SATPREP
Assignment: Calculus

1. A gradient function is given by $\dfrac{dy}{dx} = 10e^{2x} - 5$. When $x = 0$, $y = 8$. Find the value of y when $x = 1$.

2. Let $f(x) = e^{-3x}$ and $g(x) = \sin\left(x - \dfrac{\pi}{3}\right)$.

   (a) Write down
      (i) $f'(x)$;
      (ii) $g'(x)$.

   (b) Let $h(x) = e^{-3x} \sin\left(x - \dfrac{\pi}{3}\right)$. Find the exact value of $h'\left(\dfrac{\pi}{3}\right)$.

3. The graph of the function $y = f(x)$ passes through the point $\left(\dfrac{3}{2}, 4\right)$. The gradient function of f is given as $f'(x) = \sin(2x - 3)$. Find $f(x)$.

4. (a) Find $\displaystyle\int \dfrac{1}{2x+3}\,dx$.

   (b) Given that $\displaystyle\int_0^3 \dfrac{1}{2x+3}\,dx = \ln\sqrt{P}$, find the value of P.

5. Let $h(x) = \dfrac{6x}{\cos x}$. Find $h'(0)$.

6. Let $f(x) = e^x \cos x$. Find the gradient of the normal to the curve of f at $x = \pi$.

7. A particle moves along a straight line so that its velocity, v m s^{-1} at time t seconds is given by $v = 6e^{3t} + 4$. When $t = 0$, the displacement, s, of the particle is 7 metres. Find an expression for s in terms of t.

8. Let $g(x) = 2x \sin x$.
   (a) Find $g'(x)$.

   (b) Find the gradient of the graph of g at $x = \pi$.