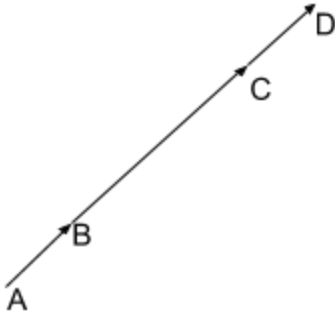


## Q2



Let distance between inner and outer boundary be  $d$  and width of inner boundary be  $w$ . It is given that total width is 18 yards. Hence we have:

$$w + 2d = 18$$

Cross ratio along width is given by:

$$\begin{aligned} CR_1 &= \frac{AC}{AD} : \frac{BC}{BD} \\ &= \frac{w+d}{w+2d} * \frac{w+d}{w} = \frac{w+18}{18*2} * \frac{w+18}{2*w} = \frac{(w+18)^2}{72*w} \end{aligned}$$

Hence  $w$  is solution of quadratic equation with  $a = 1$ ,  $b = (36 - 72 * CR_1)$ ,  $c = 324$

Similarly cross ratio along length is given by:

$$CR_2 = \frac{(l+44)^2}{176*l}$$

Hence  $l$  is solution of quadratic equation with  $a = 1$ ,  $b = (88 - 176 * CR_2)$ ,  $c = 1936$

We calculate cross ratios using points from image in matlab. We draw two lines crossing to find intersection with outer boundary. Store that image as `wembley_corners.jpg` in output folder. Further coordinates are with respect to new image.

$$A_1 = (245, 517), B_1 = (282, 494), C_1 = (518, 351), D_1 = (529, 344)$$

$$A_2 = (870, 505), B_2 = (789, 490), C_2 = (115, 382), D_2 = (80, 377)$$

Solving these two equations in matlab, we get:

$$w = 21.0632 \text{ or } 15.3823$$

$$l = 50.9117 \text{ or } 38.0266$$

Since width is less than 18 yards and length is less than 44 yards, we have final answer:

**Width = 15.38 yards**

**Length = 38.03 yards**