1. **(CI)** Determine the equations of the derivatives of the following functions.

   a. $y = x ln(x)$
   b. $y = \frac{4}{x^2} sin(x)$
   c. $y = 2x^3 e^{-x}$
   d. $y = x^3 cos(x)$
   e. $y = e^{3x} cos(x)$
   f. $y = -\frac{\sqrt{x}}{5} ln(x)$

2. **(CI)** Determine the equations of the lines *tangent* to the following functions at the specified points.

   a. $g(x) = xe^{1+x^2}$ at the point where *x* = 0.
   b. $h(x) = x^2 cos(x)$ at the point where *x* = π .
   c. $f(x) = \frac{1}{x} ln(x)$ at the point where *x* = *e*.

3. **(CA)** Determine the equations of the lines *normal* to the following functions at the specified points.

   a. $g(x) = xe^{1+x^2}$ at the point where *x* = ½ .
   b. $h(x) = x^2 cos(x)$ at the point where *x* = ¼ .
   c. $f(x) = \frac{1}{x} ln(x)$ at the point where *x* = e^2.

4. **(CI)** For the curve of $g(x) = e^x \sin(x)$ on the domain of $-\pi \leq x \leq \pi$,

   a. Show that g(x) has 2 zeroes at x = - π and x = 0 and x = π .
   b. Find the equations of *g*\`(*x*) and *g*\`\`(*x*).
   c. Find the values of *x* for which *g*\`(*x*) = 0.
   d. Hence, determine the interval(s) of increase and decrease of *g*(*x*) and classify the extrema.
   e. Sketch the function, given your previous work.

5. **(CI)** Given the function $g(x) = xe^x - e^x$,

   a. Find the exact values of *g*(*1*) and *g*(0).
   b. Show that $\frac{d}{dx} g(x) = e^x + g(x)$.
   c. Determine the intervals of increase and decrease for *y* = *g*(*x*).
   d. Show that *g*(*x*) has an inflection point at *x* = -1.
   e. Determine the interval in which *g*(*x*) is concave up.
   f. Sketch the function given your previous work.