

## AS Mathematics Exam Questions by Topic Chapter 17: The binomial distribution

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These questions are taken from the Specimen Exam materials and the real 2018 papers for the new syllabus AS and A-level mathematics courses and arranged by chapter of the textbooks by Goldie et al (available here: <https://amzn.to/39umfr5> and <https://amzn.to/3hE8kBL> ). There are a mixture of questions from OCR A, OCR B (MEI), Edexcel and AQA. Although the style of questions varies a little across the exam boards the content of the syllabus is almost identical so these are suitable for students preparing for any exam board.

Free problem sets for all other chapters, as well as video solutions, full past papers and other content for GCSE and A-level maths can be found at:

<https://mathsaurus.com/>

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### AQA 2018 Paper 3 Question 15:

- 15** Abu visits his local hardware store to buy six light bulbs.  
He knows that 15% of all bulbs at this store are faulty.
- 15 (a)** State a distribution which can be used to model the number of faulty bulbs he buys. **[1 mark]**
- 15 (b)** Find the probability that all of the bulbs he buys are faulty. **[1 mark]**
- 15 (c)** Find the probability that at least two of the bulbs he buys are faulty. **[2 marks]**
- 15 (d)** Find the mean of the distribution stated in part (a). **[1 mark]**
- 15 (e)** State two necessary assumptions in context so that the distribution stated in part (a) is valid. **[2 marks]**
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OCR B MEI Sample Paper 2 Question 5:

- 5 In a particular country, 8% of the population has blue eyes. Find the probability that, in a random sample of 20 people, exactly two have blue eyes. [2]

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AQA AS 2018 Paper 2 Question 15:

- 15 Nicola, a darts player, is practising hitting the bullseye. She knows from previous experience that she has a probability of 0.3 of hitting the bullseye with each dart.
- Nicola throws eight practice darts.
- 15 (a) Using a binomial distribution, calculate the probability that she will hit the bullseye three or more times. [2 marks]
- 15 (b) Nicola throws eight practice darts on three different occasions. Calculate the probability that she will hit the bullseye three or more times on all three occasions. [2 marks]
- 15 (c) State two assumptions that are necessary for the distribution you have used in part (a) to be valid. [2 marks]

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AQA Sample Paper 3 Question 9:

- 9 A survey has found that, of the 2400 households in Growmore, 1680 eat home-grown fruit and vegetables.
- 9 (a) Using the binomial distribution, find the probability that, out of a random sample of 25 households in Growmore, exactly 22 eat home-grown fruit and vegetables. [2 marks]
- 9 (b) Give a reason why you would **not** expect your calculation in part (a) to be valid for the 25 households in Gifford Terrace, a residential road in Growmore. [1 mark]
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Edexcel 2018 Paper 3 Question 3:

3. In an experiment a group of children each repeatedly throw a dart at a target. For each child, the random variable  $H$  represents the number of times the dart hits the target in the first 10 throws.

Peta models  $H$  as  $B(10, 0.1)$

- (a) State two assumptions Peta needs to make to use her model. (2)

- (b) Using Peta's model, find  $P(H \geq 4)$  (1)

For each child the random variable  $F$  represents the number of the throw on which the dart first hits the target.

Using Peta's assumptions about this experiment,

- (c) find  $P(F = 5)$  (2)

Thomas assumes that in this experiment no child will need more than 10 throws for the dart to hit the target for the first time. He models  $P(F = n)$  as

$$P(F = n) = 0.01 + (n - 1) \times \alpha$$

where  $\alpha$  is a constant.

- (d) Find the value of  $\alpha$  (4)

- (e) Using Thomas' model, find  $P(F = 5)$  (1)

- (f) Explain how Peta's and Thomas' models differ in describing the probability that a dart hits the target in this experiment. (1)

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OCR B MEI 2018 Paper 2 Question 8:

- 8 Every morning before breakfast Laura and Mike play a game of chess. The probability that Laura wins is 0.7. The outcome of any particular game is independent of the outcome of other games. Calculate the probability that, in the next 20 games,

- (i) Laura wins exactly 14 games, [2]

- (ii) Laura wins at least 14 games. [2]
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Edexcel AS 2018 Paper 2 Question 5:

5. A biased spinner can only land on one of the numbers 1, 2, 3 or 4. The random variable  $X$  represents the number that the spinner lands on after a single spin and  $P(X = r) = P(X = r + 2)$  for  $r = 1, 2$

Given that  $P(X = 2) = 0.35$

- (a) find the complete probability distribution of  $X$ . (2)

Ambroh spins the spinner 60 times.

- (b) Find the probability that more than half of the spins land on the number 4  
Give your answer to 3 significant figures. (3)

The random variable  $Y = \frac{12}{X}$

- (c) Find  $P(Y - X \leq 4)$  (3)

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OCR A AS 2018 Paper 1 Question 11:

- 11 The probability that Janice sees a kingfisher on any particular day is 0.3. She notes the number,  $X$ , of days in a week on which she sees a kingfisher.

- (i) State one necessary condition for  $X$  to have a binomial distribution. [1]

Assume now that  $X$  has a binomial distribution.

- (ii) Find the probability that, in a week, Janice sees a kingfisher on exactly 2 days. [1]

Each week Janice notes the number of days on which she sees a kingfisher.

- (iii) Find the probability that Janice sees a kingfisher on exactly 2 days in a week during at least 4 of 6 randomly chosen weeks. [3]

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OCR A AS Sample Paper 1 Question 10:

- 10 (i) Write down and simplify the first four terms in the expansion of  $(x + y)^7$ , in ascending powers of  $x$ . [2]

- (ii) Given that the terms in  $x^2y^5$  and  $x^3y^4$  in this expansion are equal, find the value of  $\frac{x}{y}$ . [2]

- (iii) A hospital consultant has seven appointments every day. The number of these appointments which start late on a randomly chosen day is denoted by  $L$ . The variable  $L$  is modelled by the distribution  $B\left(7, \frac{3}{8}\right)$ . Show that, in this model, the hospital consultant is equally likely to have two appointments start late or three appointments start late. [3]