Engineering Surveying
3rd Stage

Horizontal Curve

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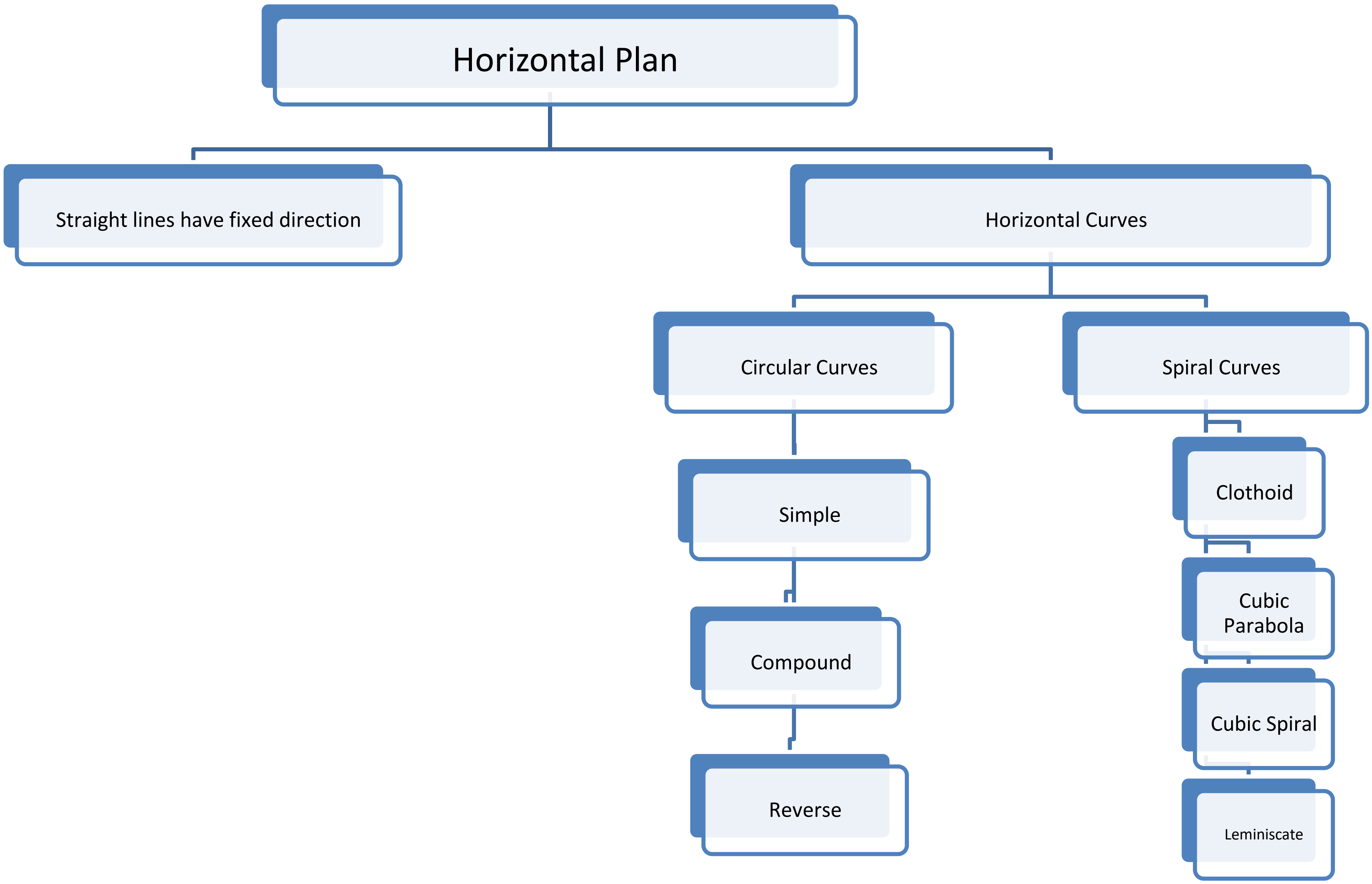
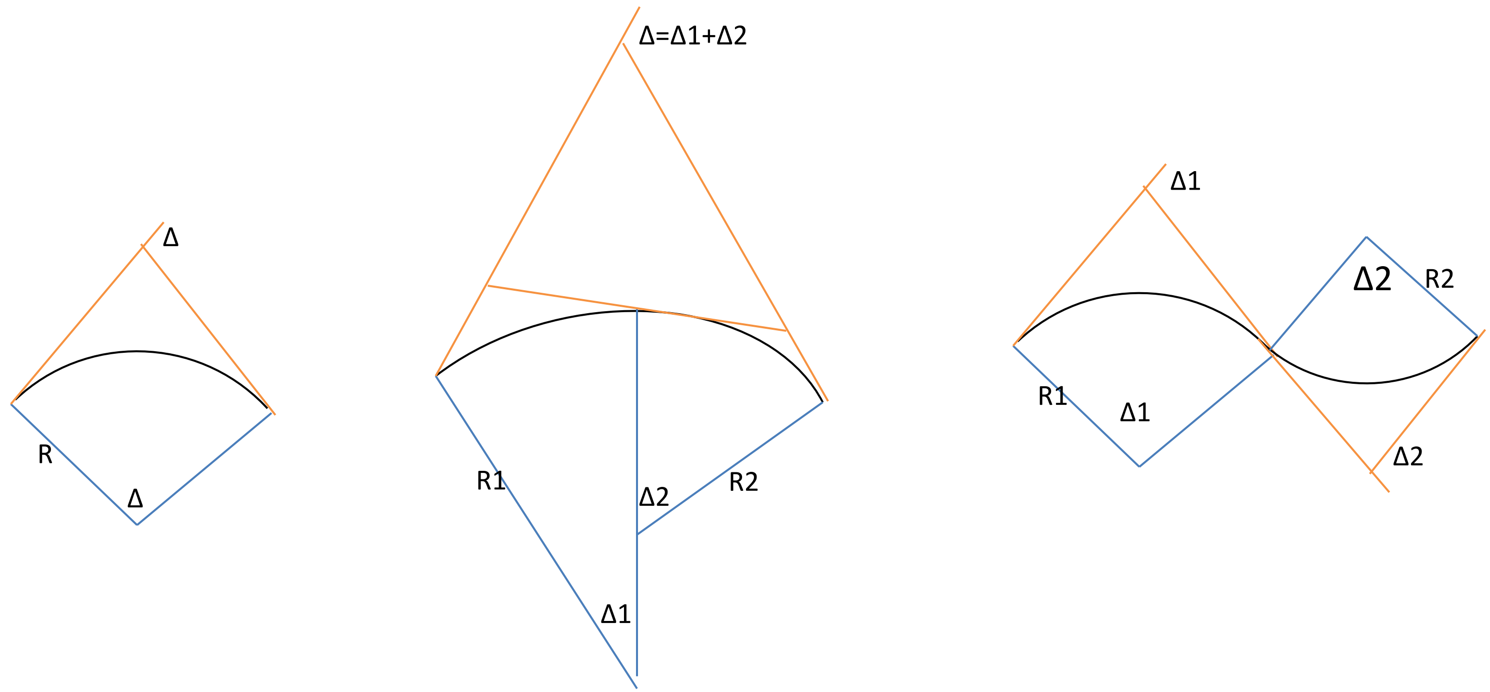
Horizontal Plan

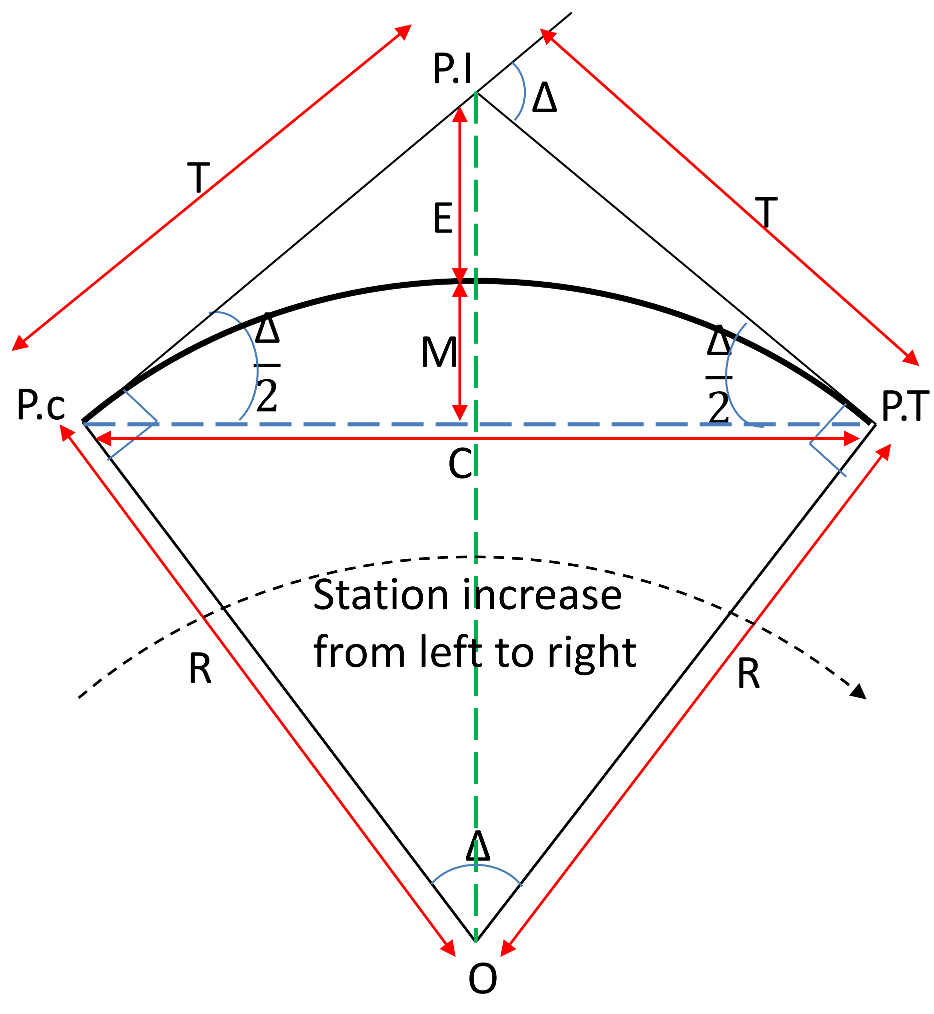


Circular Curves



Simple   Compound   Reverse

Simple Circular Curve



Symbols & Terms of Simple Circular Curve

- Δ= Intersection angle , Deflection angle or Central angle
- R= Radius of curve
- T =Tangent length
- L= length of curve
- C= Chord length or L.C=long chord
- M=Middle distance
- E=External distance
- P.C=Point of curvature or B.C=Beginning of curve or T.C=Tangent to curve point
- P.I=Point of intersection or V=Vertex or I.P=Intersection point
- P.T=Point of tangency or E.C=End of curve or C.T=Curve to tangent point
- D=Degree of curve or Degree of curvature

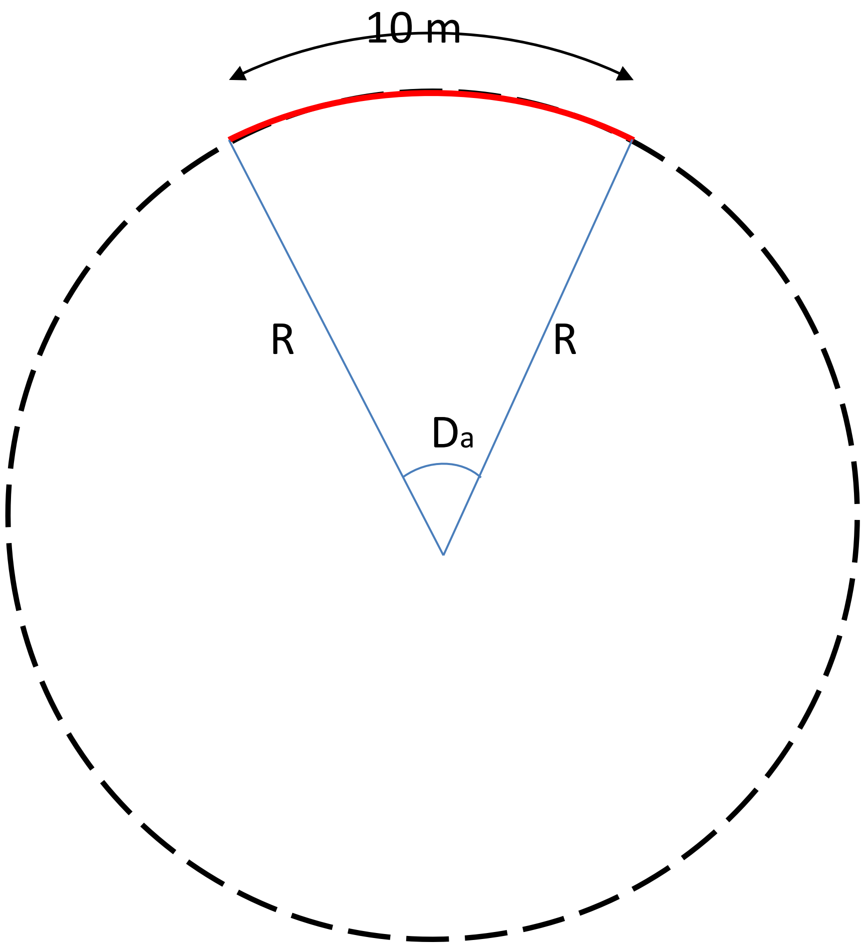
Degree of curvature

Da° ⟶ 10 m

360° ⟶ 2πR

$$D_a^{o} = \frac{3600}{2\pi R}$$

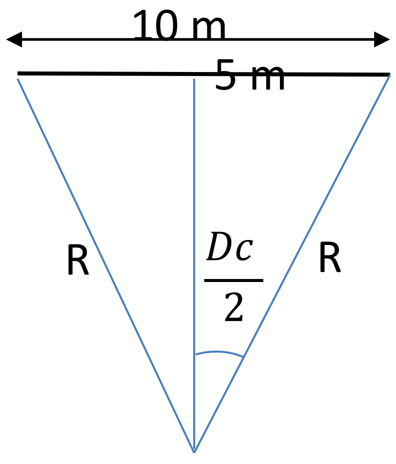
$$\mathbf{Da^{o} = \frac{573}{R}}$$



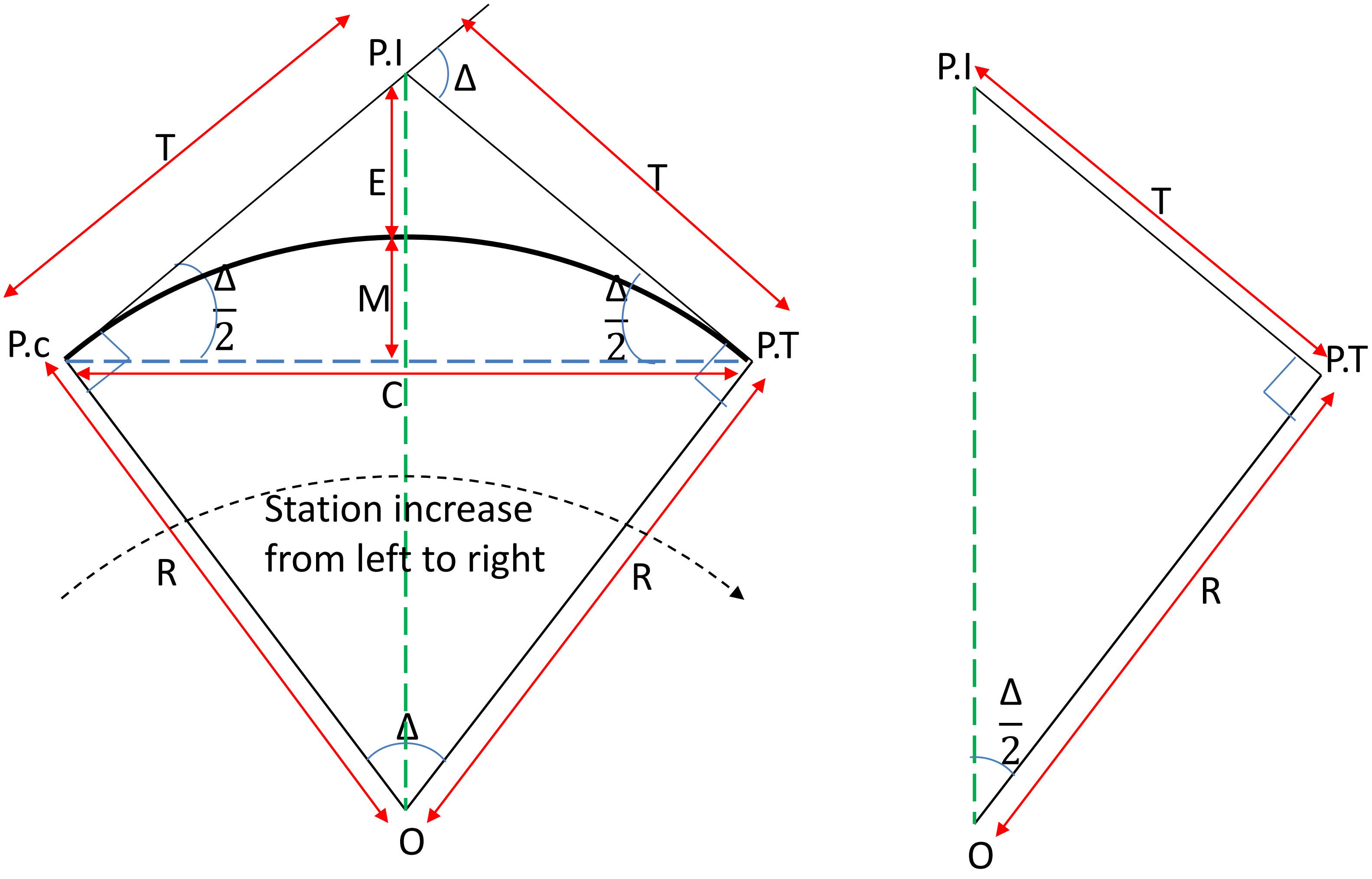
Degree of curvature

$\text{Sin } D_c^o = \frac{5}{R}$

$$\mathbf{Dc^o = \sin^{-1}\left(\frac{5}{R}\right)}$$



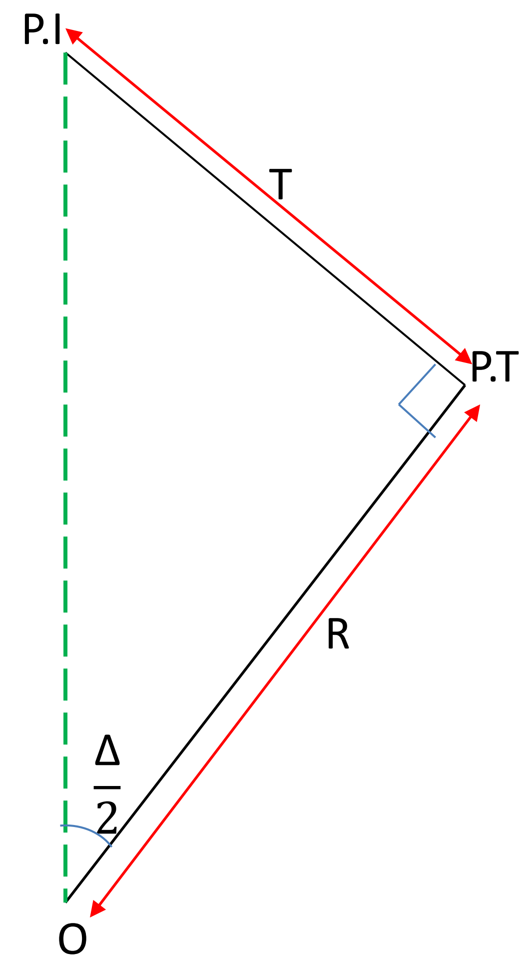
Tangent length



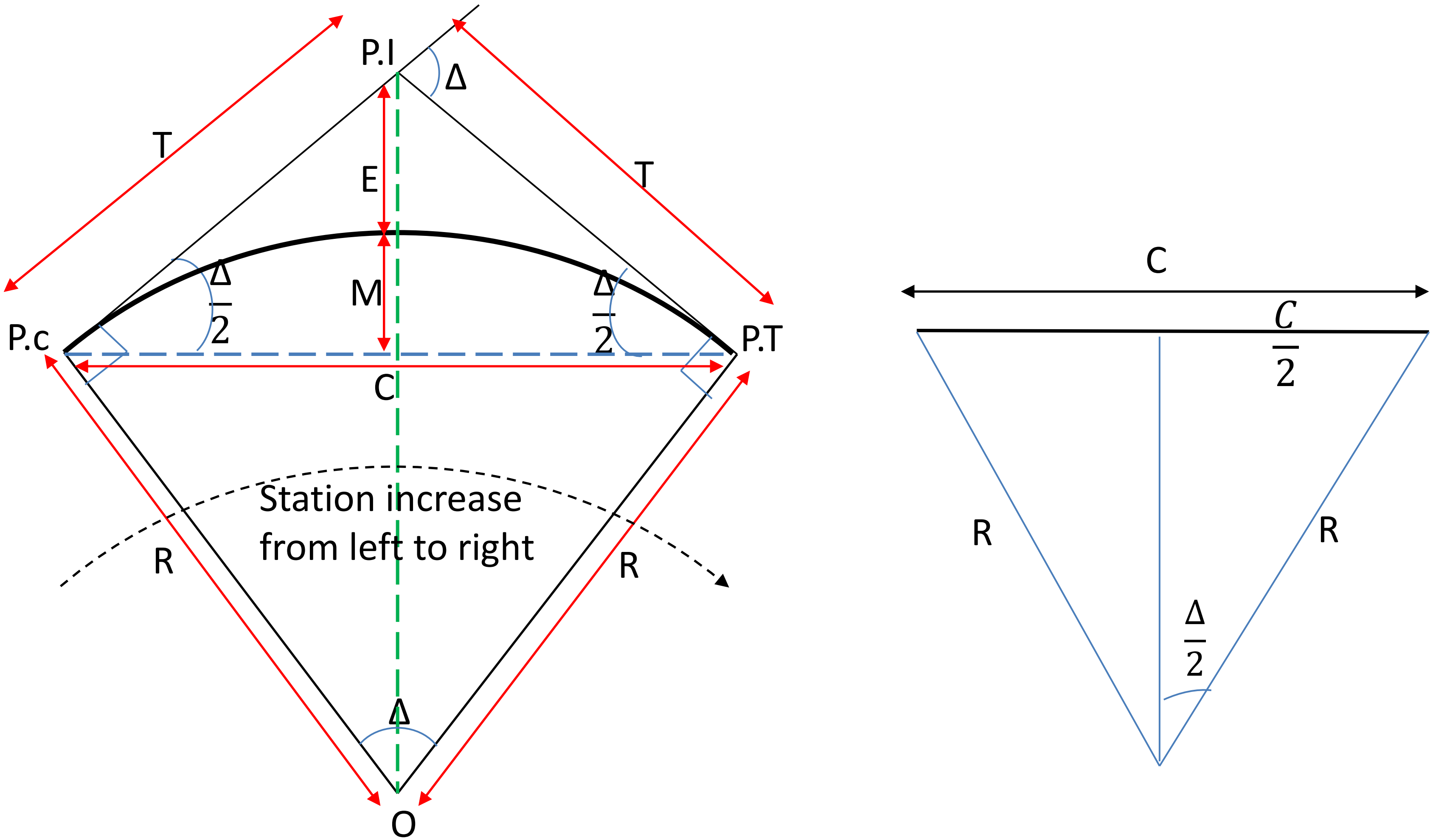
Tangent length

- $\tan\frac{\Delta}{2} = \frac{T}{R}$

$$\mathbf{T = R * \boldsymbol{tan}\frac{\boldsymbol{\Delta}}{2}}$$



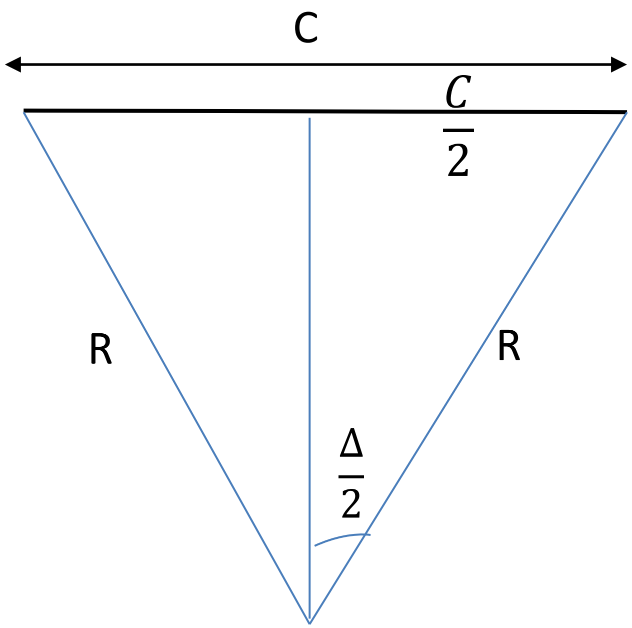
Chord length



Chord length

- $\sin\frac{\Delta}{2} = \frac{\frac{C}{2}}{R}$

$$\mathbf{C = 2*R*}\ \boldsymbol{sin\frac{\Delta}{2}}$$



length of curve

- Δ ↘↙ L
- 360^0 ↙↘ $2\pi R$

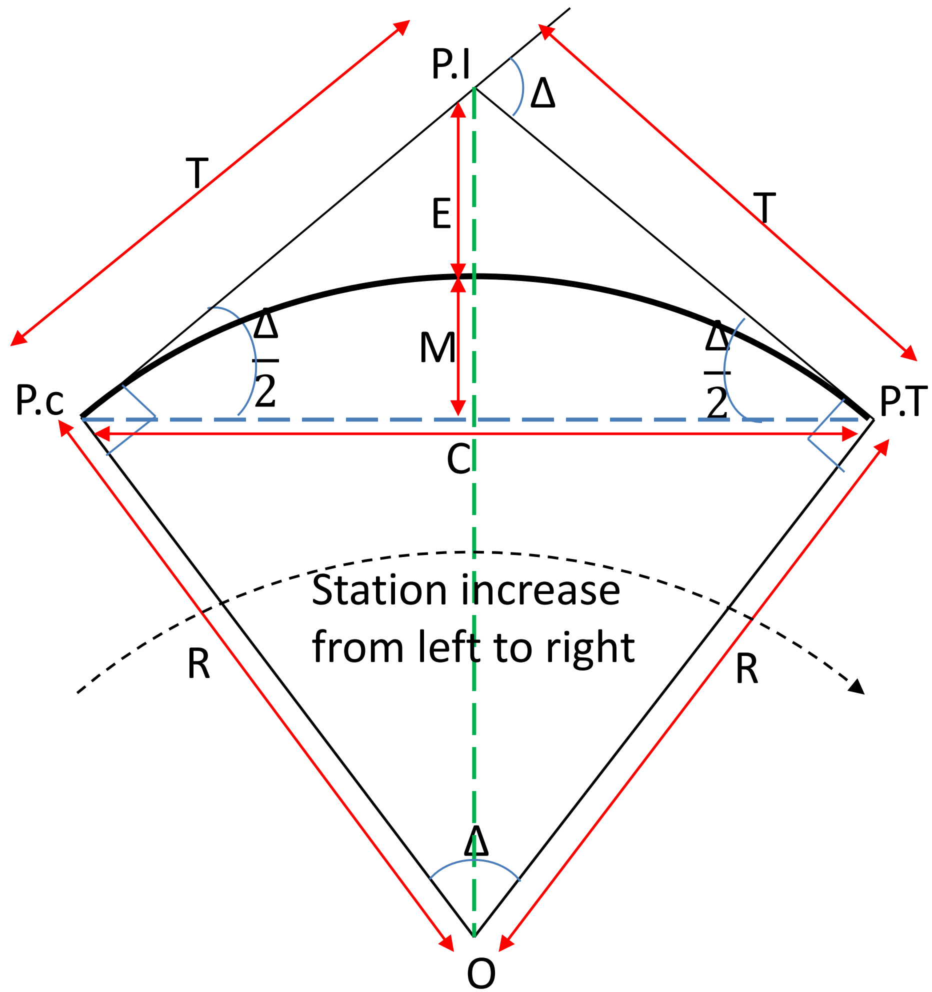
(Δ corresponds to L; 360° corresponds to 2πR — cross-multiply)

- $L = \frac{\pi . R . \Delta^0}{180^0}$

L = R*Δ$_{rad}$

$$\frac{L}{\Delta^0} = \frac{10}{D^0}$$

L = 10*$\frac{\Delta^0}{D^0}$

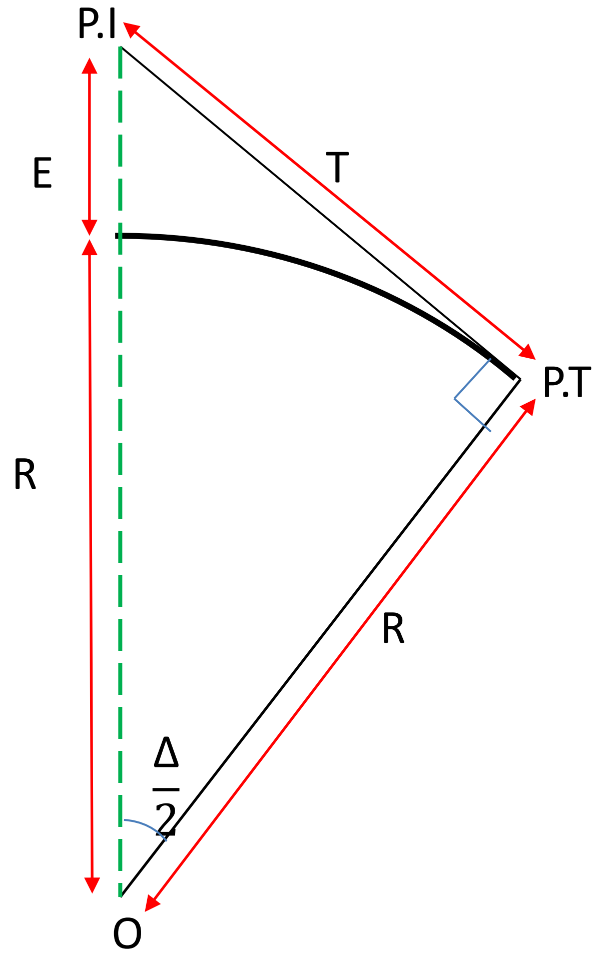


External distance

- $\cos\frac{\Delta}{2} = \frac{R}{R+E}$

$$\mathbf{E= R(}\frac{1}{cos\frac{\Delta}{2}} - 1)$$

$$\mathbf{E = T.}\, tan\frac{\Delta}{4}$$

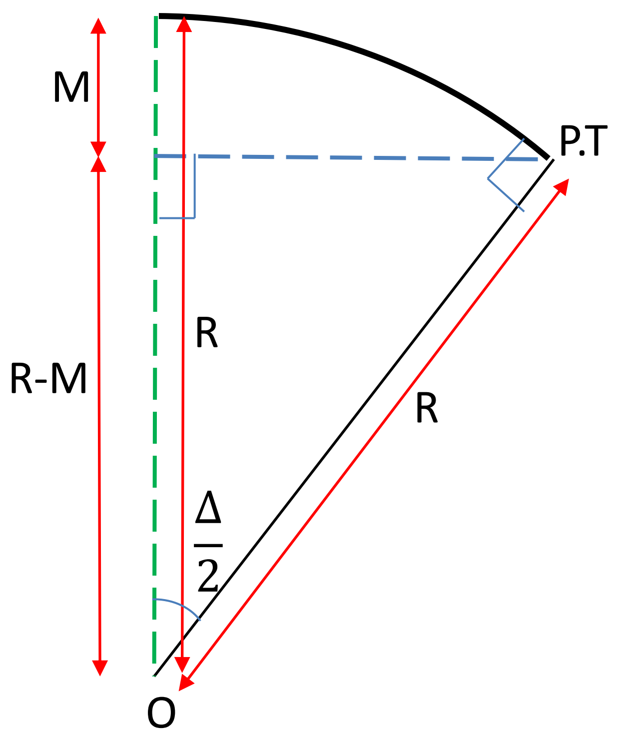


Middle distance

- $\cos\frac{\Delta}{2} = \frac{R-M}{R}$

$$\mathbf{M= R(1-\cos\frac{\Delta}{2})}$$

$$\mathbf{M= R[1-\sqrt{1-(\frac{C}{2R})^2}\ ]}$$



Stations

- Stat. P.C= Stat. P.I – T
- Stat. P.T= Stat. P.C + L
- 2T>L>C

Example

- Compute the elements of the simple circular curve if you know:
- R=250 m , Δ=52°36' and station of P.I=14 + 80

- $Da^{o} = \frac{573}{R} = \frac{573}{250} = 2.292^{0} = 2^{0}17'31''$

$Da^{o} = 2^{0}18'$

- $T = R * tan\frac{\Delta}{2} = 250 * tan\frac{52^{o}36'}{2}$

$T = 123.56$ m

- $C = 2*R*sin\frac{\Delta}{2} = 2*250 * sin\frac{52^{o}36'}{2}$

C = 221.54 m

- $L = \frac{\pi.R.\Delta^{0}}{180^{0}} = \frac{\pi*250*52^{o}36'}{180^{0}}$

L = 229.51 m

- E= $R\left(\frac{1}{\cos\frac{\Delta}{2}} - 1\right)$ = 250 $\left(\frac{1}{\cos\frac{52^{o}36'}{2}} - 1\right)$

E=28.87 m

- M= $R\left(1 - \cos\frac{\Delta}{2}\right)$ = $250\left(1 - \cos\frac{52^{o}36'}{2}\right)$

M= 25.88 m

- Stat. P.C = Stat. P.I – T = (14+80) – (1+23.56)

Stat. P.C=(13+56.44)

- Stat. P.T= Stat. P.C + L = (13+56.44)+ (2+29.51)

Stat. P.T=(15+85.95)

- 2T>L>C