Year 4 Math Assignment 14: Differentiation **Time: 45 mins**

1. Differentiate the following with respect to x:

   (a) $y = 2\tan(1 - x^3)$ (b) $y = 2\sin(\frac{1}{x})$

   (c) $y = -5\cos(x - 2x^3)$ (d) $y = (1 + \sin x)^2$

   (e) $y = \sqrt{\cos x}$ (f) $\tan^4 2x - \cos^3 5x$

2. Given that $y = \sin x + 3\cos x$, show that $\cos x \frac{dy}{dx} + y\sin x = 1$.

3. Given that $y = A\sin 3x + B\cos 3x$, where A and B are constants, show that $\frac{d^2y}{dx^2} + 9y = 0$.

4. Find the equation of the tangent and the normal to the curve $y = x + \sin 3x$ at the point $x = \frac{\pi}{3}$.

5. In the diagram, angle OAB = angle COD = x rad. OA = 7 cm and OD = 1 cm. CD and AB are each perpendicular to OB. Show that $AB + BC + CD = 8\sin x + 6\cos x$.

   Find the value of x for which $AB + BC + CD$ is a stationary value. Determine the nature of this stationary value and find its value.