**Question**

In how many ways can the letters of the word SCOTLAND be arranged in a line?

1. In how many of these arrangements do the two vowels come together?
2. How many of the arrangements begin with S and end with the two vowels?

**Solution**

The letters of the word SCOTLAND can be arranged in 8! Ways.

8! = 8 X 7 X 6 X 5 X 4 X 3 X 2 X 1 = 40320 ways

1. If the two vowels come together, we treat them as one “unit”.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | A | O |  |  |  |

 There are now seven “units” (or boxes) and these can be arranged in 7! = 5040 ways.

For each arrangement of these boxes, the box containing AO can be arranged in 2! Ways.

Therefore the number of arrangements is 7! X 2! – 5040 X 2 = 10080 ways.

1. Arrangements beginning with S and ending with AO or OA.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S |  |  |  |  |  | AO |

 The S is fixed and we treat AO as one “unit” and that is also fixed. The remaining 5 letters can be arranged in 5! Ways.

 For each of these arrangements, AO can be arranged in 2! Ways, therefore the number of arrangements is 5! X 2! = 120 X 2 = 240