Y	Q	Integration	
2024	2	(a) Find partial fractions for $$\frac{7-2x}{(2x-1)(x+1)}$$	3
		(b) Hence find $\int \frac{7-2x}{(2x-1)(x+1)} dx$	1
2024	14	(a) State the integral of $3\sec 3x \tan 3x$ with respect to x.	1
		(b) Hence use integration by parts to find $\int 3\sin^2 3x \sec 3x \tan 3x\, dx$.	2
2023	5	Use the substitution $u = \tan x$ to evaluate $\int_0^{\frac{\pi}{3}} \tan^2 x \sec^2 x\, dx$.	4
2023	9	(a) Find $f(t)$ if $f'(t) = \frac{4t+17}{2t^2+17t+8}$ and $f(0) = \ln 4$, where $t \geq 0$.	2
		(b) If $f'(t)$ represents the velocity of a particle in $m\,s^{-1}$, where t is the time in seconds, calculate its displacement after 3 seconds.	1
2023	17	(a) Use integration by parts to find $\int x\sin 2x\, dx$.	3
2022	7	Use integration by parts to find $\int 18x\sin 3x\, dx$.	3
2019	8	A particle, starting from rest, moves with an acceleration of $2t\sqrt{2t+1}\ ms^{-2}$, where t is the time in seconds. Use integration by parts, or otherwise, to determine the velocity of the particle after 4 seconds.	5
2019	17	(a) Find $\int e^t \sec^2(e^t)\, dt$	1
		(b) Given your answer describes the displacement of a particle, explain why the particle will never come to rest.	2
2018	2	(a) Find partial fractions for $$\frac{13+6x+5x^2}{(1+x)(2-x)(3+x)}.$$	4
		(b) Show that $\int_0^1 \frac{13+6x+5x^2}{(1+x)(2-x)(3+x)} dx = \ln\frac{a}{b}$ where a and b are positive integers.	3
2018	13	Find the exact value of the integral $\int_0^{\sqrt{5}} \frac{2x^3}{\sqrt{x^2+4}} dx$ using the substitution $u = x^2+4$.	6
2017	10	Use integration by parts to obtain $\int x^2 \sin 5x\, dx$.	5

2017	15	A car of mass m kg is travelling along a straight horizontal road. It experiences resistances of total magnitude $\dfrac{mkv^2}{6}$, where v m s^{-1} is its velocity at any time and k is a positive constant. The engine of the car works at a constant rate P watts.	
		(a) Show that $\dfrac{dv}{dx} = \dfrac{6P - mkv^3}{6mv^2}$ where x metres is the displacement of the car from a fixed point O.	2
		(b) If the car starts from rest, find an expression, in terms of k, P, m and v, for the displacement of the car while it is accelerating.	4
2016 Spec	10	Find the exact value of $\displaystyle\int_{2}^{7} \dfrac{x}{\sqrt{x+2}}\, dx$ using the substitution $u = x + 2$.	5