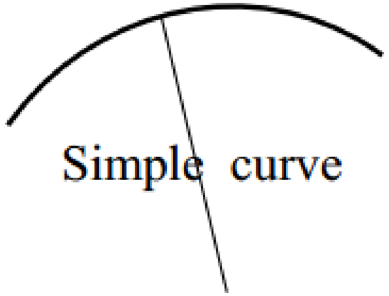
CE-103

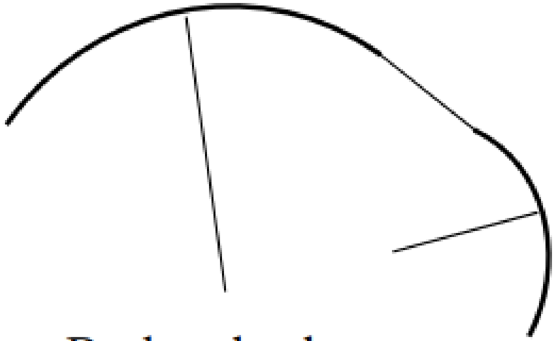
Surveying

Lecture-11

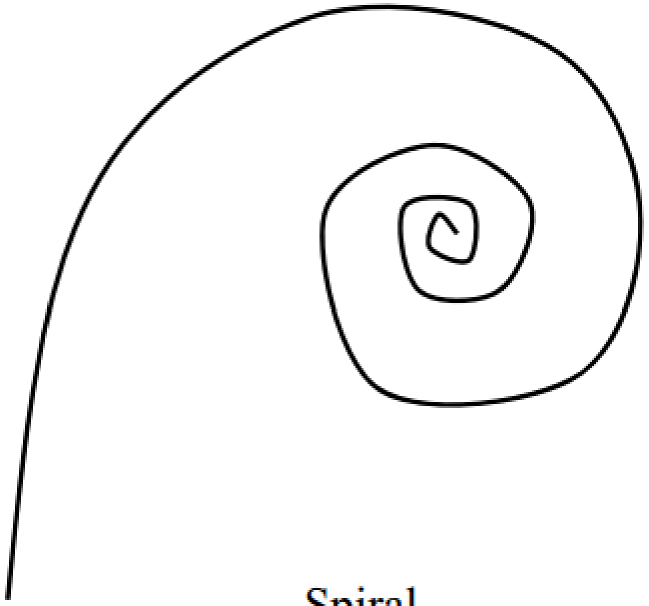
Curve Surveying



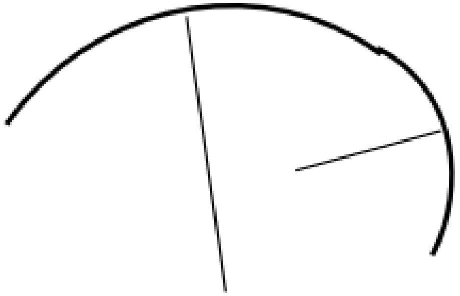
Simple curve



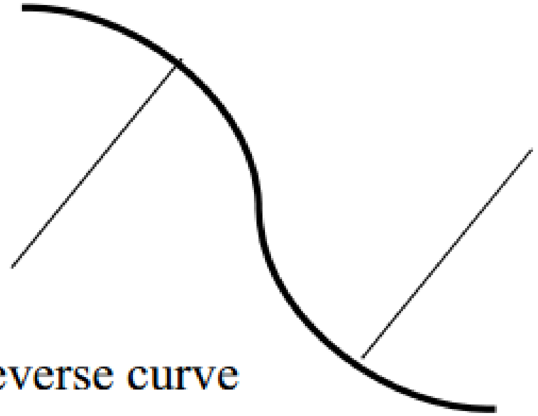
Broken-back curves



Spiral

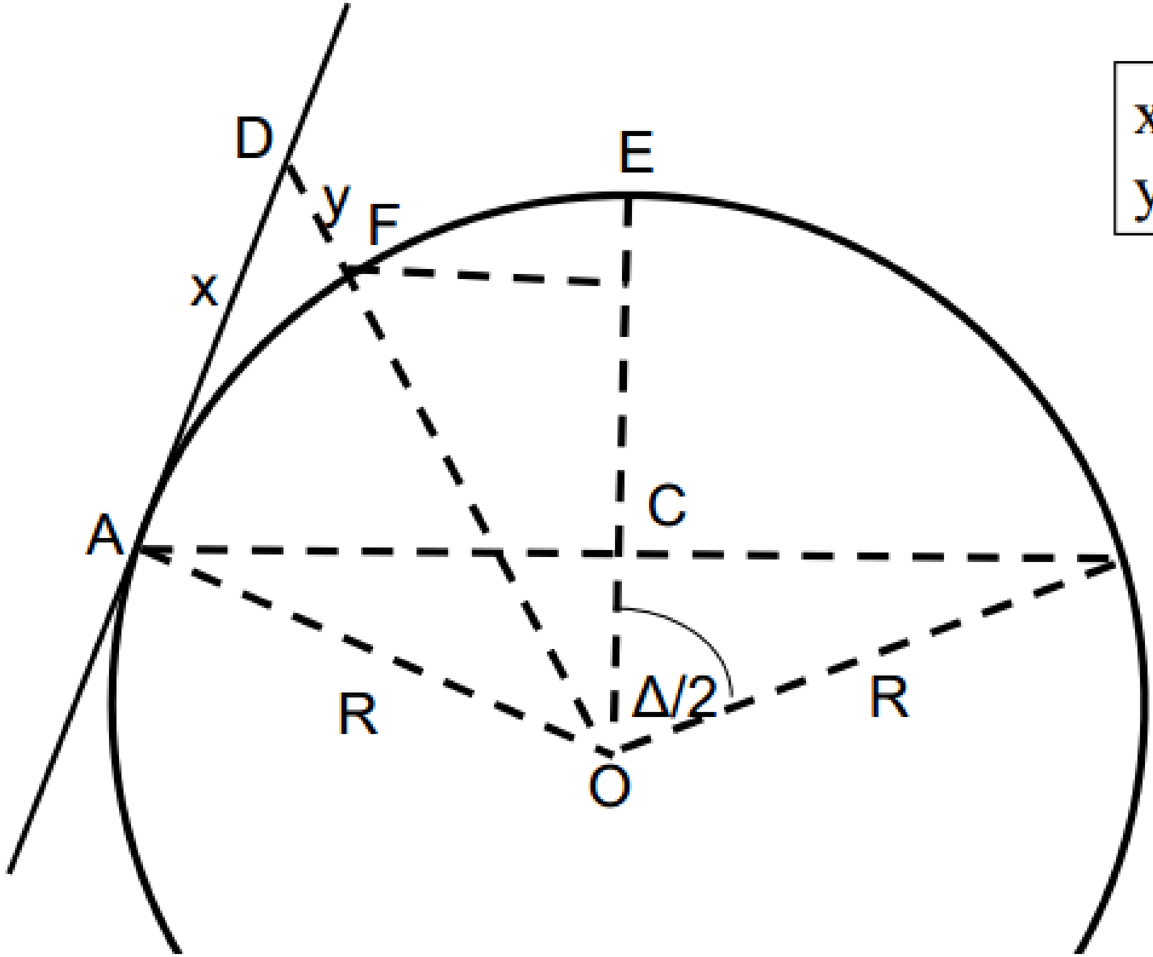


Compound curve



Reverse curve

Radial offset from tangent



x = known
y = ?

ΔOAD=>>

$(R+y)^2 = x^2 + R^2$

$y = \sqrt{(x^2 + R^2)} - R$

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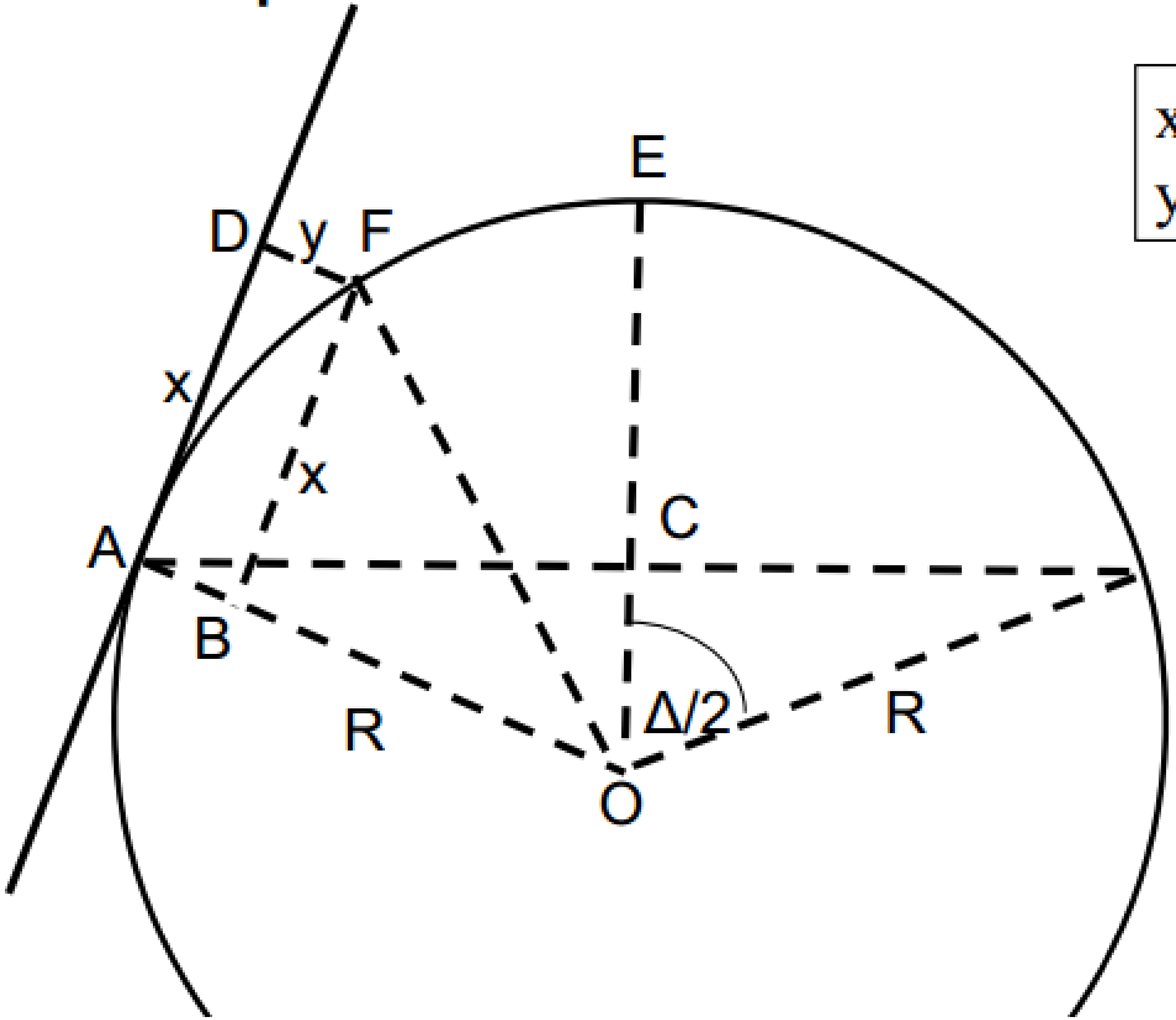
Perpendicular offset from tangent



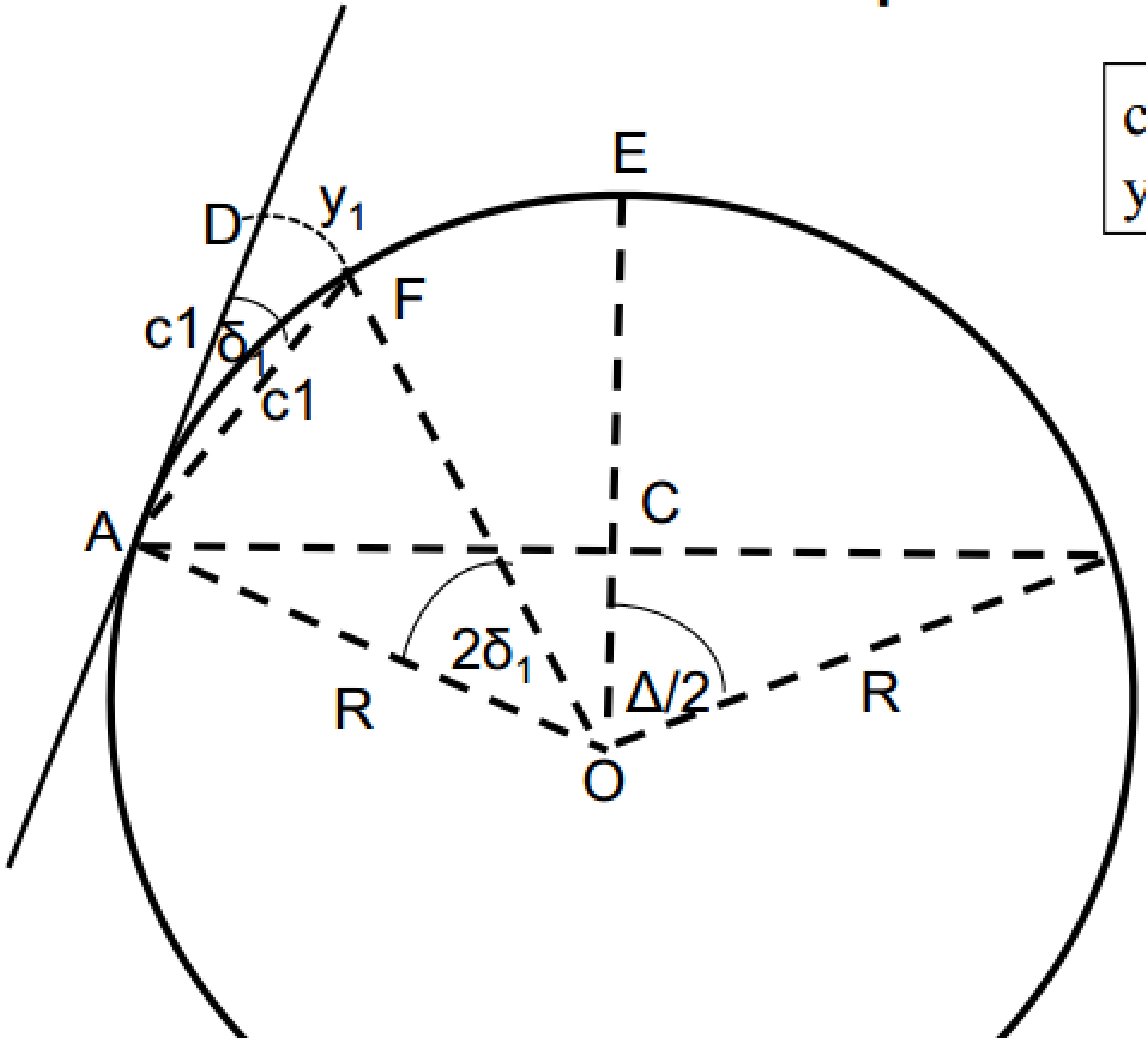
$x = \text{known}$
$y = ?$

ΔOBF=>>

$$(R-y)^2 + x^2 = R^2$$

$$y = R - \sqrt{(R^2 - x^2)}$$

offset from chords produced



c_1 = known
y_1 = ?

$y_1 = c_1\delta_1$

$c_1 = R(2\delta_1)$

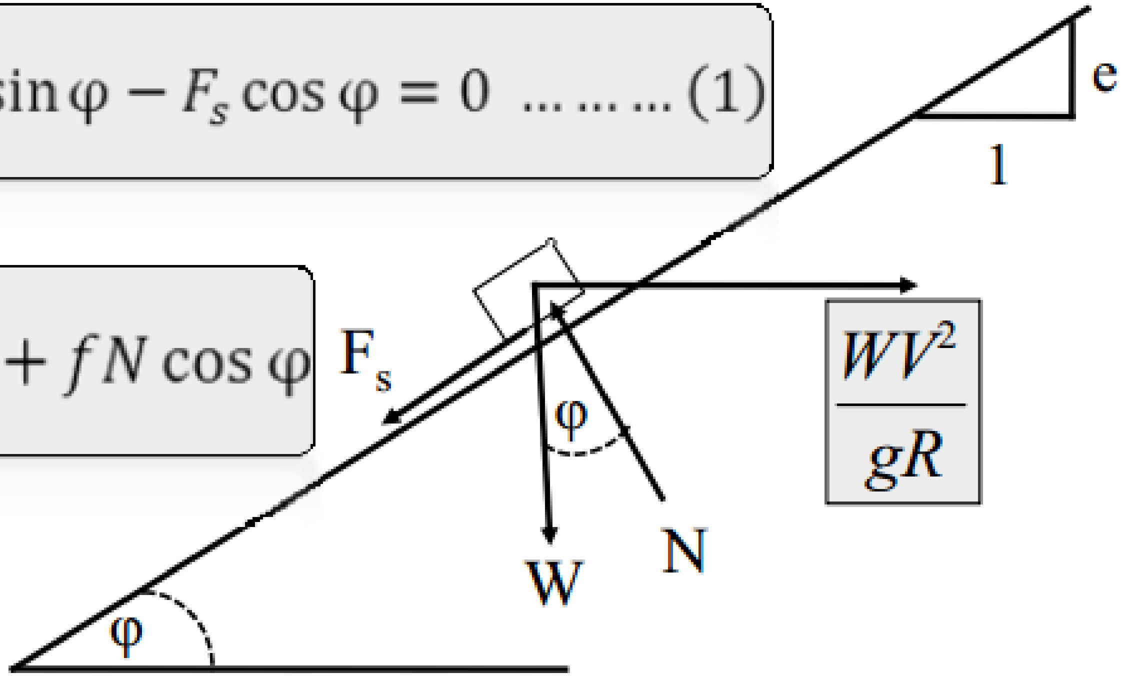
$y_1 = c_1^2/2R$

$$y_1 = \frac{c_1^{\,2}}{2R}$$

Considering side friction

$$\frac{WV^2}{gR} - N\sin\varphi - F_s\cos\varphi = 0 \quad \ldots\ldots\ldots (1)$$

$$\frac{WV^2}{gR} = N\sin\varphi + fN\cos\varphi$$



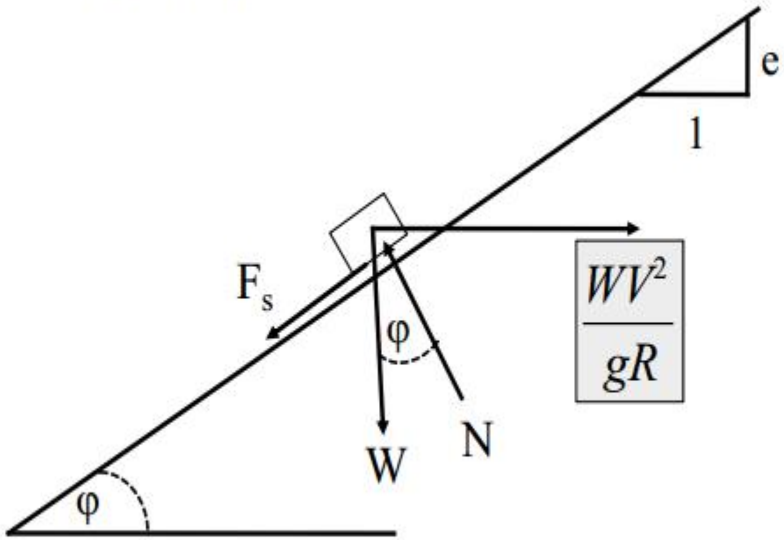
$$W = \frac{N}{\frac{V^2}{gR}}(\sin\varphi + f\cos\varphi)$$

$F_s = fN$, where f is static side friction coefficient

$\tan\varphi = e =$ rate of super elevation

$F_s = fN$, where f is static friction coefficient

$\tan\varphi = e$ = rate of superelevation



$$-W + N\cos\varphi - F_s \sin\varphi = 0 \;\ldots\ldots\ldots (2)$$

$$W = N\cos\varphi - fN\sin\varphi = N(\cos\varphi - f\sin\varphi)$$

$$N(\cos\varphi - f\sin\varphi) = \frac{N}{\frac{V^2}{gR}}(\sin\varphi + f\cos\varphi)$$

$$\frac{V^2}{gR} = \frac{\sin\varphi + f\cos\varphi}{\cos\varphi - f\sin\varphi}$$

$$\frac{V^2}{gR} = \frac{\tan\varphi + f}{1 - f\tan\varphi}$$

$$\frac{V^2}{gR} = \frac{e + f}{1 - ef}$$

The value of the product **ef** in this equation is always small. As a result, **(1-ef)** term is normally omitted in highway and street designs, thus providing slightly more conservative values.

$$e + f = \frac{V^2}{gR}$$

Calculate the offsets (radial offset method) at 50 ft interval along tangents to locate having 3 inch cant ,0.002 friction factor and design velocity 75 mph.

$$R = \frac{V^2}{g\,(e + f)}$$

$$y = \sqrt{R^2 + x^2} - R$$

$$\Rightarrow R = \frac{\left(75 \times \frac{5280}{3600}\right)^2}{32 \times \left(\frac{3}{12} + 0.002\right)}$$

$$\therefore R = 1500 \text{ ft}$$

x	y
0	0
50	0.833
100	3.330
150	7.481
200	13.275

Thank You

Stay Safe
Stay Aware