**Age 14+ Level ★★★**
Worksheet 1**1. Medal Ceremony**

6 pupils have, between them, won three gold medals, two silver medals and a bronze medal in a painting competition.

Unfortunately, their teacher has lost all record of which medals should go to which pupils, so he allocates them by drawing names out of a hat. The first 3 names drawn receive the gold medals, the next two drawn have the silver medals, and the bronze medal goes to the remaining pupil.

How many different ways can the medals be allocated by this method?

2. Domino Match

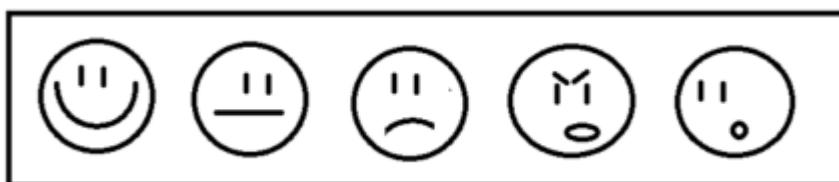
A standard set of dominoes has numbers from 1 to 6, and blanks, arranged so that every number appears once with each other number, and once with itself (the doubles).

Two dominoes are chosen from the set at random.

What is the probability that they 'match' - that is, that one end of one matches at least one end of the other?

3. Face Order

How many ways can the five faces below be ordered if the smiling face cannot be on either end?

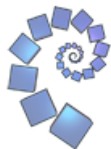
**4. Vegtown Elections**

Elections in Vegtown were held recently.

Everyone who voted for the Broccoli Party had already eaten broccoli. Of those who voted for other parties, 90% had never eaten broccoli. 46% of voters had eaten broccoli.

What percentage of voters voted for the Broccoli Party?

These problems are adapted from UKMT (ukmt.org.uk) and WMC (competition.ac) problems.

**Age 14+ Level ★★★**
Worksheet 2**1. Two Girls**

There are 10 girls in a mixed class.

If two pupils from the class are selected at random, then the probability that both are girls is 0.15.

How many boys are in the class?

2. Phone Call

A new taxi firm needs a memorable phone number.

They want a number which has a maximum of two different digits.

Their phone number must start with the digit 3 and be six digits long.

How many such numbers are possible?

3. Dropouts

A language school reports that:

- 75% of students starting a French course have never been to France
- Of the students who have never been to France, 60% graduate.
- Of the students who have visited France before, 70% graduate.

What percentage of the students who graduate had never been to France?

4. Winning Marble

A prisoner is given a chance to win her freedom.

She is given two boxes and some marbles.

She must put the marbles into the boxes.

Afterwards, she will be blindfolded, and will choose a box and select a marble. If she draws a white marble, she will go free; otherwise, she will remain in prison.

The prisoner has 10 white marbles and 10 black marbles. She can put as many of the marbles of each colour as she likes into each box. She must use up all the marbles.

How can she maximise the probability that she will go free?

In that case, what is the probability that she will go free?

These problems are adapted from UKMT (ukmt.org.uk) and WMC (competition.ac) problems.

**Age 14+ Level ★★★**
Worksheet 3**1. Descending Deal**

The cards in a set of 36 are numbered 1 to 36.
The cards are shuffled and four cards are dealt.

What are the chances of them being dealt in descending order?

2. Counting Kangaroos

Rachel draws 36 kangaroos using three different colours.
25 of the kangaroos are drawn using some grey, 28 are drawn using some pink and 20 are drawn using some brown.
Five of the kangaroos are drawn using all three colours.

How many kangaroos did she draw that use only one colour?

3. Different Digital Clock

A digital clock uses two digits to display hours, two digits to display minutes and two digits to display seconds, e.g. 10:23:42.

How many times between 10:00:00 and 11:00:00 on the same morning are all six digits different?

4. Numbers or Letters?

Here are two games that you might play:

Game One:

You have a bag of 26 tiles, each with a different letter of the alphabet.

You choose a tile, write down the letter, and put it back in the bag.

Then you choose a second tile, write down the letter, and put it back in the bag. Then you choose a third tile.

If the three letters came out in strictly ascending alphabetical order, you win. Otherwise, you lose.

Game Two:

You roll a 10-sided dice three times, writing down the number that is shown each time. If the three numbers are in strictly ascending numerical order, you win. Otherwise, you lose.

Which game offers you the best chance of winning?

These problems are adapted from UKMT (ukmt.org.uk) and WMC (competition.ac) problems.