



GCSE to A-level progression: Mathematical skills student booklet

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Introduction to the booklet

The aims of this booklet are:

- to provide you with an introduction to some of the maths skills required at A-level Psychology
- to support your transition from GCSE to A-level Psychology by outlining and explaining the role played by mathematics in the study of the subject
- to provide you with opportunities to practise applying some of your GCSE Mathematics skills to a psychology context. You will do this by completing a range of past paper questions from GCSE, AS and A-level Psychology.
- to increase your confidence and readiness to successfully undertake your studies of Psychology.

Why are mathematical skills important in Psychology?

The *British Psychological Society* defines Psychology as ‘the science of mind and behaviour.’ As a science, Psychology requires research to test hypotheses so that researchers can come to evidence-based conclusions. For many studies, mathematics and statistics play a key role. For example, in a laboratory experiment the researcher(s) will collect data and then use maths to identify patterns and trends.

You will most likely already be familiar with practical research activities through your studies of subjects such as the GCSE Sciences, and you will know that such studies collect data which requires analysis. Similarly, when you carry out quantitative research in Psychology, you will collect, handle and interpret data to test your hypotheses, and report your results. This will support the detection of patterns and trends in the data you have collected.

Your mathematical knowledge will enable you to understand and interpret the data found in your psychological research. Furthermore, it will also make a significant contribution to your analytical and critical skills in all the topics you study in A-level Psychology.

Mathematical Requirements in A-level Psychology

At least **10%** of the marks in assessments for Psychology require mathematical skills.

At least 10% of the overall assessment of Psychology will contain mathematical skills equivalent to Level 2 or above.

What mathematical skills will I cover in A-level Psychology?

You can read the full AQA A-level Psychology specification on the AQA website [here](#). We will focus on *some* of the mathematical skills required at A-level Psychology, focusing on a particular part of the specification, namely *4.2.3.2 Data handling and analysis* (page 20). This section is part of the compulsory *Research Methods* section of the specification and you can read the detail in the table (Data handling and analysis) on the following page.

Take a few minutes to think back to your studies of GCSE Mathematics and complete Task 1 on the following page.

Task 1

- Using a highlighter, carefully consider the requirements for data handling and analysis in the table below.
- Reflecting on your studies of GCSE Mathematics, highlight the skills that you have already encountered. You will not have covered all the skills, but you will definitely have studied some of them.
- This will reassure you that you already have some of the mathematical skills required to be successful in your studies of A-level Psychology.

Data handling and analysis

- Quantitative and qualitative data; the distinction between qualitative and quantitative data collection techniques.
- Primary and secondary data, including meta-analysis.
- Descriptive statistics: measures of central tendency (mean, median, mode); calculation of mean, median and mode; measures of dispersion; range and standard deviation; calculation of range; calculation of percentages; positive, negative and zero correlations.
- Presentation and display of quantitative data: graphs, tables, scattergrams, bar charts and histograms.
- Distributions: normal and skewed distributions; characteristics of normal and skewed distributions.
- Analysis and interpretation of correlation, including correlation coefficients.
- Levels of measurement: nominal, ordinal and interval.
- Content analysis and coding and thematic analysis.

You may find it useful to look at the *Mathematical Requirements and Exemplification* section of the specification, where you will find more detail of on the mathematical skills required at A-level Psychology (a copy is also in Appendix 1 of this booklet).

Assessment criteria for mathematics in A-level Psychology

At least 10% of the overall assessment of A-level Psychology will contain mathematical skills equivalent to Level 2 or above.

The mathematical skills required in the specification will be assessed specifically in the research methods topic (Paper 2) and more broadly in Paper 1 and Paper 3 (see the specification for further information). You will develop your skills through both the study of the specification content and ethical practical research activities, involving:

- designing research
- conducting research
- analysing and interpreting data.

You will also find some of the skills developed in your study of GCSE Science helpful when designing and conducting research, eg hypothesis, experiments and variables.

Other Useful Resources and Documents

You can find a range of resources to support your learning at the AQA A-level Psychology website [here](#).

Command words

Command words are used in questions to tell you what is required when answering the question. You can find definitions of the command words used in Psychology assessments on the [website](#).

They are very similar to the command words used at GCSE.

Subject-specific vocabulary

You can find a list of some of the subject specific vocabulary used in our AS and A-level specification [here](#).

You will become familiar with, and gain understanding of, these terms as you work through the course.

Transition maths activities

The booklet has been produced so that it can be as a hard-copy. It may also be provided to you as an electronic document. You can complete these activities independently or in class.

The activities are focused on some of the mathematical skills required for A-level Psychology. You will already have studied the skills at GCSE Mathematics, and it is a good idea to revisit your notes on these particular skills before completing the activities. The activities are not a test, and after you have completed an activity the *Answers booklet* will guide you through each answer. The *Answers booklet* is not produced like an exam mark scheme, but is designed to help you get the most out of the activities. The activities focus on the following aspects of data handling and analysis:

- the use of ratios, fractions and percentages
- mathematical symbols
- significant figures
- descriptive statistics - measures of central tendency and dispersion
- correlation
- graphs

The questions require you to **apply** the skills that you have already developed in GCSE Mathematics to a psychology context. You will notice that there is quite a bit of reading in the questions and it is important that you read this information carefully before answering the questions. You will not yet be familiar with some of the psychological ideas contained in the scenarios that accompany the questions, but your mathematical skills should ensure that you are still able answer the questions successfully.

The questions are taken from GCSE, AS and A-level Psychology past papers and have been selected to give you the opportunity to practice applying your maths skills in a psychological context.

Extend your learning

You might want to also carry out independent research into some of the concepts/ideas in the scenarios that you have not encountered before, for example:

- what is the meaning of obedience?
- what is an fMRI scan?
- who was Milgram?
- what is a stereotype?

By doing this you will widen your understanding of some psychological concepts before embarking on your studies of A-level Psychology.

Helpful Links

Use the web links within each Mathematical skills table if you would benefit from a reminder of the math skills contained within the activities.

Activity 1: Ratios, fractions and percentages

Use ratios, fractions and percentages.	For example, calculating the percentages of cases that fall into different categories in a study.
--	---

Mathematical Skill	Need a reminder?
Use of ratios, fractions and percentages.	Ratios bbc.co.uk/bitesize/topics/zwrlycw Percentages bbc.co.uk/bitesize/guides/z9sgdxs/revision/1 Fractions bbc.co.uk/bitesize/guides/zt6p34j/revision/1

Question 1

A psychologist measured the amount of time spent in free flowing and non-flowing conversation within a five-minute period.

In one conversation, 75% of the five minutes were flowing conversation.

Which is the correct ratio of non-flowing to flowing conversation for this pair? Shade **one** box.

[1 mark]

- | | | |
|----------|-----|--------------------------|
| A | 1:2 | <input type="checkbox"/> |
| B | 1:3 | <input type="checkbox"/> |
| C | 1:5 | <input type="checkbox"/> |
| D | 1:8 | <input type="checkbox"/> |

Question 2

Read the item and then answer the questions that follow.

A researcher conducted a study into obedience. An actor told people to pick up litter in a local park. The actor's appearance was altered. In Condition A the actor wore a uniform and in Condition B he wore casual clothes. The actor told 40 people to pick up litter in each condition. The number of people who picked up litter in each condition was recorded.

The number of people who did or did not pick up litter

	Condition A	Condition B
Picked up litter	22	8
Did not pick up litter	18	32

In **Condition B**, 20% of people picked up litter. Calculate the percentage of people who picked up litter in **Condition A**. Show your workings.

[2 marks]

Workings:

Answer _____

Question 3

Read the item and then answer the question that follows.

A doctor works with patients who have had a stroke. Each patient has an fMRI scan which shows the stroke has caused damage to part of the visual pathway in the brain. The doctor is able to offer treatment to patients, either eye surgery or eye exercises.

Number of patients offered eye surgery or eye exercises.

Eye surgery	Eye exercises
11	9

What percentage of patients were offered eye exercises as a treatment?

Show your workings.

[2 marks]

Workings:

Answer _____

Question 4

A 16 year old psychology student decided to carry out a study on age stereotyping for her GCSE coursework. She did this in the following way:

- she wrote a list of four hobbies
- she found a photograph of her 20 year old sister and of her 70 year old grandmother
- she selected 10 participants by making a list of all the girls in her year and choosing every third name. She did this because she wanted all her participants to be females of the same age.
- she showed all the participants the picture of her sister and asked them to choose the hobby which they thought she would most enjoy
- she then showed all the participants the picture of her grandmother and asked them to choose the hobby which they thought she would most enjoy.

She put her findings into a table. Her findings are in the table below.

The number of participants choosing hobbies for a 20 year old and for a 70 year old

Hobby	Number of participants choosing the hobby for the 20 year old	Number of participants choosing the hobby for the 70 year old
Knitting	0	8
Ballroom dancing	0	2
Going to the gym	7	0
Playing computer games	3	0

- (a) (i) Calculate the percentage of participants who chose knitting as a hobby for the 70 year old.

[1 mark]

- (ii) Calculate the percentage of participants who chose going to the gym as a hobby for the 20 year old.

[1 mark]

Question 5

A researcher carried out a study based on Asch's research to see if task difficulty affects conformity.

Easy task condition: the standard line was very different from the incorrect comparison lines.

Difficult task condition: the standard line was very similar to the incorrect comparison lines.

Participants took part in only one condition and were not matched. They were asked to state which comparison line was the same as the standard line. In both conditions, four confederates (people working with the researcher) gave the same wrong answer. The researcher recorded whether each participant did or did not conform.

The results of the genuine participants were recorded in the table below.

The number of people who did and did not conform in each condition

	Number of people who conformed	Number of people who did not conform
Easy condition	6	14
Difficult condition	18	2

- (i) Refer to the data in the table above. Which of **A**, **B**, **C** or **D** is the correct ratio of participants who conformed in the easy condition to those who conformed in the difficult condition?

Shade **one** box only.

[1 mark]

A 1:2

B 1:3

C 1:4

D 3:1

Question 5 (continued)

(ii) Refer to the data in the table above. Which of **A**, **B**, **C** or **D** is the correct percentage of participants who did not conform in the study?

Shade **one** box only.

[1 mark]

- | | | |
|----------|-------|-----------------------|
| A | 5% | <input type="radio"/> |
| B | 35% | <input type="radio"/> |
| C | 40% | <input type="radio"/> |
| D | 87.5% | <input type="radio"/> |

Question 6

Students often claim that listening to music helps them to concentrate. A psychologist was not aware of any previous research in this area. She decided to investigate this claim.

Forty students from a nearby sixth form centre volunteered to take part in her study. They each answered the following question:

‘Do you think that you concentrate on your work ‘better’, ‘worse’ or ‘the same’ if you listen to music while working?’

She obtained the results in **Table 1**.

Table 1: Responses to question - ‘Do you think that you concentrate on your work ‘better’, ‘worse’ or ‘the same’ if you listen to music while working?’

Better	Worse	The same
22	8	10

What percentage of the students reported that they would be able to concentrate ‘better’ if they listened to music while they worked? Show your workings.

[2 marks]

Question 7

In 1987, a survey of 1000 young people found that 540 said they smoked cigarettes, whilst 460 said they did not. In 2017, a similar survey of another 1000 young people found that 125 said they smoked cigarettes, whilst 875 said they did not.

Calculate the ratio of smokers to non-smokers in 2017. Give your answer in the simplest form.

Show your workings.

[2 marks]

Activity 2: Calculations

Question 1

A psychologist was at a concert where someone threw a bottle onto the stage and seriously injured one of the band members. The psychologist decided to use this incident to investigate the accuracy of eye witness testimony. She asked 10 people who saw the bottle being thrown, if they would allow her to interview them about this. A week later she interviewed each witness separately in a quiet room and asked them the same closed questions about what they had seen. She recorded their answers. It took her two and a half hours in total to interview the 10 witnesses.

Calculate how many hours it would have taken the psychologist to interview all 1000 people who were at the event. Show your workings.

[2 marks]

Activity 3: Maths symbols

Understand and use the symbols, for example, $=$, $<$, $<<$, $>>$, $>$

Question 1

Ten A-level students took part in a study of attitudes to Milgram's research on obedience. They were asked about the value of Milgram's research and about ethical concerns with Milgram's research. For each student, the researcher recorded two scores out of 10, a 'value of research' score and an 'ethical concern' score. A high 'value of research' score means the student thinks Milgram's research was very valuable and a high 'ethical concern' score means that the student thinks that Milgram's research caused many ethical concerns. The findings are shown in Table 1 below.

Student	Value of research score	Ethical concern score
1	6	10
2	8	9
3	9	7
4	5	7
5	2	3
6	6	8
7	7	7
8	9	8
9	6	10
10	6	7

How many students have a 'value of research' score of <6 ? (Shade one box only).

[1 mark]

A 2 students

B 3 students

C 4 students

D 5 students

Question 2

A psychologist used a set of negative images to assess violent attitudes before and after participants played a 30-minute computer game. In a repeated measures design, 15 participants were tested before and after playing the game using a single set of images.

Each participant had a different total score in the before condition, where the maximum score was 40 and the median score was 23.

How many of the participants had a score $<$ the median in the before condition?

[4 marks]

Activity 4: Descriptive statistics

Descriptive statistics: Measures of Central Tendency (Mean, Median, Mode), and Measures of Dispersion (Range and Standard Deviation).

Understand the terms mean, median and mode.	For example, explaining the differences between the mean, median and mode and selecting which measure of central tendency is most appropriate for a given set of data. Calculate standard deviation.
Find arithmetic means.	For example, calculating the means for two conditions using raw data from a class experiment.
Understand measures of dispersion, including standard deviation and range.	For example, explaining why the standard deviation might be a more useful measure of dispersion for a given set of scores (eg where there is an outlying score).

Mathematical Skill	Need a reminder?
Descriptive Statistics (Mean Mode Median and Range)	bbc.co.uk/bitesize/guides/znhsqk7/revision/1

Questions continue on the following page.

Question 1

Look at the table below which contains some examples of ways to analyse data.

Description	Term
Calculated by looking at the middle score in a set of data after the data has been put into ascending order.	
Calculated by finding the most frequently occurring score.	
Calculated by adding up all of the scores and dividing the total by the number of participants.	

From the following list of terms, choose the one that matches each description and write **A**, **B**, **C** or **D** in the box next to the correct description.

[3 marks]

- A** Mean
- B** Mode
- C** Median
- D** Range

Question 2

A psychologist was interested in the effects of violent computer games on aggression in young boys. Following appropriate ethical procedures, she set up a study in which she identified ten boys who played violent computer games for at least two hours a day (Group A), and another group of ten boys who did not play violent computer games (Group B). The boys were systematically observed in their school playground on five separate occasions and the total number of aggressive behaviours they demonstrated was recorded. The data are given in the table below:

The effects of playing violent computer games on aggressive behaviour in boys.

Group A	Number of aggressive acts	Group B	Number of aggressive acts
1	19	1	8
2	9	2	7
3	3	3	11
4	18	4	7
5	13	5	6
6	16	6	24
7	5	7	9
8	3	8	10
9	7	9	5
10	35	10	10
Median		Median	

Complete the table by calculating the median for the two groups.

[2 marks]

Question 3 (a)

Researchers wanted to evaluate the effectiveness of using cognitive behaviour therapy (CBT) to treat unipolar depression. They put up posters in a Doctors' surgery asking for volunteers who had been diagnosed with depression to complete a questionnaire. The researchers chose 10 people who had only received medication for depression, and 10 people who had received both CBT and medication.

The participants were asked to rate the effectiveness of their treatment on a scale of 0-10 where 0 is not at all effective and 10 is very effective. The results are shown in the table below.

Ratings of effectiveness for types of treatment for depression.

Participant	Medication	Participant	Medication and CBT
1	3	11	10
2	6	12	5
3	5	13	7
4	4	14	8
5	6	15	8
6	8	16	9
7	9	17	6
8	4	18	8
9	7	18	8
10	8	20	9

Calculate the median rating of effectiveness for the group that was treated with both medication and CBT. Show your workings.

[2 marks]

Workings:

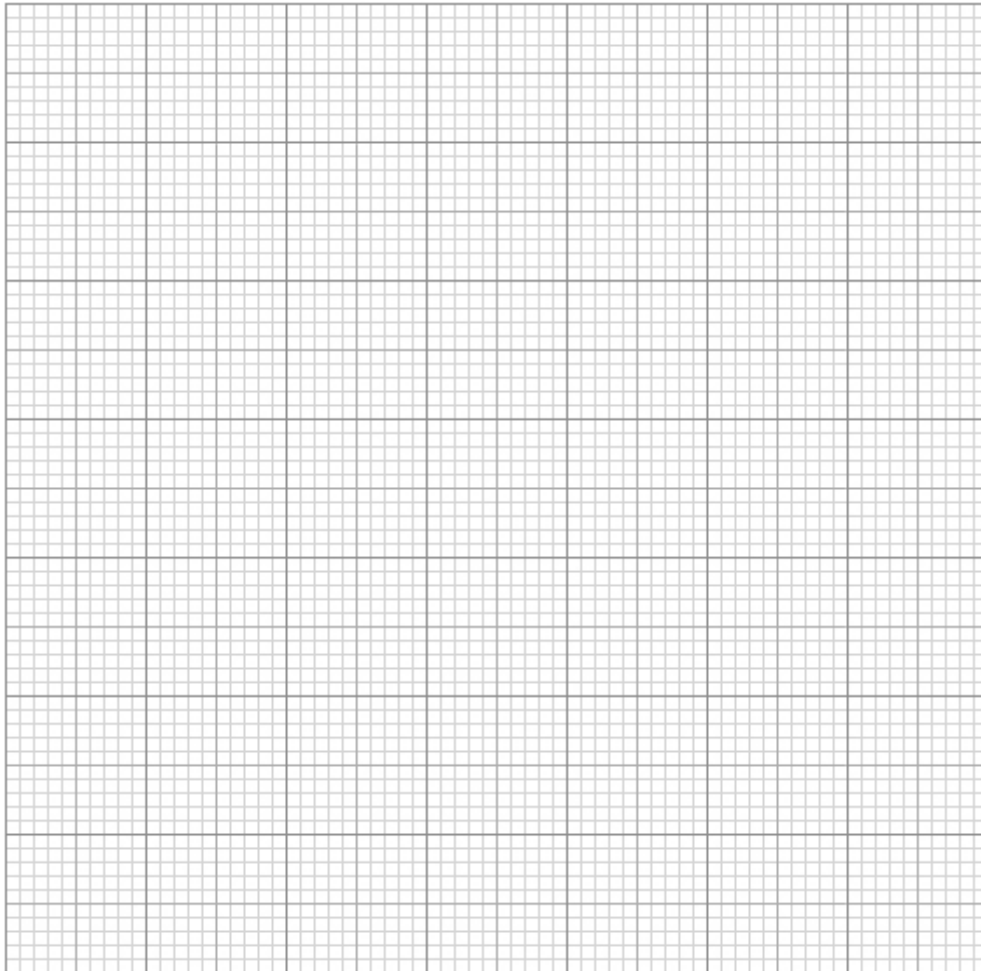
Answer _____

Question 3 (b)

The median rating of effectiveness for the medication group was 6. Use your answer from **part (a)** to sketch a suitable diagram of the median ratings for effectiveness of treatment on the graph paper below.

Provide a suitable title and labels for your diagram.

[4 marks]



Question 4

In a follow-up study, the psychologist obtained a volunteer sample of 10 students ages 17 years from a different sixth form centre. Using a repeated measures design, participants were asked to complete two puzzle tasks as quickly as possible.

Task A was to find 10 differences in a 'spot the difference' puzzle while working in silence.

Task B was to find 10 differences in another 'spot the difference' puzzle while listening to music through headphones.

The tasks were counterbalanced and the time taken to complete each task was recorded for each student.

Table 2: Times taken (in seconds) to complete Task A (silence) and Task B (music).

Calculate the mean values for **both** Task A **and** Task B. Show your workings.

[4 marks]

Participant	Task A (silence)	Task B (music)
1	67	82
2	45	70
3	58	60
4	43	59
5	72	77
6	90	105
7	101	90
8	37	59
9	54	83
10	63	89

Task A:

Task B:

Activity 5: Significant figures

Use an appropriate number of significant figures.	For example, expressing a correlation coefficient to two or three significant figures.
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Mathematical Skill	Need a reminder?
Significant figures	bbc.co.uk/bitesize/guides/zv3rd2p/revision/4

Question 1

Table 1 Mean number of seconds taken to complete the 400m run and the standard deviation for both conditions

	Condition A (without music)	Condition B (with music)
Mean 400m time (s)	123	117
Standard deviation	9.97	14.5

Calculate the percentage decrease in the mean time it took participants to run 400 metres when listening to music. Show your workings.

Answer to **three** significant figures.

[4 marks]

Workings:

Question 2

Julia decided to record how many hours her baby slept for in the day and in the night for one week.

Table 1 The number of hours slept in the day and the number of hours slept in the night over one week

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Number of hours slept in the day	8.5	9.0	7.0	9.5	10.5	6.5	8.5
Number of hours slept in the night	9.0	8.0	8.5	7.0	7.5	10.5	8.0

1 0 Calculate the mean number of hours slept in the night. Show your workings.

Give your answer to **two** significant figures.

[3 marks]

Question 3

A teacher showed her Year 12 Psychology class a video clip of a girl shopping in a busy high street with her boyfriend. Near the end of the clip, the girl had her handbag stolen by a man in a black jacket. Later, 10 of the students were interviewed about the events in the video clip using a cognitive interview. The remaining 9 students were interviewed using a standard interview.

Each student was assigned a score based on the accuracy of their answers to the questions in the interview. The results can be seen in the table below.

Accuracy scores for students in the standard and cognitive interview conditions

Standard interview condition		Cognitive interview condition	
Student	Accuracy score	Student	Accuracy score
1	8	10	13
2	8	11	13
3	6	12	11
4	9	13	8
5	10	14	11
6	7	15	14
7	9	16	11
8	8	17	13
9	8	18	15
		19	18

Calculate the mean accuracy score for the cognitive interview condition. Give your answer to **two** significant figures.

[3 marks]

Activity 6: Correlation

Use a scatter diagram to identify a correlation between two variables.	For example, plotting two variables from an investigation on a scatter diagram and identifying the pattern as a positive correlation, a negative correlation or no correlation.
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Mathematical Skill	Need a reminder?
Correlation	bbc.co.uk/bitesize/guides/zrq4jxs/revision/8

Questions continue on the next page.

Question 1

Read the text below and then answer the questions that follow.

Two researchers obtained a sample of ten people whose ages ranged from 20 to 60 years old.

Each participant was asked to take part in a discussion of social care issues. This included discussion about who should pay for social care for elderly people and how to deal with people struggling with mental health problems. A confederate of the researchers was given a script to follow in which a series of discussion points was written for the confederate to introduce.

Each participant then came into a room individually and the discussion with the confederate took place. The maximum time allowed for a discussion was 30-minutes.

The researchers observed the discussions between the confederate and participants and rated the active engagement of the participants in the discussion. The ratings were between 1, (not at all interested) and 20, (extremely interested.) The researchers believed that the rating provided a measurement of the participants' attitudes towards social care issues.

The following data were obtained in the study:

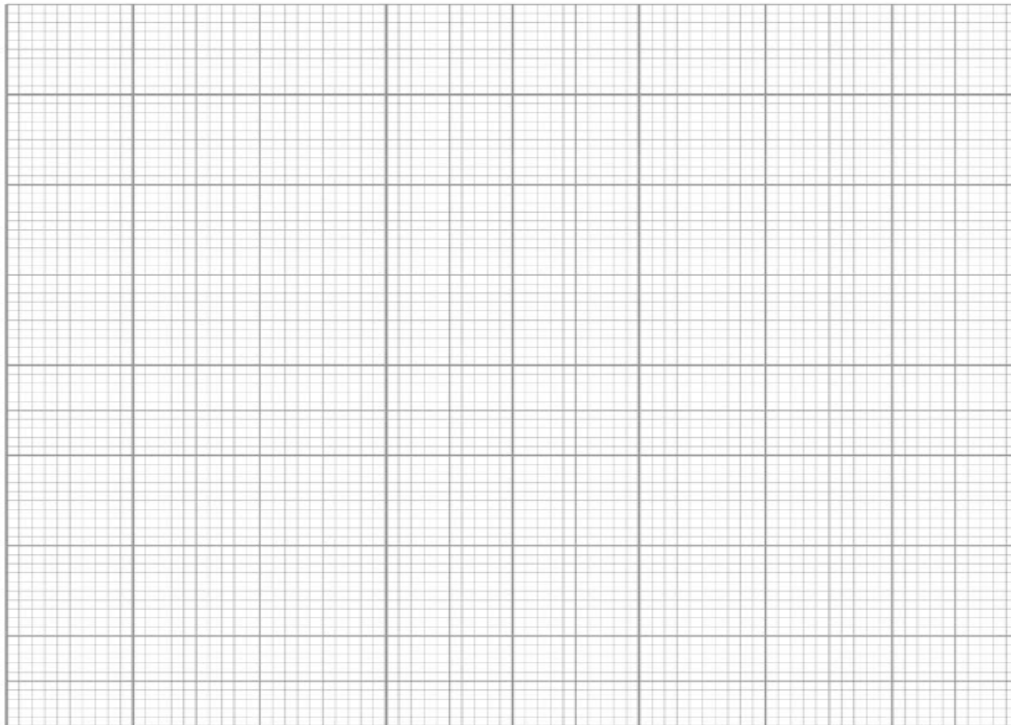
The relationship between age and attitude to social care.

Age of participant	Attitude to social care issues rating
21	5
23	3
34	8
36	12
40	10
47	13
52	17
53	15
58	18
60	20

Question 1 (continued)

(a) Use the graph paper below to sketch a display of the data given in the table above. You do not need to give your display a title.

[3 marks]



Question 2

A recent study recorded the amount of time that children spent in day care from birth to four years, and asked each child's mother to rate her child for aggression and disobedience. The study found that, as the time spent in day care went up, the mothers' rating of aggression and disobedience also went up.

(a) What kind of correlation is this research showing?

[1 mark]

Question 3

A researcher studying depression wanted to see whether or not there was a relationship between level of self-esteem and negative schema score. She constructed two questionnaires and asked ten people who had been diagnosed with depression to complete them.

One questionnaire measured the participant's level of self-esteem. A low score (out of 50) indicated low self-esteem.

The other questionnaire measured whether the participant showed evidence of negative schema. A low score (out of 50) indicated evidence of negative schema.

The two sets of results for each participant are shown in the table below.

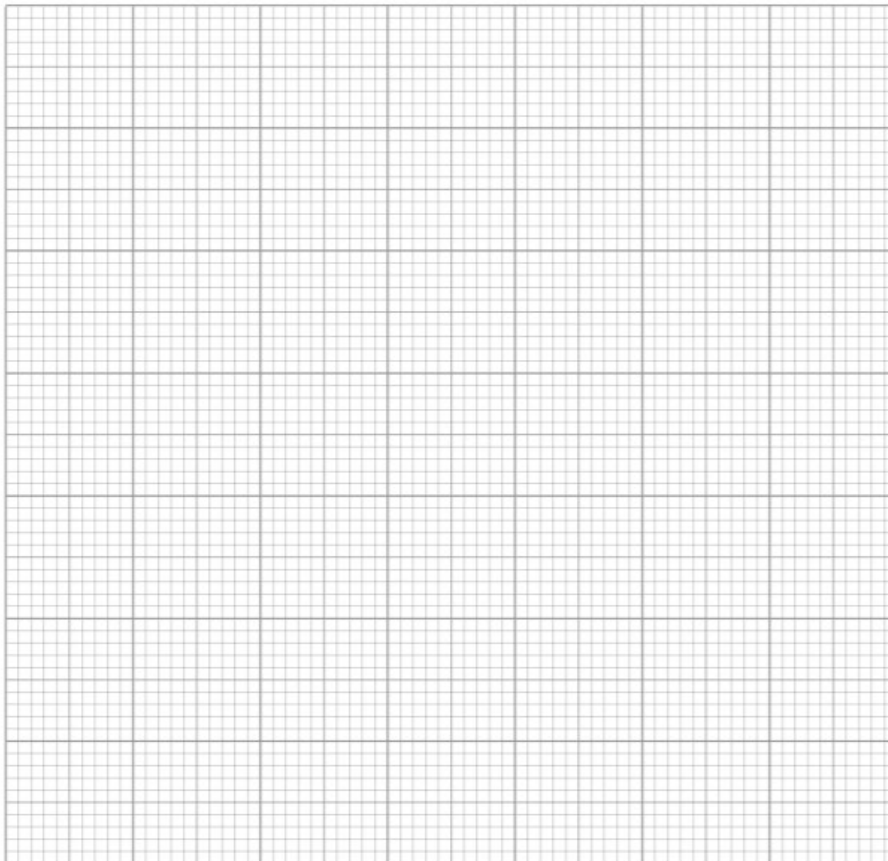
Table 1 Self-esteem score and negative schema score for each patient

Participant	1	2	3	4	5	6	7	8	9	10
Self-esteem score	8	9	9	11	13	17	18	18	20	22
Negative schema score	11	15	13	18	12	14	20	16	17	19

Draw a suitable graphical display to represent the data in **Table 1**. Label your graph appropriately.

[4 marks]

Title: _____



Activity 7: Construct and interpret tables, diagrams and graphs

Construct and interpret frequency tables and diagrams, bar charts and histograms.	<p>For example, selecting and sketching an appropriate form of data display for a given set of data.</p> <p>For example, using a set of numerical data (a set of scores) from a record sheet to construct a bar graph.</p>
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Mathematical Skill	Need a reminder?
Plotting Graphs	<p>bbc.co.uk/bitesize/guides/zrq4jxs/revision/2</p> <p>Remember to note the difference between a bar chart and a histogram, and know when you should use each.</p>

Question 1

When comparing the data for males and females, the psychologist found that there was a difference in the proportion of friendly and aggressive social interactions. This is shown in **Table 2**.

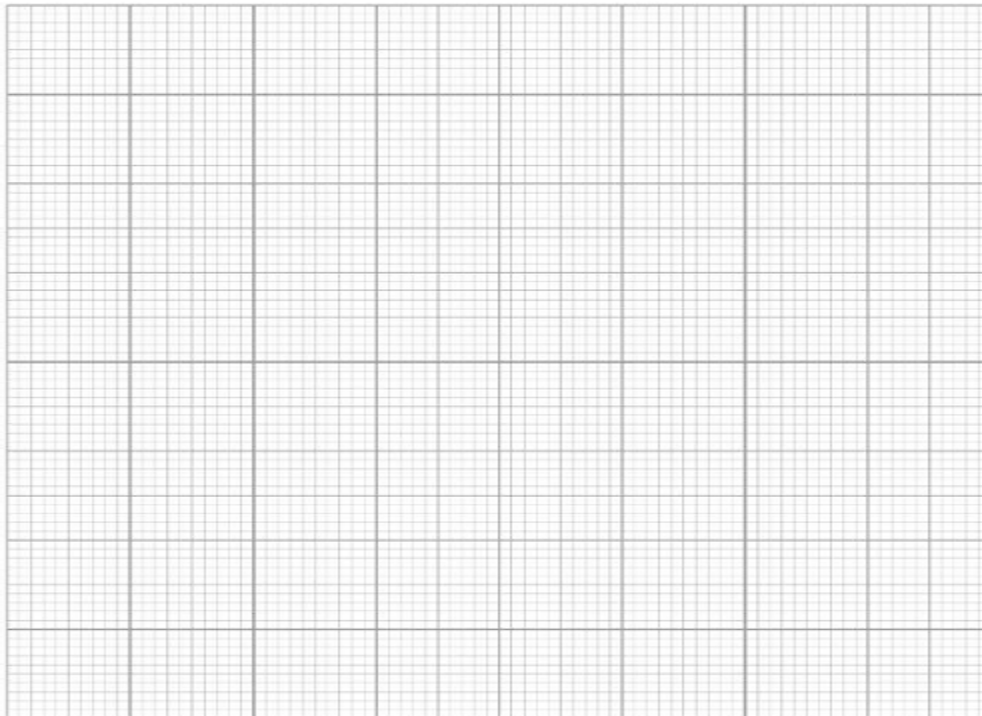
Table 2 Percentage of friendly and aggressive social interactions in dreams reported by males and females

	Males	Females
Friendly	40%	56%
Aggressive	60%	44%

Draw a suitable graphical display to represent the data in Table 2 box. Label your graph appropriately.

[4 marks]

Title _____



Question 2

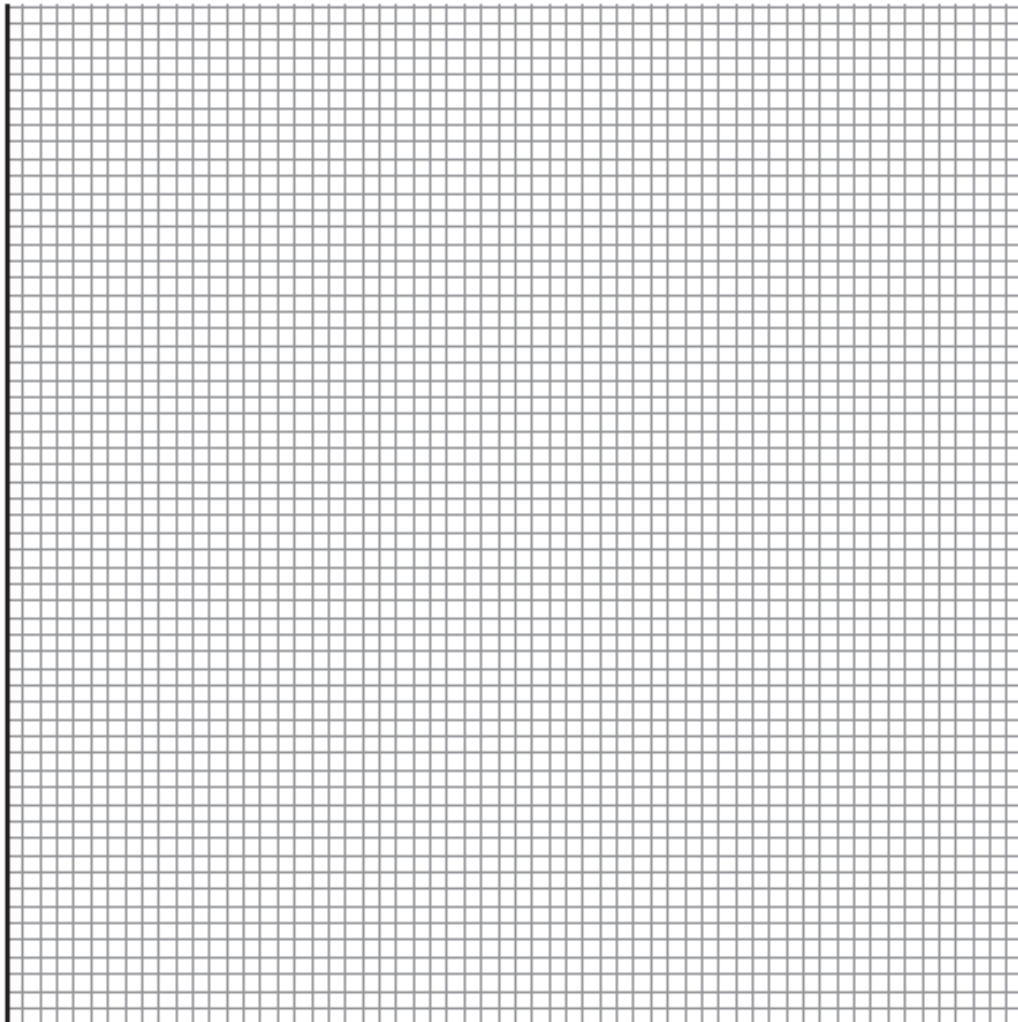
Two groups of patients took part in a trial to compare the effectiveness of two different drug therapies. One of the groups was given **Drug A** and the other group was given **Drug B**. All patients completed a rating scale at the start of a ten-week course of treatment and again at the end of the course. This scale measured the severity of symptoms.

The **Drug A** group had an average score of 9 before the therapy and an average score of 4 at the end of the course.

The **Drug B** group had an average score of 7 before the therapy and an average score of 5 at the end of the course.

Sketch and label a bar chart to illustrate the data.

[4 marks]



Question 3

A teacher wants to see if there is a difference in the mindsets of her Year 9 and Year 11 students. She designs a questionnaire to measure Year 9 and Year 11 students' attitudes towards learning. She uses the answers on the questionnaire to identify whether each student has a fixed or a growth mindset.

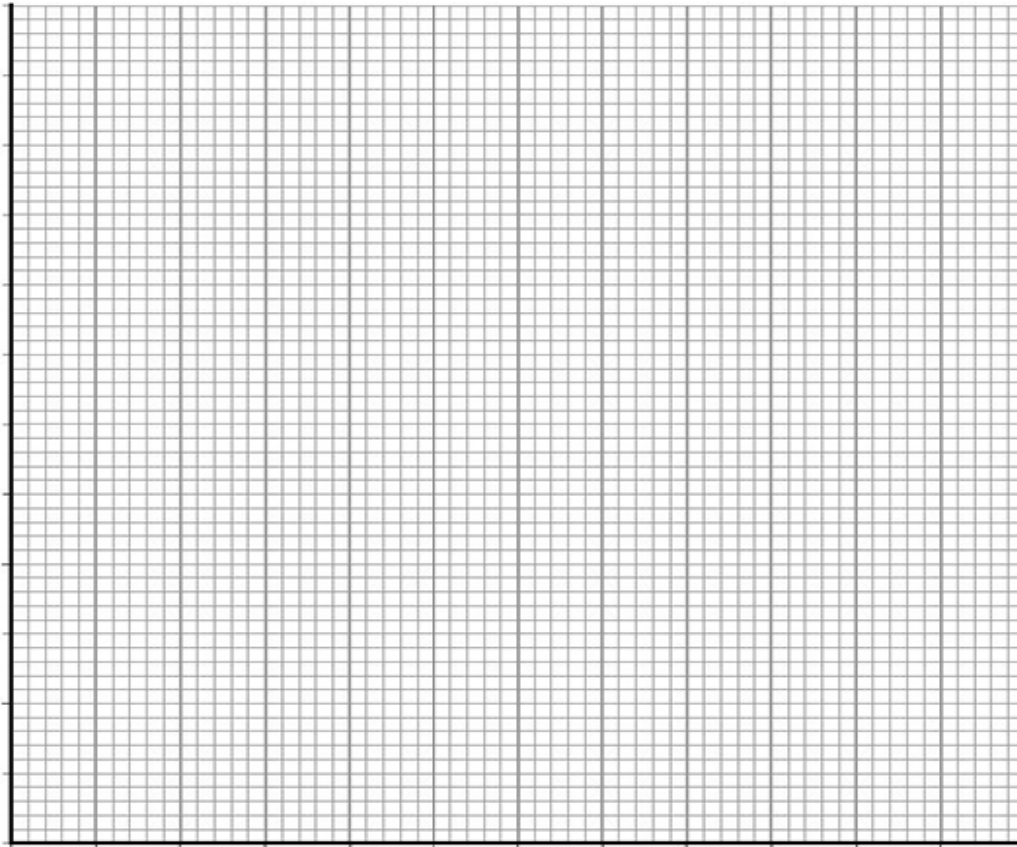
- (a) The teacher analyses the answers to each questionnaire to identify whether each student has a fixed or a growth mindset. Her results are shown in the table below.

Number of students in Year 9 and Year 11 with fixed or growth mindsets

Year	No. of students with a fixed mindset	No. of students with a growth mindset
Year 9	8	12
Year 11	11	9

Use the information in the table to sketch a graph to display the number of students in Year 9 and Year 11 with a fixed or growth mindset. Provide a suitable title and fully label your graph.

[4 marks]



Question 4

Research findings indicate an improvement in memory if the locations of learning and recall are the same. To test these findings, an experiment was conducted under the following conditions:

Condition 1: 20 people learned and recalled **Word list A** in the same location.

Condition 2: The same 20 people learned **Word list B** in one location and recalled **Word list B** in a different location.

The experiment was counterbalanced and the two conditions were completed in a single day.

Mean number of words recalled in the two conditions and the standard deviation for both conditions

	Condition 1 (same location)	Condition 2 (different locations)
Mean number of words recalled	19.3	14.6
Standard deviation	2.43	2.41

- (i) Name an appropriate graph that could be used to display the means shown in the table above.

Suggest appropriate X and Y axis labels for your choice of graph.

[3 marks]

Name of graph:

X axis:

Y axis:

Question 5

A psychologist wanted to test whether listening to music improves running performance. The psychologist conducted a study using 10 volunteers from a local gym. The psychologist used a repeated measures design. Half of the participants were assigned to condition A (without music) and half to condition B (with music). All participants were asked to run 400 metres as fast as they could on a treadmill in the psychology department. All participants were given standardised instructions. All participants wore headphones in both conditions. The psychologist recorded their running times in seconds. The participants returned to the psychology department the following week and repeated the test in the other condition.

The results of the study are given in **Table 1** below.

Table 1 Mean number of seconds taken to complete the 400m run and the standard deviation for both conditions

	Condition A (without music)	Condition B (with music)
Mean 400m time (s)	123	117
Standard deviation	9.97	14.5

Explain why a histogram would not be an appropriate way of displaying the means shown in Table 1.

[2 marks]

Extra space _____

Review of learning

Topic	Total	Calculate your % mark for each section	Comment: How confident are you on this area? Is there anything you need to do?
Ratios, fractions and percentages			
Calculations			
Maths symbols			
Descriptive statistics			
Significant figures			
Correlation			
Plotting graphs			

Appendix 1: Mathematical requirements and exemplification

Mathematical skills	Exemplification of mathematical skill in the context of A-level Psychology
Arithmetic and numerical computation	
Recognise and use expressions in decimal and standard form.	For example, converting data in standard form from a results table into decimal form in order to construct a pie chart.
Use ratios, fractions and percentages.	For example, calculating the percentages of cases that fall into different categories in an observation study.
Estimate results.	For example, commenting on the spread of scores for a set of data, which would require estimating the range.
Handling data	
Use an appropriate number of significant figures.	For example, expressing a correlation coefficient to two or three significant figures.
Find arithmetic means.	For example, calculating the means for two conditions using raw data from a class experiment.
Construct and interpret frequency tables and diagrams, bar charts and histograms.	For example, selecting and sketching an appropriate form of data display for a given set of data.
Understand simple probability.	For example, explaining the difference between the 0.05 and 0.01 levels of significance.
Understand the principles of sampling as applied to scientific data.	For example, explaining how a random or stratified sample could be obtained from a target population.
Understand the terms mean, median and mode.	For example, explaining the differences between the mean, median and mode and selecting which measure of central tendency is most appropriate for a given set of data. Calculate standard deviation.

Mathematical skills	Exemplification of mathematical skill in the context of A-level Psychology
Use a scatter diagram to identify a correlation between two variables.	For example, plotting two variables from an investigation on a scatter diagram and identifying the pattern as a positive correlation, a negative correlation or no correlation.
Use a statistical test.	For example, calculating a non-parametric test of differences using data from a given experiment.
Make order of magnitude calculations.	For example, estimating the mean test score for a large number of participants on the basis of the total overall score.
Distinguish between levels of measurement.	For example, stating the level of measurement (nominal, ordinal or interval) that has been used in a study.
Know the characteristics of normal and skewed distributions.	For example, being presented with a set of scores from an experiment and being asked to indicate the position of the mean (or median, or mode).
Select an appropriate statistical test.	For example, selecting a suitable inferential test for a given practical investigation and explaining why the chosen test is appropriate.
Use statistical tables to determine significance.	For example, using an extract from statistical tables to say whether or not a given observed value is significant at the 0.05 level of significance for a one-tailed test.
Understand measures of dispersion, including standard deviation and range.	For example, explaining why the standard deviation might be a more useful measure of dispersion for a given set of scores, eg where there is an outlying score.
Understand the differences between qualitative and quantitative data.	For example, explaining how a given qualitative measure (for example, an interview transcript) might be converted into quantitative data.
Understand the difference between primary and secondary data.	For example, stating whether data collected by a researcher dealing directly with participants is primary or secondary data.

Mathematical skills	Exemplification of mathematical skill in the context of A-level Psychology
Algebra	
Understand and use the symbols: =, <, <<, >>, >, α , \sim .	For example, expressing the outcome of an inferential test in the conventional form by stating the level of significance at the 0.05 level or 0.01 level by using symbols appropriately.
Substitute numerical values into algebraic equations using appropriate units for physical quantities.	For example, inserting the appropriate values from a given set of data into the formula for a statistical test, eg inserting the N value (for the number of scores) into the Chi Square formula.
Solve simple algebraic equations.	For example, calculating the degrees of freedom for a Chi Square test.
Graphs	
Translate information between graphical, numerical and algebraic forms.	For example, using a set of numerical data (a set of scores) from a record sheet to construct a bar graph.
Plot two variables from experimental or other data.	For example, sketching a scatter diagram using two sets of data from a correlational investigation