Derivatives

Question 1. *Calculate the derivative of the following functions:*

- $f_0(x) = 3x^2$
- $f_1(x) = 5x^2 - 18$
- $f_2(x) = 5x^2 - 18x + 39$
- $f_3(x) = \sin(x)$
- $f_4(x) = \sin(x) * x^2$
- $f_5(x) = \frac{5x^3 - 2x + 1}{2x - 7}$
- $f_6(x) = ax^2 + bx + c$

Question 2. *Calculate the second order derivative of the same functions:*

- $f_0(x) = 3x^2$
- $f_1(x) = 5x^2 - 18$
- $f_2(x) = 5x^2 - 18x + 39$
- $f_3(x) = \sin(x)$
- $f_4(x) = \sin(x) * x^2$
- $f_5(x) = \frac{5x^3 - 2x + 1}{2x - 7}$
- $f_6(x) = ax^2 + bx + c$

Question 3. *Find the anti-derivative of the following functions:*

- $g_0(x) = 3x^2$
- $g_1(x) = 5x^2 - 18$
- $g_2(x) = 5x^2 - 18x + 39$
- $g_3(x) = \sin(x)$
- $g_4(x) = ax^2 + bx + c$

Question 4. *Calculate the following partial derivatives:*

- $h_1(x, y) = 3x^2 + y^2$ *w.r.t.* x $\left(\frac{\partial h_1}{\partial x}\right)$
- $h_1(x, y) = 3x^2 + y^2$ *w.r.t.* y $\left(\frac{\partial h_1}{\partial x}\right)$

- $h_2(x, y, z) = 5x^3 - 18y^2 - 18x + 39z^5 + 40xy + z^2x^3y$ w.r.t. x $\left(\frac{\partial h_2}{\partial x}\right)$

- $h_2(x, y, z) = 5x^3 - 18y^2 - 18x + 39z^5 + 40xy + z^2x^3y$ w.r.t. y $\left(\frac{\partial h_2}{\partial y}\right)$

- $h_2(x, y, z) = 5x^3 - 18y^2 - 18x + 39z^5 + 40xy + z^2x^3y$ w.r.t. z $\left(\frac{\partial h_2}{\partial z}\right)$

Question 5. *Calculate the following second / third order partial derivatives:*

- $h_1(x, y) = 3x^2 + y^2$ *w.r.t.* x *then* y $\left(\frac{\partial^2 h_1}{\partial x \partial y}\right)$

- $h_1(x, y) = 3x^2 + y^2$ *w.r.t.* y *then* x $\left(\frac{\partial^2 h_1}{\partial y \partial x}\right)$

- $h_2(x, y, z) = 5x^3 - 18y^2 - 18x + 39z^5 + 40xy + z^2x^3y$ *w.r.t.* x *and* x $\left(\frac{\partial^2 h_2}{\partial x^2}\right)$

- $h_2(x, y, z) = 5x^3 - 18y^2 - 18x + 39z^5 + 40xy + z^2x^3y$ *w.r.t.* y *and* x $\left(\frac{\partial^2 h_2}{\partial y \partial x}\right)$

- $h_2(x, y, z) = 5x^3 - 18y^2 - 18x + 39z^5 + 40xy + z^2x^3y$ *w.r.t.* z *then* x *and* y $\left(\frac{\partial^3 h_2}{\partial x \partial y \partial z}\right)$