1. a) $2\ln|2x+3|$ OR $2\ln(2x+3)$ M1

$2\ln 3$ OR $\ln 9$ A1

b) $-\frac{1}{4}\cos(4x+\frac{\pi}{6})$ M1

$-\frac{1}{4}\sqrt{3}$ c.a.o A1

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2 a) CORRECT METHOD OF EQUATING COEFFICIENTS OR ELIMINATION M1

$A=16$ $B=-16$ $C=-16$ A3

b) $1+x+x^2$

$1+x+\frac{3}{4}x^2$

$1+\frac{1}{2}x+\frac{1}{4}x^2$

MA3

$16+16x+16x^2$

$-4-4x-3x^2$ OR $4+4x+3x^2$

$-8-4x-2x^2$ OR $8+4x+2x^2$

A1

CORRECTLY ARRIVES AT THE ANSWER GIVEN $(4+8x+11x^2+\dots)$ A1 MUST SEE ALL 3 LINES PREVIOUSLY

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3. a) $4t+5=s-1$

$4-2t=5s-4$

$t=3-2s$

ANY TWO M1

ATTEMPTS SOLUTION M1

$s=2$ $t=-1$ A1 A1

CHECKS 3rd EQUATION + COMMENT MA1

$(6,1,-1)$ A1

b) $-10+4-2=\sqrt{4+16+1}\sqrt{25+1+4}\cos\theta$ o.e M1 STRUCTURE

M1 ALL CORRECT

$\theta=71.4°$ OR 1.25^c c.a.o

c) SIGHT OF $t=-1,3,6$ (ALL THREE) OR ATTEMPT TO FIND $|AB|$ OR $|BC|$ M1

$4:3$ A1 dep on previous M1

4\. a) $\frac{dx}{du} = -2u$ OR $\frac{du}{dx} = \frac{1}{2}(4-x)^{\frac{1}{2}}$ O.E B1

$\int (4-u^2-1)u(-2u)\,du$ OR SIMILAR/EQUIVALENT M1

$\int 2u^4 - 6u^2\,du$ M1

$\frac{2}{5}u^5 - 2u^3\ (+C)$ M1

$\frac{2}{5}(4-x)^{\frac{5}{2}} - 2(4-x)^{\frac{3}{2}}\ (+C)$ A1

b) FACTORIZES $(4-x)^{\frac{3}{2}}$ OUT OR $\pm\frac{2}{5}(4-x)^{\frac{3}{2}}$ M1

SIMPLIFIES CORRECTLY TO THE ANSWER GIVEN (CONVINCINGLY) A1

$\left[-\frac{2}{5}(x+1)(4-x)^{\frac{3}{2}} + C\right]$

c) $-\frac{2}{3}(x+1)(4-x)^{\frac{3}{2}} - \int -\frac{2}{3}(4-x)^{\frac{3}{2}}\,dx$ M1 M1

$- \boxed{\frac{4}{15}(4-x)^{\frac{5}{2}}}$ A1

FACTORIZES $k(4-x)^{\frac{3}{2}}$ OUT AND CONVINCINGLY ARRIVES TO THE ANSWER GIVEN A1

5\. a) $2x$ $\quad -8\frac{dy}{dx}$ $\quad 8y\frac{dy}{dx}$ B2 1eeoo

REARRANGES CORRECTLY TO THE ANSWER GIVEN $\frac{x}{4(1-y)}$ M A1

b) $4y^2 - 8y = 0$ O.E M1

$y = 0, 2$ A1 dep

$1 - y = 0$ OR $y = 1$ M1

$x^2 - 8 + 4 = 0$ O.E M1

$x = 2, -2$ A1 dep

AREA $= 4 \times 2 = 8$ A1 dep on All 5 previous marks

6. a) $\frac{2\cos 2\theta}{6\sec^2\theta} = 0$ M1 EITHER TOP OR BOTTOM

M1 STRUCTURE OF LHS

M1 $(=0)$

$\cos 2\theta = 0$ AND $\theta = \frac{\pi}{4}$ MA1

$P(6, 1)$ A1

b) $\pi \int_0^{\frac{\pi}{4}} (\sin 2\theta)^2 (6\sec^2\theta)\, d\theta$ M1 STRUCTURE INC π / LIMITS

M1 All correct

$4\sin^2\theta\cos^2\theta \times \frac{6}{\cos^2\theta}$ THEN ANSWER GIVEN MA1

c) USE OF $\frac{1}{2} - \frac{1}{2}\cos 2\theta$, e.g. $24\left(\frac{1}{2} - \frac{1}{2}\cos 2\theta\right)$ o.e B1

$12\theta - 6\sin 2\theta$ MA1

$\left[\cdots \right]^{\frac{\pi}{4}} - \left[\cdots \right]^{0}$ M1

$3\pi^2 - 6\pi$ o.e EXACT A1

7. a) $\frac{dV}{dt} = k \times \frac{1}{V}$ o.e B1

$\frac{dV}{dr} = 4\pi r^2$ B1

$\frac{dV}{dr} \times \frac{dr}{dt} = \dots$ OR $4\pi r^2 \frac{dr}{dt}$ M1

$4\pi r^2 \frac{dr}{dt} = \frac{K}{4\pi r^3}$ M1

dep

$\frac{dr}{dt} = \frac{3K}{16\pi^2 r^5}$ OR $\frac{A}{16\pi^2 r^2}$ A1

b) $\int r^5 \, dr = \int A \, dt$ [$\int$ MAY BE MISSING] B1

$\frac{1}{6} r^6 = At + C$ OR $r^6 = Bt + D$ M1 A1

$t=0$ $r=2$, $C = \frac{32}{3}$ OR $D = 64$ M1

$t=1$ $r=3$, $729 = 1 \times B + D$

$\frac{243}{2} = 1 + A + C$ M1

GIVES THE CORRECT ANSWER CONVINCINGLY & CORRECTLY A1

c) AWRT 4.0 (ACCEPT 4 WITH WORKINGS ONLY) A1

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8. $\frac{dx}{d\theta} = \sec^2\theta$ B1

SIGHT OF LIMITS 0 & $\frac{\pi}{4}$ B1

$\frac{8\sec^2\theta}{(\sec^2\theta)^2}$ o.e M1

$8\cos^2\theta$ A1 dep

USE OF $\frac{1}{2} + \frac{1}{2}\cos 2\theta$ e.g. $\int_0^{\frac{\pi}{4}} 4 + 4\cos 2\theta$ B1

$4\theta + 2\sin 2\theta$ M1

$[\dots\dots] - [\dots\dots]$ M1 dep

$\pi + 2$ A1 c.a.o