**Points of Inflection**

A point of inflection is where the gradient (not the graph itself) takes a local max/min value.

At a point of inflection, the shape of a graph changes from a *concave upwards* to a *concave downwards* curve, or vice versa.

Usually, at a point of inflection, $\frac{d^{2}y}{dx^{2}}=0$, but this is not always the case.

Points of inflection can be *stationary points of inflection* or *non-stationary points of inflection*.

**Stationary Point of Inflection**

In the example below, where $y=x^{3}$, there is a stationary inflection point.

I.e. at the point of inflection, the gradient also zero and $\frac{dy}{dx}=0$.



Gradient reaches min value

**Non-Stationary Point of Inflection**

In the example below, where $y=x+\frac{1}{x}$, there is a non-stationary inflection point.

I.e. at the point of inflection, the gradient is not zero and $\frac{dy}{dx}\ne 0$.



Gradient reaches max value

|  |  |  |
| --- | --- | --- |
|  | $$\frac{dy}{dx}=0$$ | $$\frac{dy}{dx}\ne 0$$ |
| $$\frac{d^{2}y}{dx^{2}}>0$$ | Stationary point, minimum |  |
| $$\frac{d^{2}y}{dx^{2}}=0$$ | Stationary point of inflection | Non-stationary point of inflection |
| $$\frac{d^{2}y}{dx^{2}}<0$$ | Stationary point, maximum |  |