Question	Scheme	Marks	AOs
5(a)	10 (m)	B1	2.2a
		(1)	
(b)	$y=5\Rightarrow 10\sin\left(\frac{t^2}{4}\right)=5\Rightarrow \sin\left(\frac{t^2}{4}\right)=\frac{1}{2}\Rightarrow \frac{t^2}{4}=...$	M1	3.1b
	$\Rightarrow (t=)$ awrt 3.2 or $\sqrt{\frac{10\pi}{3}}$ (or condone $10\sqrt{6}$ or awrt 24.5 in degrees)	A1	1.1b
	$x=100\sqrt{t}=100\sqrt{"\sqrt{\frac{10\pi}{3}}"}=...$	dM1	2.1
	$(x=)$ awrt $180(\text{m})$ (or awrt 495 (m) (see notes))	A1	3.2a
		(4)	
Alt(b)	$x=100\sqrt{t}\Rightarrow \sqrt{t}=\frac{x}{100}\Rightarrow t=\left(\frac{x}{100}\right)^2\Rightarrow y=...$ or $y=10\sin\left(\frac{t^2}{4}\right)\Rightarrow t=2\sqrt{\sin^{-1}\left(\frac{y}{10}\right)}\Rightarrow x=...$	M1	3.1b
	$y=10\sin\left(\frac{1}{4}\left(\frac{x}{100}\right)^4\right)$ or $x=100\sqrt{2\sqrt{\sin^{-1}\left(\frac{y}{10}\right)}}$	A1	1.1b
	$10\sin\left(\frac{1}{4}\left(\frac{x}{100}\right)^4\right)=5\Rightarrow\left(\sin\left(\frac{1}{4}\left(\frac{x}{100}\right)^4\right)=\frac{1}{2}\Rightarrow\frac{1}{4}\left(\frac{x}{100}\right)^4=\frac{5\pi}{6}\Rightarrow\right)x=...$ or $x=100\sqrt{2\sqrt{\sin^{-1}\left(\frac{5}{10}\right)}}\Rightarrow x=...$	dM1	2.1
	$(x=)$ awrt $180(\text{m})$ (or awrt 495 (m) (see notes))	A1	3.2a
		(4)	
			(5 marks)

Notes

(a)

B1: 10 (m) condone lack of units but if given they must be metres oe (condone $y=\ldots$)

(b) **Note the angle unit is radians in the question but condone assuming the angle unit is degrees to score all available marks.**

M1: Sets $y = 5$ and uses the parametric equation for y to reach at least $\frac{t^2}{4} = ...$ (expression or value - you do not need to be concerned by the angle it is set equal to including if it is degrees or radians). May be implied by awrt 1.4, awrt 3.2 or awrt 11.0, awrt 24.5. If just a value for t is stated then you may need to check $y = 5$ was substituted in.

A1: awrt 3.2 or $\sqrt{\frac{10\pi}{3}}$ which may be seen as $\frac{\sqrt{30\pi}}{3}$. May be seen within their working. Condone if other values are seen.

If assuming the angle unit is degrees then condone $10\sqrt{6}$ or awrt $24.5(^\circ)$ Do not withhold this mark if they proceed to use a different value for t

dM1: Correct use of their t value to find a value for x. It is dependent on the previous method mark. May be implied by awrt 120 or awrt 180 (or awrt 331 or awrt 495 if they have assumed the angle unit was degrees). If just a value is stated then you may need to check this is correct for their value of t.

A1: awrt 180 (m) or awrt 495 (m) condone lack of units but if given they must be metres (providing all previous marks have been scored)

As a minimum sight of awrt 3.2 (or awrt 24.5) and awrt 180 (m) (or awrt 495 (m)) can score M1A1dM1A1

Note if more than one answer is given score for awrt 180 (m) (awrt 495 (m)) and isw

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Alt(b) Finding the cartesian equation

M1: Uses the x parameter to eliminate t and find y in terms of x so that $t = Bx^2 \Rightarrow y = C\sin\left(Dx^4\right)$ oe where $B, C, D \neq 0$ May just see the cartesian equation of the required form.

Alternatively uses the y parameter to eliminate t and find x in terms of y so that $x = P\sqrt{Q\sqrt{\sin^{-1}\left(Ry\right)}}$ where $P, Q, R \neq 0$

The $y =$ or $x =$ may be implied by further work

A1: $y = 10\sin\left(\frac{1}{4}\left(\frac{x}{100}\right)^4\right)$ oe or $x = 100\sqrt{2\sqrt{\sin^{-1}\left(\frac{y}{10}\right)}}$ oe (allow unprocessed indices)

The $y =$ or $x =$ may be implied by further work

dM1: Sets their $"10\sin\left(\frac{1}{4}\left(\frac{x}{100}\right)^4\right)" = 5$, and proceeds to find a value for x. It is dependent on the previous method mark. You do not need to be concerned by the mechanics of the rearrangement. Alternatively they may substitute $y = 5$ into $x = "100\sqrt{2\sqrt{\sin^{-1}\left(\frac{y}{10}\right)}}"$ and proceed to find a value for x.

May be implied by awrt 120 or awrt 180 (or awrt 331 or awrt 495 if they have assumed the angle unit was degrees).

A1: awrt 180 (m) or awrt 495 (m) condone lack of units but if given they must be metres (providing all previous marks have been scored)

Note if more than one answer is given score for awrt 180 (m) (awrt 495 (m)) and isw