

# Anti-differentiation (integration): more complex examples

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7:24 AM

Anti-differentiation = integration

$$\int 5x \, dx = \frac{5x^2}{2} + c$$

$$\begin{aligned} \text{if } y &= \frac{5x^2}{2} + 15 \\ \frac{dy}{dx} &= \frac{2 \times 5x^2}{2} + 15 \\ &= 5x^2 \end{aligned}$$

$$\textcircled{1} \int \frac{8}{x^2} \, dx$$

$$\begin{aligned} &= \int 8x^{-2} \, dx \\ &= \frac{8x^{-1}}{-1} + c \\ &= -8x^{-1} + c \\ &= \frac{-8}{x} + c \quad \checkmark \end{aligned}$$

$$\begin{aligned} \text{check: } y &= -8x^{-1} + 4 \\ y &= \frac{-8}{x} + 4 \\ \frac{dy}{dx} &= -1 \times -8x^{-2} \\ &= 8x^{-2} \\ &= \frac{8}{x^2} \end{aligned}$$

$$\textcircled{2} \int \frac{3}{\sqrt[4]{x^3}} \, dx =$$

$$\begin{aligned} &= \int \frac{3}{x^{\frac{3}{4}}} \, dx \\ &= \int 3x^{-\frac{3}{4}} \, dx \\ &= \int 3x^{-0.75} \, dx \\ &= \frac{3x^{-0.75+1}}{-0.75+1} + c \\ &= \frac{3x^{0.25}}{0.25} + c \\ &= 12x^{\textcircled{0.25}} + c \\ &= 12x^{\frac{1}{4}} + c \quad \checkmark \end{aligned}$$

check:

$$\begin{aligned} \text{if } y &= 12x^{\frac{1}{4}} + c \\ \frac{dy}{dx} &= \frac{1}{4} \times 12x^{\frac{1}{4}-1} \\ &= 3x^{-\frac{3}{4}} \\ &= \frac{3}{x^{\frac{3}{4}}} = \frac{3}{\sqrt[4]{x^3}} \end{aligned}$$

$$\textcircled{3} \int (2x-1)^2 \, dx =$$

$$\begin{aligned} &= \int 4x^2 - 4x + 1 \, dx \\ &= \frac{4x^3}{3} - \frac{4x^2}{2} + x + c \\ &= \frac{4x^3}{3} - 2x^2 + x + c \quad \checkmark \end{aligned}$$

check:

$$\begin{aligned} y &= \frac{4}{3}x^3 - 2x^2 + x + 6 \\ \frac{dy}{dx} &= \frac{4}{3} \times 3x^2 - 4x + 1 \\ &= 4x^2 - 4x + 1 \\ &= (2x-1)^2 \end{aligned}$$

$$x^4 \quad \sqrt{x}$$