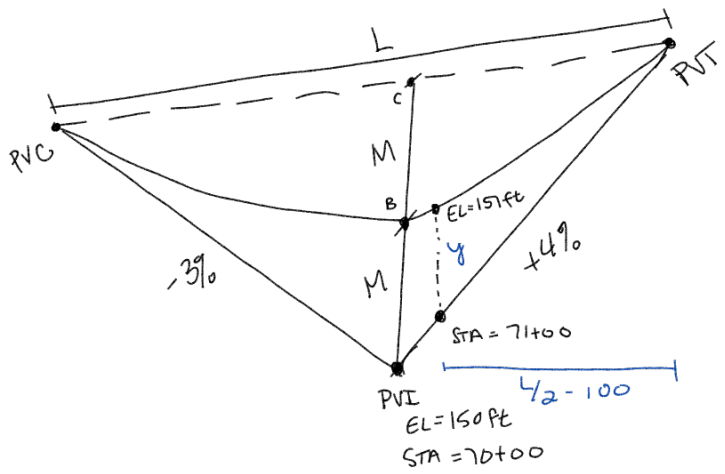
Surveying
Vertical Curves
Example 1

A -3% downgrade intersects a +4% upgrade at elevation 150 ft at station 70+00. It is desired to pass a vertical curve through a point of elevation 157 ft and at station71+00. Determine the curve length required.



ELEVATION OF $C = \dfrac{EL_{PVC} + EL_{PVT}}{2}$

$$EL_{PVC} = \frac{L}{2}(0.03) + 150$$

$$EL_{PVT} = \frac{L}{2}(0.04) + 150$$

$$EL_C = \frac{\left[\frac{L}{2}(0.03)+150\right] + \left[\frac{L}{2}(0.04)+150\right]}{2}$$

$$= \frac{0.015L + 0.02L + 300}{2}$$

$$= \frac{0.035L + 300}{2}$$

$$= 0.0175L + 150$$

$$M = \frac{EL_C - EL_{PVI}}{2} = \frac{[0.0175L + 150] - 150}{2} = 0.00875L$$

$$EL_{71+00} = 100\,ft(0.04) + 150\,ft = 154\,ft$$

$$y = \frac{4Mx^2}{L^2} \Rightarrow \quad y = 157\text{ft} - EL_{71+00} = 157\text{ft} - 154\text{ft} = 3\text{ft}$$

$$3 = \frac{4(0.00875L)(\tfrac{1}{2}L - 100)^2}{L^2}$$

↳ SOLVE FOR L

$$\therefore \boxed{L = 684.4\text{ ft}}$$