14 Calculus

Calculus has widespread applications in science and engineering and is used to solve complex and expansive problems that cannot be solved by algebra alone. It builds on analytic geometry and includes two major branches; differential and integral calculus, which are related by the Fundamental Theorem of Calculus.

Applications of differential calculus include computations involving velocity and acceleration, the slope of a curve, and optimization. Applications of integral calculus include computations involving area, volume, arc length, centre of mass, work, and pressure.

For an overview go to `http://en.wikipedia.org/wiki/Calculus`

Exercises 14.1:

(i) Find the area of the region bounded by the graph of the parabola $y = x^2$, the x-axis, and the vertical lines $x = 0$ and $x = 1$.

(ii) Find the anti-derivative of the function $y = cos(2x)$.

(iii) What is the average value of the function $y = sin(x)$ over the interval $0 < x < pi$?

14.1   Answers to Exercises

14.1:

(i) Area $= 1/3$ of a unit of area.

(ii) Antiderivative $y = (1/2)\sin(2x) + \text{constant}$

(iii) Average value $= (1/\text{pi})[-\cos(\text{pi}) + \cos(0)] = 2/\text{pi}$.