

Name:

Roll Number:

Section: A\_\_

**Note:** Justify your answers (as always!).

Let  $\gamma, \delta, \alpha, \beta \in \mathbb{R}$  be four *constants*, with  $\gamma \neq 0$ . And we define  $f : \mathbb{R} \rightarrow \mathbb{R}, x \mapsto \gamma x^3 + \delta x^2 + \alpha x + \beta$ , a cubic polynomial function.

Question 1) Use the **First Derivative test** to determine the point(s) where  $f$  can have a local extremum (either local maximum or local minimum).

You should find a condition on  $\gamma, \delta, \alpha, \beta$  for the local extrema to exist, and their (possible) location should also depend on the coefficients  $\gamma, \delta, \alpha, \beta$ .

Question 2) Use the **Second Derivative test** to determine which of these extremum is a *local* maximum and which is a *local* minimum.

Question 3) Apply this to find the local maximum and local minimum for this function  $f : x \mapsto x^3 + 2x^2 + x + 1$  (if they exist).

**Answer:**

You can use the back of the sheet if you need.

You can use this side of the sheet if you need.