UK 11+ Exam Data Handling & Probability Investigations

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Introduction to Data Handling and Probability

Data handling and probability are essential topics in the 11+ mathematics curriculum. These investigations will help you develop the skills needed to:

- Read and interpret different types of graphs and charts
- Extract information from data presentations
- Calculate averages and analyse data sets
- Understand probability concepts and language
- Conduct simple probability experiments
- Apply statistical thinking to real-world problems

> ***Study Tip:*** *When approaching any data handling question, always start by reading the title, labels, and key carefully. This will help you understand what the data represents before attempting to answer questions.*

Investigation 1: Reading and Interpreting Charts

Foundation Level - Building Basic Skills

Bar charts are one of the most common ways to display data. They show information using rectangular bars where the height represents the frequency or amount.

Key Features of Bar Charts:

- Title - tells you what the chart is about
- Axes - horizontal (x-axis) and vertical (y-axis)
- Scale - shows the units of measurement
- Bars - represent the data values
- Labels - identify what each bar represents

Investigation 1A: School Transport Survey

A survey was conducted asking 120 students how they travel to school. The results are shown in the bar chart below:

Mode of Transport	Number of Students
Walk	35
Car	45
Bus	25
Bicycle	15

Questions:

1. Which mode of transport is most popular?
2. How many more students travel by car than by bicycle?
3. What fraction of students walk to school?
4. If 5 more students started cycling, how many would cycle in total?

Activity 1: Create Your Own Bar Chart

Survey your classmates about their favourite subjects. Record the data and create a bar chart. Make sure to include:

- A clear title
- Labelled axes
- An appropriate scale
- Neat, evenly spaced bars

Investigation 2: Pictograms and Scaling

Intermediate Level - Developing Skills

Pictograms use symbols or pictures to represent data. The key feature is the scale, which tells you how many units each symbol represents.

Investigation 2A: Library Book Borrowing

A library recorded the number of books borrowed each day last week. The pictogram shows the results:

Day	Books Borrowed
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	

Key:  **= 8 books**

Questions:

1. How many books were borrowed on Wednesday?
2. On which day were the most books borrowed?
3. How many more books were borrowed on Friday than on Monday?
4. What was the total number of books borrowed during the week?

Investigation 2B: Half Symbols in Pictograms

Sometimes pictograms use half symbols. A cinema recorded ticket sales:

Film	Tickets Sold
Action Movie	🎬🎬🎬🎬🎬
Comedy	🎬🎬🎬🎬🎬🎬🎬
Drama	🎬🎬🎬🎬🎬🎬📽️
Horror	🎬🎬🎬📽️

Key: 🎬 = 10 tickets, 📽️ = 5 tickets

Questions:

1. How many tickets were sold for the drama film?
2. Which film sold the most tickets?
3. How many more tickets did the comedy sell than the horror film?
4. What was the total number of tickets sold?

Investigation 3: Line Graphs and Trends

Intermediate Level - Developing Skills

Line graphs show how data changes over time. They are particularly useful for showing trends and patterns.

Investigation 3A: Temperature Throughout the Day

The temperature was recorded every 2 hours from 6am to 6pm:

Time	6am	8am	10am	12pm	2pm	4pm	6pm
Temperature (°C)	8	12	18	22	25	21	16

Questions:

1. At what time was the temperature highest?
2. By how much did the temperature rise between 6am and 2pm?
3. During which 2-hour period did the temperature fall the most?

4. What was the difference between the highest and lowest temperatures?

Investigation 3B: Two-Line Graphs

A garden centre recorded the number of plants sold and the rainfall over 6 months:

Month	Jan	Feb	Mar	Apr	May	Jun
Plants Sold	20	30	55	80	95	110
Rainfall (mm)	45	38	32	28	22	18

Questions:

1. In which month were the most plants sold?
2. What was the total rainfall over the 6 months?
3. How many more plants were sold in June than in February?
4. Is there a relationship between rainfall and plant sales? Explain.

Investigation 4: Pie Charts and Fractions

Advanced Level - Mastering Skills

Pie charts show data as parts of a whole circle. Each sector represents a fraction or percentage of the total.

Investigation 4A: Favourite Colours Survey

240 students were asked about their favourite colour. The pie chart shows the results divided into 8 equal sections:

Colour	Sections	Fraction
Blue	3	3/8
Red	2	2/8 = 1/4
Green	2	2/8 = 1/4
Yellow	1	1/8

Questions:

1. How many students chose blue as their favourite colour?
2. How many students chose red?
3. Which colour was chosen by exactly 60 students?
4. How many more students chose blue than yellow?

Investigation 4B: School Subjects Pie Chart

A pie chart shows how 360 students spend their study time. The chart is divided into 12 equal sections:

Subject	Sections	Fraction
Mathematics	4	4/12 = 1/3
English	3	3/12 = 1/4
Science	3	3/12 = 1/4
Other	2	2/12 = 1/6

Questions:

1. How many students study mathematics?
2. What fraction of students study English?
3. How many students study subjects other than Mathematics, English, and Science?
4. What percentage of students study Science?

Investigation 5: Calculating Mean Averages

Advanced Level - Mastering Skills

The mean is the most common type of average. It is calculated by adding all the values together and dividing by the number of values.

Mean = Sum of all values ÷ Number of values

Investigation 5A: Test Scores

Sarah's test scores in mathematics were: 78, 85, 92, 88, 77

Questions:

1. What is Sarah's mean test score?
2. If Sarah scores 90 on her next test, what will her new mean be?
3. What score does Sarah need on her 7th test to have a mean of 85?

Investigation 5B: Weather Data

The daily temperatures for a week were: 18°C, 22°C, 25°C, 28°C, 26°C, 23°C, 20°C

Questions:

1. What was the mean temperature for the week?
2. How many days had temperatures above the mean?
3. What was the difference between the highest temperature and the mean?

Investigation 5C: Frequency Tables and Mean

A dice was rolled 20 times with the following results:

Number on Dice	Frequency
1	2
2	4
3	3
4	5
5	3
6	3

Questions:

1. Calculate the mean of the dice rolls.

2. Which number appeared most frequently?
3. How many times was a number greater than 4 rolled?

Investigation 6: Understanding Probability Language

Foundation Level - Building Basic Skills

Probability describes how likely something is to happen. We use special words to describe different levels of probability:

- **Impossible:** Will never happen (probability = 0)
- **Unlikely:** Probably won't happen (probability less than 1/2)
- **Even chance:** Might or might not happen (probability = 1/2)
- **Likely:** Probably will happen (probability greater than 1/2)
- **Certain:** Will definitely happen (probability = 1)

Investigation 6A: Probability in Daily Life

For each event, decide whether it is impossible, unlikely, even chance, likely, or certain:

1. It will rain somewhere in the UK tomorrow
2. You will grow to be 3 metres tall
3. A coin will land on heads when flipped
4. The sun will rise tomorrow
5. You will win the lottery this week
6. A traffic light will be red when you reach it
7. Your birthday will fall on a weekend this year
8. You will breathe air today

Investigation 6B: Probability Scale

Place the following events on a probability scale from 0 to 1:

1. Rolling a 6 on a standard dice
2. Picking a red card from a standard deck

3. It being dark at midnight
4. Getting heads on a coin flip
5. Rolling a 7 on a standard dice
6. Picking a heart from a standard deck

Investigation 7: Simple Probability Experiments

Intermediate Level - Developing Skills

Simple probability can be calculated using the formula:

Probability = Number of favourable outcomes ÷ Total number of possible outcomes

Investigation 7A: Coin Flipping

A fair coin has two sides: heads and tails.

Questions:

1. What is the probability of getting heads?
2. What is the probability of getting tails?
3. If you flip a coin 10 times, how many times would you expect to get heads?
4. What is the probability of getting heads OR tails?

Investigation 7B: Dice Rolling

A standard dice has 6 faces numbered 1, 2, 3, 4, 5, 6.

Questions:

1. What is the probability of rolling a 4?
2. What is the probability of rolling an even number?
3. What is the probability of rolling a number greater than 4?
4. What is the probability of rolling a 7?

5. What is the probability of rolling a number less than 7?

Investigation 7C: Spinner Experiments

A spinner is divided into 8 equal sections: 3 red, 2 blue, 2 green, 1 yellow.

Questions:

1. What is the probability of spinning red?
2. What is the probability of spinning blue?
3. What is the probability of spinning green or yellow?
4. Which colour is most likely to be spun?
5. What is the probability of not spinning red?

Investigation 8: Experimental vs Theoretical Probability

Advanced Level - Mastering Skills

Theoretical probability is what we expect to happen based on mathematics. Experimental probability is what actually happens when we conduct experiments.

Investigation 8A: Coin Flipping Experiment

Tom flipped a coin 50 times and got these results:

Outcome	Frequency
Heads	23
Tails	27
Total	50

Questions:

1. What is the theoretical probability of getting heads?
2. What is the experimental probability of getting heads?
3. What is the experimental probability of getting tails?

4. Why might the experimental probability differ from the theoretical probability?

Investigation 8B: Dice Rolling Experiment

A dice was rolled 60 times with these results:

Number	1	2	3	4	5	6
Frequency	8	12	9	11	10	10

Questions:

1. What is the theoretical probability of rolling a 3?
2. What is the experimental probability of rolling a 3?
3. What is the experimental probability of rolling an even number?
4. Which number appeared most frequently in the experiment?

Investigation 8C: Bag of Coloured Balls

A bag contains balls of different colours. Students picked a ball, recorded the colour, and put it back. After 40 picks:

Colour	Red	Blue	Green	Yellow
Frequency	16	12	8	4

Questions:

1. What is the experimental probability of picking a red ball?
2. What is the experimental probability of picking a blue ball?
3. Based on the results, how many balls of each colour do you think are in the bag?
4. What would you expect to happen if this experiment was repeated 100 times?

Investigation 9: Real-World Data Analysis

Advanced Level - Mastering Skills

Real-world data analysis combines all the skills you've learned. You'll need to read charts, calculate averages, and make predictions.

Investigation 9A: School Canteen Analysis

The school canteen recorded meal sales for a week:

Day	Mon	Tue	Wed	Thu	Fri
Pasta	45	38	52	41	49
Sandwiches	32	35	28	33	37
Salad	18	22	25	20	30
Pizza	25	30	35	28	42

Questions:

1. Which meal was most popular overall?
2. What was the mean number of pasta meals sold per day?
3. On which day were the most meals sold in total?
4. What percentage of Friday's meals were pizza?
5. If the pattern continues, how many salads would you expect to sell on the following Monday?

Investigation 9B: Weather and Ice Cream Sales

An ice cream shop recorded daily sales and temperature:

Day	Temperature (°C)	Ice Creams Sold
Monday	18	45
Tuesday	22	65
Wednesday	25	85
Thursday	28	110
Friday	31	135

Questions:

1. What was the mean temperature for the week?
2. What was the mean number of ice creams sold per day?
3. Describe the relationship between temperature and ice cream sales.
4. How many ice creams would you expect to sell on a day when the temperature is 26°C?
5. If the temperature dropped to 15°C, how might this affect sales?

Investigation 10: Mixed Practice Problems

Mastery Level - Exam Preparation

These problems combine multiple skills and reflect the types of questions you might encounter in 11+ exams.

Investigation 10A: Sports Club Membership

A sports club has 200 members. The pie chart shows the distribution of members across different sports:

- Football: 90 members
- Tennis: 50 members
- Swimming: 40 members
- Athletics: 20 members

The probability that a randomly selected member plays football is 90/200 = 9/20.

Questions:

1. What fraction of members play tennis?
2. What is the probability that a randomly selected member plays swimming?
3. If 30 new members join and all play athletics, what fraction of the total membership would athletics represent?
4. What is the probability that a randomly selected member does NOT play football?

Investigation 10B: Class Test Results

A class of 30 students took a test. The bar chart shows the distribution of scores:

Score Range	Number of Students
0-20	2
21-40	5
41-60	8
61-80	10
81-100	5

Questions:

1. What fraction of students scored between 61-80?
2. What is the probability that a randomly selected student scored above 60?
3. How many students scored 40 or below?
4. What percentage of students scored in the top two score ranges?

Solutions and Answers

Investigation 1A Solutions:

1. Car (45 students)
2. 45 - 15 = 30 more students
3. 35/120 = 7/24
4. 15 + 5 = 20 students

Investigation 2A Solutions:

1. 5 × 8 = 40 books
2. Friday (7 × 8 = 56 books)
3. 56 - 24 = 32 more books
4. 24 + 32 + 40 + 48 + 56 = 200 books

Investigation 2B Solutions:

1. 6 × 10 + 5 = 65 tickets
2. Comedy (70 tickets)
3. 70 - 35 = 35 more tickets
4. 50 + 70 + 65 + 35 = 220 tickets

Investigation 3A Solutions:

1. 2pm (25°C)
2. 25 - 8 = 17°C
3. 2pm to 4pm (25°C to 21°C = 4°C drop)
4. 25 - 8 = 17°C

Investigation 4A Solutions:

1. 3/8 × 240 = 90 students
2. 1/4 × 240 = 60 students
3. Green and Red (60 students each)
4. 90 - 30 = 60 more students

Investigation 5A Solutions:

1. (78 + 85 + 92 + 88 + 77) ÷ 5 = 420 ÷ 5 = 84
2. (420 + 90) ÷ 6 = 510 ÷ 6 = 85
3. To have mean of 85 over 7 tests: 85 × 7 = 595 total needed. Current total after 6 tests = 510. Need 595 - 510 = 85

Investigation 6A Solutions:

1. Certain
2. Impossible
3. Even chance

4. Certain
5. Unlikely
6. Even chance
7. Likely (2/7 chance)
8. Certain

Investigation 7A Solutions:

1. 1/2 or 0.5
2. 1/2 or 0.5
3. 5 times (approximately)
4. 1 (certain)

Investigation 7B Solutions:

1. 1/6
2. 3/6 = 1/2
3. 2/6 = 1/3
4. 0 (impossible)
5. 1 (certain)

Investigation 8A Solutions:

1. 1/2 or 0.5
2. 23/50 = 0.46
3. 27/50 = 0.54
4. Random variation - with small samples, results may differ from theoretical probability

Investigation 10A Solutions:

1. 50/200 = 1/4

2. 40/200 = 1/5

3. 50/230 = 5/23

4. 110/200 = 11/20

> ***Final Tips for Success:***
>
> - *Always read the question carefully and identify what information is given*
> - *Look for key words like "mean", "probability", "fraction", "percentage"*
> - *Check your calculations and make sure your answer makes sense*
> - *When dealing with probability, remember that all probabilities must be between 0 and 1*
> - *Practice drawing your own charts and graphs to understand how they work*

Remember: Data handling and probability questions often appear in 11+ exams because they test your ability to interpret information, calculate accurately, and think logically. Regular practice with these types of investigations will help you develop confidence and fluency in these important mathematical skills.