



Experiments

About 50 minutes Calculator allowed 44 marks

Date _____

A Do Now

The first question is what today's lesson needs. The others bring back earlier topics.

- A1** Needed today [2 marks] **A2** Last lesson [2 marks]
- Cara records the age of 20 cars, and the price of 20 different cars. Can Cara draw a scatter diagram of the age against the price? Give a reason.
- 360 students are asked, "Have you ever cheated in a test?" Each flips a coin in private. If it lands heads, they tick Yes. Otherwise they answer truthfully. 261 tick Yes. Estimate how many of the 360 students would truthfully answer Yes.

- A3** Maths skill [2 marks] **A4** Maths skill [2 marks]
- A length, L cm, is 2 cm correct to 1 decimal place. Write down the error interval for L .
- Work out $1.5^2 - 0.9 \times 0.8$.

Answer

Answer

Answer

B Example, then your turn

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

Mia tests whether the amount of fertiliser affects the mass of tomatoes a plant grows. Name the explanatory variable, the response variable and one extraneous variable.

Hint The explanatory variable is the one Mia changes.

- B1** Sam tests whether the length of a warm-up affects a runner's 100 m time. Name the explanatory variable, the response variable and one extraneous variable he should control. [3 marks]

EXAMPLE 2

One class uses a new reading app in its normal lessons for a term. Is this a laboratory, field or natural experiment? Give one disadvantage of it.

Hint Where does it happen, and who chooses what changes?

EXAMPLE 3

A dentist gives a new toothpaste to 40 people and asks another 40 people to keep using their usual toothpaste. Explain why the second group is needed.

Hint What would the dentist compare the first group with?

EXAMPLE 4

Six people's pulse rates, in beats per minute, before and after a breathing exercise:

Before: 78, 84, 72, 90, 81, 75

After: 71, 80, 70, 82, 75, 72

The people are in the same order in both lists. Work out the mean change and say what it shows.

Hint Work out after minus before for each person first.

EXAMPLE 5

Design an experiment to test whether people react faster with their writing hand.

Hint Decide what to measure, what to keep the same, and how many times to do it.

B2 A researcher compares exam results in towns where floods closed the schools for a month with towns where they stayed open. Name the type of experiment and give one disadvantage of it. [2 marks]

B3 A coach uses matched pairs to test whether an energy drink improves cyclists' times. Describe how he should choose the pairs, and what each cyclist in a pair does. [2 marks]

B4 Eight workers' typing speeds, in words per minute, before and after a course: [3 marks]

Before: 32, 41, 28, 45, 36, 39, 30, 43

After: 38, 44, 35, 46, 41, 40, 36, 47

The workers are in the same order. Work out the mean increase, then say what it shows.

B5 Design an experiment to test whether the length of a paper aeroplane's wings affects how far it flies. [3 marks]

C Practice

- C1** A scientist tests a new air filter in a laboratory rather than in a busy street. Give one advantage and one disadvantage of this. [2 marks]

- C2** In a trial, 120 patients use a new cream and 80 use a cream with no medicine in it. 84 of the first group and 44 of the second group get better. Compare the two groups. [2 marks]

- C3** In a trial of a sleeping tablet, half the volunteers get a tablet with no medicine in it. Explain why, and why the volunteers are not told which tablet they get. [2 marks]

- C4** To test a new grass seed, Ben sows it in the north half of a field and the old seed in the south half. Explain why this is not a fair test, and suggest an improvement. [2 marks]

D Exam-style questions

- D1** Tom times 5 of his friends running 100 m after an energy drink and 5 others with no drink. The drink group's mean time is 0.8 seconds faster. Tom says, "This proves the drink makes people run faster." [2 marks]

Is Tom correct? Give two reasons for your answer.

- D2** A teacher tests whether music helps students remember words. She puts 12 students into 6 matched pairs. In each pair one student learns a list of 20 words with music and the other in silence. Their scores are shown.

Pair	A	B	C	D	E	F
Music	12	15	9	14	11	13
Silence	14	15	11	13	14	15

- (a) Describe how the teacher should choose the pairs. [1 mark]

- (b) Work out the mean of the differences, silence score minus music score. [2 marks]

Answer

- (c) Does the data support the claim "Students remember more words with music"? Give a reason. [1 mark]

(d) Give two reasons why her conclusion may not be reliable.

[2 marks]

Total for D2: 6 marks

- D3** Josh's plan to test whether a new fertiliser makes sunflowers taller: give it to 4 plants on a sunny windowsill and none to 4 plants in a dark cupboard; measure the heights after one week; if the fertilised plants are taller, the fertiliser works. Assess Josh's plan. [4 marks]

E Extension

No route is given. The hints are at the end of the sheet. Use one at a time.

- E1** In a vaccine trial, 2000 people have the vaccine and 2000 have an injection with no medicine in it. 12 of the vaccinated people and 30 of the others catch the illness. Estimate how many cases the vaccine would prevent among 5000 people who have it. [3 marks]

Answer

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Work out the proportion of each group that caught the illness.
- Hint 2** $\frac{30}{2000} = 0.015$ without the vaccine and $\frac{12}{2000} = 0.006$ with it.
- Hint 3** $0.015 - 0.006 = 0.009$, and $0.009 \times 5000 = 45$ cases prevented.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

- I can name the explanatory, response and extraneous variables in an experiment. ☐ ☐ ☒
- I can explain control groups and matched pairs, and work with before-and-after data. ☐ ☐ ☒
- I can design a fair experiment and assess someone else's. ☐ ☐ ☒