

7. A card is drawn from a normal pack of cards.  
 If a king is drawn you win €50.  
 If a diamond is drawn you win €8.  
 If a Jack is drawn you lose €5.  
 If you draw any other card, you neither win nor lose.  
 If it costs €10 to play this game, how much can you expect to win or lose?  
 Give your answer correct to the nearest 10c.

8. A sports club sells 1000 tickets for a confined draw.  
 There is one prize of €100, five prizes of €50 and ten prizes of €20.  
 Find the expected value of a prize.

9. Here is the sample space when two dice are thrown and the scores are added.  
 (i) What is the probability of getting a total of 9?

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

In a casino, a game consists of throwing two dice and adding the scores.

If you score a total of 7, you win €24.

If you score 9, you lose €27.

For all other scores you neither win nor lose.

If you play this game, what do you expect to win or lose?

If you pay €2 to play this game, could you say it was a fair game? Explain your answer.

10. Make out a sample space for all the outcomes when three coins are tossed.  
 A game consists of tossing three coins and counting the number of heads obtained.  
 If you get exactly two heads you win €20.  
 For any other result you lose €5.  
 If you pay €2 to play this game, how much can you expect to win or lose?  
 Use your answer to state whether or not the game is fair.

## Section 6.10 The fundamental principle of counting —

A make of car comes in four different models as shown below:



Standard (S)



Classic (C)



Elegant (E)



Diamond (D)

Each model comes in three different colours: silver(*s*), red(*r*), and black(*b*).

Here are the choices a customer has:

(*S, s*), (*S, r*), (*S, b*), (*C, s*), (*C, r*), (*C, b*), (*E, s*), (*E, r*), (*E, b*), (*D, s*), (*D, r*), (*D, b*).

There are 12 choices listed.

For each of the **4** models, there are **3** colours.

The number of choices is found by multiplying the number of models by the number of colours,

$$\text{i.e. } 4 \times 3 = 12.$$

This example illustrates the **Fundamental Principle of Counting** which is given on the right.

If one task can be done in  $x$  ways, **and** following this, a second task can be done in  $y$  ways, then the first task followed by the second task can be done in  $xy$  ways.

### Example 1

A team consists of 11 players.

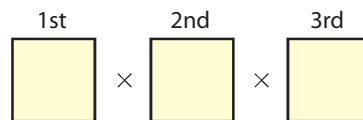
In how many ways can a captain and vice-captain be chosen?

$$\begin{array}{ccccccc} \text{Captain} & & \mathbf{and} & & \text{Vice-captain} & & \\ 11 & & \times & & 10 & & = 110 \end{array}$$

$\therefore$  there are 110 ways of selecting a captain and vice-captain.

**and** indicates multiplication

When dealing with two or more operations, it can be convenient to use 'boxes' for the selection, as shown on the right.

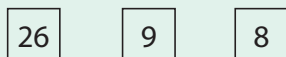


### Example 2

A code consists of a letter of the alphabet followed by two different digits from 1 to 9 inclusive. How many codes are possible?

There are 26 letters and 9 digits.

We use three 'boxes' as each code consists of 1 letter and 2 digits.



The first box can be filled in 26 ways.....

The second box can be filled in 9 ways.....

The third box can be filled in 8 ways.....

9 digits

1 digit used

$$\begin{aligned} \therefore \text{Number of Codes} &= 26 \times 9 \times 8 \\ &= 1872 \end{aligned}$$

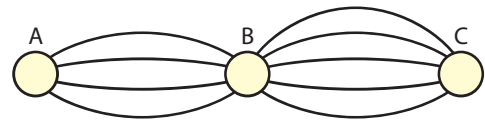
There are 26 letters in the alphabet.

## Exercise 6.10

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1. A dice is thrown and a coin is tossed.  
How many different outcomes are possible?  
List these outcomes.
2. A lunch menu has 3 starters and 4 main courses.  
How many different two-course meals are possible?
3. A code consists of three different digits from 1 to 9.  
How many codes are possible?

4. There are four roads from  $A$  to  $B$  and five roads from  $B$  to  $C$ .  
In how many different ways can a person travel from  $A$  to  $C$ ?



5. A pupil must choose one subject out of each of the following subject groups:  
Group A has 3 modern language subjects.  
Group B has 2 science subjects.  
Group C has 2 business subjects.  
How many different subject selections are possible?
6. A code consists of one of the letters  $A, B, C, D, E$  and  $F$  and one digit from 1 to 9.  
How many different codes are possible?
7. A coin is tossed and a digit from 0 to 9 is selected. How many different outcomes are possible?
8. A car manufacturer produces different types of cars as follows:
  - the model can be Saloon, Estate or Hatchback
  - the colours can be silver, black or red
  - the style can be Standard, Deluxe or Premium.How many different choices of car does a buyer have?
9. A committee consists of 10 people.  
In how many ways can a chairperson and secretary be chosen?
10. How many different 3-digit numbers can be formed from the digits 4, 5, 6, 7, 8, 9 if each digit is used once only in a number?
11. There are eight horses in a race.  
In how many ways can the first three places be filled?

## Section 6.11 Arrangements (permutations)

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The letters  $A, B$  and  $C$  can be arranged in a line in the following ways:

ABC    ACB    BAC    BCA    CAB    CBA