



TOPIC TEST · IB MATHEMATICS: APPLICATIONS AND INTERPRETATION

# Statistics and probability

## Higher level

45 minutes

### Instructions

- 7 questions, 40 marks, on SL 4.1 to 4.11 (HL: also AHL 4.12 to 4.17). Answer in the spaces provided.
- Total: 40 marks. Answer all questions.
- A graphic display calculator is allowed. You need a clean copy of the formula booklet.
- Show your working: most marks go to the method, not to the final number.
- Sit it in one go, timed. Then mark it with the mark scheme, honestly.

Name .....

Date .....

Score .....

Every question in this test is new, written by Pietro Meloni in the style of the current papers, to check one topic of the syllabus under timed conditions. It is not IB material and not endorsed by the IB.



Mark scheme and the other tests: scan the code

1. A cycling club has 540 members: 270 ride road bikes, 162 ride mountain bikes and 108 ride on the track. The secretary chooses a sample of 40 members by selecting members at random from each of the three groups, in proportion to the size of the group.

(a) State the name of this sampling technique. [1]

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(b) Find the number of mountain bike riders in the sample. [1]

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(c) The distances, in km, ridden last week by the mountain bike riders in the sample were

18, 25, 31, 22, 40, 27, 35, 29, 24, 33, 38, 26.

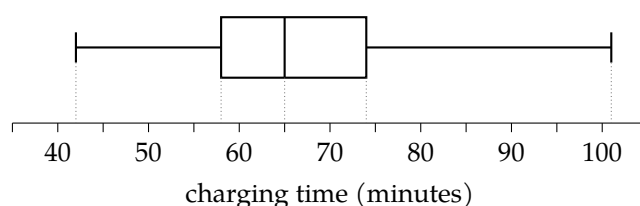
Find the mean and the standard deviation of these distances. [2]

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2. A phone manufacturer tested 300 phones of one model and recorded the time, in minutes, that each phone took to charge from 0 % to 100 %. The box plot summarises the results.



The minimum is 42 minutes, the quartiles are 58 and 74 minutes and the maximum is 101 minutes.

(a) Write down the median charging time. [1]

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(b) Find the interquartile range. [1]

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- (c) Determine whether the longest charging time is an outlier. Justify your answer. [2]

- (d) Estimate the number of phones in the test that took more than 58 minutes to charge. [1]

3. At a music festival, 200 visitors were asked what type of ticket they held and how they had travelled to the site. The results are shown in the table.

|                | Train | Car | Bus | Total |
|----------------|-------|-----|-----|-------|
| Day ticket     | 34    | 60  | 26  | 120   |
| Weekend ticket | 36    | 30  | 14  | 80    |
| Total          | 70    | 90  | 40  | 200   |

One of these visitors is chosen at random.

- (a) Find the probability that the visitor travelled by car. [1]

- (b) Given that the visitor travelled by train, find the probability that they held a weekend ticket. [2]

- (c) Determine whether the events “the visitor held a weekend ticket” and “the visitor travelled by car” are independent. Justify your answer. [2]

4. A greenhouse grower records, for eight weeks in spring, the number of hours of sunshine in the week,  $x$ , and the mass of tomatoes picked from one row of plants that week,  $y$  kg.

|                       |      |      |      |      |      |      |      |      |
|-----------------------|------|------|------|------|------|------|------|------|
| Sunshine, $x$ (hours) | 22   | 26   | 29   | 31   | 34   | 36   | 40   | 43   |
| Mass, $y$ (kg)        | 14.6 | 15.2 | 18.9 | 17.8 | 21.4 | 20.1 | 24.3 | 24.6 |

- (a) The grower investigates the relationship between  $x$  and  $y$ .

- (i) Find the value of Pearson's product-moment correlation coefficient,  $r$ . [2]

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- (ii) Interpret, in context, the value of  $r$ . [1]

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- (b) Find the equation of the regression line of  $y$  on  $x$ . [2]

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- (c) Use your equation to estimate the mass of tomatoes picked in a week with 33 hours of sunshine. [2]

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- (d) In one week in summer there are 60 hours of sunshine. Comment on the reliability of using the equation to estimate the mass of tomatoes picked in that week. [1]

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5. The masses of eggs laid on a farm are normally distributed with mean 62 g and standard deviation 4.5 g. An egg with a mass of more than 68 g is graded “very large”.

- (a) Find the probability that a randomly chosen egg is graded very large. [2]

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- (b) The lightest 5 % of eggs are used for baking. Find the greatest mass of an egg used for baking. [2]

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- (c) A tray holds 30 eggs chosen at random. Let  $Y$  be the number of very large eggs on the tray.

- (i) Find  $E(Y)$ . [1]

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- (ii) Find the probability that there are at least 3 very large eggs on the tray. [3]

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6. Calls to a technical helpline arrive randomly at a mean rate of 2.4 calls every 10 minutes.

- (a) Find the probability that exactly 3 calls arrive in a 10-minute period. [2]

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- (b) Find the probability that more than 15 calls arrive in one hour. [3]

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7. The flight times, in minutes, of a delivery drone on a full charge can be modelled by a normal distribution. A random sample of 10 flights gave the following times.

19.2, 20.5, 18.4, 19.8, 21.1, 18.9, 19.5, 20.2, 18.7, 19.6

(a) Find unbiased estimates of the mean and the variance of the flight times. [2]

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(b) Find a 95 % confidence interval for the mean flight time. [2]

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(c) The manufacturer claims that the mean flight time is at least 20.5 minutes. Comment on this claim. [1]

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