



eClassroom

INTERNATIONAL A LEVEL MATHEMATICS • STATISTICS 1

Statistics 1

Exam Questions by Topic

Pearson Edexcel International Advanced Level (WST01/01) • Calculator and Statistical Tables allowed

Multi-step exam questions at the difficulty of the real WST01 paper, with a full mark scheme

Chapters (tap a chapter to jump to it)	Qs	Marks	Page	My score
1 Mathematical Modelling Not examined on its own: modelling ideas are tested within Chapters 2 to 7	—	—	Not applicable	
2 Measures of Location and Spread Averages, quartiles, interpolation, standard deviation, coding	10	83	own PDF	
3 Representations of Data Histograms, stem and leaf, box plots, outliers, skewness, comparisons	10	80	own PDF	
4 Probability Venn and tree diagrams, conditional probability, independence	10	80	own PDF	
5 Correlation and Regression PMCC, least squares regression, interpretation, coding	10	84	own PDF	
6 Discrete Random Variables Probability and cumulative distributions, $E(X)$, $\text{Var}(X)$, uniform	10	82	own PDF	
7 The Normal Distribution Standardising, tables, finding μ and σ , conditional problems	10	83	2	

[Full mark scheme](#)

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CHAPTER 7 • KEY SKILLS

7

The Normal Distribution

Specification S1: the Normal distribution • 10 questions • 83 marks • about 100 minutes

1 StandardisingIf $X \sim N(\mu, \sigma^2)$ then $Z = \frac{X - \mu}{\sigma} \sim N(0, 1^2)$. Note σ^2 is the variance.**2 Using the table** $P(Z < z) = \Phi(z)$. For negative z : $\Phi(-z) = 1 - \Phi(z)$. $P(Z > z) = 1 - \Phi(z)$ **3 Ranges** $P(a < X < b) = \Phi(z_b) - \Phi(z_a)$. Draw a sketch and shade the region.**4 Percentage points**From a probability to a value: use the percentage points table in full, e.g. 5% gives $z = 1.6449$ **5 Finding μ or σ** Write $\frac{x - \mu}{\sigma} = \pm z$ with the correct sign (below the mean: negative) and solve.**6 Finding μ and σ**

Two probabilities give two equations: solve them simultaneously.

7 SymmetryThe curve is symmetrical about μ : $P(X < \mu) = 0.5$ and $P(\mu - k < X < \mu + k) = 2\Phi\left(\frac{k}{\sigma}\right) - 1$ **8 Conditional probability** $P(X > a | X > b) = \frac{P(X > a)}{P(X > b)}$ for $a > b$.

Find the numerator from the overlap.

9 Samples and countsSeveral independent items: multiply (or use $1 - \dots$). Expected number $= n \times \text{probability}$.**Skills map** every skill above is tested at least once; interleaved skills come from GCSE or other chapters

Skill	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Marks	5	5	5	5	5	12	12	11	11	12
1 Standardising	•	•	•	•		•	•	•	•	•
2 Using the table	•	•	•	•	•	•	•	•	•	•
3 Ranges	•					•	•		•	•
4 Percentage points		•		•	•	•	•	•		•
5 Finding μ or σ			•	•				•		•
6 Finding μ and σ							•			
7 Symmetry			•		•			•	•	•
8 Conditional probability						•	•	•	•	•
9 Samples and counts						•		•		•
Interleaved: tree diagrams and conditionals (Chapter 4)						•			•	
Interleaved: quartiles and outliers (Chapters 2, 3)					•			•		
Interleaved: simultaneous and linear equations (P1)							•			•

Exam difficulty. Questions 1 to 5 check each skill on its own. Questions 6 to 10 are multi-part questions built like the 11 to 14 mark questions on a real WST01 paper, where one part leads into the next and skills are combined.**Must learn.** Quote table values in full (4 decimal places). Round z to 2 decimal places for the Φ table. Always sketch the curve and shade the region you want.

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1. The random variable $X \sim N(50, 4^2)$

Find

(a) $P(X < 56)$

(2)

(b) $P(44 < X < 58)$

(3)

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Question 1 continued

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2. The random variable $X \sim N(120, 15^2)$

(a) Find $P(X > 99)$

(2)

(b) Find the value of a such that $P(X > a) = 0.05$

(3)

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3. The random variable $X \sim N(30, \sigma^2)$. Given that $P(X < 36) = 0.8413$

(a) find the value of σ ,

(3)

(b) write down $P(X < 24)$, giving a reason.

(2)

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Question 3 continued

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4. The random variable $X \sim N(\mu, 5^2)$. Given that $P(X > 40) = 0.2$

(a) find the value of μ ,

(3)

(b) find $P(X < 30)$

(2)

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Question 4 continued

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5. The random variable $X \sim N(80, 12^2)$

(a) Find the lower quartile and the interquartile range of X .

(3)

An outlier is a value more than $1.5 \times$ the interquartile range above the upper quartile.

(b) Find the probability that a randomly chosen value of X is an outlier of this kind.

(2)

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Question 5 continued

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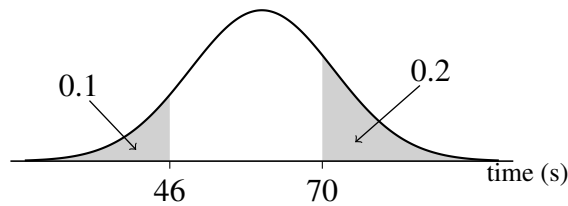
(Total for Question 6 is 12 marks)



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7.

**Figure 1**

The times, T seconds, taken by students to solve a puzzle are modelled by $T \sim N(\mu, \sigma^2)$.

Figure 1 shows that 10% of students take less than 46 seconds and 20% take more than 70 seconds.

- (a) Show that $46 = \mu - 1.2816\sigma$ and write down a second equation in μ and σ . (3)
- (b) Find the value of μ and the value of σ . (3)
- (c) Find $P(50 < T < 65)$ (3)
- (d) Given that a student takes more than 50 seconds, find the probability that the student takes more than 65 seconds. (3)



Question 7 continued

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8. The heights of a type of plant are normally distributed with mean 25 cm. 80% of the plants have a height between 20 cm and 30 cm.
- (a) Show that the standard deviation of the heights is 3.90 cm, to 3 significant figures. (3)
- (b) Find the probability that a randomly chosen plant is taller than 32 cm. (2)
- (c) Given that a plant is taller than 25 cm, find the probability that it is taller than 30 cm. (2)
- (d) Four plants are chosen at random. Find the probability that at least one of them is taller than 30 cm. (2)
- (e) Find the value of k such that 50% of the plants have a height between $(25 - k)$ cm and $(25 + k)$ cm. (2)

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Question 8 continued

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Question 8 continued

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(Total for Question 8 is 11 marks)



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9. A factory has two machines. Machine A makes 60% of the bolts and machine B makes the rest. The lengths, in mm, of bolts from machine A are distributed $N(50, 0.4^2)$ and the lengths of bolts from machine B are distributed $N(50.2, 0.5^2)$.

A bolt is acceptable if its length is between 49.5 mm and 50.5 mm.

- (a) Find the probability that a bolt from machine A is acceptable. (3)

- (b) Find the probability that a bolt from machine B is acceptable. (3)

A bolt is chosen at random from the factory's output.

- (c) Find the probability that it is acceptable. (2)

- (d) Given that the bolt is acceptable, find the probability that it was made by machine A . (3)



Question 9 continued

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10. The random variable $X \sim N(\mu, \sigma^2)$, where $\sigma = \frac{\mu}{4}$

Given that $P(X < 30) = 0.0228$

- (a) show that $\mu = 60$, and find the value of σ .

(4)

- (b) Find $P(X > 75 | X > 60)$

(3)

- (c) Find the value exceeded by 5% of the values of X .

(2)

200 independent values of X are recorded.

- (d) Find the expected number of these values that lie between 45 and 75, and state what proportion of a normal distribution lies within one standard deviation of the mean.

(3)



Question 10 continued

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