1. Differentiate the following expressions with respect to x.

   (a) $3x^2 - 7x + 3\sin x$. 2

   (b) $\dfrac{1}{2(3x^2+4)^2}$. 2

2. The function g is defined for $t \in \mathbb{R}$ by $g(t) = (\sin t + \cos t)^3$.
   Find a formula for $g'(t)$. 2

3. Find the equation of the tangent to the curve with equation $y = \sin(3x) + 3$ at the point where $x = \frac{\pi}{3}$. 5

4. Find the values of x for which the function defined for $x \in \mathbb{R}$ by $f(x) = x^3 - 6x - 5$ is decreasing. 4

5. Calculate the angle between the positive direction of the x-axis and the tangent to the curve with equation $y = 2x^3 - 3x - 10$ at the point where $x = -1$. 4

6. Acceleration is defined as the rate of change of velocity.
   An object is travelling in a straight line. The velocity, v m/s, of this object, t seconds after the start of the motion, is given by $v(t) = 8\cos(2t - \frac{\pi}{2})$.

   (a) Find a formula for $a(t)$, the acceleration of this object, t seconds after the start of the motion. 3

   (b) Determine whether the velocity of the object is increasing or decreasing when $t = 10$. 2

24 Marks