**Using integration to calculate the area under a curve**

# Worked exampleA black and white drawing of a brick wall with an archway at the top.

You are constructing a new roof for a factory similar in shape to that shown in Figure 1. You need to calculate the area of brickwork that will be required to fill under the arch.

The proportions and roof line for an arch for the new building are shown in Figure 2 below and can be represented by the quadratic equation:

**Figure 1**

**Figure SEQ Figure \\* ARABIC 1: The factory roof line**

A graph of the function y equals minus 0.2 x squared add 4 x.
The x-axis goes from 0 to 20 and is labelled distance across width of building, m.
The y axis goes from 0 to 25 and is labelled height from base of roof, m.
The graph is a curve that looks like a smooth n shape. The bases of the n are at 0, 0 and 20, 0. The height of the curve is 20 metres.

**Figure 2: The proportions and roof line of the proposed building**

The area, , under the curve between and is to be determined.

We can write this as an integration calculation:

**Step 1: Integrate each term.**

When we have limits, it’s a definite integral. We use square brackets and add the limits to the top and bottom of the bracket.

**Remember:** When integrating, you add 1 to the power and divide by the new power.

**Step 2: Apply definite limits.**

To find the area, we need to evaluate the integral at each limit, and , and find the difference.

At :

At :

This means that the integration calculation is:

**So, enough bricks will need to be purchased to cover an area of 264 m2.**