Pearson Edexcel International Advanced Level

Friday 31 October 2025

Morning (Time: 1 hour 30 minutes)

Paper reference **WST02/01A**

Mathematics

International Advanced Subsidiary/Advanced Level
Statistics S2
Question Paper

You must have:
Answer book (sent separately).
Do not return this question paper with the answer book.

Turn over ▶

P87447A

©2025 Pearson Education Ltd.
M:1/1/1/

P 8 7 4 4 7 A

Pearson

stemup.co.uk

1. A continuous random variable X has cumulative distribution function

$$F(x) = \begin{cases} 0 & x < 2 \\ \frac{1}{20}(x^2 - 4) & 2 \leqslant x \leqslant 4 \\ \frac{1}{5}(2x - 5) & 4 < x \leqslant 5 \\ 1 & x > 5 \end{cases}$$

(a) Calculate $P(X > 4)$

(2)

(b) Find the value of a such that $P(3 < X < a) = 0.642$

(4)

(c) Find the probability density function of X, specifying it for all values of x.

(4)

(Total for Question 1 is 10 marks)

---

2. Bill owns a restaurant.

Over the next four weeks Bill decides to carry out a sample survey to obtain the customers' opinions.

(a) Suggest a suitable sampling frame for the sample survey.

(1)

(b) Identify the sampling units.

(1)

(c) Give one advantage and one disadvantage of taking a census rather than a sample survey.

(2)

Bill believes that only 30% of customers would like a greater choice on the menu.

He takes a random sample of 50 customers and finds that 20 of them would like a greater choice on the menu.

(d) Test, at the 5% significance level, whether or not the percentage of customers who would like a greater choice on the menu is more than Bill believes.
State your hypotheses clearly.

(5)

(Total for Question 2 is 9 marks)

stemup.co.uk

3. Left-handed people make up 10% of a population.

A random sample of 60 people is taken from this population.

The discrete random variable Y represents the number of left-handed people in the sample.

(a) (i) Write down an expression for the exact value of $P(Y \leqslant 1)$

(ii) Evaluate your expression, giving your answer to 3 significant figures.

(3)

(b) Using a Poisson approximation, estimate $P(Y \leqslant 1)$

(2)

(c) Using a normal approximation and standardisation, estimate $P(Y \leqslant 1)$

(5)

(d) Give a reason why the Poisson approximation is a more suitable estimate of $P(Y \leqslant 1)$

(1)

(Total for Question 3 is 11 marks)

stemup.co.uk

4. The function $f(x)$ is defined as

$$f(x) = \begin{cases} \frac{1}{9}(x+5)(3-x) & 1 \leqslant x \leqslant 4 \\ 0 & \text{otherwise} \end{cases}$$

Albert believes that $f(x)$ is a valid probability density function.

(a) Sketch $f(x)$ and comment on Albert's belief.

(3)

The continuous random variable Y has probability density function given by

$$g(y) = \begin{cases} ky(12 - y^2) & 1 \leqslant y \leqslant 3 \\ 0 & \text{otherwise} \end{cases}$$

where k is a positive constant.

(b) Use calculus to find the mode of Y

(3)

(c) Use algebraic integration to find the value of k

(3)

(d) Find the median of Y giving your answer to 3 significant figures.

(3)

(e) Describe the skewness of the distribution of Y giving a reason for your answer.

(2)

(Total for Question 4 is 14 marks)

stemup.co.uk

5. Cars stop at a service station randomly at a rate of 3 every 5 minutes.

(a) Calculate the probability that in a randomly selected 10 minute period,

(i) exactly 7 cars will stop at the service station,

(ii) more than 7 cars will stop at the service station.

(4)

Using a normal approximation, the probability that more than 40 cars will stop at the service station during a randomly selected n minute period is 0.2266 correct to 4 significant figures.

(b) Find the value of n
You must show all stages of your working.

(9)

(Total for Question 5 is 13 marks)

---

6. A bag contains a large number of coins. It contains only 1p, 5p and 10p coins.

The fraction of 1p coins in the bag is q, the fraction of 5p coins in the bag is r and the fraction of 10p coins in the bag is s

Two coins are selected at random from the bag and the coin with the highest value is recorded. Let M represent the value of the highest coin.

The sampling distribution of M is given below

m	1	5	10
$P(M = m)$	$\frac{1}{25}$	$\frac{13}{80}$	$\frac{319}{400}$

(a) List all the possible samples of two coins which may be selected.

(2)

(b) Find the value of q, the value of r and the value of s

(7)

(Total for Question 6 is 9 marks)

stemup.co.uk

7. The continuous random variable X is uniformly distributed over the interval $[a , b]$

(a) Find an expression, in terms of a and b, for $E(3 - 2X)$

(2)

(b) Find $P(X > \frac{1}{3}b + \frac{2}{3}a)$

(2)

Given that $E(X) = 0$

(c) find an expression, in terms of b only, for $E(3X^2)$

(3)

Given also that the range of X is 18

(d) find $Var(X)$

(2)

(Total for Question 7 is 9 marks)

TOTAL FOR PAPER IS 75 MARKS

stemup.co.uk

BLANK PAGE

stemup.co.uk

BLANK PAGE

stemup.co.uk

Please check the examination details below before entering your candidate information

Candidate surname StemUp Model Solution | Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Friday 31 October 2025

Morning (Time: 1 hour 30 minutes)

Paper reference **WST02/01A**

Mathematics

International Advanced Subsidiary/Advanced Level
Statistics S2
Answer Book

You must have:
Question paper (sent separately)
Mathematical Formulae and Statistical Tables (Yellow), calculator

Total Marks

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Values from the statistical tables should be quoted in full. If a calculator is used instead of the tables, the value should be given to an equivalent degree of accuracy.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 7 questions in this question paper. The total mark for this paper is 75.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ▶

P87487A

©2025 Pearson Education Ltd.
M:1/1/

P 8 7 4 8 7 A 0 1 2 4

Pearson

Question 1

Write the answer to Question 1 on these 2 pages

(a) $P(X > 4) = 1 - F(4) = 1 - \frac{1}{20}(4^2 - 4) = 1 - \frac{12}{20} = 1 - \frac{3}{5}$

$= \frac{2}{5} \quad (= 0.4)$

(b) $F(3) = \frac{1}{20}(3^2 - 4) = \frac{5}{20} = 0.25$

$F(a) - F(3) = 0.642 \Rightarrow F(a) = 0.642 + 0.25 = 0.892$

$F(4) = 0.6 < 0.892$, so $4 < a \leq 5$:

$\frac{1}{5}(2a - 5) = 0.892 \Rightarrow 2a - 5 = 4.46 \Rightarrow 2a = 9.46$

$a = 4.73$

(c) $f(x) = \frac{d}{dx}F(x)$

$2 \leq x \leq 4$: $f(x) = \frac{d}{dx}\left(\frac{1}{20}(x^2 - 4)\right) = \frac{2x}{20} = \frac{1}{10}x$

$4 < x \leq 5$: $f(x) = \frac{d}{dx}\left(\frac{1}{5}(2x - 5)\right) = \frac{2}{5}$

$$f(x) = \begin{cases} \frac{1}{10}x, & 2 \leq x \leq 4 \\ \frac{2}{5}, & 4 < x \leq 5 \\ 0, & \text{otherwise} \end{cases}$$

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 1 continued

This is the end of Question 1 answer space. Please turn the page for Question 2 answer space.

(Total for Question 1 is 10 marks)

Question 2

Write the answer to Question 2 on these 2 pages

(a) A list of all the customers who eat in the restaurant (over the four weeks)

(b) The individual customers (who eat in the restaurant)

(c) Advantage: a census gives a totally accurate (unbiased) result

Disadvantage: it is time consuming and expensive to obtain and analyse the data (and hard to make sure every customer is included)

(d) X = number of customers who would like a greater choice on the menu

H_0: $p = 0.3$ H_1: $p > 0.3$

Under H_0, $X \sim B(50, 0.3)$

$P(X \geqslant 20) = 1 - P(X \leqslant 19) = 1 - 0.9152$

$= 0.0848 > 0.05$

Not significant, so do not reject H_0 (20 is not in the critical region $X \geqslant 21$)

There is no evidence to reject Bill's belief: the percentage of customers who would like a greater choice on the menu is not more than 30%.

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 2 continued

This is the end of Question 2 answer space. Please turn the page for Question 3 answer space.

(Total for Question 2 is 9 marks)

Question 3

Write the answer to Question 3 on these 4 pages

(a)(i) $Y \sim B(60, 0.1)$

$P(Y \leqslant 1) = P(Y = 0) + P(Y = 1) = (0.9)^{60} + 60(0.1)(0.9)^{59}$

(ii) $= 0.0017970\ldots + 0.0119800\ldots = 0.013777\ldots$

$P(Y \leqslant 1) = 0.0138$ (3 s.f.)

(b) n large, p small: $\lambda = np = 60 \times 0.1 = 6$, $Y \approx Po(6)$

$P(Y \leqslant 1) = e^{-6} + 6e^{-6} = 7e^{-6} = 0.017351\ldots$

$P(Y \leqslant 1) \approx 0.0174$

(c) $np = 6$, $np(1 - p) = 60 \times 0.1 \times 0.9 = 5.4$, $Y \approx W \sim N(6, 5.4)$

$P(Y \leqslant 1) \approx P(W < 1.5)$ (continuity correction)

$= P\left(Z < \frac{1.5 - 6}{\sqrt{5.4}}\right) = P(Z < -1.936\ldots)$

$= P(Z < -1.94) = 1 - 0.9738$

$= 0.0262$

(d) p (= 0.1) is small and not close to 0.5 (and n is large), so the Poisson approximation is better; its value (0.0174) is closer to the true value 0.0138.

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 3 continued

Question 3 continued

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 3 continued

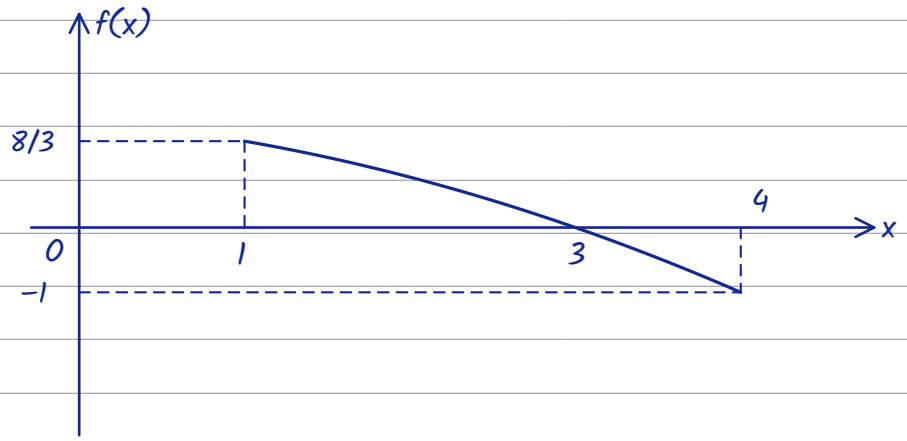
This is the end of Question 3 answer space. Please turn the page for Question 4 answer space.

(Total for Question 3 is 11 marks)

Question 4

Write the answer to Question 4 on these 4 pages

(a)



$f(x) < 0$ for $3 < x \leq 4$, and a probability cannot be negative, so $f(x)$ is not a valid probability density function. Albert is wrong.

(b) $g(y) = k(12y - y^3) \Rightarrow g'(y) = k(12 - 3y^2)$

$g'(y) = 0 \Rightarrow 12 - 3y^2 = 0 \Rightarrow y^2 = 4$

Mode = 2

(c) $\int_1^3 k(12y - y^3)\,dy = k\left[6y^2 - \frac{y^4}{4}\right]_1^3 = 1$

$k\left(6 \times 3^2 - \frac{3^4}{4} - 6 \times 1^2 + \frac{1^4}{4}\right) = k\left(\frac{135}{4} - \frac{23}{4}\right) = 28k = 1$

$k = \frac{1}{28}$

(d) $\int_1^m \frac{1}{28}(12y - y^3)\,dy = \frac{1}{28}\left(6m^2 - \frac{m^4}{4} - \left(6 \times 1^2 - \frac{1^4}{4}\right)\right) = 0.5$

$6m^2 - \frac{m^4}{4} - \frac{23}{4} = 14 \Rightarrow 24m^2 - m^4 - 23 = 56$

$m^4 - 24m^2 + 79 = 0 \Rightarrow m^2 = \frac{24 \pm \sqrt{(576 - 316)}}{2} = 12 \pm \sqrt{65}$

$1 \leq m \leq 3$ so $m^2 = 12 - \sqrt{65} = 3.9377\ldots$, $m = 1.98437\ldots$

Median = 1.98 (3 s.f.)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 4 continued

(e) Median (1.98) ≈ mode (2), so there is no skew
(the distribution is approximately symmetrical).

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 4 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 4 continued

This is the end of Question 4 answer space. Please turn the page for Question 5 answer space.

(Total for Question 4 is 14 marks)

Question 5

Write the answer to Question 5 on these 4 pages

(a) X = number of cars in 10 minutes, $X \sim Po(6)$

(i) $P(X = 7) = P(X \leq 7) - P(X \leq 6) = 0.7440 - 0.6063$

$= 0.1377 \quad (\approx 0.138)$

(ii) $P(X > 7) = 1 - P(X \leq 7) = 1 - 0.7440$

$= 0.256$

(b) Let Y = number of cars in n minutes: $Y \sim Po(\lambda)$ with $\lambda = \frac{3n}{5} = 0.6n$

λ large, so $Y \approx W \sim N(\lambda, \lambda)$

$P(Y > 40) \approx P(W > 40.5) = 0.2266$ (continuity correction)

$P(Z > 0.75) = 0.2266 \Rightarrow \frac{40.5 - \lambda}{\sqrt{\lambda}} = 0.75$

$\lambda + 0.75\sqrt{\lambda} - 40.5 = 0$

Let $u = \sqrt{\lambda}$: $u^2 + 0.75u - 40.5 = 0$

$u = \frac{-0.75 \pm \sqrt{(0.75^2 + 4 \times 40.5)}}{2} = \frac{-0.75 \pm 12.75}{2}$

$u = 6 \quad (u = \sqrt{\lambda} > 0$, reject $-6.75)$

$\sqrt{\lambda} = 6 \Rightarrow \lambda = 36$

$0.6n = 36 \Rightarrow n = 60$

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 5 continued

Question 5 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 5 continued

This is the end of Question 5 answer space. Please turn the page for Question 6 answer space.

(Total for Question 5 is 13 marks)

Question 6

Write the answer to Question 6 on these 4 pages

(a) $(1, 1)$, $(1, 5)$, $(5, 1)$, $(5, 5)$, $(1, 10)$, $(10, 1)$, $(5, 10)$, $(10, 5)$, $(10, 10)$

(b) $M = 1$: $(1, 1) \Rightarrow q \times q = q^2 = \frac{1}{25} \Rightarrow q = \frac{1}{5}$

$M = 5$: $(1, 5), (5, 1), (5, 5) \Rightarrow qr + rq + r^2 = \frac{13}{80}$

$r^2 + 2\left(\frac{1}{5}\right)r - \frac{13}{80} = 0 \Rightarrow r^2 + 0.4r - 0.1625 = 0$

$r = \frac{-0.4 \pm \sqrt{(0.4^2 + 4 \times 0.1625)}}{2} = \frac{-0.4 \pm 0.9}{2}$

$r > 0 \Rightarrow r = \frac{1}{4}$

$q + r + s = 1 \Rightarrow s = 1 - \frac{1}{5} - \frac{1}{4} = \frac{11}{20}$

(check $M = 10$: $2qs + 2rs + s^2 = \frac{22}{100} + \frac{22}{80} + \frac{121}{400} = \frac{319}{400}$ ✓)

$q = \frac{1}{5}$, $r = \frac{1}{4}$, $s = \frac{11}{20}$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 6 continued

Question 6 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 6 continued

This is the end of Question 6 answer space. Please turn the page for Question 7 answer space.

(Total for Question 6 is 9 marks)

Question 7

Write the answer to Question 7 on these 3 pages

(a) $E(X) = \frac{a+b}{2}$

$E(3-2X) = 3 - 2E(X) = 3 - 2 \times \frac{a+b}{2} = 3 - a - b$

(b) $P\left(X > \frac{1}{3}b + \frac{2}{3}a\right) = \frac{b - (b/3 + 2a/3)}{b-a} = \frac{2b/3 - 2a/3}{b-a} = \frac{2}{3}$

(c) $E(X) = \frac{a+b}{2} = 0 \Rightarrow a = -b$

$E(3X^2) = \int_{-b}^{b} \frac{1}{b-(-b)} \times 3x^2 \, dx = \left[\frac{x^3}{2b}\right]_{-b}^{b} = \frac{b^3 - (-b^3)}{2b}$

$= b^2$

(d) Range $= b - a = 18$ (so $X \sim U[-9, 9]$)

$Var(X) = \frac{(b-a)^2}{12} = \frac{18^2}{12} = 27$

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 7 continued

Question 7 continued

(Total for Question 7 is 9 marks)

TOTAL FOR PAPER IS 75 MARKS

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA