IBDP Mathematics
Analysis and approaches (SL)
Integration by substitution

Integration by substitution

No product rule and quotient rule for integration

Multiply

1. $\int (x^2 + 3x)^3 (2x + 3)\, dx$

Let $u = x^2 + 3x$

$\dfrac{du}{dx} = 2x + 3$

$dx = \dfrac{du}{2x+3}$

$\int u^3 (2x + 3)\, dx$

$= \int u^3 (\cancel{2x + 3}) \dfrac{du}{\cancel{2x+3}}$

$= \int u^3\, du$

$= \dfrac{1}{4} u^4 + C$

$= \dfrac{1}{4} (x^2 + 3x)^4 + C$

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2. $\int 3x^2(x^3-2)\,dx$

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Fraction

1. $\int \frac{3x^2+2}{x^3+2x} dx$

Let $u = x^3 + 2x$

$\frac{du}{dx} = 3x^2 + 2$

$dx = \frac{du}{3x^2+2}$

$\int \frac{3x^2+2}{u} dx$

$= \int \frac{3x^2+2}{u} \text{ X } \frac{du}{3x^2+2}$

$= \int \frac{1}{u} du$

$= \ln u + C$

$= \ln x^3 + 2x + C$

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2. $\int \frac{4x^3-1}{x^4-x} dx$

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Paper 1

1. Let $f'(x) = \sin^3(2x)\cos(2x)$.

   Find $f(x)$, given that $f\left(\dfrac{\pi}{4}\right) = 1$.

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2. Let $g(x) = \dfrac{\ln x}{x}$.

(a) Find $g'(x)$.

(b) Find $\int g(x)\,dx$.

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