Could it be YOU?

UNIT 18

In this unit, students use number and data handling skills within the context of the national lottery. They are also encouraged to examine the motivation of people who participate in the lottery and consider what this tells them about different priorities in life.

Using this unit

This unit is accessible for all students at GCSE level. It is expected that this unit would take about 3 hours, plus the time for collecting data using a prepared questionnaire.

As a preliminary activity, students are asked to use a questionnaire to do a survey on various aspects of the national lottery. This questionnaire will need to be issued at least two lessons prior to starting the unit. This is because it is necessary to collate the results before other work can begin. The beginning and concluding sections encourage students to consider why so many people take part in the lottery. Also, throughout the unit there are statements which offer opportunities for further reflection.

The central sections examine how much people spend on the lottery, where the money goes, the idea of luck and the probability of winning. There is also an optional extension activity, which is more suitable for Intermediate/Higher tier students. This leads students through the process of calculating the probability of a jackpot.

It is hoped that the unit will encourage students to examine both the positive attributes and the possible dangers of the lottery. Sensitivity may be needed if students are asked to take the questionnaire home. Some parents may not wish to take part in the survey.

Students will require a scientific calculator with a factorial button.

Mathematical content

Number & Algebra (AT2)
- **Calculate percentages**
- **Explore number patterns**
- **Understand and use factorials**
- **Calculate combinations**

Handling data (AT4)
- **Interpret information from tables**
- **Use a questionnaire to collect data**
- **Identify all the possible outcomes**
- **Calculate a probability based on equally likely outcomes**
- **Recognise that the total probability of all mutually exclusive outcomes is 1**

Spiritual and moral development

It is hoped that students will reflect upon what is important to them in life, when considering the advantages and disadvantages of the national lottery. They are also encouraged to consider the extent to which they believe life is governed by chance.

TEACHER'S NOTES

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Background

The National Lottery Act was passed by Parliament in 1993, enabling a national lottery to be set up in the UK. The Camelot consortium, one of eight consortia, was awarded the licence. Camelot outlined a plan that would maximise sales whilst retaining the lowest percentage of sales income to cover all operating costs, including profits. The first draw took place on 19th November 1994. Anyone aged 16 or over can take part.

Since then the lottery has gone from strength to strength. Most of the adult population of the UK have played in the lottery with an estimated 65% of the population playing regularly. In early 1997, a new midweek draw held on a Wednesday was started.

Further free information including the "rules of play" can be obtained from Camelot at the address given below.

Additional sources

Available from Camelot are:
The National Lottery Fact Pack
Rules For On-Line Games And The National Lottery Game Procedures 2nd Edition
Fact sheet on National Lottery winning numbers and draw results

Camelot Group Plc., The National Lottery, PO. Box 287, Watford, Herts, WD1 8TT

Notes on the activities

National Lottery Questionnaire

This is a preliminary activity, which must be completed before starting on the other tasks in the unit. The students should all use at least one questionnaire, possibly with their own household. However, if possible, further adults could also be interviewed. The questionnaires should then be processed and the results summarised. Students will need their own questionnaire back as well as a copy of the class results, when they are doing the unit.

Why play the lottery?

After a brief account of the national lottery in Britain students work through a short exercise on marketing the national lottery. They are asked to think up their own slogan.

Class discussion

There is scope for class discussion throughout the unit. It would be particularly beneficial for the introductory session to include a class discussion on the issues raised. It will then set the scene for the rest of the unit. Areas for discussion include:

- the ways in which people were encouraged to play the lottery;
- the students' ideas for marketing the lottery;
- their own views on the positive and negative aspects of the lottery.

"It's only a pound!"

Students calculate how much money is spent on the national lottery in Britain and, using results from their class survey, how much is spent by families in their own neighbourhood. Students should be encouraged to reflect on whether this is a good way to spend the money in light of the needs of the local community.

Where does all the money go?

In this section, students look at where each pound that is used to buy a ticket goes and whether they think this is a fair distribution. They should be given an opportunity to compare their ideas with those of others in the class. This might include reviewing who should benefit most from the lottery and the value of the prizes.

Lucky numbers

In this section, students examine whether in reality there are certain numbers which are "lucky" for people and whether or not choosing the same numbers each time or choosing the numbers at random has any effect on chances of winning. They will need to appreciate the difference between the theoretical and the practical in probability, when considering the data provided. Students are then encouraged to think more generally about the idea of being lucky and what it is based upon.

It's all a matter of chance

In this section, students consider the probabilities of winning the different prizes. (Note: It is at this point that the optional extension activity *What chance a jackpot?* can be used.) This section aims to highlight the fact that even though the chance of winning the jackpot is very small, the idea that "it could be me" operates as a significant driving force in people's participation.

Note that in this section on different probabilities the word *chance* has been used. This is because this word ties in better with common understanding of the lottery. Students should be made aware of this in relation to their understanding of probability in order that there is no confusion.

Finally in this section, students are encouraged to think whether or not our lives and the events that take place in our lives are based purely on chance or whether there may be other forces at work.

What are we hoping for?

In this final section, students should be encouraged to think again about the possible motivations for playing the lottery. This then leads on to further reflection of what people hope for in their lives and whether the lottery can provide it. Students could be asked to produce a written response either as preparation for or as a result of a final class discussion.

Class discussion

There are a fair number of issues raised by this unit and a final class discussion is important in order to draw the threads together. In particular, the following could be addressed:

- the students' views on why people play the lottery;
- the students' views on what people are really hoping for through the lottery.

What chance a jackpot? (extension activity)

This activity can be used just as students are starting the *It's all a matter of chance* activity. In this extension activity, students are led through a process that leads to calculating the probability of the national lottery jackpot. The first stage requires students to list all possible outcomes and then the associated probabilities in some simple lotteries. This is followed by using Pascal's triangle to find the number of possible winning combinations. Finally, the students are introduced to the formula for calculating combinations. Some of the mathematics is beyond GCSE but it is worthwhile leading students through it.

TEACHER'S NOTES

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Answers

Task 2:
1. 30 million.
2. a) £70.5 million, b) £122.20.

Task 5:
1. a) less than a chance in a million.
2. a) 0.018, b) 2%.
3. Possible answer is guessing correctly a playing card selected at random from a normal pack.
4. a) 53/54, b) 98%.

Task 6:
1. a)

1,2	1,3	1,4	1,5	1,6	1,7	2,3	2,4	2,5	2,6	2,7
3,4	3,5	3,6	3,7	4,5	4,6	4,7	5,6	5,7	6,7	

b) 21 possibilities, c) 1/21, d) 1/21.

2. a)

1,2,3	1,2,4	1,2,5	1,2,6	1,2,7	1,3,4	1,3,5	1,3,6	1,3,7	1,4,5	1,4,6
1,4,7	1,5,6	1,5,7	1,6,7	2,3,	2,3,5	2,3,6	2,3,7	2,4,5	2,4,6	2,4,7
2,5,6	2,5,7	2,6,7	3,4,5	3,4,6	3,4,7	3,5,6	3,5,7	3,6,7	4,5,6	4,5,7
4,6,7	5,6,7									

b) 35 different choices, c) 1/35.

Task 7:
2. 56 possible choices.
3. 1/15.
4. a) This can include patterns in rows, columns and diagonals
   b)

Row 9	9	36	84	126	126	84	36	9	1	
Row 10	10	45	120	210	252	210	120	45	10	1

Task 8:
1. a) 210, b) 26334.
2. a) 1/220, b) 1/4845.
3. b) 13983816, c) 1/13983816.

Could it be YOU?

UNIT 18

Why play the lottery?

National lotteries take place in quite a few countries around the world. In Britain, the national lottery began in 1994. From the time it started, it has been extremely popular and most adults have played at least once. Many play regularly and it is estimated that as many as 65% of all adults play every week. In other words, nearly 2 out of every 3 adults take part in the lottery each week.

When the lottery was starting in Britain some of the reasons given to people in order to encourage them to take part were:

- It would be **fun** to take part.
- They might end up with millions of pounds to **spend** on themselves.
- The **chance** of winning millions of pounds is the same for everyone so it might as well be them.
- Millions of pounds would be given to **good causes.**
- The **moment of winning**, when they discover they have won millions of pounds, would be the most exciting moment of their lives.

1

1. Why do you think so many people take part in the lottery?

2. What do you think is the main attraction?

3. Imagine you were setting up a national lottery in a country for the first time. What would your slogan be?

The slogan used to promote the British national lottery was

'It could be you!'

What do you think – could it be you?

"It's only a pound!"

It costs £1 to buy a ticket for the lottery. Some people say, "It's only a pound – that's not much to spend, really". In this section you will examine how much is spent by people on the lottery. You will need your results from the National Lottery Questionnaires that you completed earlier.

2

1. If the number of adults in Britain is 45 million and nearly 2 out of every 3 adults play every week, approximately how many people are playing?

2. Each player spends on average £2.35 a week on the lottery.
   a) How much money is spent altogether in Britain each week on the lottery?
   b) How much does each player spend on average in a year on the lottery in Britain?
   c) Do you think this is money well spent?
   d) What sort of things could that money have been spent on instead?

3. a) How much is spent in your home every week on the lottery?
   b) How much is that over a whole year?
   c) Is this higher or lower than the national average?

4. a) Work out the total amount spent each week by the families surveyed by your class.
   b) Work out the total amount spent each year by these families.
   c) Work out the average amount spent each week by the families surveyed by your class.
   d) What is the average amount for the year?

5. a) Do you think this is money well spent or are there other things this money could have been spent on in your area?
   b) Are the average figures for your class higher or lower than the national figures?
   c) Can you think of any reasons why this might be the case?
   d) What is the highest amount spent by any one person?

6. a) How many families have lost more money than they have won?
   b) What percentage is this of all the families surveyed?
   c) Is this a higher or lower percentage than you would expect?

Can you imagine what it would be like to win a big jackpot prize?

In what ways do you think it would change your life?

Where does all the money go?

So what happens to all the money that is spent on lottery tickets? Some of the money goes towards the prize money. Some has to be paid to various people including the Government Treasury, the shop where you play (Retailer), and the organisers for their operating costs and profit. The rest goes towards good causes such as the arts, sports, charities, National Heritage and the Millennium Fund. The table below shows how the current organisers distribute every pound spent on the lottery.

Prize Money	50p
Treasury Duty	12p
Good Causes	28p
Retailer Commission	5p
Operating costs & profit	5p
Total	**£1**

The treasury duty is a fixed amount and cannot be changed from 12p.

3

1. Which of the five sections in the table would you give most to?
2. Which section would you give least to?
3. Write down how much you would give each area.
4. Ask one or two of your friends how they would split up each pound. Write down what they say.

Lucky numbers

Many people when selecting their six numbers choose the same numbers each time. They might use their house number or the day of the month they were born on. These numbers are often considered to be "lucky." The table below shows how many times each number appeared during the first 50 lottery draws.

Number	1	2	3	4	5	6	7	8	9	10	11	12	13
Times drawn	7	8	8	7	15	6	6	7	5	8	6	6	5
Number	14	15	16	17	18	19	20	21	22	23	24	25	26
Times drawn	6	11	12	8	6	5	5	8	12	4	6	9	6
Number	27	28	29	30	31	32	33	34	35	36	37	38	39
Times drawn	5	8	6	10	9	7	5	6	5	6	5	9	1
Number	40	41	42	43	44	45	46	47	48	49			
Times drawn	7	8	7	7	10	8	8	7	8	6			

4

1. Using the results from your questionnaires, work out what percentage of families in your class select the same numbers most of the time.
2. What sort of reasons did people give for saying that some numbers were "lucky" for them?
3. For the families surveyed by your class, did those who used "lucky" numbers do any better than those who chose any numbers? Explain how you work out your answer.
4. Do you think that some numbers are more "lucky" than others and so more likely to come up?
5. Do the results of the first 50 draws surprise you or are they what you would have expected? Explain your answer.

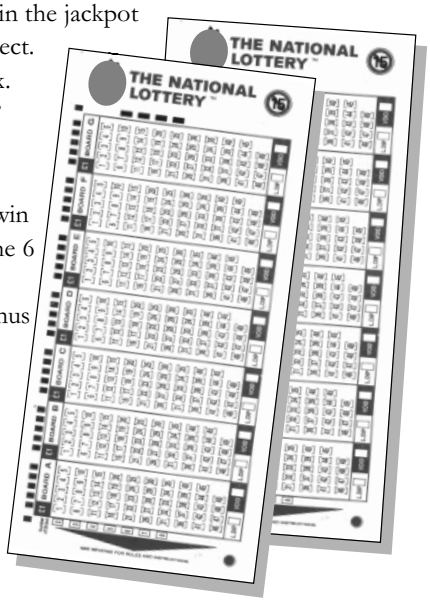
Are some people especially lucky or unlucky in life?

If you think they are, can you explain why you think this?

It's all a matter of chance

In Britain it was found that chance was the most appealing reason for people wanting to take part in the lottery. The idea that "someone has to win the jackpot so it might as well be me" was considered the most important reason why people might want to take part. It was therefore decided to make this the main issue when advertising the lottery. Outside every shop selling tickets and on every advertisement is the slogan "It could be You".

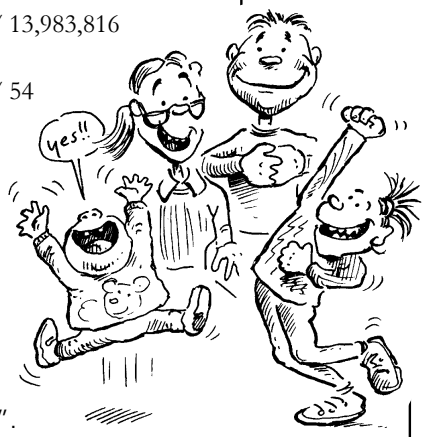
To take part in the lottery you choose six numbers between 1 and 49. To win the jackpot (usually worth millions of pounds) you have to get all the six numbers correct. (To work out the chance of getting all six numbers correct is quite complex. Your teacher may ask you to do this by using the "What chance a jackpot?" sheet).



Of course you don't have to get all 6 of your numbers correct in order to win a prize. The smallest prize is £10 and is won if you have chosen three of the 6 numbers selected. The chance of winning £10 is 1 in 57. There are other larger prizes for getting 4 or 5 of your numbers correct. There is also a Bonus Number which may be used when people get 5 numbers out of their six correct. The prize money for these categories is not fixed but depends on the number of people who have played.

The table on the next page shows the chances of winning each prize category. We are using the word "chance" here. This is really the same as "probability" which you may be more used to using in mathematics.

Match 3 out of 6 (£10 prize)	1 / 57
Match 4 out of 6	1 / 1033
Match 5 out of 6	1 / 55,492
Match 5 out of 6 plus the Bonus number	1 / 2,330,636
Match 6 out of 6 (Jackpot)	1 / 13,983,816
The chance of winning any sort of prize	1 / 54



5

1. You may have heard of the phrase "A chance in a million".
   a) Is the chance of winning the jackpot on the lottery more or less than "A chance in a million"?
   b) What do you think now of the slogan used in advertising the lottery –

"It could be You!"?

2. Look at the chance of winning the £10 prize.
   a) Write this chance as a decimal.
   b) Write it as a percentage probability.

3. Look at the overall chance of winning any of the prizes. Can you think of anything else that has a chance of about 1 / 54.

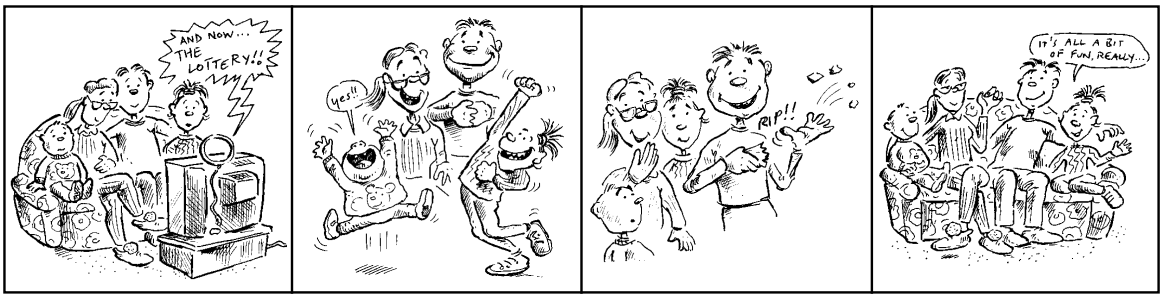
4. a) What is the chance that you will not win a prize at all in any one week?
   b) Write this as a percentage probability.

There are many ways of looking at life.
How do you react to these two different viewpoints?

> Life is a lottery – everything that happens to me in life is just chance.

> "I know the plans I have for you," declares the Lord,
> "plans to prosper you and not to harm you,
> plans to give you hope and a future."
> (quotation from the *Bible*)

Just a bit of fun?



What are we hoping for?

The lottery in Britain is certainly proving to be popular, so much so that a Wednesday draw was introduced early in 1997. Having considered in the unit different aspects of the lottery, you are now asked to think about the questions below.

What do you think really drives people to take part in the lottery?

Is it just a bit of fun?

Is it because money goes to good causes?

Is it because people think that they have a good chance of winning some kind of a prize?

Is it because people hope that they might win the jackpot and so their lives will change for the better?

What are you hoping for from life?

What is important to you?

How do these compare to winning the lottery?

Write your response to these questions in preparation for a class discussion.

What chance a jackpot? (extension activity)

You are going to work out the chance of winning the jackpot in the British national lottery. This is quite complex so you will do it in several stages. You will start by considering some simpler lotteries.

Imagine a lottery in which you have just the numbers 1 to 5 to choose from. In this lottery you have to pick just 2 out of the 5 numbers. There are 10 different ways you could choose 2 of those numbers:

1,2 1,3 1,4 1,5 2,3 2,4 2,5 3,4 3,5 4,5

It does not matter in which order the numbers are picked, because in the lottery 1 followed by 2 would be considered the same as 2 followed by 1. Each of the possible choices is equally likely to be selected, so the chance (or probability) of having the winning numbers is 1/(the total number of possible choices). So the chance of winning the jackpot in this simple lottery is 1/10.

6

1. Imagine a lottery with the numbers 1 to 7 where you have to choose two numbers.
   a) Write down all your possible choices. The list has been started for you:

   1,2 1,3 1,4 1,5 1,6 1,7 2,3 2,4

   b) How many different possibilities are there?
   c) What is the chance of (2,5) being the winning numbers?
   d) What is the chance of (1,3) being the winning numbers?

2. Now imagine the lottery still with the numbers 1 to 7 but where you have to choose three numbers.
   a) Write down all your possible choices. Again the list has been started for you:

   1,2,3 1,2,4 1,2,5 1,2,6 1,2,7 1,3,4 1,3,5 1,3,6
   1,3,7 1,4,5 1,4,6, 1,4,7 1,5,6 1,5,7 1,6,7 2,3,4
   2,3,5 2,3,6

   b) How many different choices are there altogether?
   c) What is the chance that the 3 numbers you choose are the winning numbers?

Look at this table. The pattern of numbers in this table is very important and has many applications. The number pattern is often called Pascal's Triangle.

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Row 1	1							
Row 2	2	1						
Row 3	3	3	1					
Row 4	4	6	4	1				
Row 5	5	10	10	5	1			
Row 6	6	15	20	15	6	1		
Row 7	7	21	35	35	21	7	1	
Row 8	8	28	56	70	56	28	8	1

We can use Pascal's Triangle to find the total number of choices there are for different lotteries. For example, consider our simple lottery with 5 numbers where we have to choose 2. The total number of choices is found in Row 5, Column 2. The number there is 10, which is what we found before.

7

1. We can use the table to check the answers we got in task 6.
   a) Check your answer to 1b). Is it correct?
   b) Check your answer to 2b). Is it correct?

2. Imagine a lottery with numbers 1 to 8 where you choose 3 numbers. How many possible choices are there?

3. Imagine a lottery with numbers 1 to 6 where you choose 2 numbers. What is the chance that your choice will be the winning numbers?

4. a) What patterns can you see in the table?
   b) Using the patterns you have found, try to write down the next two rows in the table.
   c) See if you can find a copy of Pascal's Triangle to see how the numbers continue.

Note

6! is read "6 **factorial**".
6! means 6 x 5 x 4 x 3 x 2 x 1
so 6! = 720

8! means 8 x 7 x 6 x 5 x 4 x 3 x 2 x 1
so 8! = 40,320

When calculating the factorial for larger numbers, it is best to use the ! button, which you should find on most scientific calculators.

The number of ways of choosing 2 numbers from 5 can be written as $^{5}C_{2}$. The letter C is used to stand for **combinations**. In general, the number of ways (or combinations) of selecting r numbers from n is $^{n}C_{r}$
There is a formula for working out the number of combinations.

$$^{n}C_{r} = \frac{n!}{(n - r)!r!}$$

For example:

$$^{5}C_{2} = \frac{5!}{(5 - 2)! \times 2!} = \frac{5!}{3! \times 2!} = \frac{5 \times 4 \times 3 \times 2 \times 1}{(3 \times 2 \times 1) \times (2 \times 1)} = \frac{120}{6 \times 2} = 10$$

This means that we can now work out the number of combinations there are without having to write them all out or using Pascal's Triangle.

8

1. Work out how many possible choices there are in the following lotteries where you
   a) choose 4 numbers from 1 to 10;
   b) choose 5 numbers from 1 to 22.

2. Work out the chance of winning the jackpot in the following lotteries where you
   a) choose 3 numbers from 12;
   b) choose 4 numbers from 20.
   c) How small would you describe the chance of a jackpot as in lottery b) ?

3. Do you know roughly what the chance is of winning the national lottery jackpot?
   a) Write it down. Have a guess if you don't know.
   b) How many ways are there of choosing 6 numbers from 1 to 49.
   c) What is the chance of winning the jackpot in the national lottery?

!

If you go and buy a lottery ticket on a Saturday morning, the chance of you dying by the time the draw takes place in the evening is greater than the chance of you winning the Jackpot.

National Lottery Questionnaire

We are doing research on the national lottery and examining the impact it has on society. We would be grateful if you could take some time to answer the following questions.

1. How often do you play the national lottery? Please tick just one of the boxes below:

Never	☐
Occasionally (less than once a month)	☐
Regularly (more than once a month)	☐
Every Week	☐

2. If you never play, please state the reason why you have decided not to play. You may then ignore the rest of the questionnaire.

_____

_____

3. If you do play, how much do you spend on average, to the nearest pound, per week on the national lottery?

Average spent each week _____

4. Since the lottery began have you lost more money than you have won? Yes ☐ No ☐

5. Do you usually select the same six numbers each time you play? Yes ☐ No ☐

6. Do you have "lucky numbers"? Yes ☐ No ☐

If yes, write down the reason you think they are "lucky".

_____

_____

7. What would you say is your main reason for taking part in the national lottery?

_____

_____

Thank you for taking part in this survey.