

Question			Answer	Marks	AO	Guidance
8	(a)		Using $\sin x \approx x$ and $\cos x \approx 1 - \frac{1}{2}x^2$ $\sqrt{\sin 4x} + 2 \cos 2x \approx \sqrt{4x} + 2\left(1 - \frac{1}{2}(2x)^2\right)$ So $y \approx 2\sqrt{x} + 2 - 4x^2$	M1	1.1	Uses both given small angle approximations in the expression. Must see $\sqrt{4x}$ and $\frac{1}{2}(2x)^2$ or $\frac{1}{2} \times 4x^2$ condone missing brackets. Also allow for clear use of $\cos 2x = 1 - 2\sin^2 x$ and $\sin x \approx x$ used.
8	(b)		DR $\int_0^{0.1} (\sqrt{\sin 4x} + 2 \cos 2x) \, dx$ $\approx \int_0^{0.1} \left(2x^{\frac{1}{2}} + 2 - 4x^2 \right) \, dx$ $= \left[\frac{2x^{\frac{3}{2}}}{\frac{3}{2}} + 2x - \frac{4}{3}x^3 \right]_0^{0.1}$ $= \left(\frac{4}{3}0.1^{\frac{3}{2}} + 0.2 - \frac{0.004}{3} \right) - 0 = 0.24083...$	A1 [2]	1.1	AG Convincing argument to reach given answer
				M1	3.1a	Attempts to integrate the expression in powers of x Must be seen
				A1	1.1	At least 2 correct terms (no FT from (a) as answer given)
				A1	1.1	Fully correct indefinite integral. Need not be simplified
				A1	1.1	Correct value from correct indefinite integral. Allow for 0.24 or better if the method is clear. (Do not allow for 0.24059... which is obtained by integrating the original function by calculator.)
				[4]		

Question			Answer	Marks	AO	Guidance
8	(b)		Alternative solution			
			Use trapezium rule to find an area	M1		Also allow for a single trapezium
			Correct $\frac{h}{2}$ for the number of strips used	A1		Soi For example $\frac{0.1}{2}, \frac{0.05}{2}, \frac{0.025}{2}, \frac{0.01}{2}$ used for 1, 2, 4 10 strips
			At least 3 correct ordinates used	A1		Must be ordinates from the approximating function eg 2, 2.4372... and 2.5924... seen
			Area is approximately 0.24	A1		Accept awrt 0.24
					[4]	

Table of values

x	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.1		0.025	0.075
actual y	2	2.199573	2.281092	2.342396	2.39275	2.435732	2.473165	2.506127	2.535317	2.561214	2.584167083		2.313465	2.52116
y from approx	2	2.1996	2.281243	2.34281	2.3936	2.437214	2.475498	2.50955	2.540085	2.5676	2.592455532		2.313728	2.525223

Answers

	using approx	using original function
1 strip	0.229623	0.229208
2 strips	0.236672	0.235817
4 strips	0.23931	0.239061
10 strips	0.240434	0.240194