Bank of England Museum

THE FUTURE OF MONEY

The Future of Money

PACK 2

Futureproofing Today's Systems

An education resource for students aged 11-14.

Contents

About the Future of Money exhibition

This resource collection is designed to accompany The Future of Money exhibition at the Bank of England Museum. The resources explore the links between the exhibition and a range of mathematical ideas, using exhibition objects and themes as a starting point for discussion and mathematical problem-solving. These activities will work in the classroom or at home and are designed for students aged 11-14.

The resources contain supporting notes for teachers, images from the exhibition and student activity sheets. There are five resource packs, each focusing on a different exhibition theme:

Pack 1: What is Money?

Topics covered include: compound measures; units of measurement; problem solving; probability

Pack 2: Futureproofing Today's Payment Systems

Topics include: data collection and questionnaires; analysing data; bar charts; pie charts.

Pack 3: Future Methods of Payment

Topics include: prime numbers and their properties; divisibility rules; sampling methods; calculating percentages

Pack 4: Education, Environment, Sustainability

Topics include: 3D shapes; adding, subtracting and dividing with decimals; problem solving

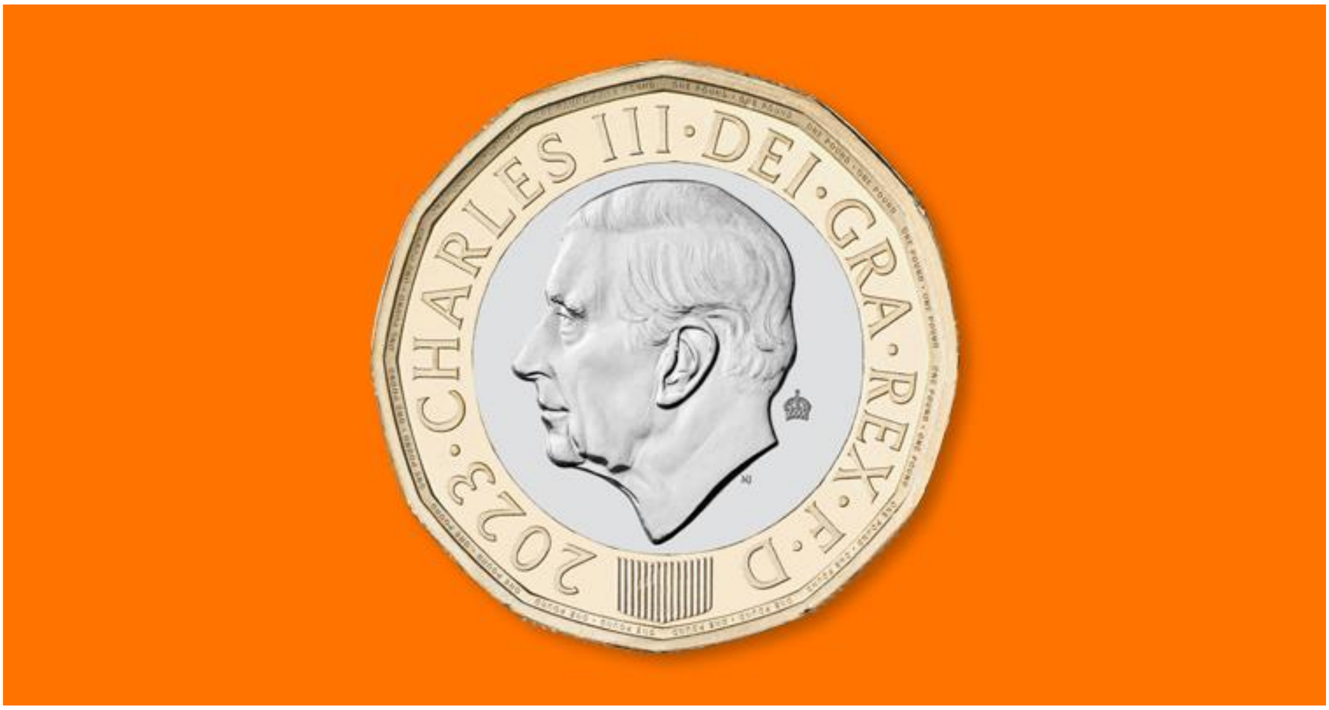
Pack 5: Data and Privacy

Topics include: sequences and patterns; problem solving; inverse operations; division with remainders

Whichever activities your students complete, we'd love to see the results, so please share them with @boemuseum **#TheFutureofMoney**

Idea in focus: Payment methods

Mathematics curriculum topics: Data collection and questionnaires



Credit: The Royal Mint

One of the essential features of money is that it can be stored and used at a later date. What if we store a form of money for so long that it loses its value, or stops being accepted as a form of payment? It is important to make sure that the money we use today holds its value in the future.

The activities in this pack are designed to explore the ways people use money, and how the features of money can affect what people do with it and who has access to it. Much of this is through discussion supported by statistical investigations which encourage students to recognise a broad range of viewpoints when making decisions.

Student activity 1: Types of money

Question 1: What is cash?

- Have you heard of the phrase “legal tender”? What does it mean?
- Can you identify two examples of money that would be defined as cash?
- What’s the difference between “money” and “cash”?

Question 2: Why do people still use cash?

- Why might someone choose to pay for something using cash?
- What percentage of people do you think only use cash (and not any of the alternative ways of paying for things)?
- How do you think cash payments have changed over time compared with other methods of payment?

Challenge: Design a questionnaire to find out how many people use cash compared to other methods of payment.

Student activity 1: Supporting notes for teachers

Question 1: What is cash?

"Cash" is physical form of currency (coins or banknotes) accepted as "legal tender".

- Have you heard of the phrase "legal tender"? What does it mean?

"Legal tender" means that if you offer to fully pay off a debt to someone in legal tender, they can't sue you for failing to repay. In England and Wales legal tender refers to coins from the Royal Mint and banknotes from the Bank of England. In Scotland and Northern Ireland it's only Royal Mint coins and not banknotes.

- Can you identify two examples of money that would be defined as cash?

Coins and banknotes.

- What's the difference between "money" and "cash"?

"Money" is anything that is widely accepted as payment for goods and services. "Cash" is a physical form of money that is created specifically for that purpose, usually by an official body such as a national bank.

Question 2: Why do people still use cash?

- Why might someone choose to pay for something using cash?

It is fast and convenient

It doesn't require any technology or an internet connection

You can see and feel it, which might help someone manage how much they have.

- How many people do you think only use cash (and not any of the alternative ways of paying for things)?

In 2022, 1.1 million people in the UK depended fully on cash, either choosing or being unable to engage with other forms of payment.

- How do you think cash payments have changed over time compared with other methods of payment?

In 2011 55% of all payments in the UK were made with cash. In 2021 this dropped to 15%, and then again to 14% in 2022. By 2032 cash payments are expected to fall to 7%.

Source: UK Finance Payment Markets Report 2023 Summary.pdf

Object in focus: Payment bracelet

Mathematics curriculum topics: Averages; range; analysing data; bar charts; pie charts

The technology used in contactless cards can also be built into other devices like mobile phones, smart watches, and wearable accessories like the payment bracelet shown above. The contactless chip inside the bracelet must be associated with a credit or debit card account, and it can be used to make payments via any contactless payment device that accepts the associated credit or debit card.

Student activity 2: Designing wearable payment technology

Task 1

Question 1: If you could use any object, item of clothing or accessory to make digital payments, what would it be?

- What things do you keep with you all the time and why?

Question 2: What do you think are the benefits of making digital payments through wearable objects?

- Why would a wearable technology that enabled you to pay for something be convenient?

Question 3: Can you think of any problems that might come with being able to make digital payments with wearable objects?

- Have you changed your mind about which objects you'd like to be able to pay for things based on our discussion?

Task 2

Choose an object that you'd like to use to make contact payments and find out if it would be a popular choice.

1. Write the name of your chosen object in the blank space below:

How interested would you be in using _______________ to make contactless payments?

2. Ask everyone in your class to answer the question above on a scale of 1 (very interested) to 5 (not at all interested), and mark their response in the tally chart below:

Response	Tally	Frequency
1 (Very interested)		
2		
3		
4		
5 (Not at all interested)		

3. When you have collected all your data, fill in the frequency column.
4. Analyse your data
5. Write your conclusions.

Student activity 2: Supporting notes for teachers

Task 1

Question 1: If you could use any object, item of clothing or accessory to make digital payments, what would it be?

Encourage students to be innovative and ask them to explain why they selected items.

Question 2: What do you think are the benefits of making digital payments through wearable objects?

Some possible reasons:

- Convenience
- More secure/difficult to lose an item if you're wearing it
- It looks good.

Question 3: Can you think of any problems that might come with being able to make digital payments with wearable objects?

Some possible problems:

- You might make a payment accidentally if you touch or pick up an object that has the ability to take payments
- Someone might trick you into making payments that you don't want to (e.g. by getting you to touch or pick up an object with the ability to take payments)
- Rings and bracelets are small, you could take them off and lose them
- Someone could steal your object.

Task 2

- Students might pick different objects individually or work together in groups.
- Students working at different levels will analyse their data in different ways, examples include:
    - Drawing bar charts and/or pie charts to represent their data visually
    - Calculating the mean, median and mode for their data, along with the range, and choose which of the averages does the best job of representing the data
- Conclusions should suggest whether their peers agree that the chosen object is a suitable choice for making contactless payments, explaining which parts of their analyses support this.
- Students could present their findings to the rest of the class or produce a poster.

Object in focus: Monopoly card

Mathematics curriculum topics: Probability; sample space diagrams

Credit: ©Hasbro Inc

Original Monopoly board games came with ‘money’ in the form of paper notes that were distributed by a player in the role of banker. Later versions have followed changes in real banking and money by introducing digital ways to keep track of money paid to and received from other players.

An early version of the game was created in 1903 as an educational tool to demonstrate the negative aspects of a particular model of economics related to buying and selling land and properties.

Sometimes things may seem fair, but if we analyse them mathematically, we might find that this is not necessarily the case.

Players move in Monopoly (and many other board games) by rolling two fair, six-sided dice and adding the scores together to decide how many spaces to move. Many people assume that because the dice used are ‘fair’ that this means they are equally likely to land on every space.

Student activity 3: Games and probability

Task 1

a) What does it mean for a dice to be 'fair'?

A fair, six-sided dice is rolled:

b) What is the probability that the result will be:

i) 1? ii) 6? iii) 4 iv) an even number? v) a prime number?

vi) Greater than 2? vii) Less than 4? viii) A multiple of 10?

c) What is the most likely score when a single, fair, six-sided dice is rolled?

Task 2

Two fair, six-sided dice are rolled and the results are added together.

a) List all the possible scores that can be achieved in this way.

b) Complete the table below to show all of the possible outcomes for this experiment (some have been completed as an example)

Possible results from rolling 2 dice & adding the scores		**Dice 1**					
		1	**2**	**3**	**4**	**5**	**6**
Dice 2	**1**						
	2				2+4= **6**		
	3		3+2= **5**				
	4						
	5						
	6					6+5= **11**	

Task 3

Use the table to find out how many different ways there are to get a score of:

i) 3 ii) 10 iii) 1 iv) 14 v) 6

What is the probability of getting a score of:

vi) 3 vii) 10 viii) 6 ix) 1 x) 14

c) What is the most likely score to get when rolling a single dice?

Student activity 3: Answers and supporting notes for teachers

Task 1

a) A dice is ‘fair’ if all of its faces are equally likely to be landed on when rolled.

b)

i) ⅙ ii) ⅙ iii) ⅙ iv) ½ v) ½ vi) 4/6 = ⅔ vii) ½ viii) 0

c) All of the possible scores (1, 2, 3, 4, 5 or 6) are equally likely on a fair, six-sided dice.

Task 2

a) 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.

b) Completed table:

Possible results from rolling 2 dice & adding the scores		**Dice 1**					
		1	**2**	**3**	**4**	**5**	**6**
Dice 2	**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

Task 3

i) 2 ii) 3 iii) 0 iv) 0 v) 5

vi) 2/36 = 1/18 vii) 3/36 = 1/12 viii) 5/36 ix) 0 x) 0

c) The most likely score is 7 because there are more ways to roll a 7 than there are to roll any other number.

Object in focus: Tooth Fairy notes

Mathematics curriculum topics: Questionnaires and surveys

Children start to lose their baby teeth at around 6 years of age and continue to do so until they are around 12 years old. In some cultures, children to place a lost tooth under their pillow and find some money in its place, believing it to have been left by the Tooth Fairy. Sometimes this is accompanied by a note.

Student activity 4: The Tooth Fairy investigation

Task 1

Choose a question:

- How many students in the class have heard of the tooth fairy?
- What percentage of students in your class / year group / school have received money from the tooth fairy?
- Or investigate another question from your class discussion.

To investigate, you should:

- Select a specific question you'd like to answer relating to the tooth fairy.
- Decide what data you need to collect to answer the question.
- Design a data collection sheet, considering the following:
    - Is each question necessary? (e.g. do students need to provide their name, or would it be better to allow students to respond anonymously?)
    - Does each response section allow everyone to provide an honest answer?

Task 2

- Once the data is collected, put it into a table and consider how to analyse it. You could calculate averages and ranges or use graphs or charts to present your data.
- Interpret your results: what do the charts / statistics tell you, and how does this relate to the original question?
- How closely do your results agree with others in the group/class? Are there any differences? What might have caused these?

Object in focus: Red envelopes

Mathematics curriculum topics: Exchange rates

In Chinese culture, lucky red envelopes are given on special occasions, such as Chinese New Year, weddings, and birthdays. Red symbolises good luck, and the envelope contains a gift of money.

Many cultures have similar customs. Have you ever received money for special occasions? Which occasions? How was the money given? Was it in cash, or in the form of a voucher?

Student activity 5: Calculating exchange rates

Task 1

Look up the current exchange rates for currencies represented in the discussion. For example, the exchange rate between the British Pound Sterling (GBP) and Chinese Yuan (CNY) at the time of writing is 9.0272. This means that 1 GBP is worth about 9 CNY.

A list of current exchange rates can be found on the Bank of England website at: **https://www.bankofengland.co.uk/boeapps/database/Rates.asp**

Task 2

Using the current rate of exchange between GBP and other currencies of interest, complete the following tasks:

- Can you write the exchange rate as a ratio?
- The exchange rate tells you what £1 is worth in Chinese Yuan. How can we work out what (e.g.) £10 is worth? You could find the price of some popular products (or things for sale in the school canteen) and see what these might cost in Chinese Yuan.
- How can we use this information to work out what 1 Chinese Yuan is worth in pounds sterling?