Name: **Present group members:**

Worksheet 2-1: Q1

The function $f(x) = 3x^4 - 28x^3 + 84x^2 - 96x$ over $[-1, 6]$ is plotted at desmos.com/calculator/nevlfz0yxp.
The derivative of f is $f'(x) = 12x^3 - 84x^2 + 168x - 96 = 12(x-1)(x-2)(x-4)$.

- Using the derivative, find all critical points of $f(x)$.

- Identify all stationary points, and for each stationary point, identify its type (min, max, saddle).

- Find the global minimum and maximum of $f(x)$ over the interval $[-1, 6]$.

Worksheet 2-1: Q2

Find the stationary points of $f(x, y) = 6x^2y - 3x^3 + 2y^3 - 150y$

Worksheet 2-1: Q3 On a quiz, Dr. Munch asks about a function $f : U \to \mathbb{R}$ defined on $U \subseteq \mathbb{R}^n$ where all partial deriviatives of f exist.

- Kylo Ren writes the following on his quiz.

  At a local optimum, the gradient is zero, so $\nabla f(x^*) = 0$.

  Mark his answer correct or explain why his answer is wrong.

- Rey Skywalker writes the following on her quiz.

  Since $\nabla f(\mathbf{x}^*) = 0$, f has a local optimum.

  Mark her answer correct or explain why her answer is wrong.

- Poe Dameron writes the following on his quiz.

  Since f has a local optimum at $\mathbf{x}^*$ and $\mathbf{x}^*$ is in the interior of U, the gradient is zero, meaning $\nabla f(\mathbf{x}^*) = 0$.

  Mark his answer correct or explain why his answer is wrong.

Worksheet 2-1: Q4

Let for $f(x,y) = 2x+3y : S \to \mathbb{R}$ and $S = B[0,1] = \{(x,y) : x^2+y^2 \leq 1\} = \{(x,y) : \|(x,y)\|_2 \leq 1\}$. Answer the following questions.

a) We call f a linear map if there is a matrix A such that $f(x,y) = A\mathbf{x}$, where $\mathbf{x} = \begin{bmatrix} x \\ y \end{bmatrix}$. Find the matrix A to show that f is a linear map.

b) Note that because A is just a vector, $A\mathbf{x}$ is the same as the dot product. Use this and the Cauchy-Schwartz inequality to find $\arg\min_{x \in S} f(x)$ and $\arg\max_{x \in S} f(x)$

c) What do the points you found in part (b) represent?