FORMULA SHEET

Application of Derivative

- Equation of Line:

  General : $ax + by + c = 0$

  Slope : $-\frac{a}{b}$

  Slope intercept : $y = mx + c$

  Slope : m

  Slope point form : $y - y_1 = m(x - x_1)$

- Equation of line parallel to axes:

  Line parallel to x-axis = $y = \pm b$

  Line parallel to y-axis = $x = \pm a$

  Slope of parallel Line = $m_1 = m_2$

  Slope of Perpendicular Line = $m_1 = \frac{-1}{m_2}$ or $m_1 \times m_2 = -1$

- Application of derivative in Geometry:

  Slope of tangent = $\frac{dy}{dx}$

  Slope of Normal = $\frac{-1}{\left(\frac{dy}{dx}\right)}$

- Derivative of Rate measure:

  $\frac{ds}{dt} \rightarrow$ velocity $\qquad \frac{d^2s}{dt^2} = \frac{dv}{dt} \longrightarrow$ accl^n

- Approximation:

$$F(a+h) \doteq F(a) + hF'(a)$$

- Rolle's Theorem:

If $y = F(x)$ is i) cont. at $[a,b]$

ii) diff. at (a,b)

iii) $f(a) = f(b)$

Then, There exist atleast one $c \in (a,b)$ such that

$$F'(c) = 0$$

- LMVT:

If $y = F(x)$ is i) cont. at $[a,b]$

ii) diff. at (a,b)

Then, there exist atleast one $c \in (a,b)$ such that

$$F'(c) = \frac{f(b) - f(a)}{b-a}.$$

- Increasing and decreasing:

Increasing $\longrightarrow$ i) if $x_2 > x_1$ then $F(x_2) > f(x_1)$

ii) If $F'(x) > 0$

Decreasing $\longrightarrow$ i) If $x_2 > x_1$ then $F(x_2) < F(x_1)$

ii) If $F'(x) < 0$

- Maxima and Minima:

Second derivative: $y = F(x)$ has

a) Maxima $\rightarrow$ $f'(c) = 0$ and $F''(c) < 0$

b) Minima $\rightarrow$ $f'(c) = 0$ and $F''(c) > 0$