

MODELLING WITH DIFFERENTIAL EQUATIONS

MAIN CONCEPTS

- Differential Equations naturally appear when modelling many real world problems.
- A general principle to remember is

total rate of change = rate in – rate out.

- The techniques we learnt in earlier sections, Euler's method, separable equations, slope fields etc. are useful in studying the equations obtained from modelling these systems.

ACTIVITIES

ACTIVITY 7.5.2

Suppose that you have a bank account that grows by 0.17% every year. Let $A(t)$ be the amount of money in the account in year t .

- (a) What is the rate of change of A with respect to t ?

- (b) Suppose that you are also withdrawing \$ 10,000 per year. Write a differential equation that expresses the total rate of change of A .

- (c) Sketch a slope field for this differential equation, find any equilibrium solutions, and identify them as either stable or unstable. Write a sentence or two that describes the significance of the stability of the equilibrium solution.

- (d) Suppose that you initially deposit \$ 100,000 into the account. How long does it take for you to deplete the account?

- (e) What is the smallest amount of money you would need to have in the account to guarantee that you never deplete the money in the account?

- (f) If your initial deposit is \$ 30,000, how much could you withdraw every year without depleting the account?

