IYGB GCE

Mathematics FS2

Advanced Level

Practice Paper P

Difficulty Rating: 3.3667/1.5190

Time: 1 hour 30 minutes

Candidates may use any calculator allowed by the regulations of this examination.

Information for Candidates

This practice paper follows closely the Pearson Edexcel Syllabus, suitable for first assessment Summer 2018.

The standard booklet "Mathematical Formulae and Statistical Tables" may be used.
Full marks may be obtained for answers to ALL questions.
The marks for the parts of questions are shown in round brackets, e.g. **(2)**.
There are 7 questions in this question paper.
The total mark for this paper is 75.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.
Non exact answers should be given to an appropriate degree of accuracy.
The examiner may refuse to mark any parts of questions if deemed not to be legible.

Question 1

The table below shows the number of Maths teachers x, working in 8 different towns and the number of burglaries y, committed in a given month in the same 8 towns.

Town	A	B	C	D	E	F	G	H
x	37	40	21	50	32	27	39	40
y	30	28	20	35	34	27	31	26

a) **Calculate** the product moment correlation coefficient between the number of maths teachers and the number of burglaries. **(5)**

b) Interpret the value of the product moment correlation coefficient in the context of this question. **(1)**

c) Comment on the statement

"… the Maths teachers are likely to be responsible for the burglaries …" **(2)**

Question 2

A symmetrical 95% confidence interval for the population mean of a Normal variable, based on a sample of 100 observations, is $(150.66, 166.34)$.

Determine the mean and the standard deviation of the sample. **(6)**

Question 3

A pharmaceutical company spokesman claims that a certain pill contains 250 mg of active ingredient. Tests carried out on 120 tablets resulted in a sample mean of 249 mg, with a standard deviation of s mg.

If the pharmaceutical company's spokesman claim was just rejected at the 5% level of significance, find the largest possible value of s, correct to 2 decimal places. **(8)**

Question 4

An Examining Board claims that their 2 Mathematics papers had identical grade boundaries for achieving the top grade.

The head of Mathematics of a large school decides to test this claim by looking at a random sample of 10 students from this school, whose marks were in the region of the top grade.

The percentage marks in each of the 2 papers for these 10 students are shown below.

Student	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
Percentage mark in paper A	91	85	81	90	78	82	71	88	75	94
Percentage mark in paper B	85	86	82	80	80	83	72	84	70	90

Test, at the 10% level of significance, the Examining Board's claim.

State your hypotheses clearly. **(10)**

Question 5

The continuous random variables X and Y have the following distributions.

$$X \sim \mathrm{N}\left(100, 5^2\right) \quad \text{and} \quad Y \sim \mathrm{N}\left(90, 3^2\right).$$

Determine the value of ...

a) ... $\mathrm{P}\left(X + \sum_{i=1}^{3} Y_i \; > \; 390 \right)$. **(5)**

b) ... $\mathrm{P}\left(X + 3Y > 390\right)$. **(5)**

c) ... $\mathrm{P}\left(\left|X - Y\right| < 4\right)$. **(6)**

Question 6

The continuous random variable X has probability density function $f(x)$, given by

$$f(x)=\begin{cases} k(x-1)(x-4) & 1\le x\le 4 \\ 0 & \text{otherwise} \end{cases}$$

a) Show clearly that $k=-\frac{2}{9}$ **(4)**

b) Sketch the graph of $f(x)$, for all x. **(3)**

c) State the value of $\mathrm{E}(X)$. **(1)**

d) Calculate the $\mathrm{Var}(X)$. **(5)**

The cumulative distribution function of X, is denoted by $F(x)$.

e) Find and specify fully $F(x)$. **(4)**

f) Determine with justification the skewness of the distribution. **(1)**

Question 7

Clinical trials are carried out to determine the effect of a stimulant.

Ten volunteers were given different amounts of the stimulant, X milligrams, and the amount of their nightly sleep, Y hours, were recorded in the following night.

The following summary statistics were obtained.

$$\sum X = 900, \quad \sum Y = 78.4, \quad \sum X^2 = 114\,000, \quad \sum Y^2 = 616.18, \quad \sum XY = 6834$$

The following claims are made.

- Claim 1

  For every additional 60 milligrams of the stimulant, the nightly sleep typically reduces by 40 minutes.

- Claim 2

  The expected nightly sleep would have been 8 hours if no stimulant was taken.

Comment briefly on these two claims, **fully supported** by appropriate calculations. $(\mathbf{9})$