

MOCK PAPER MARK SCHEME

Question number	Scheme	Marks
1.	<p>Uses <math>\frac{du}{dx} = 6x</math></p> <p>To give <math>\int \frac{1}{u^2} \frac{du}{3}</math></p> <p>Integrates to give <math>-\frac{1}{3u}</math></p> <p>Uses correct limits 16 and 4 (or 2 and 0 for <math>x</math>)</p> <p>To obtain <math>-\frac{1}{48} + \frac{1}{12} = \frac{1}{16}</math></p>	<p>M1</p> <p>A1</p> <p>M1, A1</p> <p>M1</p> <p>A1 (6)</p> <p><b>(6 marks)</b></p>
2.	<p>Differentiates w.r.t. <math>x</math> to give</p> $3x^2, -2x \frac{dy}{dx} + 2y, -4 + 3y^2 \frac{dy}{dx} = 0$ <p>At (4, 3)</p> $48 - (8y' + 6) - 4 + 27y' = 0$ $\Rightarrow y' = -\frac{38}{19} = -2$ <p><math>\therefore</math> Gradient of normal is <math>\frac{1}{2}</math></p> $\therefore y - 3 = \frac{1}{2}(x - 4)$ <p>i.e. <math>2y - 6 = x - 4</math></p> $x - 2y + 2 = 0$	<p>M1, B1, A1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>M1</p> <p>A1 (8)</p> <p><b>(8 marks)</b></p>

Question	Mark Scheme	Marks
<p>3. (a)</p> <p>(b)</p> <p>(c)</p>	<p><math>\frac{1+14x}{(1-x)(1+2x)} \equiv \frac{A}{1-x} + \frac{B}{1+2x}</math> and attempt <math>A</math> and or <math>B</math></p> <p><math>A = 5, B = -4</math></p> <p><math>\int \frac{5}{1-x} - \frac{4}{1+2x} dx = [-5 \ln  1-x  - 2 \ln  1+2x ]</math></p> <p><math>= (-5 \ln \frac{2}{3} - 2 \ln \frac{5}{3}) - (-5 \ln \frac{5}{6} - 2 \ln \frac{4}{3})</math></p> <p><math>= 5 \ln \frac{5}{4} + 2 \ln \frac{4}{5}</math></p> <p><math>= 3 \ln \frac{5}{4} = \ln \frac{125}{64}</math></p> <p><math>5(1-x)^{-1} - 4(1+2x)^{-1}</math></p> <p><math>= 5(1+x+x^2+x^3) - 4(1-2x + \frac{(-1)(-2)(2x)^2}{2} + \frac{(-1)(-2)(-3)(2x)^3}{6} + \dots)</math></p> <p><math>= 1 + 13x - 11x^2 + 37x^3 \dots</math></p>	<p>M1</p> <p>A1, A1 (3)</p> <p>M1 A1</p> <p>M1</p> <p>M1 A1 (5)</p> <p>B1 ft</p> <p>M1 A1</p> <p>M1 A1 (5)</p> <p><b>(13 marks)</b></p>
<p>4. (a)</p> <p>(b)</p> <p>(c)</p>	<p><math>11 + 4\lambda = 24 + 7\mu</math></p> <p><math>5 + 2\lambda = 4 + \mu</math></p> <p><math>6 + 4\lambda = 13 + 5\mu</math></p> <p><math>5 = 11 + 2\mu</math></p> <p><math>\therefore \mu = -3; \lambda = -2</math></p> <p><u>Check</u> in 3rd equation</p> <p>Use <math>\mu = -3</math> or <math>\lambda = -2</math> to obtain (3, 1, -2)</p> <p><math>\cos \theta = \frac{4 \times 7 + 2 \times 1 + 4 \times 5}{\sqrt{4^2 + 2^2 + 4^2} \sqrt{7^2 + 1^2 + 5^2}} = \frac{50}{\sqrt{36} \sqrt{75}}</math></p> <p><math>\therefore \cos \theta = \frac{50}{6 \times 5\sqrt{3}} = \frac{50\sqrt{3}}{90} = \frac{5\sqrt{3}}{9}</math></p>	<p>Give 2 of these equations and eliminate variable to find <math>\lambda</math> or <math>\mu</math>, find other</p> <p>M1</p> <p>A1 A1</p> <p>B1 (4)</p> <p>M1 A1 (2)</p> <p>M1 A1</p> <p>M1 A1 (4)</p> <p><b>(10 marks)</b></p>

Question	Mark Scheme	Marks
<p>5. (a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p> <p>(e)</p>	$\frac{dx}{dt} = -\sin t, \quad \frac{dy}{dt} = 2 \cos 2t \quad \therefore \frac{dy}{dx} = \frac{2 \cos 2t}{-\sin t}$ $2 \cos 2t = 0 \quad \therefore 2t = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}, \frac{7\pi}{2}$ $\text{So } t = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$ $\left(\frac{1}{\sqrt{2}}, 1\right) \left(\frac{1}{\sqrt{2}}, -1\right) \left(-\frac{1}{\sqrt{2}}, 1\right) \left(-\frac{1}{\sqrt{2}}, -1\right)$ $y = 2 \sin t \cos t$ $= 2 \sqrt{1 - \cos^2 t} \cos t = 2x \sqrt{1 - x^2}$ $y = -2x \sqrt{1 - x^2}$	<p>M1 A1 A1 (3)</p> <p>M1</p> <p>A1 A1 (3)</p> <p>M1 A1 (2)</p> <p>M1</p> <p>M1 A1 (3)</p> <p>B1 (1)</p> <p><b>(12 marks)</b></p>
<p>6. (a)</p> <p>(b)</p> <p>(c) (i)</p> <p>(ii)</p>	$R = \int_{\pi}^{2\pi} x^2 \sin\left(\frac{1}{2}x\right) dx = -2x^2 \cos\left(\frac{1}{2}x\right) + \int 4x \cos\left(\frac{1}{2}x\right) dx$ $= -2x^2 \cos\left(\frac{1}{2}x\right) + 8x \sin\left(\frac{1}{2}x\right) - \int 8 \sin\left(\frac{1}{2}x\right)$ $= -2x^2 \cos\left(\frac{1}{2}x\right) + 8x \sin\left(\frac{1}{2}x\right) + 16 \cos\left(\frac{1}{2}x\right)$ <p>Use limits to obtain <math>[8\pi^2 - 16] - [8\pi]</math></p> <p>Requires 11.567</p> <p>Area = <math>\frac{\pi}{4}, [9.8696 + 0 + 2 \times 15.702]</math> (B1 for <math>\frac{\pi}{4}</math> in (i) or <math>\frac{\pi}{8}</math> in (ii))</p> <p>= 32.42</p> <p>Area = <math>\frac{\pi}{8} [9.8696 + 0 + 2(14.247 + 15.702 + 11.567)]</math></p> <p>= 36.48</p>	<p>M1 A1</p> <p>M1 A1</p> <p>A1</p> <p>M1 A1 (7)</p> <p>B1 (1)</p> <p>B1, M1</p> <p>A1</p> <p>M1</p> <p>A1 (5)</p> <p><b>(13 marks)</b></p>

MOCK PAPER MARK SCHEME

Question	Mark Scheme	Marks
7. (a)	$\frac{dM}{dt} = -kM$ , where $k > 0$	M1 A1 (2)
(b)	$\frac{dM}{dt} = \ln(0.98) \times 10(0.98)^t = -0.02M$	B1, B1 (2)
(c)	$\int \frac{10 dM}{10M - 1} = - \int k dt.$ $\ln(10M - 1) = -kt + c$ <p>At <math>t = 0</math> <math>M = 10 \therefore c = \ln 99</math></p> $\text{At } t = 10 \text{ } M = 8.5 \therefore k = \frac{1}{10} \ln \frac{99}{84} (= 0.0164).$ <p>Uses <math>10M - 1 = 99 e^{-kt}</math> with values for <math>k</math> and <math>t = 15</math></p> <p>To give 7.8 grams</p>	<p>B1</p> <p>M1 A1</p> <p>M1 A1</p> <p>M1 A1</p> <p>M1</p> <p>A1 (9)</p> <p><b>(13 marks)</b></p>

accept awrt 7.8

<b>Qn</b>	<b>Specifications Section</b>	<b>AO1</b>	<b>AO2</b>	<b>AO3</b>	<b>AO4</b>	<b>AO5</b>	<b>Totals</b>	<b>Synoptic Marks Total</b>
<b>Q1</b>	5.3	4	2				6	5
<b>Q2</b>	4.1	5	3				8	6
<b>Q3</b>	1, 3, 5.1, 5.4	5	6	2			13	8
<b>Q4</b>	6.1, 6.2, 6.3, 6.5, 6.6	4	5	1			10	4
<b>Q5</b>	2, 4.1,	5	6	1			12	10
<b>Q6</b>	5.1, 5.3, 5.6	4	4			5	13	8
<b>Q7</b>	4.3, 4.2, 5.5	3	2	1	5	2	13	4
	<b>TOTAL</b>	<b>30</b>	<b>28</b>	<b>5</b>	<b>5</b>	<b>7</b>	<b>75</b>	<b>45</b>