# Railway Engineering Mathematics
# Tutorial Sheet 13

1. Differentiate the following with respect to the appropriate variable, using either the product rule or the quotient rule as required:

(a) $\quad y = 8x^5 \sin(2x)$

(b) $\quad y = e^{-2t} \cosh(7t)$

(c) $\quad y = \dfrac{9x^{-3} + 27}{3 \sin(6x)}$

(d) $\quad x = \dfrac{7 + \cos(t)}{6t^3} - 5t^2 + 7t - 9$

(e) $\quad \Delta = (12t^3 - 5t + 3)(3 \cos(4t) + 8t)$

(f) $\quad Q = 4\sqrt{T} + \dfrac{6\,e^{-3T}}{8T + 9}$

(g) $\quad Z = (2x^3 - 5)\,e^{-7x}$

(h) $\quad y = \dfrac{5 - 6\,e^{-7x}}{10x - \cos\left(\dfrac{8x}{3}\right)}$

2. Determine the gradient of the following functions at the point specified:

(a)    $y = \dfrac{2x^3 - 5x + 7}{5\,e^{8x}}$    at    $x = 3.5$

(b)    $y = (8x^2 - 5x + 7)\ln(4x) + 9x$    at    $x = 7$