SPIRAL CURVE - LINE INTERSECTION
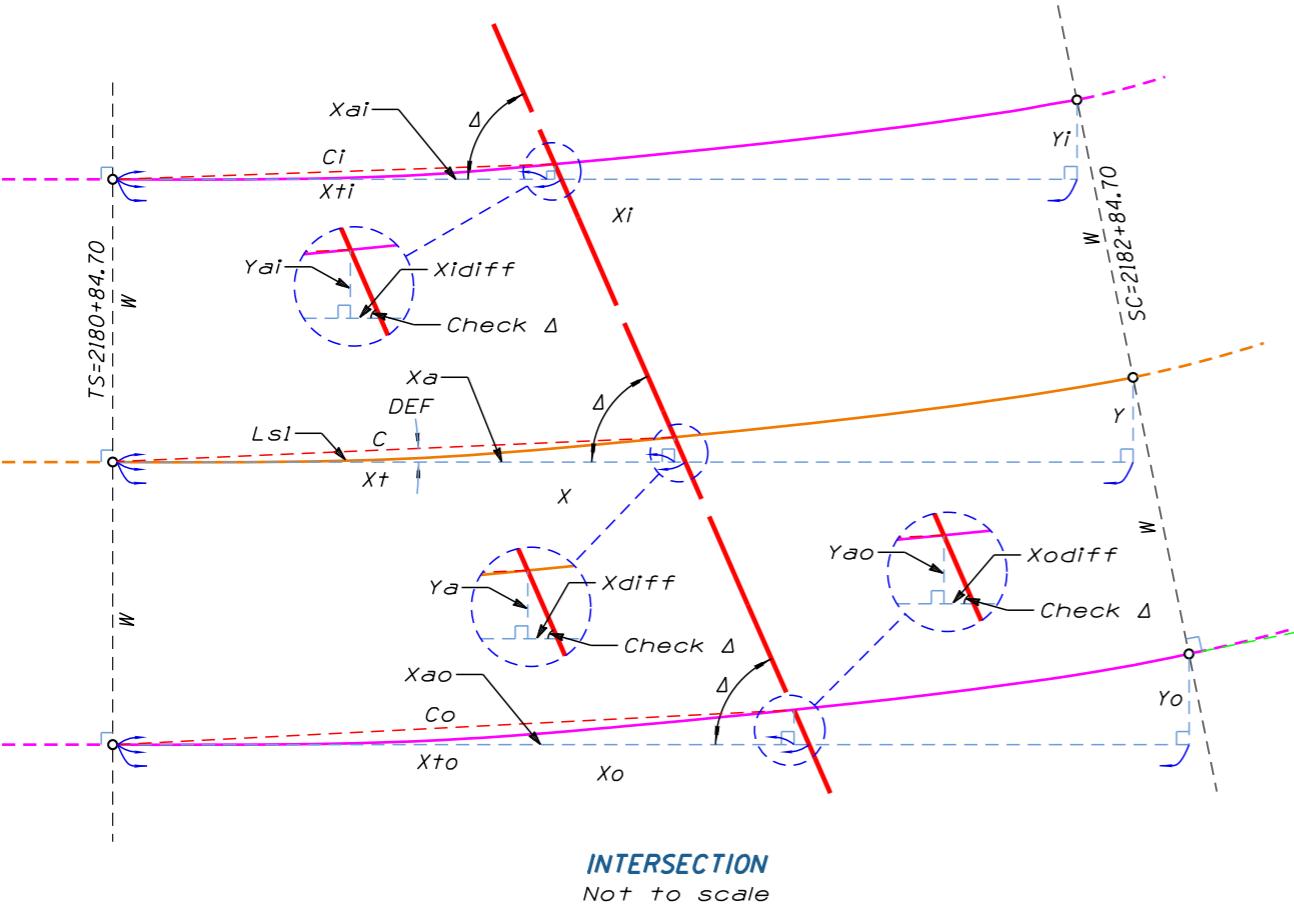

INTERSECTION
Not to scale

INSIDE SPIRAL INTERSECTION

FORMULAS

Given: $a = 1.00$, $\Delta = 66°20'20"$, $Xti = 76.43$, $W = 100.00$

$C = Ls1 - (0.00034 * a^2 * (Ls1 / 100)^5)$
$DEF = (a * Ls1^2) / 60000$
$Xa = C * Cos(DEF)$
$Ya = C * Sin(DEF)$
$Xai = Xa - (Sin(DEF * 3) * W)$
$Yai = Ya + (Cos(DEF * 3) * W) - W$
$Xidiff = Xti - Xai$
$Check \; \Delta = ArcTan(Yai / Xidiff)$

Begin Iteration
Starting values: Ls1 = 100', Tolerance = 0.0001

$C = 100 - (0.00034 * 1^2 * (100 / 100)^5) = \underline{99.99966}$
$DEF = (1 * 100^2) / 60000 = \underline{0.166667° \; or \; 0°10'00"}$
$Xa = 99.99966 * Cos(0.166667) = \underline{99.99924}$
$Ya = 99.99966 * Sin(0.166667) = \underline{0.29089}$
$Xai = 99.99924 - (Sin(0.166667 * 3) * 100.00) = \underline{99.12658}$
$Yai = 0.29089 + (Cos(0.166667 * 3) * 100.00) - 100.00 = \underline{0.28708}$
$Xidiff = 76.43 - 99.12658 = \underline{-22.69658}$
$Check \; \Delta = ArcTan(0.28708 / -22.69658) = \underline{-0.72467° \; or \; -0°43'28.8"}$

$\Delta - Check \; \Delta = 66.33889 - 0.72467 = \underline{65.61422}$ (If <= Tolerance then solution found) If no solution found then Ls1 = Ls1 - Tolerance. Repeat iteration with new Ls1 until solution is found. The solution is best found by utilizing a computer program to run the iterations.

> Starting value needs to be larger than Xti in order to find a solution.

Note:
Rounding error will occur based upon the number of decimal places used.

CENTERLINE SPIRAL INTERSECTION

FORMULAS

Given: $a = 1.00$, $\Delta = 66°20'20"$, $Xt = 120.25$

$C = Ls1 - (0.00034 * a^2 * (Ls1 / 100)^5)$
$DEF = (a * Ls1^2) / 60000$
$Xa = C * Cos(DEF)$
$Ya = C * Sin(DEF)$
$Xdiff = Xt - Xa$
$Check \; \Delta = ArcTan(Ya / Xdiff)$

Begin Iteration
Starting values: Ls1 = 200', Tolerance = 0.0001

$C = 200 - (0.00034 * 1^2 * (200 / 100)^5) = \underline{199.98912}$
$DEF = (1 * 200^2) / 60000 = \underline{0.666667° \; or \; 0°40'00"}$
$Xa = 199.98912 * Cos(0.666667) = \underline{199.97558}$
$Ya = 199.98912 * Sin(0.666667) = \underline{2.32693}$
$Xdiff = 120.25 - 199.98912 = \underline{-79.73912}$
$Check \; \Delta = ArcTan(2.32693 / -79.73912) = \underline{-1.671519° \; or \; -1°40'17.5"}$

$\Delta - Check \; \Delta = 66.33889 - 1.671519 = \underline{64.667371}$ (If <= Tolerance then solution found)
If no solution found then Ls1 = Ls1 - Tolerance.
Repeat iteration with new Ls1 until solution found.

The solution is best found by utilizing a computer program to run the iterations.

> Starting value needs to be larger than Xt in order to find a solution.

Note:
Rounding error will occur based upon the number of decimal places used.

OUTSIDE SPIRAL INTERSECTION

FORMULAS

Given: $a = 1.00$, $\Delta = 66°20'20"$, $Xto = 164.07$, $W = 100.00$

$C = Ls1 - (0.00034 * a^2 * (Ls1 / 100)^5)$
$DEF = (a * Ls1^2) / 60000$
$Xa = C * Cos(DEF)$
$Ya = C * Sin(DEF)$
$Xao = Xa + (Sin(DEF * 3) * W)$
$Yao = Ya + W - (Cos(DEF * 3) * W)$
$Xodiff = Xto - Xao$
$Check \; \Delta = ArcTan(Yao / Xodiff)$

Begin Iteration
Starting values: Ls1 = 180', Tolerance = 0.0001

$C = 180 - (0.00034 * 1^2 * (180 / 100)^5) = \underline{179.99358}$
$DEF = (1 * 180^2) / 60000 = \underline{0.54000° \; or \; 0°32'24"}$
$Xa = 179.99358 * Cos(0.54000) = \underline{179.98559}$
$Ya = 179.99358 * Sin(0.54000) = \underline{1.69637}$
$Xao = 179.98559 + (Sin(0.54000 * 3) * 100.00) = \underline{182.81264}$
$Yao = 1.69637 + 100.00 - (Cos(0.54000 * 3) * 100.00) = \underline{1.73634}$
$Xodiff = 164.07 - 182.81264 = \underline{-18.74264}$
$Check \; \Delta = ArcTan(1.73634 / -18.74264) = \underline{-5.29284° \; or \; -5°17'34.2"}$

$\Delta - Check \; \Delta = 66.33889 - 5.29284 = \underline{61.04605}$ (If <= Tolerance then solution found) If no solution found then Ls1 = Ls1 - Tolerance. Repeat iteration with new Ls1 until solution is found. The solution is best found by utilizing a computer program to run the iterations.

> Starting value needs to be larger than Xto in order to find a solution.

Note:
Rounding error will occur based upon the number of decimal places used.