**1** The discrete random variable *X* has probability function



where *k* is a positive constant.

**a** Show that **(3 marks)**

**b** Find the probability distribution of *X*. **(2 marks)**

**2** The discrete random variable *X* has probability function



Find

**a** ** **(2 marks)**

**b** P(–1 ⩽*X* < 2) **(1 mark)**

**c** P(*X >* −2.3) **(1 mark)**

**3** The discrete random variable *X* has probability function



where *k* is a positive constant.

**a** Show that *k* = 0.25 **(2 marks)**

Two independent observations *X*1 and *X*2 are made of *X*.

**b** Show that P(*X*1 + *X*2 = 5) = 0 **(1 mark)**

**c** Find the complete probability function for *X*1 + *X*2. **(3 marks)**

**d** Find P(1.3 ⩽*X*1 + *X*2⩽ 3.2) **(2 marks)**

**4** Amir and Ed play each other at badminton and for each game, independently of all others, the probability that Amir loses is 0.2

 Find the probability that, in 9 games, Amir loses:

**a** exactly 3 of the games, **(2 marks)**

**b** fewer than half of the games. **(2 marks)**

**5** A manufacturer supplies MP3 players to retailers in batches of 20, which are randomly selected. Long-term analysis shows that 5% of the players are faulty.

**a** Write down a suitable model for the distribution of the number of faulty MP3 players in a batch giving the value(s) of any parameter(s). **(2 marks)**

**b** Find the probability that a batch contains no faulty MP3 players. **(2 marks)**

**c** Show that the probability of there being more than 4 faulty MP3 players in a batch is equal to 0.0026 to 2 significant figures. **(2 marks)**

**6** Emma throws a fair coin 15 times and records the number of times it shows a head.

**a** State the appropriate distribution to model the number of times the coin shows a head giving any relevant parameter values. **(2 marks)**

**b** Find the probability that Emma records:

**i** exactly 8 heads **(2 marks)**

**ii** at least 4 heads. **(2 marks)**

**7** A manufacturer produces large quantities of coloured plates. It is known from previous records that 6% of the production will be blue.

A random sample of 10 plates was taken from the production line.

**a** Give the name of a suitable distribution to model the number of blue plates in this sample and state why it is suitable. **(2 marks)**

**b** Find the probability that there were more than 2 blue plates in the sample. **(3 marks)**

**8 a** Write down the conditions under which the binomial distribution may be a suitable model to use in statistical work. **(4 marks)**

A six-sided die is biased. When the die is thrown the number 5 is twice as likely to appear as any other number. All the other faces are equally likely to appear. The die is rolled repeatedly.

**b** Find the probability that:

**i** the first 5 will occur on the sixth throw **(5 marks)**

**ii** in the first eight throws there will be exactly three 5s. **(3 marks)**