# 4.8 Binomial distribution\_P\_1

**1a.** *[2 marks]*

Mr Burke teaches a mathematics class with 15 students. In this class there are 6 female students and 9 male students.

Each day Mr Burke randomly chooses one student to answer a homework question.

In the first month, Mr Burke will teach his class 20 times.

Find the probability he will choose a female student 8 times.

**1b.** *[4 marks]*

The Head of Year, Mrs Smith, decides to select a student at random from the year group to read the notices in assembly. There are 80 students in total in the year group. Mrs Smith calculates the probability of picking a male student 8 times in the first 20 assemblies is 0.153357 correct to 6 decimal places.

Find the number of male students in the year group.

**2a.** *[2 marks]*

The function  is defined by  where .

Find the remainder when  is divided by .

**2b.** *[1 mark]*

Find the remainder when  is divided by .

**2c.** *[4 marks]*

Prove that  has only one real zero.

**2d.** *[2 marks]*

Write down the transformation that will transform the graph of  onto the graph of .

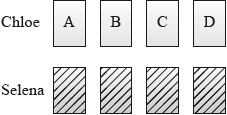
**2e.** *[6 marks]*

The random variable  follows a Poisson distribution with a mean of  and .

Find the value of .

**3a.** *[6 marks]*

Chloe and Selena play a game where each have four cards showing capital letters A, B, C and D.  
Chloe lays her cards face up on the table in order A, B, C, D as shown in the following diagram.



Selena shuffles her cards and lays them face down on the table. She then turns them over one by one to see if her card matches with Chloe’s card directly above.  
Chloe wins if **no** matches occur; otherwise Selena wins.

Show that the probability that Chloe wins the game is .

**3b.** *[3 marks]*

Chloe and Selena repeat their game so that they play a total of 50 times.  
Suppose the discrete random variable *X* represents the number of times Chloe wins.

Determine the mean of *X*.

**3c.** *[2 marks]*

Determine the variance of *X*.

**4a.** *[3 marks]*

The random variable  has the Poisson distribution . Given that , find the value of  in the form  where  is an integer.

**4b.** *[4 marks]*

The random variable  has the Poisson distribution . Find  in the form  where  and  are integers.

**5a.** *[2 marks]*

A biased coin is tossed five times. The probability of obtaining a head in any one throw is .

Let  be the number of heads obtained.

Find, in terms of , an expression for .

**5b.** *[6 marks]*

(i)     Determine the value of  for which  is a maximum.

(ii)     For this value of , determine the expected number of heads.

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