



QUESTION WORKBOOK

Calculus with hyperbolic functions

Hyperbolic functions · Year FM

7 questions · 27 marks

PRINT EDITION

SECTION A · Warm-up

- A1** Write down the derivatives of $\sinh x$ and $\cosh x$, and note the difference from the trig pattern. [2]

- A2** Differentiate $y = \cosh 3x$, and find the gradient at $x = 0$. [3]

SECTION B · Standard

- B1** Find the equation of the tangent to $y = \cosh x$ at $x = \ln 2$. [4]

- B2** Evaluate $\int \sinh x \, dx$ from 0 to $\ln 3$, exactly. [3]

B3 Evaluate $\int 1/\sqrt{(x^2 - 9)} \, dx$ from 3 to 5, giving the answer as a single logarithm. [4]

B4 Using the identity $\cosh 2x = 2 \cosh^2 x - 1$, evaluate $\int \cosh^2 x \, dx$ from 0 to 1, exactly. [4]

SECTION C · Stretch

C1 Using the substitution $x = 2 \sinh u$, show that $\int \sqrt{(x^2 + 4)} \, dx$ from 0 to $2\sqrt{3} = 2 \ln(2 + \sqrt{3}) + 4\sqrt{3}$. [7]