Section 1: Introduction

Crucial points

1. **Be careful with the sign when modelling a situation using a differential equation**
   Always consider carefully whether the rate of change is positive or negative.

2. **Be careful with notation**
   Rate of change is denoted by $\frac{\mathrm{d}}{\mathrm{d}t}$. Always use the same letters for variables that are given in the question (for example, don't change $\frac{\mathrm{d}x}{\mathrm{d}t}$ to $\frac{\mathrm{d}y}{\mathrm{d}x}$). If you change the letter used, then it may be difficult for the examiner to follow what you are doing. You can use the "dot" notation if you like (i.e. $\dot{x}$ denotes $\frac{\mathrm{d}x}{\mathrm{d}t}$, $\ddot{x}$ denotes $\frac{\mathrm{d}^2x}{\mathrm{d}t^2}$), but do make sure that your dots are clear!

3. **Make sure that you include the arbitrary constant when integrating.**
   Remember that you only need an arbitrary constant on one side of the equation.

4. **Remember to include the modulus sign, if necessary, when integrating to give a logarithmic function**
   Make sure that you think about whether it can be dropped, according to the context of the question.

5. **Be careful to manipulate logarithms and exponentials correctly.**
   In particular, remember that $\log(x + a)$ is **not** equal to $\log x + \log a$.