



AS Statistics Practice Paper A

45 Marks



1. St Mary's primary school has 29 girls and 21 boys in year 6.

The headteacher wants 20 students to complete a survey and decides to take a sample stratified by gender.

Calculate how many boys and girls the headteacher should include in the sample.

(2)

(Total marks: 2)

2. The proportion of houses in Radville which are unable to receive digital radio is 25%.

In a survey of a random sample of 30 houses taken from Radville, the number, X , of houses which are unable to receive digital radio is recorded.

a. Find $P(5 \leq X < 11)$

(3)

A radio company claims that a new transmitter set up in Radville will reduce the proportion of houses which are unable to receive digital radio. After the new transmitter has been set up, a random sample of 15 houses is taken, of which 1 house is unable to receive digital radio.

b. Test, at the 10% level of significance, the radio company's claim. State your hypotheses clearly.

(5)

(Total marks: 8)

3. An estate agent is studying the cost of office space in London. He takes a random sample of 90 offices and calculates the cost, £ x per square foot. His results are given in the table below.

Cost (£ x)	Frequency (f)	Midpoint (£ y)
$20 \leq x < 40$	12	30
$40 \leq x < 45$	13	42.5
$45 \leq x < 50$	25	47.5
$50 \leq x < 60$	32	55
$60 \leq x < 80$	8	70

(You may use $\sum fy^2 = 226687.5$)

A histogram is drawn for these data and the bar representing $50 \leq x < 60$ is 2 cm wide and 8 cm high.

a. Calculate the width and height of the bar representing $20 \leq x < 40$

(3)

b. Use linear interpolation to estimate the median cost.

(2)



c. Estimate the mean cost of office space for these data. (2)

d. An estate agent is studying the cost of office space in London. He takes a random sample of 90 offices and calculates the cost, £ x per square foot. His results are given in the table below. (2)

The median is 49 and the mean is 49.11

e. Describe, giving a reason, the skewness (1)

Rika suggests that the cost of office space in London can be modelled by a normal distribution with mean £50 and standard deviation £10

f. With reference to the skewness of the data, comment on Rika's suggestion. (1)

g. Use Rika's model to estimate the 80th percentile of the cost of office space in London. (3)

(Total marks: 14)

4. The discrete random variable X takes values 1, 2, 3, 4 and 5, and its probability distribution is defined as follows.

$$P(X = x) = \begin{cases} a & x = 1 \\ 0.5P(X = x - 1) & x = 2, 3, 4, 5 \\ 0 & \text{otherwise} \end{cases}$$

where a is a constant.

a. Find the value of a . (2)

The discrete random variable X takes values 1, 2, 3, 4 and 5, and its probability distribution is defined as follows.

The discrete probability distribution for X is given in the table.

x	1	2	3	4	5
$P(X = x)$	$\frac{16}{31}$	$\frac{8}{31}$	$\frac{4}{31}$	$\frac{2}{31}$	$\frac{1}{31}$

b. Find the probability that X is odd. (1)

c. Two independent values of X are chosen, and their sum S is found.

Find the probability that S is odd. (2)

d. Find the probability that S is greater than 8, given that S is odd. (3)

Sheila sometimes needs several attempts to start her car in the morning. She models the number of attempts she needs by the discrete random variable Y defined as follows.

$$P(Y = y + 1) = \frac{1}{2}P(Y = y) \text{ for all positive integers } y.$$

e. Find $P(Y = 1)$. (2)

(Total marks: 10)

5. A college has 80 students in Year 12.

20 students study Biology

28 students study Chemistry

30 students study Physics

7 students study both Biology and Chemistry

11 students study both Chemistry and Physics

5 students study both Physics and Biology

3 students study all 3 of these subjects

a. Draw a Venn diagram to represent this information. **(5)**

A Year 12 student at the college is selected at random.

b. Find the probability that the student studies Chemistry but not Biology or Physics. **(1)**

c. Find the probability that the student studies Chemistry or Physics or both. **(2)**

d. Determine whether studying Biology and studying Chemistry are statistically independent **(3)**

(Total marks: 11)

Total Marks for Paper: 45

Mark Scheme

1	8 boys	A1	
	12 girls	A1	
2a	$X \sim B(30, 0.25)$	B1	
	$P(X \leq 10) - P(X \leq 4) = 0.8943 - 0.0979$	M1	
	$= 0.7964$	A1	
2b	$H_0 : p = 0.25 \quad H_1 : p < 0.25$	B1: Both hypotheses correct, labelled H_0 or NH or H_a and H_1 or AH or H_a , must use p or $p(x)$ or π	B1
	$B(15, 0.25)$	M1: for using B(15, 0.25)	
	$P(X \leq 1) = 0.0802$	A1: awrt 0.0802 or CR $X \leq 1$ (allow $P(X \geq 2) = 0.9198$)	M1 A1
	NB: Allow M1 A1 for a correct CR with no incorrect working		
	Reject H_0 or Significant or 1 lies in the critical region	M1: A correct statement – do not allow contradictory non contextual statements. Follow through their Probability/CR (for 1 or 2 tail test). If no H_1 given then M0. Ignore their comparison. For a probability < 0.5 , statement must be correct compared to 0.1 for 1 tail test and 0.05 for 2 tailed test or if the probability > 0.5 , statement must be correct compared to 0.9 for 1 tail test and 0.95 for 2 tailed test.	dM1 A1cso
	There is evidence that the radio company's claim is true. Or The new transmitter will reduce the proportion of houses unable to receive radio	A1: cso (all previous marks awarded) and a correct statement containing the word company if writing about the claim or radio if full context.	
3a	Width = 4cm	B1	
	Area: $16\text{cm}^2 = 32$ offices	M1	
	Therefore, $h = 1.5\text{cm}$	A1	
3b	$45 + \frac{20}{25} \times 5$	M1	
	$= £49$	A1	
3c	$\frac{\sum fy}{90} = \frac{4420}{90}$	M1	
	$= £49.11$	A1	
3d	$\sqrt{\frac{226687.5}{90} - x^2}$	M1	
	$= £10.30$	A1	
3e	Mean \approx median so distribution is symmetric	B1	
3f	Symmetric so normal (Rika's) may be suitable	B1	
3g	$\frac{c-50}{10} = 0.8416$	M1	
	$c = 58.416$	A1	
4a	$a \left(1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} \right) = 1$	M1	

	$a = \frac{16}{31}$	A1
4b	$P(X = 1, 3, 5) = \frac{21}{31}$	B1
4c	$P(\text{sum odd}) = P(OE) + P(EO)$ $2 \times \frac{21}{31} \times (1 - \frac{21}{31})$	M1
	$= \frac{420}{961}$	A1
4d	$P(\text{Sum} > 8 \text{ and odd}) = P(\text{Sum} = 9)$ $P(4, 5) + P(5, 4)$ $= \frac{2}{31} \times \frac{1}{31} + \frac{1}{31} \times \frac{2}{31}$ $= \frac{4}{961}$	M1
	$= \frac{4}{961} \div \frac{420}{961}$	M1
	$= \frac{1}{105}$	A1
4e	$S_{\text{infinity}} = \frac{p}{1-0.5} = 1$	M1
	$P(X = 1) = 0.5$	A1

5a		B1 M1 A1 A1 B1
5b	$\frac{13}{80}$	B1
5c	$\frac{28+30-11}{80}$ $= \frac{47}{80}$	M1 A1
5d	$\frac{17+8+13}{47}$ $= \frac{38}{47}$	M1 A1
5e	$P(B \cap C) = P(B) \times P(C)$ $\frac{20}{80} \times \frac{28}{80} = \frac{7}{80}$	M1 M1
	From venn diagram, $P(B \cap C) = \frac{7}{80}$	
	Therefore they are independent.	A1