

## Week 5: Calculus

Try these exercises now, do not use a calculator, and try to solve the exercises without help

1. What does the notation  $\frac{dy}{dx}$  mean if you consider the graph of the function  $y = x^2 + 2x - 1$ ?
2. Find  $\frac{dy}{dx}$  for each of these functions: (a)  $y = x^2 + 2x$  (b)  $y = 5x^3 - 1$
3. Calculate the gradient of the curve  $y = x^2 + 2x - 1$  when  $x = 0$ ,  $x = 2$  and  $x = -1$
4. Find  $\frac{dy}{dx}$  for the curve  $y = x^2 - 3x$ . For what value of  $x$  is the gradient equal to 0?
5. Use a table of derivatives to find  $\frac{dz}{dt}$  when  $z$  is given by:
  - (a)  $z = 5t^3$
  - (b)  $z = \sqrt{t}$
  - (c)  $z = 3 \sin(t)$
  - (d)  $z = 4e^{2t}$
6. Differentiate  $y = 6 \sin(2x) + 3x^2 - 5e^{3x}$
7. If  $\frac{dy}{dx} = 2x + 5x^4 + 3$ , integrate the expression to find  $y$ .
8. What is the constant of integration and why do you need it?
9. Integrate with respect to  $x$  (a)  $x^5 - 2x^3$  (b)  $\frac{1}{x^4}$
10. Find (a)  $\int x^3 dx$  (b)  $\int \cos 2t dt$