| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 8(a)(ii) | $\frac{(2t-3)^3}{6} + \frac{3}{2} = 0$ | **M1** | **FT** *their* expression for $v$ in terms of $t$ providing of the form $\frac{(2t-3)^3}{a} + b$ where $a$ and $b$ are non-zero constants |
| | $2t - 3 = \sqrt[3]{-9}$ or<br>$2t - 3 = -2.08[0\ldots]$oe | **A1** | |
| | $t = \frac{3+\sqrt[3]{-9}}{2}$ oe isw or<br>$t = 0.46[0]$ or $0.4599[\ldots]$ | **A1** | |
| 8(a)(iii) | [Displacement:] $\frac{(2t-3)^4}{4\times2\times6} + \frac{3}{2}t\ (+d)$ | **M1** | **FT** *their* expression for $v$ in terms of $t$ providing of the form $\frac{(2t-3)^3}{a} + b$ where $a$ and $b$ are non-zero constants |
| | $\frac{(2\times2.5-3)^4}{48} + \frac{3}{2}(2.5) + d = 4$ | **M1** | Correct calculation which can be used to find $d$ |
| | [Displacement:] $\frac{(2t-3)^4}{48} + \frac{3}{2}t - \frac{1}{12}$ | **A1** | |
| | [Displacement at $t = 3$]<br>$\frac{293}{48}$ oe isw or $6.1[0]$ oe | **A1** | |
| 8(b) | $\frac{dv}{dt} = (2t - 3)^2$ oe, soi or<br>$\frac{d}{dt}(\textit{their } v) = k(2t-3)^2$ where $k$ is a non-zero constant | **B1** | **FT** *their* expression for $v$ in terms of $t$ providing of the form $\frac{(2t-3)^3}{a} + b$ where $a$ and $b$ are non-zero constants, if necessary |
| | Correct small changes relationship:<br>$\frac{\delta v}{0.02} = \textit{their}(2 \times 2.5 - 3)^2$ oe | **M1** | **FT** $\textit{their}\left.\frac{dv}{dt}\right\|_{t=2.5}$ |
| | $\delta v = 0.08$ | **A1** | |
| 9(a) | $2\sin^{-1}\left(\frac{4}{5}\right)$ or $\cos^{-1}\left(\frac{64-25-25}{-2(5)(5)}\right)$ oe | **M1** | |
| | 1.85 or 1.854 to 1.855 | **A1** | |
| 9(b)(i) | 5 × *their* 1.85 [×2] | **M1** | **FT** *their* 1.85 providing it is less than $2\pi$ |
| | 18.5 or 18.54 to 18.55 | **A1** | |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 9(b)(ii) | $\frac{1}{2} \times 5^2 \times$ *their* 1.85 | **M1** | **FT** *their* 1.85 providing it is less than $2\pi$ |
| | Correct plan e.g.<br>$\left[2 \times \frac{1}{2} \times\right] 5^2$ (*their* 1.85– sin(*their* 1.85) | **M1** | **dep** previous **M1** |
| | 22.4 or 22.21 to 22.38 nfww | **A1** | |
| 10 | $n = 7$ soi | **B1** | |
| | $5 \times \frac{7 \times 6}{2} \times 2^5 \times a^2 = 30240$ oe | **B1** | |
| | $5 \times 7 \times 2^6 \times a = b^2$ | **B1** | |
| | $a = 3$ only, nfww | **B1** | |
| | $b = \pm\sqrt{6720}$ oe, isw, nfww | **B1** | |
| | | | If first **B1** only scored then<br>**SC1** for<br>$a = 3\sqrt{5}$ or $\sqrt{45}$ or 6.71 or 6.708[2…] only<br>and<br>**SC1** for $b = \pm\sqrt{1344\sqrt{5}}$ or ±54.8[2…] |
| 11(a) | Correct use of $\pi r^2 h = 330$ to find an expression that can be used to eliminate $h$ e.g.<br>$h = \frac{330}{\pi r^2}$ or $\pi r h = \frac{330}{r}$ | **M2** | **M1** for $\pi r^2 h = 330$ soi |
| | Correct substitution and completion to given answer e.g.<br>$2\pi r^2 + 2\pi r \times \frac{330}{\pi r^2} = 2\pi r^2 + \frac{660}{r}$ | **A1** | |