# IYGB GCE

## Mathematics FS1

## Advanced Level

## Practice Paper M

Difficulty Rating: 3.2933/1.4778

## 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 8 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 masses of a particular variety of tomatoes, in grams, are assumed to be Normally distributed with mean $162$ and standard deviation $14$.

A random sample of $12$ tomatoes of this variety is selected.

Determine the probability that the mean mass of this sample will be between $160$ and $165$ grams. **(5)**

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**Question 2**

The discrete random variable $X$ has probability generating function

$$G_X(t) = k + \frac{1}{5}\left(t^2 + t^3 + t^5\right),$$

where $k$ is a positive constant.

**a)** State the value of $k$. **(1)**

**b)** Determine the value of $P(X > 4)$. **(3)**

**c)** Use $G_X(t)$ to calculate the mean and variance of $X$. **(5)**

*No credit will be given if the mean and variance of $X$ are obtained from calculations based on the probability mass function of $X$.*

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**Question 3**

A discrete random variable $X$ has negative binomial distribution, with $E(X) = 12$ and $Var(X) = 4$.

Determine the value of $P(X = 12)$. **(7)**

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**Question 4**

The discrete random variable $X$ has binomial distribution.

A random sample of $25$ observations of $X$ is used to test the hypotheses

$$\mathrm{H}_0 : \ p = 0.25 \qquad \text{against} \qquad \mathrm{H}_1 : p > 0.25,$$

at the $5\%$ level of significance.

**a)** Find size of the test. **(3)**

**b)** Given further that $p = 0.45$ determine the power of the test. **(3)**

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**Question 5**

The Dean of a faculty at a London University believes that the gender is independent of the class of the degree achieved.

A random sample of 240 male students and 80 female students were examined and the **percentages for each gender** are summarized in the table below.

| | **First Class** | **Second Upper** | **Second Lower or less** |
|---|---|---|---|
| **Male** | 22.5% | 35% | 42.5% |
| **Female** | 20% | 42.5% | 37.5% |

Use a $\chi^2$ test, at the 10% level of significance, to investigate whether there is evidence to support the Dean's claim. **(11)**

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**Question 6**

Two standard fair cubical dice, numbered 1 to 6 are such rolled and the random variable $X$ represents the sum of the scores of the two dice.

Determine the value of $\mathrm{Var}(X)$. **(7)**

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**Question 7**

It is known that during the first hour of trading, customers arrive at a garden centre at the rate of 3 customers every 10 minutes.

**a)** State two conditions, so that a Poisson distribution could be used to model the number of arrivals in the garden centre. **(2)**

**b)** State one reason as to why the Poisson model might not be suitable. **(1)**

Using a suitable Poisson model, and ignoring the answer to part **(b)**, determine the probability that...

**c)** … exactly 4 customers arrive in the first 10 minutes of trading. **(2)**

**d)** … exactly 8 customers arrive in the first 20 minutes of trading. **(2)**

**e)** … exactly 4 customers arrive in the first 10 minutes of trading and a further 4 customers arrive in the next 10 minutes. **(2)**

**f)** … the **first** customer will arrive 7 minutes after opening. **(2)**

The first hour after opening is subdivided into 6 equal 10 minute intervals.

Calculate the probability that...

**g)** … exactly 4 customers arrive in **none** of these 10 minute intervals. **(2)**

**h)** … there will be a **single** 10 minute interval, where **no** customers arrive to the garden centre. **(4)**

The garden centre claims that 98% of its seeds will germinate. It was found that in a random sample of 125 seeds, 117 seeds germinated.

**i)** Use a suitable approximation, to test at the 1% level of significance, whether the garden centre overstates thr germination proportion of its seeds. You must state your hypotheses clearly in this part. **(7)**

**Question 8**

Two cricket players, Markus and Dean, decide to throw balls at a wicket, in alternate fashion, starting with Markus. The winner is the player who is first to hit the wicket.

The probability that Markus hits the wicket is $0.2$ for any of his throws.

The probability that Dean hits the wicket is $p$ for any of his throws.

If Markus throws first, the probability he wins the game is $\frac{5}{13}$.

Determine the value of $p$. **(6)**