Railway Engineering Mathematics
Tutorial Sheet 11

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

(a) $y = 7x^2 - 9x + 8$

(b) $y = 4x^5 + 3\sin(6x)$

(c) $y = 8\cos(3x) - \dfrac{6}{x^4} + \ln(2x) - 8$

(d) $y = \sinh(0.3t) - 3\,\mathrm{e}^{2t} - 4t^7$

(e) $y = 9\sqrt{x} + \dfrac{5x^3}{2}$

(f) $y = 6\,\mathrm{e}^{-3.5x} - 6.2\cos(x) - \sin\left(\dfrac{2x}{5}\right)$

(g) $x = 4t^3 + 3\ln(4t) + 12$

(h) $y = 9\psi^2 - \dfrac{5\cos(2\psi)}{7}$

2. Evaluate the gradient of the following functions at the specified values:

   (a) $y = 5x^3 + 4x - 12 \quad \text{at} \quad x = -2$

   (b) $Q = 9\cos(t) - 2\sin(4t) \quad \text{at} \quad t = \dfrac{\pi}{2}$

   Note:

   We use radians by default when evaluating trigonometric functions.

3. Calculate $\dfrac{\mathrm{d}y}{\mathrm{d}x}$, given that:

$$y = \frac{-1}{\sqrt{2x}} - x^{\frac{3}{2}}$$