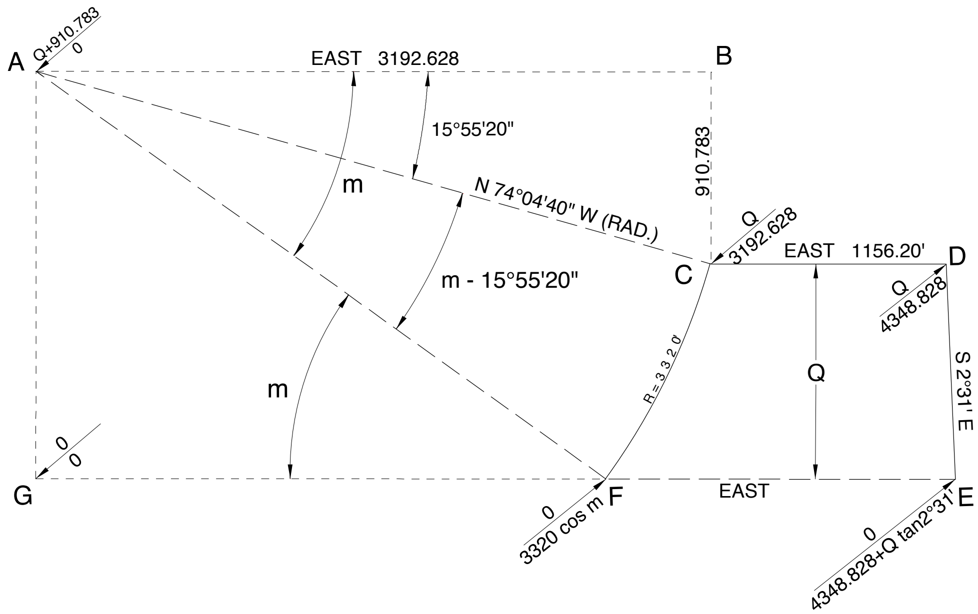
Solution

200

by Dave Lindell, L.S.



First, rotate the figure so line C-D is East. Draw A-B parallel with C-D so C-B is perpendicular to A-B. Draw E-F-G parallel with C-D at distance Q southerly so A-G is perpendicular to G-F-E. A-B is then (3320)(cos 15°55'20") = 3192.628 and B-C is (3320)(sin 15°55'20") = 910.783

Let Point G be North: 0, East: 0. The coordinate of Point A is then N: Q+910.783, E: 0. Point C is N: Q, E: 3192.628. Point D is N: Q, E: 4348.828. Point E is N: 0, E: 3192.628+1156.20+Q · tan 2°31' and Point F is N: 0, E: 3320 cos m. Then, by the method of Problem No. 92, <u>twice</u> the area of ACDEF will be:

$$(Q+910.783)(3192.628) + 4348.828\,Q + Q(4348.828 + Q\tan 2°31') - 3192.628\,Q - (3320\cos m)(Q+910.783)$$

And the area will be:

$$0.021976195\,Q^2 + 4348.828\,Q - 1660(\cos m)(Q+910.783) + 1453895.65$$

(The values of zero for the N'ing and E'ing become very apparent here!)

Subtracting the sector A-C-F should yield 36 acres, or 1,568,160 sq. ft.

The sector area is $(\pi/360)(m-15.9222222222)(3320^2)$

There are two variables, m & Q. Q = 3320 sin m – 910.783 and m can be expressed as a function of Q by the relation $\cos^2 m = 1 - \sin^2 m$, where sin m = (Q+910.783)/3320, but m is still by itself in the sector equation.
It is easier to make an educated guess of m and solve iteratively, viz.:
Since m must be larger than 15°55'20", start with m = 20°. Q is then 224.7239. And the area calculates to be 6.17056 acres. Letting m = 30°, Q is then 749.217 and the area calculates to be 22.58738 acres. Letting m = 40°, Q is 1223.272 and the area calculates to be 40.79054 acres, and we have found the range in which m falls. Interpolating linearly between m=30° and m= 40°, we are presented with m=37°22'09", from which Q=1104.291 and the area 35.851222 acres. Another linear interpolation between m=30° and m=37°22'09" yields m=37°26'55" for a Q=1107.938 and an area of 35.99861 acres. A final linear interpolation using m=37°22'09" and m=37°26'55" gives a value of m=37°26'57", a Q=1107.973 and an area of 36.00000053 acres.
Arc CF is subtended by 21°31'37" and has an arc length of 1,247.38'.
DE =[(3320)(sin 37°26'57") – 910.783]/cos2°31' = 1,109.04'
EF = 3192.628 + 1156.20 + 1107.973 · tan2°31' – (3320)(cos 37°26'57") = 1,761.80'