Please check the examination deta	ails below	/ before entering	g your candidate information			
Candidate surname		0	ther names			
Pearson Edexcel International Advanced Level	Centr	e Number	Candidate Number			
Monday 20 Ja	anı	ary 2	2020			
Afternoon (Time: 1 hour 30 minu	ıtes)	Paper Refe	rence WST01/01			
Mathematics International Advanced Subsidiary/Advanced Level Statistics S1						
You must have: Mathematical Formulae and Sta	tistical [·]	Tables (Blue)	, calculator			

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 6 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 guestion 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



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(5)

1. The discrete random variable X has the following probability distribution

x	-2	-1	1	3	4
P(X=x)	0.15	а	b	С	0.15

where a, b and c are probabilities.

The mean value of X is 1 and F(1) = 0.63

Find the value of a, the value of b and the value of c.

Question 1 continued	blank
	Q1
(Total 5 marks)	



No family had a dog and a rabbit 2 families had both a dog and a cat 12 families had a dog 14 families had a cat 11 families had a rabbit 9 families did not have any of these animals as pets family from this group is selected at random. D represents the event that the family has a dog C represents the event that the family has a cat R represents the event that the family has a rabbit Draw a Venn diagram to illustrate this information.	(
12 families had a dog 14 families had a cat 11 families had a rabbit 9 families did not have any of these animals as pets family from this group is selected at random. D represents the event that the family has a dog C represents the event that the family has a cat R represents the event that the family has a rabbit Draw a Venn diagram to illustrate this information.	
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C represents the event that the family has a cat R represents the event that the family has a rabbit Draw a Venn diagram to illustrate this information.	
R represents the event that the family has a rabbit Draw a Venn diagram to illustrate this information.	
) Draw a Venn diagram to illustrate this information.	
) State, giving a reason, a pair of mutually exclusive events from D , C and R .	
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) Find the probability that the family has exactly 2 of these kinds of animals as p	eis
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are independent.	
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) Find the probability that Sarah's family also has a pet rabbit	
) I ma the producting that suran s failing also has a per facoli.	
Find the exact value of $P([D \cup R] C')$	
	 Find the probability that the family has exactly 2 of these kinds of animals as p Showing your working clearly, determine whether or not the events D and are independent. arah's family is in the group and her family has a pet cat. Find the probability that Sarah's family also has a pet rabbit. Find the exact value of P([D ∪ R] C')

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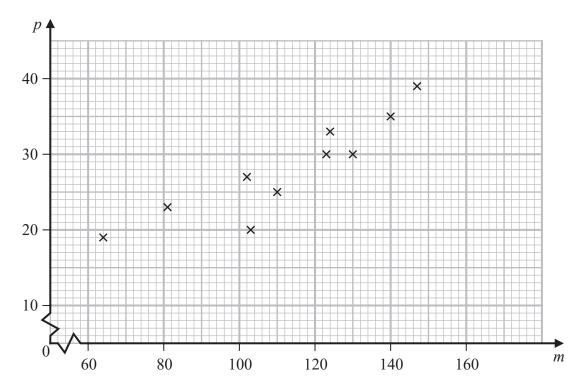
Question 2 continued	blank
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	Q2
(Total 12 mar	ks)



3. Soapern sells washing machines. When a customer buys a washing machine from Soapern, the customer is also invited to buy a guarantee policy to cover breakdowns and repairs for the next three years.

The manager of *Soapern* believes that the relationship between the number of washing machines sold (m) and the number of guarantee policies sold (p) can be modelled by a straight line.

She collected data each month for 10 months. The scatter diagram below illustrates these data.



The data are summarised by the following statistics.

$$\sum m = 1124$$
 $\sum p = 281$ $\sum mp = 32958$ $S_{mm} = 6046.4$ $S_{pp} = 382.9$

(a) Show that $S_{mp} = 1373.6$

(1)

(b) Find the value of the product moment correlation coefficient for these data.

(2)

(c) State, giving a reason, whether or not the data are consistent with the manager's belief.

(1)

The manager noticed that the total number of washing machines sold was k times the total number of guarantee policies sold and suggests a model of the form $p = \frac{1}{k}m$, where k is an integer.

(d) Find the value of k.

(2)

Jiang works for Soapern and thought that this model oversimplified the situation and suggested that a linear regression of p on m may be more appropriate.

(e) Find the equation of the linear regression of p on m, giving your answer in the form p = a + bm, where a and b should be given to 3 significant figures.

(4)

(f) Use Jiang's model to estimate the number of guarantee policies sold when 70 washing machines are sold in a month.

(1)

Usually about 70 washing machines are sold in January. *Soapern* decides to offer a bonus to staff during January based on the number of guarantee policies sold. If the number of guarantee policies sold is greater than the number estimated by the model, the bonus will be paid.

(g)	State,	giving	your	reasons,	whether	you	would	recommend	that	the	staff	use	the
	manag	ger's mo	odel o	r Jiang's	model.								

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Question 3 continued	Leave blank
	Q3
(Total 13 marks)	



4. A researcher is studying the birth weights of babies. A random sample of 98 babies was taken and their birth weights, wkg, are summarised in the table below.

Birth weight (w kg)	Frequency (f)	Birth weight midpoint (x)
$1.50 \leqslant w < 2.50$	16	2.00
$2.50 \leqslant w < 3.00$	24	2.75
$3.00 \leqslant w < 3.50$	32	3.25
$3.50 \leqslant w < 4.00$	14	3.75
$4.00 \leqslant w < 5.50$	12	4.75

(You may use
$$\sum fx = 311.5$$
 and $\sum fx^2 = 1051.125$)

A histogram is drawn to represent these data.

The bar representing the birth weight $1.50 \le w < 2.50$ has a width of 1 cm and a height of 4 cm.

- (a) Calculate the width and height of the bar representing birth weight $3.50 \le w < 4.00$ (3)
- (b) Use linear interpolation to estimate the lower quartile of the birth weights of the 98 babies.

(2)

The researcher estimated the median to be 3.14kg and the upper quartile to be 3.55kg.

(c) Use the median and quartiles to describe the skewness of these data.

(2)

- (d) Find an estimate for (i) the mean birth weight
 - (ii) the standard deviation of the birth weights.

(3)

(e) Use the formula

$$skewness = \frac{3(mean - median)}{standard deviation}$$

to estimate a value for the skewness of these data. Give your answer to 2 significant figures.

(2)

The researcher read that birth weights should be approximately normally distributed and decides to split the class $3.00 \le w < 3.50$

The frequency for $3.00 \le w < 3.25$ is 9 and the frequency for $3.25 \le w < 3.50$ is 23

- (f) (i) State, giving a reason, what the effect would be on the estimate of the median.
 - (ii) Without carrying out any further calculations state, giving a reason, what the effect of this change would be on the estimate of the mean.

(2)



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Question 7 continued	
	Q4
(Total 1	4 marks)



- 5. The random variable X has a normal distribution with mean 10 and standard deviation 6
 - (a) Find P(X < 7)

(3)

(b) Find the value of k such that

$$P(10 - k < X < 10 + k) = 0.60$$

(3)

A single observation x, of X, is to be taken.

A rectangle is drawn on a centimetre grid with vertices having coordinates (0, 0), (x, 0), (x, x - 3) and (0, x - 3)

(c) Find the probability that the area of this rectangle is more than $40\,\mathrm{cm}^2$

(8)

astion 5 continued	
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Question 5 continued	
Question 5 continued	

Question 5 continued	Leave
	Q5
(Total 14 marks)	



6. A tennis tournament has 5 rounds. After each round, winners go into the next round and losers are knocked out of the tournament. To enter the tournament players must pay an entry fee of \$10 but only the person who wins all 5 rounds receives the prize of \$260

Serena enters this tennis tournament. The random variable S represents the total number of rounds Serena wins. The probability distribution for S is given in the following table.

S	0	1	2	3	4	5
P(S=s)	k	$\frac{k}{2}$	$\frac{k}{3}$	$\frac{k}{4}$	$\frac{k}{5}$	$\frac{k}{6}$

(a) Show that
$$k = \frac{20}{49}$$

(2)

(b) Find E(S)

(3)

(c) Find Serena's expected profit if she enters the tennis tournament.

(3)

Roger also enters this tennis tournament. Given that Roger is still in the tournament, the probability that he wins the next round is a constant p.

The random variable *R* represents the total number of rounds that Roger wins.

(d) Explain why
$$P(R = 2) = p^2(1 - p)$$

(2)

(e) Find, in terms of p, the probability distribution for R.

(3)

(f) Find the smallest value of p such that Roger's expected profit is at least as great as Serena's.

(4)



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