Section 2.3

- If $f(x) = k$, where k is a constant, then $f\,'(x) = 0$.
- If $f(x) = x^n$ then $f\,'(x) = nx^{n-1}$.
- If $f(x) = b^x$ then $f\,'(x) = \ln b \cdot b^x$
- If $f(x) = e^x$ then $f\,'(x) = e^x$
- If $f(x) = \log_b x$ then $f\,'(x) = \dfrac{1}{\ln b} \cdot \dfrac{1}{x}$
- If $f(x) = \ln x$ then $f\,'(x) = \dfrac{1}{x}$
- If $h(x) = k \cdot f(x)$ where k is a constant, then $h\,'(x) = k \cdot f\,'(x)$
- If $h(x) = f(x) \pm g(x)$ then $h\,'(x) = f\,'(x) \pm g\,'(x)$
- **Marginal Business Functions**:
  - If $C(x)$ is the total cost of producing x items, then $C\,'(x)$ is the **Marginal Cost Function**.
  - If $R(x)$ is the total revenue from selling x items, then $R\,'(x)$ is the **Marginal Revenue Function**.
  - If $P(x)$ is the total profit from making and selling x items, then $P\,'(x)$ is the **Marginal Profit Function**.
- The Marginal Business Functions can be used to **approximate** the profit, revenue, or cost of the **next (i.e. single)** item.
  - The **approximate** cost from making the n^{th} item is $C\,'(n-1)$.
  - The **approximate** revenue from selling the n^{th} item is $R\,'(n-1)$.
  - The **approximate** profit from making and selling the n^{th} item is $P\,'(n-1)$.
- The Business Functions can be used to find the **exact** profit, revenue, or cost of a **single** item.
  - The **exact** cost of making the n^{th} item is $C(n) - C(n-1)$.
  - The **exact** revenue of selling the n^{th} item is $R(n) - R(n-1)$.
  - The **exact** profit of making and selling the n^{th} item is $P(n) - P(n-1)$.
- The $nDeriv($ command can be used on your calculator to approximate the value of $f\,'(a)$. It can be found by hitting MATH and then 8. The format for the command is $nDeriv(Y_1, X, a)$ (assuming the function is typed into Y_1).

  Note: The command may instead appear symbolically on your homescreen. If this is the case, you would need to enter the same inputs (Y_1, X, a) into the appropriate boxes in the symbolic notation.

1. Evaluate the following: $\frac{d}{dx}\left(3x^2+2x-4e^x+5\ln(x)+e-4\right)$

2. Find $\frac{dy}{dx}$ if $y=4\sqrt{x}-4x^2+2^x-4\ln(x)-\frac{5}{x^8}+\log_7(x)$

3. Find $h'(x)$ if $h(x)=\left(3x^2+x^5\right)\left(\sqrt[5]{x^3}-4\right)$

4. Find $k'(x)$ if $k(x)=\dfrac{\sqrt[7]{x^3}+4x^5-\frac{1}{x^2}}{\sqrt[3]{x^2}}$

5. Determine the value(s) of x for which the line tangent to the graph of $f(x) = 4x^2 - 7x + 5$ is parallel to the line $y = 10x - 5$.

6. The total profit function for a particular storage box is given by $P(x) = -0.0012x^2 + 10.45x - 500$.

   (a) Find the exact profit realized from the sale of the 100th storage box.

   (b) Use the marginal profit function to estimate the profit realized from the sale of the 100th storage box.

7. The price-demand function for a particular bag of coffee is given by $p = -\frac{2}{15}x + 10$, where x bags are sold at a unit price of $\$p$.

   (a) Find the revenue function.

   (b) Find the exact revenue of selling 30 bags of coffee.

   (c) Use marginal analysis to approximate the revenue of selling the 30th bag.

Section 2.4

- If $h(x) = f(x) \cdot g(x)$ then $h'(x) = f(x) \cdot g'(x) + g(x) \cdot f'(x)$
- If $h(x) = \dfrac{f(x)}{g(x)}$ then $h'(x) = \dfrac{g(x) \cdot f'(x) - f(x) \cdot g'(x)}{(g(x))^2}$

9. Find the derivative of each of the following functions:

   (a) $f(x) = \left(2x^2 - 5x\right)\left(4x^4 - \sqrt[5]{x^3} + 8\right)$

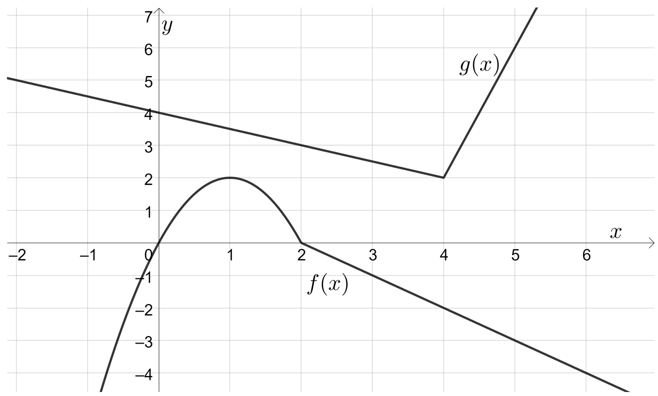
(b) $g(x) = \dfrac{3x^4 - 2^x}{8x^7 - 5}$

(c) $m(t) = \left(2t^2 - \dfrac{1}{t} + \ln(t)\right)\left(e^t + 7\log_3(t)\right)$

(d) $C(x) = \dfrac{x^2 + 7x - 4}{4^x - 5x\ln(x)}$

10. Find the equation of the line tangent to the graph of $f(x) = 4x^2e^x$ at $x = 1$.

11. Given the graphs of $f(x)$ and $g(x)$ below, determine the following:



(a) $k'(5)$ if $k(x) = \left(x^4 - f(x)\right)\left(g(x) - 2x\right)$

(b) $h'(1)$ if $h(x) = \dfrac{10 + f(x)}{3x^4 - g(x)}$

12. For what value(s) of x is the line tangent to the graph of $f(x) = \dfrac{x^2}{x^2 - x + 1}$ horizontal?

13. The cost function (in dollars) for a company that makes coffee is given by $C(x) = \dfrac{10x^{5/2}}{x^2 + x + 2}$ when x pounds of coffee are made. Find (and interpret) the marginal cost when 4 pounds of coffee are made.

14. If $f(x) = \dfrac{\ln(x)}{x^5}$, what is $f'(e)$?