1. **Fill in the derivative rules:** All you are being asked to do is *write down* the rest of the rules that you have learned about from the textbook and the Intro Video.
   Then practice using the rules to find the derivative for the given function. Do not simplify

   (a) $\frac{d}{dx}[c] = $ 0 $\qquad h(x) = 5 \qquad h'(x) = $ 0

   (b) $\frac{d}{dx}[x^n] = $ $n x^{n-1}$ $\qquad h(x) = x^{50} \qquad h'(x) = $ $50x^{49}$

   (c) $\frac{d}{dx}[c\, f(x)] = $ $c\, f'(x)$ $\qquad h(x) = 3x^2 \qquad h'(x) = $ $3(2x)$

   (d) $\frac{d}{dx}[f(x) + g(x)] = $ $f'(x) + g'(x)$ $\qquad h(x) = 5x^6 + x^7 \qquad h'(x) = $ $5(6x^5) + 7x^6$

   (e) $\frac{d}{dx}[f(x) - g(x)] = $ $f'(x) - g'(x)$ $\qquad h(x) = 6x^3 - x \qquad h'(x) = $ $6(3x^2) - 1$

   (f) $\frac{d}{dx}[e^x] = $ e^x $\qquad h(x) = \frac{1}{2}e^x \qquad h'(x) = $ $\frac{1}{2} e^x$

2. Compute the derivatives of the following functions using the above derivative rules.
   Do not simplify your answers. (If you already know what these are, DO NOT USE THE PRODUCT RULE, THE QUOTIENT RULE OR THE CHAIN RULE. If you don't know what they are, presumably you won't be using them either!)

   (a) $f(x) = (x-2)(2x+3)$ (You will need to do algebraic pre-processing first.)

   $= 2x^2 - 4x + 3x - 6 = 2x^2 - x - 6$

   $f'(x) = 4x - 1$

   (b) $g(x) = \frac{x^2}{2} - \frac{2}{x^2} + \frac{1}{\sqrt{2}}$ $= \frac{1}{2}x^2 - 2x^{-2} + \frac{1}{\sqrt{2}}$

   $g'(x) = \frac{1}{2}(2x) - 2(-2x^{-3}) + 0$

   (c) $f(t) = \sqrt{t} - e^t + t^{0.3}$ $= t^{1/2} - e^t + t^{0.3}$ $\qquad 0.3 - 1 = -0.7$

   $f'(t) = \frac{1}{2}t^{-1/2} - e^t + (0.3)t^{-0.7}$

   (d) $f(x) = \frac{x^2 + x - 1}{\sqrt{x}}$ $= x^2 x^{-1/2} + x x^{-1/2} - x^{-1/2} = x^{3/2} + x^{1/2} - x^{-1/2}$

   $f'(x) = \frac{3}{2}x^{1/2} + \frac{1}{2}x^{-1/2} - \left(\frac{-1}{2}\right)x^{-3/2}$

(e) $V(r) = \dfrac{4}{3}\pi r^3$

$V'(r) = \frac{4\pi}{3}(3r^2)$

(f) $f(x) = e^{x-3}$ $= e^x (e^{-3})$ This is a constant!

$f'(x) = \frac{1}{e^3} e^x$ $(= e^{x-3})$

(g) $H(r) = a^2r^2 + br + c$ Note a^2, b, c are constants.

$H'(r) = a^2(2r) + b$

3. At what point(s) on the curve $y = 3x + x^3$ is the tangent to the curve parallel to the line $\underbrace{y = 6x - 5}_{\text{slope} = 6}$?

This is asking the question: at what x is $y' = 6$

Note $y' = 3 + 3x^2$, so we need to solve $3 + 3x^2 = 6 \Rightarrow 3x^2 = 3$
$\Rightarrow x^2 = 1$

So at $x = 1$, $x = -1$, the slope of the TL to $y = 3x + x^3$ is equal to 6; these points are where the TL are parallel to the line $y = 6x - 5$.