

YOU & MATHS **One is odd and two is even** Three balls are drawn at random from an urn containing five balls. Each ball is numbered from 1 to 5.

- a. Find the sample space S .
- b. Find in S the elements corresponding to the event $E = \text{«one even number and two odd numbers are drawn»}$.

- a. A systematic way to find all the elements of the sample space is to write down every ordered triplet consisting of the numbers from 1 to 5. Let us first write the value of each ball:

1 2 3 4 5

and then let us write next to each number all the values that are greater than the previous number, when this is possible:

(1; 2) (2; 3) (3; 4) (4; 5)
 (1; 3) (2; 4) (3; 5)
 (1; 4) (2; 5)
 (1; 5)

Let us do it a third time, when it is possible:

(1; 2; 3) (2; 3; 4) (3; 4; 5)
 (1; 2; 4) (2; 3; 5)
 (1; 2; 5) (2; 4; 5)
 (1; 3; 4)
 (1; 3; 5)
 (1; 4; 5)

The sample space is given exactly by these triplets:

$$S = \{(1; 2; 3), (1; 2; 4), (1; 2; 5), (1; 3; 4), (1; 3; 5), (1; 4; 5), (2; 3; 4), (2; 3; 5), (2; 4; 5), (3; 4; 5)\}.$$

- b. Since we already wrote every element of S , it is now easy to verify which of these elements satisfy the condition given by E :

$$E = \{(1; 2; 3), (1; 2; 5), (1; 3; 4), (1; 4; 5), (2; 3; 5), (3; 4; 5)\}.$$

Equivalently, we could build the set E without relying on S .

An event belongs to the set E if it has exactly one even ball.

The only possibilities are 2 and 4:

2 4

The two other balls in the triplet have to have odd numbers on them. We can choose any two balls in the set $\{1, 3, 5\}$:

(2; 1; 3) (4; 1; 3)
 (2; 1; 5) (4; 1; 5)
 (2; 3; 5) (4; 3; 5)

Once again, we found that the set E consists of the elements:

$$E = \{(1; 2; 3), (1; 2; 5), (1; 3; 4), (1; 4; 5), (2; 3; 5), (3; 4; 5)\}.$$