Section 2: Finding the area under a curve

Crucial points

1. **Remember to integrate when calculating a definite integral!**
   Don't forget to actually carry out the integration. The expression you write in the square brackets must be the integrated function.

   Example: Evaluate: $\int_0^1 (x^3+1)\mathrm{d}x$

✗ ***Wrong*** $\int_0^1 (x^3+1)\mathrm{d}x = \left[x^3+1\right]_0^1 = \left(1^3+1\right)-\left(0+1\right)=1$ ✗

✓ ***Right*** $\int_0^1 (x^3+1)\mathrm{d}x = \left[\frac{1}{4}x^4+x\right]_0^1 = \left(\frac{1}{4}+1\right)-\left(0+0\right)=\frac{5}{4}$ ✓

2. **Don't add '+ *c*' inside the square brackets**
   Remember, you don't need an arbitrary constant when evaluating a definite integral.

3. **Be careful not to mix up indefinite and definite integrals**
   Definite integrals have limits of integration – numbers on top and bottom of the integral sign, whereas indefinite integrals don't!

   Example:

   $\int x^2\mathrm{d}x = \frac{1}{3}x^3+c$ – Indefinite integral

   $\int_0^1 x^2 dx = \left[\frac{x^3}{3}\right]_0^1 = = \frac{1}{3}-0=\frac{1}{3}$ – Definite integral

4. **Be careful with signs**
   When you are working out a definite integral it is very easy to make mistakes with signs, especially when dealing with negative limits. Use brackets to make your working clear.

5. **Be clear whether you are dealing with an area or just a definite integral**
   If you are dealing with an area, this may be above or below the x-axis. For an area below the x-axis, the value of the definite integral will be negative. Since an area cannot be negative, you should give your final answer in such cases as positive. However, if you are simply asked to find a definite integral, with no reference to area, then you do not need to think about graphs at all, but just give the answer as calculated directly from the definite integral, which may be positive or negative.