



TOPIC TEST • IB MATHEMATICS: ANALYSIS AND APPROACHES

Statistics and probability

Higher level

45 minutes

Instructions

- 7 questions, 40 marks, on SL 4.1 to 4.9 (HL: also AHL 4.13 and 4.14). 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. The temperature at noon, in degrees Celsius ($^{\circ}\text{C}$), was recorded at a ski resort on eight consecutive days.

$-4.5, -2.0, 1.5, -6.0, 0.5, -1.0, 3.0, -3.5$

- (a) Find the mean and the standard deviation of these temperatures. [2]

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- (b) A temperature of $C^{\circ}\text{C}$ is equal to $F^{\circ}\text{F}$, where $F = 1.8C + 32$. Find the mean and the standard deviation of the eight temperatures in degrees Fahrenheit. [2]

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2. The delivery times, in minutes, of eleven pizza orders from a restaurant are shown.

$26, 18, 30, 23, 49, 25, 30, 21, 28, 33, 23$

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

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- (b) Find the interquartile range. [2]

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- (c) Determine whether any of the delivery times is an outlier. Justify your answer. [2]

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3. The 160 students of a school year were asked whether they play a sport and whether they play a musical instrument. The results are shown in the table.

	Plays an instrument	Does not play an instrument
Plays a sport	28	68
Does not play a sport	22	42

A student is chosen at random from the year. Let S be the event that the student plays a sport and I the event that the student plays an instrument.

(a) Write down $P(S' \cap I')$. [1]

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(b) Find $P(I | S)$. [2]

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(c) Determine whether the events S and I are independent. Justify your answer. [2]

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4. A beach café records the maximum daily temperature, x °C, and the number of iced drinks sold, y , on eight days.

x (°C)	18	21	22	24	25	27	29	31
y	42	55	51	63	60	74	79	85

(a) For these data:

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

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(ii) Describe the correlation between x and y . [1]

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

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- (c) The café owner uses this equation to make predictions.

- (i) Use your equation to estimate the number of iced drinks sold on a day when the maximum temperature is 26°C .

[2]

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- (ii) She predicts the sales on a day when the maximum temperature is 38°C . Explain why this prediction may not be reliable. [1]

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5. A machine fills bottles of water labelled 500 ml. The volume of water in a bottle is normally distributed with mean 503 ml and standard deviation 2.5 ml. A bottle is *underfilled* if it contains less than 500 ml.

- (a) Find the probability that a randomly chosen bottle is underfilled. [2]

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- (b) The bottles are sold in packs of 12. Find the probability that a pack contains at least two underfilled bottles. [3]

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- (c) The machine is adjusted so that the mean volume changes but the standard deviation remains 2.5 ml. After the adjustment, 2% of the bottles are underfilled. Find the new mean volume. [3]

6. An online bookshop sends its parcels with three couriers, P, Q and R. Courier P delivers 45% of the parcels, courier Q delivers 35% and courier R delivers the rest. The probability that a parcel arrives late is 0.04 with courier P, 0.06 with courier Q and 0.15 with courier R.

- (a) Find the probability that a randomly chosen parcel arrives late. [2]

- (b) A customer complains that her parcel arrived late. Find the probability that it was delivered by courier R. [3]

7. The time, X minutes, that a customer spends at a self-service checkout is modelled by the probability density function

$$f(x) = \begin{cases} kx(6-x), & 0 \leq x \leq 4 \\ 0, & \text{otherwise,} \end{cases}$$

where k is a positive constant.

- (a) Show that $k = \frac{3}{80}$. [2]

- (b) Find the probability that a customer spends more than 3 minutes at the checkout. [1]

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(c) Find the median time spent at the checkout. [2]

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