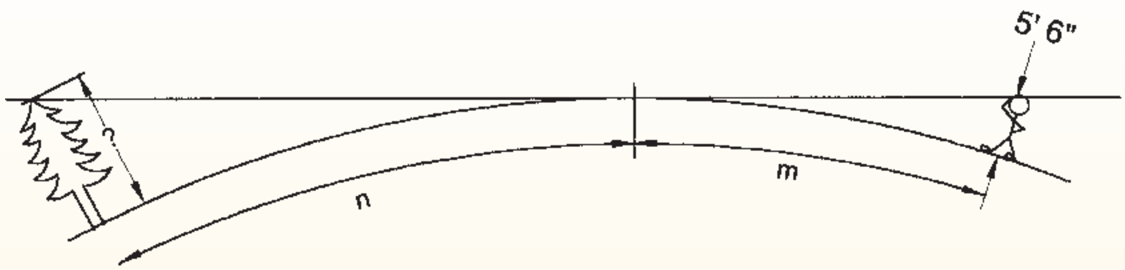
Solution to Problem 91



The distance from the observer's eye to the point of tangency is:

(C + R) = 0.574 m^2, where m is the distance in miles

(C + R) = 5.5' = 0.574 m^2, and m = 3.1 miles

From the point of tangency to the top of the tree is:

(C + R) = 0.574 n^2, with n = 13-3.1 = 9.9 miles

(C + R) = 0.574 $(9.9)^2$ = 56.2'

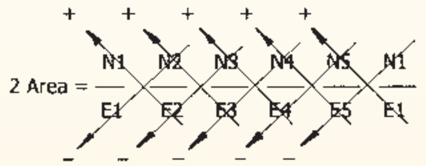
Solution to Problem 92

$\text{Area} = N_2 E_3 - \text{Area I} - \text{Area II} - \text{Area III} - \text{Area IV} - \text{Area V} - \text{Area VI}$

$$= N_2 E_3 - (N_2 - N_3)(E_3 - E_2)/2 - (N_2 - N_1)(E_2 + E_1)/2 - N_1 E_1 - (N_1 + N_5)(E_5 - E_1)/2 - (N_5 + N_4)(E_4 - E_5)/2 - (N_3 + N_4)(E_3 - E_4)/2$$

$$2\,\text{Area} = 2 N_2 E_3 - (N_2 E_3 - N_2 E_2 - N_3 E_3 + N_3 E_2) - (N_2 E_2 + N_2 E_1 - N_1 E_2 - N_1 E_1) - 2 N_1 E_1 - (N_1 E_5 - N_1 E_1 + N_5 E_5 - N_5 E_1) - (N_5 E_4 - N_5 E_5 + N_4 E_4 - N_4 E_5) - (N_3 E_3 - N_3 E_4 + N_4 E_3 - N_4 E_4)$$

$2\,\text{Area} = N_1 E_2 + N_2 E_3 + N_3 E_4 + N_4 E_5 + N_5 E_1 - N_2 E_1 - N_3 E_2 - N_4 E_3 - N_5 E_4 - N_1 E_5$, which can be rearranged as:



By "cross multiplying" the coordinates, adding the product "up" and subtracting the product "down," the algebraic sum will yield twice the area. (The algebraic sum may be negative, but the absolute value will give the correct answer: twice the area.) Note the repetition of point one's coordinates.

Substituting values:

564.653 x 289.208 + 869.208 x 652.083 + 708.917 x 535.876 +

165.933 x 375.585 + 454.458 x 119.117 – 869.208 x 119.117 –

708.917 x 289.428 – 165.933 x 652.083 – 454.458 x 535.876 –

564.653 x 375.585 = 354,041.075, divided by 2 = 177,020.54 sq.ft.

Note also that following a pattern of adding "the northing of any point times the easting of the next point" until all northings are used once and then subtracting "the easting of any point times the northing of the next point" until all the eastings are used once will give the same result, and you can start anywhere.

If the traverse is translated so E_1 and N_4 are zero it simplifies the calculations, especially if you are working with State Plane coordinates.