1. **(C5.4 - N) (CI)** Determine the equations of the lines that are *tangent* and *normal* to the following functions at the specified points. (Reminder: a **normal line** is perpendicular to a **tangent line**)
   (Cirrito 20.1, p.646)
   a. $g(x) = \sin(x)$ at the point where $x = \frac{\pi}{4}$.
   b. $h(x) = 2 - 4\cos(x)$ at the point where $x = \frac{5\pi}{6}$.
   c. $f(x) = 2\sin(x) - \cos(x)$ at the point where $x = \pi$.

2. **(C5.4 - N) (CI)** At what x value(s) in the domain of $0 \le x \le 3\pi$ does the curve $g(x) = 3 - 2\sin(x)$ have a tangent line that is parallel to the line $y - x + 6 = 0$?
   (Cirrito 20.1, p.646)

3. **(C5.4 - N) (CI)** To analyze the function $g(x) = \cos(x) - \sqrt{3}\sin(x)$ on the domain $-2\pi < x < 2\pi$,
   (Cirrito 20.1, p.646)
   a. find the x-intercepts of $g(x)$
   b. find the derivative of $g(x)$
   c. find the coordinates of the extremas of $g(x)$.
   d. find the intervals of increase and decrease of $g(x)$.
   e. sketch $g(x)$
   f. The graph of $g(x)$ can be rewritten in a new identity, in the form of $y = R\cos(x - k)$. Find the values of R and k.

4. **(C5.4 - N) (CA)** Use symbolab (at https://www.symbolab.com/) or wolframalpha (at https://www.wolframalpha.com/examples/mathematics/calculus-and-analysis/derivatives/ to determine the following derivatives:

   a. (i) $y = \sin(2x)$ (ii) $y = \sin(3x)$ (iii) $y = \sin(5x)$ (iv) $y = \sin(12x)$ (v) $y = \sin(\pi x)$

   b. (i) $i = \cos(2x)$ (ii) $y = \cos(3x)$ (iii) $y = \cos(5x)$ (iv) $y = \cos(12x)$ (v) $y = \cos(\pi x)$

   c. Summarize your observations $\Rightarrow$ what is the derivative of $f(x) = \sin(Kx)$ and $g(x) = \cos(Kx)$

5. **(C5.4 - N) (CI)** At what point(s) in the domain of $0 < x < 2\pi$ would the function $y = 4\cos(2x)$ have a slope of -4?
   (Cirrito 20.1, p.646)

6. **(C5.4 - N) (CA)** Use symbolab (at https://www.symbolab.com/) or wolframalpha (at https://www.wolframalpha.com/examples/mathematics/calculus-and-analysis/derivatives/ to determine the following derivatives:

   a. (i) $y = \sin(2x + 4)$ (ii) $y = \sin(3x - 5)$ (iii) $y = \sin(5x + 25)$ (iv) $y = \sin(\pi x - 3)$

   b. (i) $y = \cos(2x - 7)$ (ii) $y = \cos(3x + 1)$ (iii) $y = \cos(5x - 20)$ (iv) $y = \cos(\pi x + 2)$

   c. Summarize your observations ⇒ what is the derivative of the linear composites of sinusoidal functions like $f(x) = \sin(mx + b)$ and $g(x) = \cos(mx + b)$

7. **(C5.7 - N) (CI)** Here are two graphs of functions. Sketch graphs of the ***first*** derivatives of each function. Record any observations/conclusions you might make about the two functions and their derivatives.
   (Cirrito 19.2, p.60)