



Nelson's Column is the focal point of Trafalgar Square. Admiral Nelson was one of Britain's best-loved heroes, who fought valiantly for his country and won four notable naval battles, at the personal cost of losing an arm and one eye. Nelson's last and most famous battle was fought off the Spanish cape of Trafalgar on October 21st, 1805, when he defeated Napoleon and the French and Spanish fleets, but during which he lost his life, dying aboard H.M.S. Victory.

Begun in 1840, it took three years to erect this magnificent memorial. The granite column is 151 feet high surmounted by a statue of Lord Nelson which measures 18 feet. At the base are four bronze relief panels cast from armaments captured from the French. At the four corners of the monument sit the superb lions.

<http://www.aboutbritain.com/NelsonsColumn.htm>

and Wikipedia

Read the following extract from the book "Why Do Buses Come in Threes?"<sup>1</sup> and answer the questions.

1 If you stand near the base of the plinth and strain your neck you can  
2 see all of Nelson but he will appear stunted because the viewing angle  
3 is small. So you start to walk backwards, avoiding other tourists, and  
4 pigeons. As you do, you begin to get a better view of the admiral because  
5 the angle increases. However this doesn't go on indefinitely. As you  
6 retreat down Whitehall, you get a better side-on view of the statue but he  
7 becomes so remote that you begin to need binoculars to see him. There  
8 is an optimal point somewhere in your walk at which Nelson presents  
9 himself at the largest possible angle.

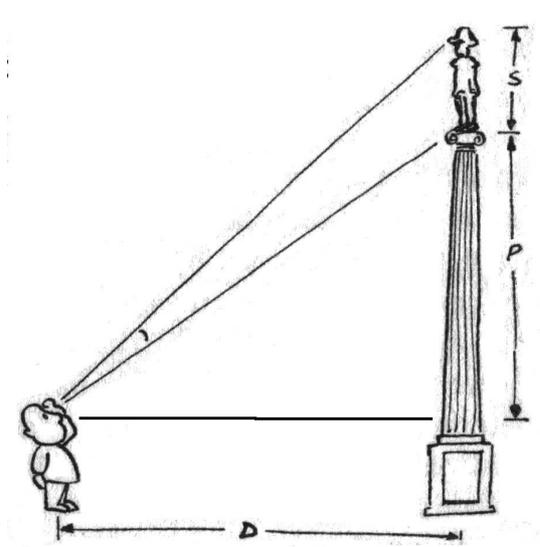
## I. Finding $\theta$

1. Describe the sketch below.

Give the values of  $P$  and  $S$  (in feet).

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<sup>1</sup>Rob Eastaway & Jeremy Wyndham



2. Suppose you are standing 100 feet away from the statue ( $D = 100$ ).
  - a) Can you work out the angles  $\alpha$  and  $\beta$ ?
  - b) In that case what is the value of  $\theta$ ?
3. Same questions if you stand 200 feet away from the statue.
4. Same questions if you stand 300 feet away from the statue.

## II. How far back should you stand ?

1. If  $x$  is the distance between you and the base of the plinth, express the angle  $\theta$  in terms of  $x$ .
2. Find the optimal point at which Nelson presents himself at the largest possible angle and give the value of the largest possible angle.

You can use the following theorem :

### THEOREM

If  $u$  is a function, the derivative of  $\arctan u$  is given by  $\frac{u'}{1+u^2}$ .

3. The book says :

The formula for the distance  $D$  to stand from a statue of height  $S$  and a plinth height  $P$  is :

$$D = \sqrt{S \times P + P^2}$$

What do you think of this formula ?

### III. Where is that on the map ?

Find a few places on the map where you could stand to have the best view of Admiral Nelson.

