

## Indefinite Integration

### Starter

In a similar way that subtraction is the opposite operation to addition, **integration** can be considered the **opposite operation** of **differentiation**.

Notation:  $\int f(x)dx \equiv$  integrate  $f(x)$  with respect to  $x$

1. The poetry for differentiating polynomials is:

*The power multiplies the coefficient,  
And decrease the power by 1.*

Write the poetry for integrating polynomials.

2. Using your poetry from question 1, find an expression for  $\int kx^n dx$ .

3. Write down three different functions that differentiate to  $2x$ .

### Notes

When the functions  $y = x^2 + 5$  and  $y = x^2 - 7$  are differentiated they both give  $\frac{dy}{dx} = 2x$ .

Therefore, when integrating  $2x$  i.e.  $\int 2x dx$ , we cannot be sure what the value of the constant will be unless extra information is given. Therefore, after integrating we include a “+c”.

$$\text{i.e. } \int 2x dx = x^2 + c$$

In general:

The poetry for integration is:

*Increase the power by one,  
Divide by the new power,  
And add a constant.*

- $\int kx^n dx = \frac{k}{n+1} x^{n+1} + c$
- $\int k dx = kx + c$

**N.B.** Always check your answer by mentally differentiating back.

**E.g. 1** Find:

(a)  $\int 21x^2 dx$     (b)  $\int (3x^4 - 2) dx$     (c)  $\int 12x^{-3} dx$     (d)  $\int x^{\frac{1}{2}} dx$

**Working:** (a)  $\int 21x^2 dx = \frac{21}{3} x^{2+1} + c = 7x^3 + c$

**N.B.** The first step above can be missed out without loss of marks

**Exercise**

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**Summary**

The poetry for integration is:

*Increase the power by one,  
Divide by the new power,  
And add a constant.*

- $\int kx^n dx = \frac{k}{n+1}x^{n+1} + c$
- $\int k dx = kx + c$