

Section B

<p>7(i) Asymptote when $1 + 2x^3 = 0$ $\Rightarrow 2x^3 = -1$ $\Rightarrow x = -\frac{1}{\sqrt[3]{2}}$ $= -0.794$</p>	<p>M1 A1 A1cao [3]</p>	<p>oe, condone $\pm \frac{1}{\sqrt[3]{2}}$ if positive root is rejected must be to 3 s.f.</p>
<p>(ii) $\frac{dy}{dx} = \frac{(1+2x^3).2x - x^2.6x^2}{(1+2x^3)^2}$ $= \frac{2x+4x^4-6x^4}{(1+2x^3)^2}$ $= \frac{2x-2x^4}{(1+2x^3)^2} *$ $\frac{dy}{dx} = 0$ when $2x(1-x^3) = 0$ $\Rightarrow x = 0, y = 0$ or $x = 1,$ $y = 1/3$</p>	<p>M1 A1 E1 M1 B1 B1 B1 B1 [8]</p>	<p>Quotient or product rule: (udv-vdu M0) $2x(1+2x^3)^{-1} + x^2(-1)(1+2x^3)^{-2}.6x^2$ allow one slip on derivatives correct expression – condone missing bracket if intention implied by following line derivative = 0 $x = 0$ or 1 – allow unsupported answers $y = 0$ and $1/3$ SC-1 for setting denom = 0 or extra solutions (e.g. $x = -1$)</p>
<p>(iii) $A = \int_0^1 \frac{x^2}{1+2x^3} dx$ <hr style="border-top: 1px dashed black;"/> either $= \left[\frac{1}{6} \ln(1+2x^3) \right]_0^1$ $= \frac{1}{6} \ln 3 *$ or let $u = 1 + 2x^3 \Rightarrow du = 6x^2 dx$ $\Rightarrow A = \int_1^3 \frac{1}{6} \cdot \frac{1}{u} du$ $= \left[\frac{1}{6} \ln u \right]_1^3$ $= \frac{1}{6} \ln 3 *$</p>	<p>M1 M1 A1 M1 E1 M1 A1 M1 E1 [5]</p>	<p>Correct integral and limits – allow \int_1^0 $k \ln(1 + 2x^3)$ $k = 1/6$ substituting limits dep previous M1 www $\frac{1}{6u}$ $\frac{1}{6} \ln u$ substituting correct limits (but must have used substitution) www</p>

<p>8 (i) $x \cos 2x = 0$ when $x = 0$ or $\cos 2x = 0$ $\Rightarrow 2x = \pi/2$ $\Rightarrow x = \frac{1}{4}\pi$ $\Rightarrow P$ is $(\pi/4, 0)$</p>	<p>M1 M1 A1 [3]</p>	<p>$\cos 2x = 0$ or $x = \frac{1}{2} \cos^{-1} 0$ $x = 0.785..$ or 45 is M1 M1 A0</p>
<p>(ii) $f(-x) = -x \cos(-2x)$ $= -x \cos 2x$ $= -f(x)$ Half turn symmetry about O.</p>	<p>M1 E1 B1 [3]</p>	<p>$-x \cos(-2x)$ $= -x \cos 2x$ Must have two of: rotational, order 2, about O, (half turn = rotational order 2)</p>
<p>(iii) $f(x) = \cos 2x - 2x \sin 2x$</p>	<p>M1 A1 [2]</p>	<p>product rule</p>
<p>(iv) $f'(x) = 0 \Rightarrow \cos 2x = 2x \sin 2x$ $\Rightarrow 2x \frac{\sin 2x}{\cos 2x} = 1$ $\Rightarrow x \tan 2x = \frac{1}{2}$ *</p>	<p>M1 E1 [2]</p>	<p>$\frac{\sin}{\cos} = \tan$ www</p>
<p>(v) $f(0) = \cos 0 - 2 \cdot 0 \cdot \sin 0 = 1$ $f'(x) = -2 \sin 2x - 2 \sin 2x - 4x \cos 2x$ $= -4 \sin 2x - 4x \cos 2x$ $\Rightarrow f'(0) = -4 \sin 0 - 4 \cdot 0 \cdot \cos 0 = 0$</p>	<p>B1ft M1 A1 E1 [4]</p>	<p>allow ft on (their) product rule expression product rule on $(2)x \sin 2x$ correct expression – mark final expression www</p>
<p>(vi) Let $u = x$, $dv/dx = \cos 2x$ $\Rightarrow v = \frac{1}{2} \sin 2x$ $\int_0^{\pi/4} x \cos 2x dx = \left[\frac{1}{2} x \sin 2x \right]_0^{\pi/4} - \int_0^{\pi/4} \frac{1}{2} \sin 2x dx$ $= \frac{\pi}{8} + \left[\frac{1}{4} \cos 2x \right]_0^{\pi/4}$ $= \frac{\pi}{8} - \frac{1}{4}$ Area of region enclosed by curve and x-axis between $x = 0$ and $x = \pi/4$</p>	<p>M1 A1 A1 M1 A1 B1 [6]</p>	<p>Integration by parts with $u = x$, $dv/dx = \cos 2x$ $\left[\frac{1}{4} \cos 2x \right]$ - sign consistent with their previous line substituting limits – dep using parts www or graph showing correct area – condone P for $\pi/4$.</p>