



QUESTION WORKBOOK

Solving differential equations

Integration · Year 12–13

6 questions · 28 marks

NAVY SCREEN EDITION

SECTION A · Warm-up

A1 Separate the variables in $dy/dx = x^2/y$, writing the result as two integrals. [2]

A2 Solve $dy/dx = 3x^2y$ for $y > 0$, given that $y = 2$ when $x = 0$. [4]

SECTION B · Standard

B1 Solve $dy/dx = y^2$, given that $y = 1$ when $x = 0$, and state the values of x for which your solution is valid. [5]

- B2** A tank is draining, and its depth h at time t satisfies $dh/dt = -k\sqrt{h}$, where k is a positive constant. Given that $h = 16$ when $t = 0$, solve the equation and find, in terms of k , the time at which the tank empties. [5]

- B3** Water leaks from a tank at a rate proportional to the volume present, so that $dV/dt = -kV$. Initially the tank holds 500 litres, and after 10 minutes it holds 250 litres. Find V as a function of t , and find the value of k to 3 significant figures. [5]

SECTION C · Stretch

- C1** A population of P thousand insects at time t years is modelled by $\frac{dP}{dt} = 0.1P(5 - P)$, $0 < P < 5$. Given that $P = 1$ when $t = 0$, show that $P = \frac{5}{1 + 4e^{-0.5t}}$. [7]