NPTEL DATA SCIENCE FOR ENGINEERS

ASSIGNMENT 4- Solution Document

1) If $f(x) = 3x^4 - 2x^3 - 3x^2 + 6$, then the first order necessary condition for either maxima or minima of $f(x)$ is

Answer: b) $\mathbf{12x^3 - 6x^2 - 6x = 0}$

$$\frac{\partial f}{\partial x} = 12x^3 - 6x^2 - 6x = 0$$

$$\frac{\partial f}{\partial x} = 0$$

2) For the function $f(x) = 3x^4 - 2x^3 - 3x^2 + 6$, which of the following points are stationary point(s) of $f(x)$?

Answers: 0, -1/2,1

Feedback:

$$\frac{\partial f}{\partial x} = 0$$

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x_{1,2} = \frac{-(-6) \pm \sqrt{(-6)^2 - 4 \cdot 12 \cdot (-6)}}{2 \cdot 12}$$

$$x_{1,2} = \frac{6 \pm \sqrt{324}}{24}$$

$$x_1 = \frac{6 - \sqrt{324}}{24} = -\frac{1}{2}$$

$$x_2 = \frac{6 + \sqrt{324}}{24} = 1$$

3) For the function $f(x) = 3x^4 - 2x^3 - 3x^2 + 6$, the stationary point(s) which maximize(s)

the value of $f(x)$ is

Answer: b) 0

Condition for maximizer $\mathrm{f}''(\mathrm{x}) < 0$; $\mathrm{f}''(\mathrm{x}) = 36x^2 - 12x - 6$

$\mathrm{f}'' - \left(\frac{1}{2}\right) = 9 > 0$

$\mathrm{f}''(0) = -6 < 0$

$\mathrm{f}''(1) = 18 > 0$

4) For the function $f(x) = 3x^4 - 2x^3 - 3x^2 + 6$, the stationary point(s) which minimize(s) the value of $f(x)$ is

Answer: -1/2, 1

Condition for minimizer $\mathrm{f}''(\mathrm{x}) > 0$; $\mathrm{f}''(\mathrm{x}) = 36x^2 - 12x - 6$

$\mathrm{f}'' - \left(\frac{1}{2}\right) = 9 > 0$

$\mathrm{f}''(0) = -6 < 0$

$\mathrm{f}''(1) = 18 > 0$

5) If the objective function, inequality constraints, equality constraints are all linear functions, then the type of optimization problem is:

Answer: c) Linear problem

If objective function, inequality constraints, equality constraints are considered as linear functions, then the type of optimization problem would be linear problem.

6) For any two points x1, and x2 in the range and any 0<λ<1, if f(x) is a convex function then:

Answer: a) $\boldsymbol{f[\lambda x_1 + (1-\lambda)x_2] \leq \lambda f(x_1) + (1-\lambda)f(x_2)}$

7) Consider an optimization function f(x), if x is the decision variable and f is a function to be minimized, then the type of optimization problem is

Answer: b)Unconstrained optimization