1. (CI) Find the equation of the tangent to the curve $y = e^{2x}$ at the point where $x = 1$. Give your answer in terms of e.

2. (CI) Let $f(x) = 3\cos(2x) + \sin^2(x)$.
   a. Show that $f`(x) = -5\sin(2x)$
   b. In the interval $\frac{\pi}{4} \le x \le \frac{3\pi}{4}$, one normal to the graph of f has an equation $x = k$. Find the value of k.

3. (CA) Let $f(x) = \cos(2x)$ and let $g(x) = \ln(3x - 5)$ and let $h(x) = f(x) \times g(x)$.
   a. Explain why the domain of $h(x)$ is $x > \frac{5}{3}$.
   b. Determine the equation of $h`(x)$.
   c. Hence, or otherwise, determine the intervals in which $h(x)$ is concave down. Include explanations of how you used the calculator to determine your domain interval.

4. (CI) Consider the function $f(x) = k\sin(x) + 3x$, where k is a constant.
   a. Find $f`(x)$.
   b. When $x = \frac{\pi}{3}$, the gradient of the curve of $f(x)$ is 8. Find the value of k.

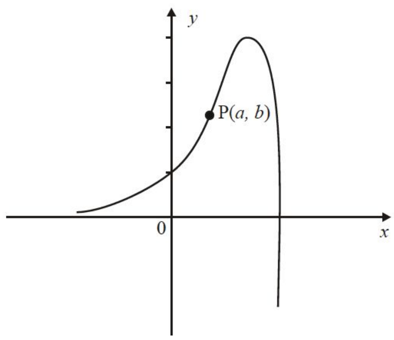
5. (CI) Consider the curve $y = \ln(3x - 1)$. Let P be a point on the curve where $x = 2$.
   a. Find the gradient of the curve at P.
   b. The normal to the curve at P cuts the x-axis at R. Find the coordinates of R.

6. (CI) Let $g(x) = 2x\sin(x)$. Find the gradient of the curve at $x = \pi$.

7. (CI) Find the exact value of $h`\left(\frac{\pi}{3}\right)$ if $h(x) = e^{-3x}\sin\left(x - \frac{\pi}{3}\right)$.

8. (CI) The diagram shows part of the graph of the curve with equation $y = e^{2x}\cos x$.

   a. Show that $\frac{dy}{dx} = e^{2x}(2\cos(x) - \sin(x))$.
   b. Hence, find $\frac{d^2y}{dx^2}$ (the second derivative).



There is an inflexion point at P(a,b).

   c. Use your results from parts (a) and (b) to prove that:
      i. $\tan(a) = \frac{3}{4}$,
      ii. the gradient of the curve at P is e^{2a}.