**1** Geovani has to pass an entrance examination to get into cookery school. He can take the examination as many times as he likes. The probability of him passing on any one attempt is 0.35

**a** Find the probability that

**i** he passes on the fourth attempt **(2 marks)**

**ii** he takes at least five attempts to pass. **(2 marks)**

**b** State two assumptions that you have used in your model. **(2 marks)**

**2** Steve is a keen fisherman. The probability that he catches a fish each time he casts his line is 0.2. *X* represents the number of times he casts his line before catching a fish.

**a** State the distribution that can be used to model *X* **(1 marks)**

Using the model in part **a**,

**b** find

**i** the probability that Steve catches his first fish on his third attempt **(2 marks)**

**ii** the expected number of attempts he makes to catch his first fish. **(2 marks)**

**c** Show that the standard deviation of the number of attempts it takes Steve to catch a fish is  **(2 marks)**

Once Steve has caught a fish, he tries to catch a second fish.

**d** Find the probability that he caught the first fish on the third attempt and a second fish on the sixth attempt. **(2 marks)**

**3** Felicia is an archer. The probability that she hits the bullseye with each arrow is 0.7. She shoots arrows until she hits the bullseye six times and the random variable *Y* is the number of arrows she needs to shoot.

**a** State a suitable distribution to model *Y* and state clearly the parameters used. **(2 marks)**

**b** State two conditions that are necessary for the model suggested in part **a** to be valid. **(2 marks)**

**c** Find the probability that

**i** it takes her nine attempts to score six bullseyes **(2 marks)**

**ii** it takes her nine attempts to score six bullseyes, given that she hits a bullseye on her first attempt. **(3 marks)**

**4** Kajol is trying to solve puzzles in a computer game. The probability that she solves each puzzle is 0.6. The random variable *X* represents the number of attempts she needs before she has solved five puzzles.

**a** State a suitable distribution to model *X* and state one assumption that has to be made for the model to be valid. **(2 marks)**

**b** Find the probability that it takes Kajol 10 attempts to solve five puzzles. **(2 marks)**

**c** Find the mean number of attempts needed. **(2 marks)**

**d** Show that the standard deviation of the number of attempts needed is  **(2 marks)**

**5** Iona selects coins at random from a large bag that contains 200 mixed silver coins. She notes the value of the coin and replaces it. She continues to select coins until she has chosen a 10 pence piece *r* times. She models the situation using a negative binomial distribution and the random variable *X* represents the total number of times she selects a coin.

**a** Suggest that the mean and the variance of *X* are 12 and 36 respectively, calculate

**i** the number of 10 pence pieces in the bag. **(5 marks)**

**ii** the value of *r* **(1 mark)**

Phillip says that Iona’s model is not suitable.

**b** Give a reason why Phillip says this. **(1 mark)**

**6** Robbie is playing a game called ‘Whack-a-mole’. The probability that he whacks a mole on any one attempt is 0.55

**a** Show that the probability that Robbie whacks his first mole on his second attempt is 0.2475 **(2 marks)**

**b** Find the probability that he

**i** whacks his fourth mole on his seventh attempt. **(2 marks)**

**ii** whacks his eighth mole on his 12th attempt, given that he whacks two moles in his first three attempts. **(3 marks)**

**c** Find the expected number of attempts Robbie needs to whack four moles. **(1 mark)**

**d** Show that the standard deviation of the number of attempts needed to whack four moles is  **(2 marks)**

**e** Give one reason why the models used in parts **a** to **d** might not be suitable. **(1 mark)**