

Question	Scheme	Marks	AOs
12	$\frac{4x+9}{x+3} = 4 - \frac{3}{x+3}$	Let $u = x+3$ $\int \frac{4x+9}{x+3} dx = \int \frac{4(u-3)+9}{u} du$	M1 1.1b
	$\int 4 - \frac{3}{x+3} dx$ $= 4x - 3 \ln(x+3)$	$= \int 4 - \frac{3}{u} du$ $4u - 3 \ln u$	dM1 A1 2.1 1.1b
	Uses limits 5 and 1 and uses correct ln work $= 20 - 3 \ln 8 - 4 + 3 \ln 4 = \dots$	Uses limits 8 and 4 and uses correct ln work $= 32 - 3 \ln 8 - 16 + 3 \ln 4 = \dots$	ddM1 1.1b
	$16 - 3 \ln 2$ or $16 + 3 \ln \left(\frac{1}{2}\right)$ oe		A1 2.1
			(5)

(5 marks)

Notes

M1: Attempts to use an appropriate method to integrate the function.

If division is used look for $4 \pm \frac{k}{x+3}$

If substitution is used look for $u = x+3$ and a full attempt to get the integral in x into an integral in u

dM1: Dependent upon the previous t M mark. It is for the full method of integrating the function.

For division look for $4x \pm k \ln(x+3)$

For substitution look for $4u \pm k \ln u$

A1: Fully correct integration

M1: For the key steps of using the correct limits for their function with correct ln work to get a simplified expression

A1: $16 - 3 \ln 2$ or $16 + 3 \ln \left(\frac{1}{2}\right)$ oe such as $16 - \ln 8$