IYGB GCE

Mathematics FS2

Advanced Level

Practice Paper N

Difficulty Rating: 3.2667/1.4634

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 9 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 marks obtained by a group of students, in two separate tests.

Student	A	B	C	D	E	F	G	H
Test 1	27	38	17	29	41	42	32	9
Test 2	13	24	17	17	29	19	25	8

The first test is out of 50 marks while the second test is out of 30 marks.

Let x and y represent the marks obtained in Test 1 and Test 2, respectively.

The following summary statistics are given.

$$\sum x = 235,\ \sum x^2 = 7853,\ \sum y = 152,\ \sum y^2 = 3214,\ \sum xy = 4904.$$

a) Find, showing full workings, the value of the product moment correlation coefficient between x and y. **(4)**

b) Explain how the value of the product moment correlation coefficient between x and y will be affected if the individual test marks were converted into percentage marks. **(1)**

Question 2

A random sample of 12 observations, taken from a Normally distributed population of variance 250, is listed below.

$$120, 113, 109, 98, 79, 121, 140, 99, 110, 117, 85, 92.$$

Test at 10% level of significance whether there is evidence that the variance is greater than 250. **(7)**

Question 3

A continuous random variable X has the following cumulative distribution function $F(x)$, defined by

$$F(x)=\begin{cases} 0 & x<0 \\ \frac{1}{5}x^2\left(6-x^2\right) & 0\le x\le 1 \\ 1 & x>1 \end{cases}$$

a) Find $\mathrm{P}(X>0.5)$. **(2)**

b) Define $f(x)$, the probability density function of X, for all values of x. **(3)**

A skewness coefficient can be calculated by the formula

$$\frac{\text{mean}-\text{mode}}{\text{standard deviation}}.$$

c) Given that $\mathrm{E}(X)=\frac{16}{25}$ and $\mathrm{E}\left(X^2\right)=\frac{7}{15}$, evaluate the skewness coefficient for this distribution. **(7)**

Question 4

A nutritional researcher is investigating the effect of dieting literature in promoting weight loss in overweight individuals.

The weights of random sample of 9 subjects were recorded, then they were given the dieting literature, and their weights were recorded again 9 weeks later.

The results are shown below.

Subject	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Weight Before (kg)	95.2	96.0	100.2	88.2	91.7	85.0	74.3	83.7	87.0
Weight After (kg)	93.1	95.1	98.1	90.7	90.6	87.2	71.3	80.1	89.1

Test, at the 10% level of significance, whether there is evidence that the dieting literature has some effect in promoting weight loss. **(8)**

Question 5

The table below shows the marks obtained by a group of students, in two separate tests.

Student	A	B	C	D	E	F	G	H
Test 1	35	42	21	55	33	29	39	40
Test 2	30	28	21	38	35	27	30	k

Use linear regression for the test marks of the students A – G , to estimate the value of k , for student H.

Detailed workings are expected. **(7)**

Question 6

Olson has a rope which is 180 cm long. The tip of one of the two ends of the rope is dyed red. Olson cuts his rope at a random point so he now has two pieces.

The random variable X represents the length, in cm, of the piece of the rope whose tip is dyed red.

a) Determine the value of …

i. … $\mathrm{P}(X < 70)$. **(1)**

ii. … $\mathrm{E}(X)$. **(1)**

iii. … the standard deviation of X . **(3)**

b) Calculate the probability that the length of the **shorter** piece of the rope is less than 70 cm. **(2)**

Question 7

A car hire company washes their cars after being returned by clients.

The time it takes to wash a car, in minutes, is assumed to be a Normal variable with mean 14 and standard deviation of 4.

The time it takes to wash a van, in minutes, is also assumed to be a Normal variable with mean 20 and standard deviation of 6.

a) Determine the probability that the time it takes to wash the next van will be greater than the total time taken to wash the next 2 cars. **(6)**

b) Find the probability that the time it takes to wash the next van will more than twice the time taken to wash the next car. **(6)**

Question 8

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

$$f(x) \equiv \begin{cases} mx & 0 \le x \le 4 \\ k & 4 \le x \le 9 \\ 0 & \text{otherwise} \end{cases}$$

where m and k are positive constants.

Given that the graph of $f(x)$ consists of two straight lines meeting at $x = 4$, find as an exact simplified fraction the value of $\mathrm{E}(X)$. **(10)**

Question 9

A saw mill cut planks of wood whose lengths X m are such so that $X \sim \mathrm{N}(\mu, \sigma^2)$.

A random sample of these planks were chosen and a 95% confidence interval for μ was calculated to be $(5.85, 6.34)$.

Find the standard error for the mean and hence construct a 90% confidence interval for μ, based on the same sample. **(7)**
