To find the highest or lowest elevation of point on curve, the first derivative of equation (B):

$$y' = rx + g_1$$

now $y' = 0$, and substituting x_0 instead of x

$$0 = r(x_0) + g_1 \Rightarrow \boxed{x_0 = \frac{-g_1}{r}}$$

the horizontal distance for the highest or lowest point in curve with station ....(C)

station

Substituting equation(C) in equation (A), we can easily find the highest or lowest elevation of point on the curve :

$$\boxed{y_0 = \frac{r}{2}(x_0)^2 + g_1(x_0) + \text{Elevation BVC}}$$

$$\text{Elevation of P.V.I} = \text{Elevation of BVC} \mp g_1 * \frac{L}{2}$$

$$\text{Elevation of EVC} = \text{Elevation of PVI} \mp g_2 * \frac{L}{2}$$

$$\text{station of PVI} = \text{station of BVC} + \frac{L}{2}$$

$$\text{station of EVC} = \text{station of PVI} + \frac{L}{2}$$

$\because \Delta y$ (is the difference elevation between tangent and curve @ distance x)

$\Rightarrow \Delta y = |$ formulation of tangent $-$ formulation of vertical curve

$\because$ formulation of tangent $= g_1 x +$ Elevation BVC

$\because$ " " vertical curve $= \frac{r}{2}x^2 + g_1 x +$ Elevation BVC

$$\Rightarrow \therefore \Delta y = \frac{r}{2}\cdot x^2$$

We can calculate Δy with Δe through:

$$\frac{\Delta e}{(L/2)^2} = \frac{\Delta y}{x^2} \Rightarrow \Delta y = \frac{\Delta e \cdot x^2}{(L/2)^2} \Rightarrow \Delta y = 4\,\Delta e \cdot \left(\frac{x}{L}\right)^2$$

$$\text{Where } \Delta e = \frac{r}{2}\cdot x^2 \Rightarrow \Delta e = \frac{r}{2}\cdot\left(\frac{L}{2}\right)^2$$

$$= \frac{A}{2\cancel{L}}\cdot\frac{L^{\cancel{2}}}{4}$$

station

$$\Rightarrow \Delta e = \frac{AL}{8}$$

Example 1/ The vertical curve contains two grade, the first grade was upward 2.8% while the second one downward 4.6%. These grades meet at intersection point (PVI), which the Reduce level and station of (PVI) were (48.30 m) and (13+70), respectively. The length of vertical curve was 500 m. Find

1) The Reduce levels and stations of the tangent points.
2) The Reduce levels of the curve @ 100 m interval.
3) The station and Reduce level of highest point on the curve.