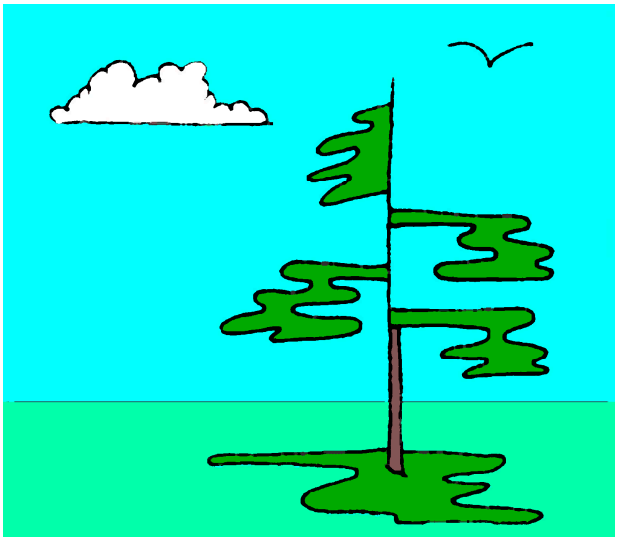
NorthWoods Software



Program Name: Moment_of_Inertia-Segment

Project Number: -

Project Description: -

Project Designer: Dik

Last Revised (yy-mm-dd): 21.11.21

Reference: NBCC, CSA S16

Disclaimer:
Created using SMath Studio, a MathCAD workalike from https://en.smath.info/view/SMathStudio. The User is responsible to verify data and calculations using an alternative method

Menu:

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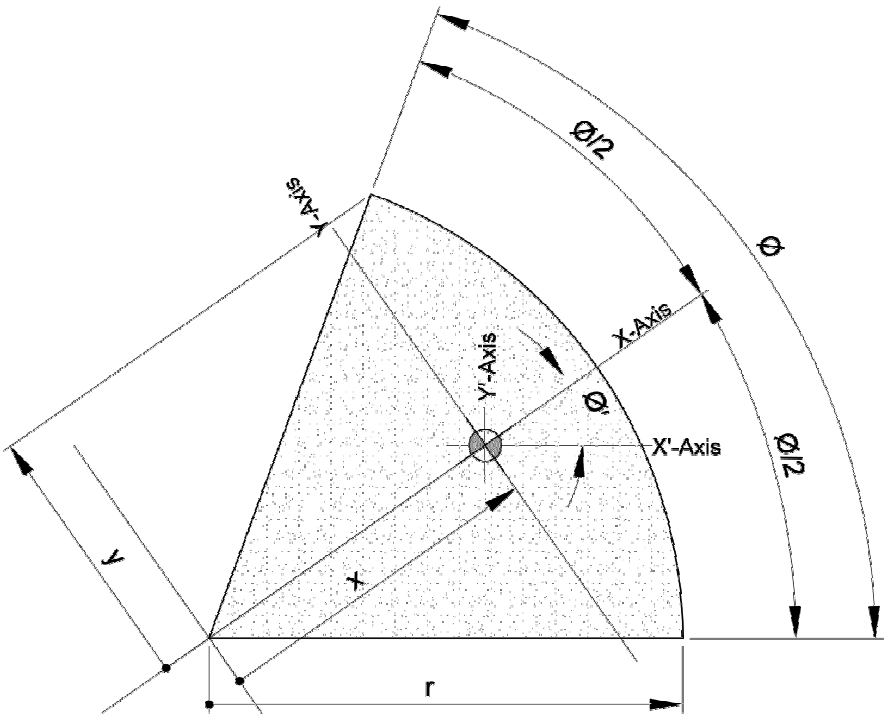
Defined Units:

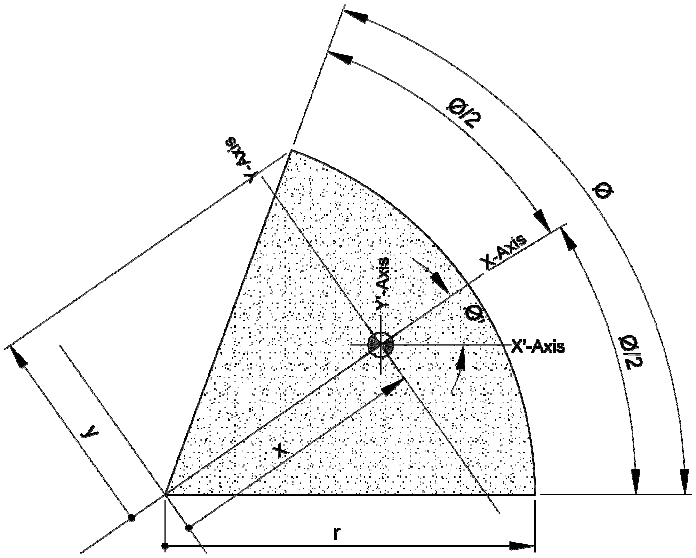
$grav := 9.80665 \frac{m}{sec^2}$					Acceleration
$K := kip$					Force
$K\_ft := K\ ft$	$kN\_m := kN\ m$	$K\_in := K\ in$	$kN\_mm := kN\ mm$	$lb\_in := lbf\ in$	Moment
$kNmpm := \frac{kN\_m}{m}$	$iKpi := \frac{K\_in}{in}$				Moment per Unit Length
$pcf := \frac{lbf}{ft^3}$	$kNpcm := \frac{kN}{m^3}$	$kgpcm := \frac{kg}{m^3}$			Density
$Klf := \frac{K}{ft}$	$pli := \frac{plf}{in}$	$plf := \frac{lbf}{ft}$	$kNpm := \frac{kN}{m}$	$Kpi := \frac{K}{in}$	Force/Unit Length
$kNpmm := \frac{kN}{mm}$					Force/Unit Length
$psf := \frac{lbf}{ft^2}$	$Ksf := \frac{K}{ft^2}$	$Ksi := \frac{K}{in^2}$	$kNpsm := \frac{kN}{m^2}$	$psi := \frac{lbf}{in^2}$	Pressure
$Npsmm := \frac{N}{mm^2}$					Pressure
$pci := \frac{lbf}{in^3}$					Subgrade Modulus
$psfpf := \frac{psf}{ft}$	$kPapm := \frac{kPa}{m}$				Pressure per Depth
$pmcf := \frac{lb}{ft^3}$	$lb := lbf$				Force
$mph := \frac{mi}{hr}$	$kph := \frac{km}{hr}$	$mps := \frac{m}{sec}$			Velocity/Speed
$ispf := \frac{in^2}{ft}$	$mmspm := \frac{mm^2}{m}$				Area per Unit Length
$ppf := \frac{lbf}{ft}$	$Npm := \frac{N}{m}$				Stiffness

c b a



Data Input:

$r := 20\ in$	$r = 20.00\ in$	$r = 508.00\ mm$	Radius of Segment
$\phi := 40\ °$	$\phi = 40.00\ °$		Included Angle of Segment
$\phi' := 0\ °$	$\phi' = 0.00\ °$		Angle of Rotation of Segment
$\phi_{ovr2} := \frac{\phi}{2}$	$\phi_{ovr2} = 20.00\ °$		
$A := \phi_{ovr2} \cdot r^2$	$A = 139.63\ in^2$	$A = 90081.33\ mm^2$	Area of Segment
$x := \frac{2 \cdot r \cdot \sin(\phi_{ovr2})}{3 \cdot \phi_{ovr2}}$	$x = 13.06\ in$	$x = 331.83\ mm$	X-Axis Centroidal Distace
$y := r \cdot \sin(\phi_{ovr2})$	$y = 6.84\ in$	$y = 173.75\ mm$	Y-Axis Centroidal Distance
$Ix := \frac{r^4}{4} \cdot \left(\phi_{ovr2} - \sin(\phi_{ovr2}) \cdot \cos(\phi_{ovr2})\right)$	$Ix = 1106.88\ in^4$	$Ix = 4.61 \cdot 10^8\ mm^4$	Moment of Inertia (X-Axis)
$Iy := \frac{r^4}{4} \cdot \left(\phi_{ovr2} + \sin(\phi_{ovr2}) \cdot \cos(\phi_{ovr2})\right) - A \cdot x^2$	$Iy = 2987.87\ in^4$	$Iy = 1.24 \cdot 10^9\ mm^4$	Moment of Inertia (Y-Axis)
$Ixy := 0\ in^4$	$Ixy = 0.00\ in^4$	$Ixy = 0.00\ mm^4$	Polar Moment of Inertia
$Ix' := \frac{Ix + Iy}{2} + \left(\frac{Ix - Iy}{2}\right) \cdot \cos(2 \cdot \phi') - Ixy \cdot \sin(2 \cdot \phi')$	$Ix' = 1106.88\ in^4$	$Ix' = 4.61 \cdot 10^8\ mm^4$	Transformed M of Inertia (X-Axis)
$Iy' := \frac{Ix + Iy}{2} - \left(\frac{Ix - Iy}{2}\right) \cdot \cos(2 \cdot \phi') + Ixy \cdot \sin(2 \cdot \phi')$	$Iy' = 2987.87\ in^4$	$Iy' = 1.24 \cdot 10^9\ mm^4$	Transformed M of Inertia (Y-Axis)
$Ixy' := \frac{Ix - Iy}{2} \cdot \sin(2 \cdot \phi') + Ixy \cdot \cos(2 \cdot \phi')$	$Ixy' = 0.00\ in^4$	$Ixy' = 0.00\ mm^4$	Trans Polar Moment of Inertia



Summary

Radius of Segment	$r = 20.00\ \text{in}$	$r = 508.00\ \text{mm}$
Included Angle of Segment	$\phi = 40.00\ °$	
Angle of Rotation of Segment	$\phi' = 0.00\ °$	
Area of Segment	$A = 139.63\ \text{in}^2$	$A = 90081.33\ \text{mm}^2$
X-Axis Centroidal Distace	$x = 13.06\ \text{in}$	$x = 331.83\ \text{mm}$
Y-Axis Centroidal Distance	$y = 6.84\ \text{in}$	$y = 173.75\ \text{mm}$
Moment of Inertia (X-Axis)	$Ix = 1107\ \text{in}^4$	$Ix = 4.61 \cdot 10^8\ \text{mm}^4$
Moment of Inertia (Y-Axis)	$Iy = 2988\ \text{in}^4$	$Iy = 1.24 \cdot 10^9\ \text{mm}^4$
Polar Moment of Inertia	$Ixy = 0.00\ \text{in}^4$	$Ixy = 0.00\ \text{mm}^4$
Transformed M of Inertia (X-Axis)	$Ix' = 1107\ \text{in}^4$	$Ix' = 4.61 \cdot 10^8\ \text{mm}^4$
Transformed M of Inertia (Y-Axis)	$Iy' = 2988\ \text{in}^4$	$Iy' = 1.24 \cdot 10^9\ \text{mm}^4$
Trans Polar Moment of Inertia	$Ixy' = 0.00\ \text{in}^4$	$Ixy' = 0.00\ \text{mm}^4$