2}{2}}{2x}$ and substitute into $P$	M1	1.1b
	Use $P = 2x + 2y + \pi x$ with their $y$ substituted	M1	2.1
	$P = 2x + \frac{250}{x} - \frac{\pi x^2}{2x} + \pi x = 2x + \frac{250}{x} + \frac{\pi x}{2}$ *	A1*	1.1b
		(4)	
<b>(b)</b>	$x > 0$ and $y > 0$ (distance) $\Rightarrow \frac{250 - \frac{\pi x^2}{2}}{2x} > 0$ or $250 - \frac{\pi x^2}{2} > 0$ o.e.	M1	2.4
	As $x$ and $y$ are distances they are positive so $0 < x < \sqrt{\frac{500}{\pi}}$ *	A1*	3.2a
		(2)	
<b>(c)</b>	Differentiates $P$ with negative index correct in $\frac{dP}{dx}; x^{-1} \rightarrow x^{-2}$	M1	3.4
	$\frac{dP}{dx} = 2 - \frac{250}{x^2} + \frac{\pi}{2}$	A1	1.1b
	Sets $\frac{dP}{dx} = 0$ and proceeds to $x =$	M1	1.1b
	Substitutes their $x$ into $P = 2x + \frac{250}{x} + \frac{\pi x}{2}$ to give perimeter = 59.8 M	A1	1.1b
		(4)	
			<b>(10 marks)</b>

## Question 16 continued

### Notes:

(a)

**B1:** Correct area equation

**M1:** Rearranges **their** area equation to make  $y$  the subject of the formula and attempt to use with an expression for  $P$

**M1:** Use correct equation for perimeter with their  $y$  substituted

**A1\*:** Completely correct solution to obtain and state printed answer

(b)

**M1:** States  $x > 0$  and  $y > 0$  and uses their expression from (a) to form inequality

**A1\*:** Explains that  $x$  and  $y$  are positive because they are distances, and uses correct expression for  $y$  to give the printed answer correctly

(c)

**M1:** Attempt to differentiate  $P$  (deals with negative power of  $x$  correctly)

**A1:** Correct differentiation

**M1:** Sets derived function equal to zero and obtains  $x =$

**A1:** The value of  $x$  may not be seen (it is 8.37 to 3sf or  $\sqrt{\left(\frac{500}{4 + \pi}\right)}$ )

Need to see awrt 59.8 M with units included for the perimeter