GCSE Higher Mathematics
Practice Test 3: Statistics

Instructions:
Answer all questions. Show your working clearly.
Calculators may be used unless stated otherwise.
Time allowed: 90 minutes

Section A: Advanced Averages and Spread

1. The table shows the distribution of phone battery life:

Battery life (hours)	Frequency
8-11	5
12-15	9
16-19	14
20-23	18
24-27	21
28-31	15
32-35	8
36-39	4

Calculate:

(a) The total number of phones tested
(b) An estimate of the mean battery life
(c) The modal class
(d) An estimate of the median battery life
(e) An estimate of the range

2. For the data set: 16, 19, 22, 25, 28, 31, 34, 37, 40, 46

(a) Calculate the mean
(b) Find the median and quartiles (Q1 and Q3)
(c) Calculate the interquartile range
(d) Calculate the standard deviation
(e) Identify any outliers using the 1.5 × IQR rule

3. Two data sets have the following properties:

- Set P: mean = 62, standard deviation = 11, n = 30
- Set Q: mean = 58, standard deviation = 15, n = 20

(a) Calculate the combined mean

(b) Calculate the combined standard deviation

(c) Which set is more consistent? Explain.

(d) Calculate the coefficient of variation for each set

4. The masses (in grams) of 36 components are summarized:

$$\sum x = 1800, \sum x^2 = 92400$$

(a) Calculate the mean mass

(b) Calculate the variance

(c) Calculate the standard deviation

(d) If each component is reduced by 5g, find the new mean and standard deviation

Section B: Histograms and Frequency Density

5. The histogram shows the distribution of internet download speeds:

[Imagine a histogram with: 0-20 Mbps (density 1.5), 20-40 Mbps (density 2.8), 40-60 Mbps (density 3.6), 60-80 Mbps (density 2.2), 80-120 Mbps (density 0.9)]

(a) Complete the frequency table

(b) Calculate the total number of users

(c) Estimate the mean download speed

(d) Find the modal class

(e) What percentage of users have speeds below 40 Mbps?

6. Draw a histogram for this data about apartment rental prices:

Rent (£/month)	Frequency
600-800	18
800-1000	28
1000-1100	12
1100-1300	20
1300-1600	15
1600-2000	8

(a) Calculate the frequency density for each class

(b) Draw the histogram

(c) Estimate the median rental price

(d) What fraction of apartments rent for more than £1100/month?

7. A histogram shows data with unequal class widths. The class 25-30 has frequency density 12 and the class 30-40 has frequency 60.

(a) Find the frequency for the 25-30 class

(b) Find the frequency density for the 30-40 class

(c) If the total frequency is 300, suggest frequencies for other classes

Section C: Cumulative Frequency and Box Plots

8. The table shows the cumulative frequency of running times:

Time (minutes)	Cumulative Frequency
≤ 12	4
≤ 16	14
≤ 20	28
≤ 24	46
≤ 28	62
≤ 32	74
≤ 36	82
≤ 40	85

   (a) Draw the cumulative frequency curve

   (b) Find the median

   (c) Find the quartiles Q1 and Q3

   (d) Calculate the interquartile range

   (e) Draw a box plot

   (f) Estimate the 75th percentile

9. Two box plots show the distribution of salaries for two departments:

   [Imagine box plots: Department X (min 28000, Q1 35000, median 42000, Q3 48000, max 65000), Department Y (min 32000, Q1 38000, median 45000, Q3 52000, max 68000)]

   Compare the distributions by commenting on:

   (a) Central tendency (medians)

   (b) Spread (ranges and IQRs)

   (c) Shape and outliers

   (d) Which department has more variable salaries?

10. The cumulative frequency curve for response times (in seconds) passes through these points: (2, 0), (4, 12), (6, 28), (8, 45), (10, 58), (12, 67), (14, 72)

    (a) Find the median response time

    (b) Find the quartiles

    (c) What percentage have response times between 5 seconds and 9 seconds?

    (d) Draw the corresponding box plot

Section D: Scatter Graphs and Correlation

11. The table shows data for 10 houses:

Area (m^2)	80	95	110	125	140	155	170	185	200	215
Price (£000s)	185	215	245	275	305	335	365	395	425	455

    (a) Plot a scatter graph

    (b) Describe the correlation

    (c) Calculate the equation of the line of best fit

    (d) Use your line to predict the price for a $160m^2$ house

(e) Estimate the area for a house priced at £320,000

(f) Calculate the correlation coefficient

12. The equation of a regression line is $y = -1.5x + 95$.

(a) Interpret the gradient

(b) Interpret the y-intercept

(c) If $x = 30$, predict y

(d) If $y = 56$, estimate x

(e) State assumptions made when using this model

13. Classify these correlation coefficients and describe the relationships:

(a) $r = 0.92$

(b) $r = -0.68$

(c) $r = 0.31$

(d) $r = -0.87$

(e) $r = 0.74$

Section E: Advanced Probability

14. A jar contains 7 green marbles, 5 blue marbles, and 4 red marbles. Two marbles are drawn without replacement.

(a) Draw a tree diagram

(b) Find P(both green)

(c) Find P(both same color)

(d) Find P(at least one blue)

(e) Find P(different colors)

15. The probability that a light bulb fails within a year is 0.08, independently of other bulbs.

(a) Find the probability that exactly 2 out of 6 bulbs fail

(b) Find the probability that at least 3 out of 6 bulbs fail

(c) Find the expected number of failures in 25 bulbs

(d) In a batch of 50 bulbs, find P(more than 6 failures)

16. A computer test has 15 multiple choice questions, each with 5 options. A student guesses randomly.

(a) Find P(correct answer on one question)

(b) Find P(exactly 4 correct answers)

(c) Find P(at least 10 correct answers)

(d) Find the expected number of correct answers

(e) Find the most likely number of correct answers

17. Events E and F are such that P(E) = 0.7, P(F) = 0.5, and P(E F) = 0.28.

(a) Find P(E F)

(b) Find P(E')

(c) Find P(E — F)

(d) Find P(F — E)

(e) Are E and F independent? Justify your answer

Section F: Conditional Probability and Independence

18. A survey of 240 teenagers about social media usage gives:

    - 150 use Instagram
    - 96 use TikTok
    - 54 use both platforms

    (a) Draw a Venn diagram
    (b) Find P(uses Instagram — uses TikTok)
    (c) Find P(uses TikTok — uses Instagram)
    (d) Find P(uses exactly one platform)
    (e) Are the platform usages independent? Explain

19. In a garment factory, 55% of items are sewn by Machine P and 45% by Machine Q. Machine P produces 4% defective items, Machine Q produces 6% defective items.

    (a) Draw a tree diagram
    (b) Find the probability an item is defective
    (c) If an item is defective, find the probability it was sewn by Machine P
    (d) If an item is not defective, find the probability it was sewn by Machine Q

20. A collection has 12 fiction books numbered 1-12 and 9 non-fiction books numbered 1-9. A book is selected at random.

    (a) Find P(fiction and prime number)
    (b) Find P(non-fiction — number divisible by 3)
    (c) Find P(number ¿ 8)
    (d) Are book type and number range independent?

21. A diagnostic scan is 88% accurate for positive cases and 94% accurate for negative cases. 4% of patients have the condition.

    (a) Find the probability of a positive scan result
    (b) If someone has a positive scan, find the probability they have the condition
    (c) If someone has a negative scan, find the probability they don't have the condition
    (d) Comment on the effectiveness of the scan

Section G: Hypothesis Testing and Sampling

22. A spinner is suspected of being biased towards red. It's spun 25 times and lands on red 9 times.

    (a) State the null and alternative hypotheses
    (b) Calculate the probability of getting 9 or more reds if the spinner is fair (assuming 4 equal sections)
    (c) At the 5% significance level, is there evidence the spinner is biased?
    (d) What would be a Type I error in this context?

23. A sample of 45 smartphone batteries has mean charge time 180 minutes and standard deviation 28 minutes.

    (a) Calculate a 95% confidence interval for the population mean

(b) Interpret your confidence interval

(c) What assumptions are made?

(d) How would the interval change with a 99% confidence level?

24. A website claims 90% customer satisfaction. In a sample of 120 customers, 104 report satisfaction.

(a) Test at 5% level whether the claim is justified

(b) Calculate the critical value

(c) State your conclusion

(d) What is the p-value for this test?

Section H: Problem Solving and Integration

25. A gym records member workout durations over 150 sessions. The data shows:

- Mean = 65 minutes
- Standard deviation = 12 minutes
- Distribution is approximately normal

(a) Find P(workout duration ¿ 80 minutes)

(b) Find the duration exceeded by only 15% of members

(c) What percentage of workouts last between 50 and 75 minutes?

(d) If the gym has 200 members per day, estimate daily equipment usage over 45 minutes

26. A quality inspector samples 10 products every hour. Over 8 hours, the number of defective products found was: 0, 2, 1, 3, 1, 0, 2, 1.

(a) Calculate the mean and standard deviation

(b) Test whether the defect rate exceeds 12%

(c) Create a control chart with warning limits

(d) Comment on process stability

27. Compare these three mutual fund options over 5 years:

- Fund A: Mean return 7%, standard deviation 9%
- Fund B: Mean return 11%, standard deviation 16%
- Fund C: Mean return 5%, standard deviation 6%

(a) Calculate the coefficient of variation for each

(b) Which offers the best risk-adjusted return?

(c) Using normal distribution, find P(loss) for each fund

(d) Recommend an option for a moderate-risk investor

28. A university studies the relationship between class attendance and final grades. The correlation is 0.72.

(a) What does this correlation suggest?

(b) If attendance has mean 85% and standard deviation 12%, and grades have mean 68 and standard deviation 16, find the regression equation

(c) Predict the grade for a student with 92% attendance

(d) Calculate the coefficient of determination and interpret it

29. Design a statistical investigation to test whether a new app improves student learning outcomes:

(a) State hypotheses

(b) Describe the sampling method

(c) Identify variables and potential confounding factors

(d) Outline the analysis plan

(e) Discuss limitations and assumptions

Answer Space

Use this space for your working and answers.

END OF TEST

Total marks: 100

For more resources and practice materials, visit:
stepupmaths.co.uk