Railway Engineering Mathematics
Tutorial Sheet 12

1. Differentiate the following with respect to the appropriate variable:

(a) $y = 6\sin(7x - 3)$

(b) $y = 3\sqrt[4]{9x + 5}$

(c) $y = \left(4x^3 - 3x\right)^6$

(d) $y = 5\left(2x^2 + 7x - 1\right)^{-4}$

(e) $\gamma = \dfrac{7}{\sqrt{3t^2 + 6t - 9}}$

(f) $\psi = -3\,\mathrm{e}^{6x^2 - 1}$

(g) $\theta = 7 + 3\sinh(6r^2 - 7r + 9) - 8r + \dfrac{5}{6r^3}$

(h) $\Delta = -4(5t^2 - 6)^3 + 18\sqrt{t} - \dfrac{2\sin(2t - 8)}{3}$

2. Determine the gradient of:

(a) $y = 4.5\,\mathrm{e}^{3x+1}$ at $x = -0.04$

(b) $y = 5\cos^4(9x)$ at $x = 2.5$