| Question | Scheme | Marks |
|---|---|---|
| 2(a) | $\frac{3x+4}{(x-2)(2x+1)^2}=\frac{A}{x-2}+\frac{B}{2x+1}+\frac{C}{(2x+1)^2}$ | |
| | $3x+4=A(2x+1)^2+B(x-2)(2x+1)+C(x-2)$ <br> E.g. $x=2\to 10=A\times 25\Rightarrow A=...$ or $x=-\frac{1}{2}\to\frac{5}{2}=C\times-\frac{5}{2}\Rightarrow C=...$ <br> or $x^2:0=4A+2B, x:3=4A-3B+C, x^0:4=A-2B-2C\to A=...$ | M1 |
| | One of $A=\frac{2}{5},B=-\frac{4}{5},C=-1$ | A1 |
| | $\Rightarrow A=...,B=...$ and $C=...$ | M1 |
| | $\frac{3x+4}{(x-2)(2x+1)^2}=\frac{2}{5(x-2)}-\frac{4}{5(2x+1)}-\frac{1}{(2x+1)^2}$ or $A=\frac{2}{5},B=-\frac{4}{5},C=-1$ | A1 |
| | | (4) |
| (b) | $\int\frac{p}{x-2}\,dx=\alpha\ln(x-2)$ or $\int\frac{q}{2x+1}\,dx=\beta\ln(2x+1)$ <br> Alt: $\int\frac{8x+9}{(2x+1)^2}\,dx=\int\frac{8x+4}{(2x+1)^2}+\frac{5}{(2x+1)^2}\,dx=\gamma\ln(2x+1)^2+...$ | M1 |
| | $\int\frac{k}{(2x+1)^2}\,dx=\frac{K}{2x+1}$ | M1 |
| | $\int_7^{12}\frac{3x+4}{(x-2)(2x+1)^2}\,dx=\left[\frac{"2"}{5}\ln(x-2)-\frac{"4"}{5}\times\frac{1}{2}\ln(2x+1)+\frac{"1"}{4x+2}\right]_7^{12}$ | A1ft |
| | $=\left(\frac{2}{5}\ln(10)-\frac{2}{5}\ln(25)+\frac{1}{50}\right)-\left(\frac{2}{5}\ln(5)-\frac{2}{5}\ln(15)+\frac{1}{30}\right)=...$ | DM1 |
| | $=\frac{2}{5}\ln\frac{10}{25}+\frac{1}{50}-\frac{2}{5}\ln\frac{5}{15}-\frac{1}{30}=\frac{2}{5}\ln\frac{10\times 15}{25\times 5}+...$ | M1 |
| | $\frac{2}{5}\ln\frac{6}{5}-\frac{1}{75}$ (oe) | A1 |
| | | (6) |
| | | (10 marks) |

| Question Number | Scheme | Marks |
|---|---|---|
| 5(i) | $\int x^2e^x\,dx=x^2e^x-\int 2xe^x\,dx(+c)$ | M1A1 |
| | $\int xe^x\,dx=xe^x-\int e^x\,dx(+c)$ | M1 |
| | $\int x^2e^x\,dx=x^2e^x-2xe^x+2e^x(+c)$ <br> Also allow $\int x^2e^x\,dx=x^2e^x-(2xe^x-2e^x)(+c)$ | A1 |
| | | (4) |

| | | |
|---|---|---|
| **(ii)** | $u=(1-3x)^{\frac{1}{2}} \Rightarrow u^2=1-3x \Rightarrow 2u\frac{\mathrm{d}u}{\mathrm{d}x}=-3$ <br> or <br> $u=(1-3x)^{\frac{1}{2}} \Rightarrow \frac{\mathrm{d}u}{\mathrm{d}x}=-\frac{3}{2}(1-3x)^{-\frac{1}{2}}$ | B1 |
| | $\int \frac{27x}{\sqrt{1-3x}}\mathrm{d}x = 27\int \frac{\frac{1-u^2}{3}}{u}\left(-\frac{2u}{3}\right)\mathrm{d}u$ <br> or <br> $\int \frac{27x}{\sqrt{1-3x}}\mathrm{d}x = 27\int \frac{\frac{1-u^2}{3}}{\sqrt{1-3x}}\left(-\frac{2}{3}\sqrt{1-3x}\right)\mathrm{d}u$ | M1 |
| | $6\int (u^2-1)\mathrm{d}u$ or $-6\int (1-u^2)\mathrm{d}u$ | A1 |
| | $6\left(\frac{u^3}{3}-u\right)(+k)$ | A1ft |
| | $6\left(\frac{(1-3x)^{\frac{3}{2}}}{3}-(1-3x)^{\frac{1}{2}}\right)(+k)=2(1-3x)^{\frac{1}{2}}(1-3x-3)(+k)$ | M1 |
| | $=-2(1-3x)^{\frac{1}{2}}(2+3x)(+k)$ or $=-2(1-3x)^{\frac{1}{2}}(3x+2)(+k)$ | A1 |
| | | **(6)** |
| | | **Total 10** |

| Question Number | Scheme | Marks |
|---|---|---|
| **2** | $\int \frac{\ln x}{x^2}\mathrm{d}x = \int x^{-2}\ln x\,\mathrm{d}x = \frac{x^{-1}}{-1}\ln x - \int \frac{x^{-1}}{-1}\times\frac{1}{x}\,\mathrm{d}x$ | M1A1 |
| | $= \frac{x^{-1}}{-1}\ln x + \int x^{-2}\,\mathrm{d}x$ | |
| | $= \frac{x^{-1}}{-1}\ln x + \frac{x^{-1}}{-1}(+c)$ | dM1A1 |
| | $\int_1^{e} \frac{\ln x}{x^2}\mathrm{d}x = \left[\frac{-1}{x}\ln x - \frac{1}{x}\right]_1^{e} = \left(\frac{-1}{e}\ln e - \frac{1}{e}\right)-\left(\frac{-1}{1}\ln 1 - \frac{1}{1}\right)$ | ddM1 |
| | $=1-\frac{2}{e}$ | A1 |
| | | **(6)** |