1. $\frac{1}{3}xe^{3x} - \int \frac{1}{3}e^{3x}\,dx$ MA2

$\frac{1}{3}xe^{3x} - \frac{1}{9}e^{3x} \cdot (+c)$ MA1

$\left[\frac{1}{9}e - \frac{1}{9}e\right] - \left[0 - \frac{1}{9}\right] = 9$ A1

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

$\frac{dV}{dr} \times \frac{dr}{dt}$ OR $4\pi r^2 \times 2.5$ M1

$\left.\frac{dV}{dt}\right|_{r=8} = 10\pi \times 8^2$ M1

640π OR A.W.R.T 2011 A1

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3. a) $2x - 4y - 4x\frac{dy}{dx} + 2y\frac{dy}{dx}$ B3

REARRANGES CORRECTLY AND CONVINCINGLY TO THE ANSWER GIVEN $\frac{dy}{dx} = \frac{x-2y}{2x-y}$ MA1

b) SIGHT OF $y^2 - 8y + 4 = 13$ O.E

$(y+1)(y-9) = 0$

$y = \begin{cases} -1 \\ 9 \end{cases}$ (BOTH)

c) SIGHT OF $\frac{4}{5}$ OR $\frac{16}{5}$ B1

$y+1 = \frac{4}{5}(x-2)$ OR $y-9 = \frac{16}{5}(x-2)$ B1

SOLVES EQUATIONS SIMULTANEOUSLY, AT LEAST ONE SIGNIFICANT STEP M1

$\left(-\frac{13}{6}, -\frac{13}{3}\right)$ A1 A1

4. a) $1 + nax + \frac{1}{2}n(n-1)a^2x^2 + \frac{1}{6}n(n-1)(n-2)a^3x^3$ B3

$an = 15$ AND $\frac{1}{2}n(n-1)a^2 = \frac{1}{6}n(n-1)(n-2)$ M1

SENSIBLE SOLUTION OF SIMULTANEOUS EQUATIONS M1

$a = 6$ CORRECTLY OBTAINED A1

b) $n = \frac{5}{2}$ A1

c) $-\frac{405}{8}$ c.a.o A1

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5. $\int \frac{1}{y}\,dy = \int \frac{5}{(2+x)(1-2x)}\,dx$

OR

$\int \frac{1}{5y}\,dy = \int \frac{1}{(2+x)(1-2x)}\,dx$

M1 FOR SEPARATION

M1 FOR $\int$ $\int$ dep

ATTEMPTS TO FIND PARTIAL FRACTIONS, CORRECT SENSIBLE METHOD M1

$\frac{1}{2+x} + \frac{2}{1-2x}$ OR $\frac{\frac{1}{5}}{2+x} + \frac{\frac{2}{5}}{1-2x}$ A2

$\ln y$ OR $\frac{1}{5}\ln y$ OR $\frac{1}{5}\ln 5y$ (MAY USE MODULUS SIGNS) M1

$\ln(x+2) - \ln(1-2x)$ OR $\frac{1}{5}\ln(x+2) - \frac{1}{5}\ln(1-2x)$ (MAY USE MODULUS SIGNS) M1

ATTEMPTS TO APPLY $x=0$ $y=0$ (SO LONG AS THERE IS A CONSTANT) M1

$C = 1$ OR $C = 0$ MA1 dep

GIVES FINAL ANSWER AS $y = \frac{x+2}{1-2x}$ A1 c.a.o

6. a) $(9,-2,14)-(8,0,12)$ OR $(1,-2,2)$ O.E B1

$\underline{r} = (8,0,12) + \lambda(1,-2,2)$ A1 "STRUCTURE"

A1 ALL CORRECT

b) DOTS "$(1,-2,2)$" $\cdot (2,1,0)$ M1

OBTAINS ZERO + COMMENT A1

c)
$$\left.\begin{aligned} 2\lambda+12 &= 2 \\ -2\lambda &= \mu+9 \\ \lambda+8 &= 2\mu+1 \end{aligned}\right)$$
M1 2 EQUATIONS SEEN

M1 ALL 3 EQUATIONS SEEN

$\lambda = -5$ A1

$\mu = 1$ A1

CHECKS THE "THIRD" COMPONENT + COMMENT M1

$P(3,10,2)$ A1

d) $D(-3,7,2)$ B1 2 CORRECT

B1 ALL 3 CORRECT

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7. a) 0.2031 & 0.8602 BOTH SEEN B1

b) $\frac{2\pi/5}{2}\left[0+0+2(0.2031+0.8602+0.8602+0.2031)\right)$ M1 STRUCTURE

M1 ALL CORRECT

A.W.R.T 2.67 A1

c) $\frac{du}{dx} = -\frac{1}{2}\sin\left(\frac{1}{2}x\right)$ OE. B1

LIMITS -1 & 1 B1

$\int_1^{-1} \sin^3\left(\frac{1}{2}x\right) \times \frac{-2}{\sin\left(\frac{1}{2}x\right)}\, du$ OR $\int_1^{-1} -2\sin^2\left(\frac{1}{2}x\right)\, du$ M1

USE OF $1-\cos^2\left(\frac{1}{2}x\right)$ M1

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

$2u - \frac{2}{3}u^3$ M1

$\frac{8}{3}$ c.a.o A1

8. a) $\int_0^{\frac{\pi}{4}} \cos^2\theta \times \sec^2\theta \, d\theta$ o.e M1 INTEGRAND B1 LIMITS

$\int 1 \, d\theta$ M1

$\left[\theta\right]_{\cdots}^{\cdots}$ M1

$\frac{\pi}{4}$ c.a.o A1

b) $\pi \int_0^{\frac{\pi}{4}} (\cos^2\theta)^2 \sec^2\theta \, d\theta$ M1 INTEGRAND M1 ALL CORRECT

$\int \cos^2\theta \, d\theta$ M1

USE OF $\frac{1}{2}+\frac{1}{2}\cos 2\theta$ M1

$\frac{1}{2}\theta + \frac{1}{4}\sin 2\theta$ M1

$\frac{1}{8}\pi(\pi+2)$ OR EXACT EQUIVALENT A1

c) ATTEMPTS TO USE $1+\tan^2\theta = \sec^2\theta$ M1

$y = \frac{1}{x^2+1}$ c.a.o A1