



Solution to Problem 7 I

LINE C-E = R x sin ϕ = 2640, SO $\sin \phi = \frac{2640}{R}$

ARC LENGTH M-E = 2640.5 = R x ϕ (IN RADIANS), SO $\phi = \frac{2640.5}{R}$

$$\frac{\sin \phi}{\phi} = \frac{2640 / R}{2640.5 / R} = 0.999810642$$

FROM TRIGONOMETRY, $\sin \phi = \phi - \frac{\phi^3}{3!} + \frac{\phi^5}{5!} - \frac{\phi^7}{7!} + \dots$

$$0.999810642 = 1 - \frac{\phi^2}{6} + \frac{\phi^4}{120} - \dots, \text{ FROM WHICH}$$

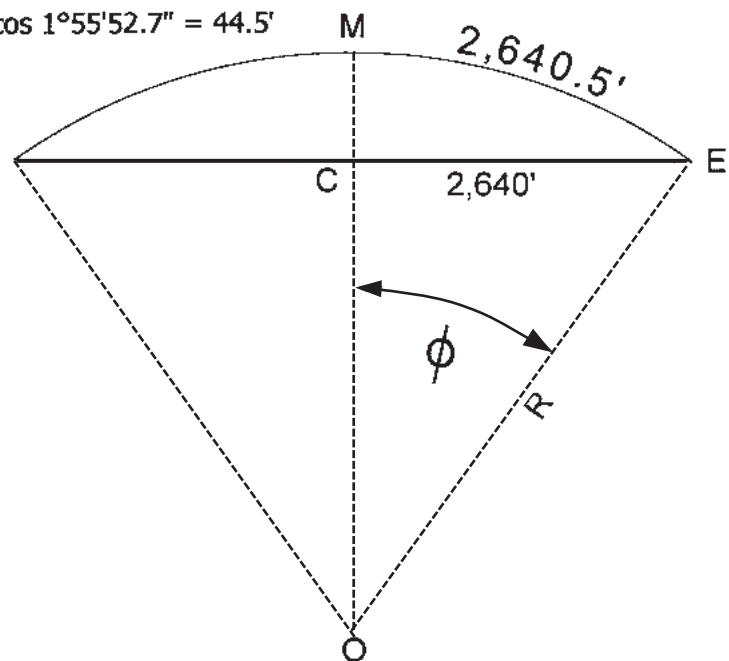
$$\phi^4 - 20 \phi^2 + 0.02272297 = 0 \text{ AFTER DROPPING ALL TERMS ABOVE } \phi^4$$

USING THE QUADRATIC EQUATION TO SOLVE FOR ϕ^2 AND THEN TAKING THE SQUARE ROOT OF THE RESULT YIELDS A GOOD APPROXIMATION:

$$\phi = 0.033707759 \text{ RADIANS OR } 1^{\circ}55'52.7''$$

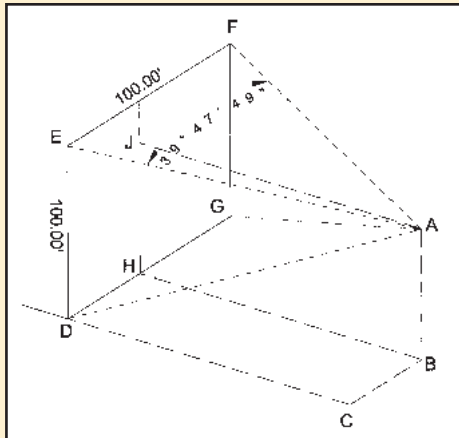
$$\text{FROM WHICH } R = 2640.5 / 0.033707759 = 78,335.08'$$

$$\text{MAKING } C-M = 78,335.08 - 78,335.08 \cos 1^{\circ}55'52.7'' = 44.5'$$





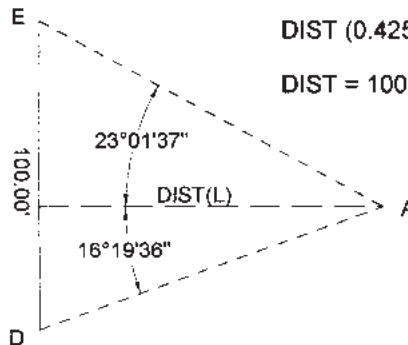
Solution to Problem 72



ON THE LEFT SIDE: $(\text{DIST}) \tan 23^\circ 01' 37'' + (\text{DIST}) \tan 16^\circ 19' 36'' = 100.00$

$$\text{DIST} (0.425029929 + 0.292925752) = 100$$

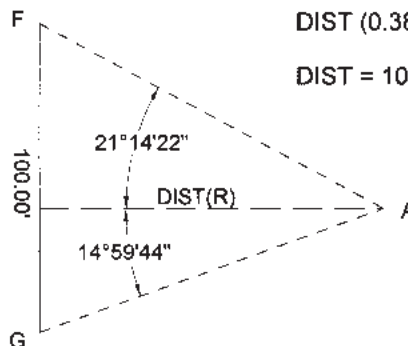
$$\text{DIST} = 100 / 0.717955681 = 139.284'$$



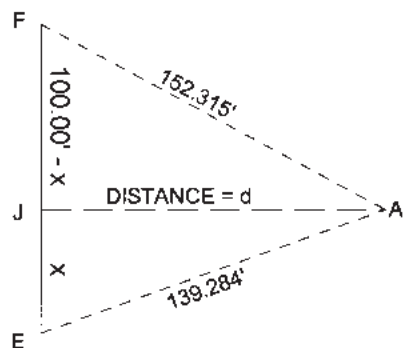
ON THE RIGHT SIDE: $(\text{DIST}) \tan 21^\circ 14' 22'' + (\text{DIST}) \tan 14^\circ 59' 44'' = 100.00$

$$\text{DIST} (0.388666657 + 0.267866055) = 100$$

$$\text{DIST} = 100 / 0.656532712 = 152.315'$$



FROM THE TOP:



$$d^2 = 139.284^2 - x^2 \text{ \& } d^2 = 152.315^2 - (100 - x)^2$$

$$139.284^2 - x^2 - 152.315^2 + 100^2 - 200x + x^2 = 0$$

from which $x = 31.001'$ and $100 - x = 68.999'$
and $d = 135.790'$

J-E in this sketch is equivalent to B-C or H-D and equals the distance from the prolongation of the left side of the building

Note: $\arctan x/d = 12^\circ 51' 37''$ &
 $\arctan (100 - x) / d = 26^\circ 56' 11''$
the sum of which is $39^\circ 47' 48''$

