(8) (a) $\int_{-1}^{2} \left(x^2+2x+3-(2x^2+x+1)\right) dx$

$\int_{-1}^{2} (-x^2+x+2)\, dx$

(b) $\int_{-1}^{2} (-x^2+x+2)\, dx$

$= \left[-\frac{x^3}{3}+\frac{x^2}{2}+2x\right]_{-1}^{2}$

$= \left(-\frac{2^3}{3}+\frac{2^2}{2}+2(2)\right)-\left(-\frac{(-1)^3}{3}+\frac{(-1)^2}{2}+2(-1)\right)$

$= \left(-\frac{8}{3}+2+4\right)-\left(\frac{1}{3}+\frac{1}{2}-2\right)$

$= \left(-2\frac{2}{3}+6\right)-\left(\frac{5}{6}-2\right)$

$= 3\frac{1}{3}-\left(-1\frac{1}{6}\right)$

$= 3\frac{2}{6}+1\frac{1}{6}$

$= 4\frac{1}{2}$

Question			Generic scheme	Illustrative scheme	Max mark
8.	(a)		•[1] state integral	•[1] $\int_{-1}^{2}\left(-x^2+x+2\right)dx$	1

Notes:

1. Evidence for •[1] may be appear in part (b). However, where candidates make no attempt to answer part (a), •[1] is not available.
2. •[1] is not available to candidates who omit the limits or 'dx'.
3. •[1] is awarded for a candidates final expression for the area. However, accept $\int_{-1}^{2}\left(\left(x^2+2x+3\right)-\left(2x^2+x+1\right)\right)dx$ or $\int_{-1}^{2}\left(x^2+2x+3\right)dx-\int_{-1}^{2}\left(2x^2+x+1\right)dx$ without further working.
4. For $\int_{-1}^{2} x^2+2x+3-2x^2+x+1\,dx$, see Candidates A and B.

Commonly Observed Responses:

Candidate A	**Candidate B**
(a) $\int_{-1}^{2} x^2+2x+3-2x^2+x+1\,dx$ $\int_{-1}^{2}\left(-x^2+x+2\right)dx$ •[1] ✓ Treat missing brackets as bad form as subsequent working is correct.	(a) $\int_{-1}^{2} x^2+2x+3-2x^2+x+1\,dx$ (b) $\int_{-1}^{2}\left(-x^2+x+2\right)dx$ •[1] ✓ •[1] awarded in part (b)
Candidate C - error in simplification (a) $\int_{-1}^{2}\left(x^2+2x+3\right)-\left(2x^2+x+1\right)dx$ $\int_{-1}^{2} x^2+x+2\,dx$ •[1] ✗	

Question			Generic scheme	Illustrative scheme	Max mark
	(b)		•2 integrate expression from (a)	•2 $-\frac{1}{3}x^3+\frac{1}{2}x^2+2x$	3
			•3 substitute limits	•3 $\left(-\frac{1}{3}(2)^3+\frac{1}{2}(2)^2+2(2)\right)$ $-\left(-\frac{1}{3}(-1)^3+\frac{1}{2}(-1)^2+2(-1)\right)$	
			•4 evaluate area	•4 $\frac{9}{2}$	

Notes:

5. Where a candidate differentiates one or more terms at •2 then •2, •3 and •4 are unavailable.
6. Do not penalise the inclusion of '$+c$' or the continued appearance of the integral sign.
7. Candidates who substitute limits without integrating any term do not gain •3 or •4.
8. Where a candidate arrives at a negative value at •4 see Candidates D and E.

Commonly Observed Responses:

Candidate D

Eg $\int_{-1}^{2}\left(x^2-x-2\right)dx$

⋮

$=-\frac{9}{2}=\frac{9}{2}$ •4 ✗

However…

$=-\frac{9}{2}$, hence area is $\frac{9}{2}$. •4 ✓

Candidate E

Eg $\int_{2}^{-1}\left(-x^2+x+2\right)dx$

⋮

$=-\frac{9}{2}$ cannot be negative so $\frac{9}{2}$ units² •4 ✗

However…

$=-\frac{9}{2}$, hence area is $\frac{9}{2}$. •4 ✓

Candidate F - not using expression from (a)

(a) $\int_{-1}^{2} x^2+2x+3\,dx$ •1 ✗

(b) $\int_{-1}^{2}\left(x^2+2x+3\right)-\left(2x^2+x+1\right)dx$

$=\left[-\frac{1}{3}x^3+\frac{1}{2}x^2+2x\right]_{-1}^{2}$ •2 ✓ 2

$=\left(-\frac{1}{3}(2)^3+\frac{1}{2}(2)^2+2(2)\right)$

$-\left(-\frac{1}{3}(-1)^3+\frac{1}{2}(-1)^2+2(-1)\right)$ •3 ✓ 1

$=\frac{9}{2}$ •4 ✓ 1