

Integration by substitution

No product rule and quotient rule for integration

Multiply

1. $\int (x^2 + 3x)^3 (2x + 3) dx$ Let $u = x^2 + 3x$ $\frac{du}{dx} = 2x + 3$ $dx = \frac{du}{2x+3}$ $\int u^3 (2x + 3) dx$ $= \int u^3 (\frac{2x+3}{2x+3}) \frac{du}{2x+3}$ $= \int u^3 du$ $= \frac{1}{4}u^4 + C$

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



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

Fraction

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

Let
$$u = x^3 + 2x$$

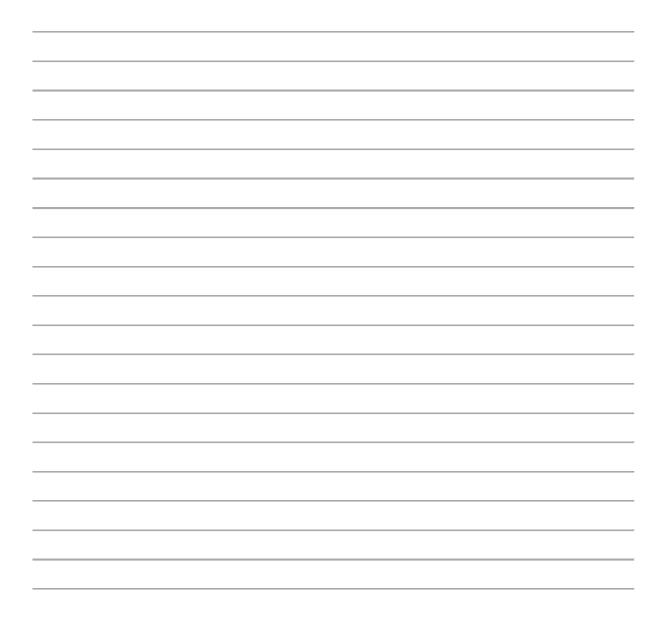
 $\frac{du}{dx} = 3x^2 + 2$
 $dx = \frac{du}{3x^2 + 2}$

$$\int \frac{3x^2 + 2}{u} dx$$
$$= \int \frac{3x^2 + 2}{u} x \frac{du}{3x^2 + 2}$$
$$= \int \frac{1}{u} du$$
$$= \ln u + C$$
$$= \ln x^3 + 2x + C$$





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

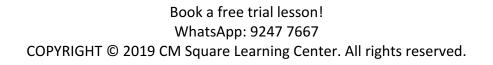






1. Use
$$f'(x) = sin^3(2x)\cos(2x)$$
.

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





2. Use
$$g(x) = \frac{\ln x}{x}$$
.

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

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

