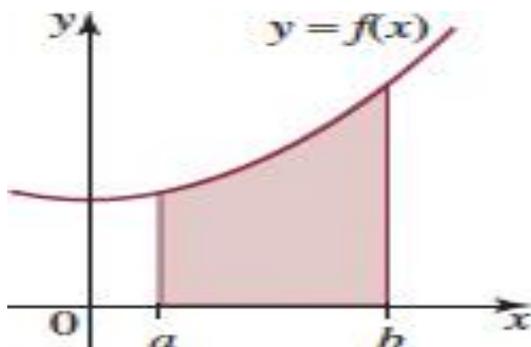


## Goals

This fortnight we are going to:

- Understand the use of areas of rectangles (and other shapes) to approximate the area under a given curve between defined intervals
- Understand the use of sigma notation and limits to approximate area under a curve
- Find an exact area under a given curve using definite integrals
- Use your CAS calculator to integrate functions and find definite integral



## Theoretical Components

Make notes on the following chapters:

### Maths Quest 12 Mathematical Methods

- 9D - Approximating areas enclosed by functions
- 9E - The fundamental theorem of integral calculus
- 9F - Signed areas
- 9G - Further areas

### Area under the curve:

- <http://www.rootmath.org/calculus/area-intro>
- <https://www.intmath.com/integration/3-area-under-curve.php>

### Exact area under the curve using definite integral:

The first video is 17 minutes long, but worth the watch.

- <https://www.youtube.com/watch?v=WUvTyaaNkzM>
- <https://www.youtube.com/watch?v=ODwkTt0RMDg>
- <https://www.youtube.com/watch?v=GtCYrxxTjH4>
- <https://www.khanacademy.org/math/old-ap-calculus-ab/ab-antiderivatives-ftc/ab-fundamental-theorem-of-calc/v/connecting-the-first-and-second-fundamental-theorems-of-calculus>

## Practical Components

### Do the following questions:

Organise your solutions neatly in your exercise book.

Chapter 9 of Maths Quest 12 Mathematical Methods (pdf – Google Classroom)

- 9D: 1, 3, 5, 7, 9
- 9E: 1-2 (1st and 3rd column), 4, 5 (1st and 3rd column), 6-10
- 9F: 1, 3-4 (1st column), 5-6 (1st column), 10-11
- 9G: 2 (1st column), 3-5, 11-17

## Investigation

See next page

Other

Mathspace Task

**Fun fact:** The integral of a function is usually interpreted as the area between the graph of the function and the  $x$ -axis. This is straightforward for simple functions such as polynomials, but what about more exotic functions? When does this interpretation break down? Lebesgue integration is a technique that extends the classical idea of integration to cover a larger class of functions, replacing the area under a curve with a concept known as a *measure*.

## Week 11 and 12 Investigation

### Question 1:

Explain the **Fundamental Theorem of Calculus** in your own words. (What does this theorem mean to you and how do we use it.) Use diagrams to assist in your explanation if you need.

### Question 2:

- Draw the curves  $y = x$  and  $y = x^2$  on the same axes and work out the intersection points.
- Do this calculation  $\int_0^1 x \, dx - \int_0^1 x^2 \, dx$ .
- Looking at the graphs in part a and the equation in part b. Explain what you have worked out in this question in terms of area.