1 A fair six-sided die, with faces marked 1, 2, 3, 4, 5, 6, is thrown repeatedly until a 4 is obtained.

(a) Find the probability that obtaining a 4 requires fewer than 6 throws. [2]

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On another occasion, the die is thrown 10 times.

(b) Find the probability that a 4 is obtained at least 3 times. [3]

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3 Kayla is competing in a throwing event. A throw is counted as a success if the distance achieved is greater than 30 metres. The probability that Kayla will achieve a success on any throw is 0.25.

(a) Find the probability that Kayla takes more than 6 throws to achieve a success. [2]

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(b) Find the probability that, for a random sample of 10 throws, Kayla achieves at least 3 successes. [3]

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2 An ordinary fair die is thrown until a 6 is obtained.

(a) Find the probability that obtaining a 6 takes more than 8 throws. [2]

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Two ordinary fair dice are thrown together until a pair of 6s is obtained. The number of throws taken is denoted by the random variable X.

(b) Find the expected value of X. [1]

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(c) Find the probability that obtaining a pair of 6s takes either 10 or 11 throws. [2]

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2 Hazeem repeatedly throws two ordinary fair 6-sided dice at the same time. On each occasion, the score is the sum of the two numbers that she obtains.

(a) Find the probability that it takes exactly 5 throws of the two dice for Hazeem to obtain a score of 8 or more. [2]

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(b) Find the probability that it takes no more than 4 throws of the two dice for Hazeem to obtain a score of 8 or more. [2]

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(c) For 8 randomly chosen throws of the two dice, find the probability that Hazeem obtains a score of 8 or more on fewer than 3 occasions. [3]

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2 George has a fair 5-sided spinner with sides labelled 1, 2, 3, 4, 5. He spins the spinner and notes the number on the side on which the spinner lands.

(a) Find the probability that it takes fewer than 7 spins for George to obtain a 5. [2]

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George spins the spinner 10 times.

(b) Find the probability that he obtains a 5 more than 4 times but fewer than 8 times. [3]

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1   The 40 members of a club include Ranuf and Saed. All 40 members will travel to a concert. 35 members will travel in a coach and the other 5 will travel in a car. Ranuf will be in the coach and Saed will be in the car.

In how many ways can the members who will travel in the coach be chosen?   [3]

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2   An ordinary fair die is thrown repeatedly until a 1 or a 6 is obtained.

(a)   Find the probability that it takes at least 3 throws but no more than 5 throws to obtain a 1 or a 6.
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On another occasion, this die is thrown 3 times. The random variable X is the number of times that a 1 or a 6 is obtained.

(b) Draw up the probability distribution table for X. [3]

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(c) Find E(X). [2]

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5 In a certain region, the probability that any given day in October is wet is 0.16, independently of other days.

    (a) Find the probability that, in a 10-day period in October, fewer than 3 days will be wet. [3]

    (b) Find the probability that the first wet day in October is 8 October. [2]

    (c) For 4 randomly chosen years, find the probability that in exactly 1 of these years the first wet day in October is 8 October. [2]

4 Ramesh throws an ordinary fair 6-sided die.

(a) Find the probability that he obtains a 4 for the first time on his 8th throw. [1]

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(b) Find the probability that it takes no more than 5 throws for Ramesh to obtain a 4. [2]

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Ramesh now repeatedly throws two ordinary fair 6-sided dice at the same time. Each time he adds the two numbers that he obtains.

(c) For 10 randomly chosen throws of the two dice, find the probability that Ramesh obtains a total of less than 4 on at least three throws. [4]

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1 The score when two fair six-sided dice are thrown is the sum of the two numbers on the upper faces.

(a) Show that the probability that the score is 4 is $\frac{1}{12}$. [1]

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The two dice are thrown repeatedly until a score of 4 is obtained. The number of throws taken is denoted by the random variable X.

(b) Find the mean of X. [1]

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(c) Find the probability that a score of 4 is first obtained on the 6th throw. [1]

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(d) Find P($X < 8$). [2]

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6 In a game, Jim throws three darts at a board. This is called a 'turn'. The centre of the board is called the bull's-eye.

The random variable X is the number of darts in a turn that hit the bull's-eye. The probability distribution of X is given in the following table.

x	0	1	2	3
P($X = x$)	0.6	p	q	0.05

It is given that E(X) = 0.55.

(a) Find the values of p and q. [4]

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(b) Find Var(X). [2]

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Jim is practising for a competition and he repeatedly throws three darts at the board.

(c) Find the probability that $X = 1$ in at least 3 of 12 randomly chosen turns. [3]

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(d) Find the probability that Jim first succeeds in hitting the bull's-eye with all three darts on his 9th turn. [1]

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4 A fair 5-sided spinner has sides labelled 1, 2, 3, 4, 5. The spinner is spun repeatedly until a 2 is obtained on the side on which the spinner lands. The random variable X denotes the number of spins required.

(a) Find P($X = 4$). [1]

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(b) Find P($X < 6$). [2]

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Two fair 5-sided spinners, each with sides labelled 1, 2, 3, 4, 5, are spun at the same time. If the numbers obtained are equal, the score is 0. Otherwise, the score is the higher number minus the lower number.

(c) Find the probability that the score is greater than 0 given that the score is **not** equal to 2. [3]

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The two spinners are spun at the same time repeatedly .

(d) For 9 randomly chosen spins of the two spinners, find the probability that the score is greater than 2 on at least 3 occasions. [3]

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4   Jacob has four coins. One of the coins is biased such that when it is thrown the probability of obtaining a head is $\frac{7}{10}$. The other three coins are fair. Jacob throws all four coins once. The number of heads that he obtains is denoted by the random variable X. The probability distribution table for X is as follows.

x	0	1	2	3	4
$P(X = x)$	$\frac{3}{80}$	a	b	c	$\frac{7}{80}$

(a)   Show that $a = \frac{1}{5}$ and find the values of b and c.   [4]

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(b)   Find $E(X)$.   [1]

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Jacob throws all four coins together 10 times.

(c) Find the probability that he obtains exactly one head on fewer than 3 occasions. [3]

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(d) Find the probability that Jacob obtains exactly one head for the first time on the 7th or 8th time that he throws the 4 coins. [2]

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3 80% of the residents of Kinwawa are in favour of a leisure centre being built in the town.

20 residents of Kinwawa are chosen at random and asked, in turn, whether they are in favour of the leisure centre.

(a) Find the probability that more than 17 of these residents are in favour of the leisure centre.   [3]

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(b) Find the probability that the 5th person asked is the first person who is **not** in favour of the leisure centre. [1]

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(c) Find the probability that the 7th person asked is the second person who is **not** in favour of the leisure centre. [2]

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