Binomial probability problems

Grade 9 | Higher | 5 questions, 21 marks

GCSE Statistics topic practice

Name: _____ **Date:** _____ **Score:** _____ **/ 21**

1 Farah catches a train to work on 3 mornings. She models the number of mornings on which her train is late with a binomial distribution. The probability that the train is late on any morning is 0.2

You may use $(p + q)^3 = p^3 + 3p^2q + 3pq^2 + q^3$

a. Work out the probability that the train is late on exactly one of the 3 mornings. (2)

b. Write down one assumption Farah has made by using a binomial distribution. (1)

(3 marks)

2 A quiz has 4 multiple choice questions. Each question has 3 possible answers and only one of them is correct. Tomasz guesses the answer to every question. The table shows the probability distribution of the number of questions he gets correct.

Number correct	0	1	2	3	4
Probability	$\frac{16}{81}$	$\frac{32}{81}$		$\frac{8}{81}$	

You may use $(p + q)^4 = p^4 + 4p^3q + 6p^2q^2 + 4pq^3 + q^4$

a. Complete the table. (2)

b. To pass the quiz Tomasz needs at least 3 correct answers. Work out the probability that he passes. (1)

c. 162 students each guess the answer to every question. Work out an estimate for the number of these students who pass. (1)

(4 marks)

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3 A factory makes light bulbs and sells them in packs of 4. Each bulb works with probability p, independently of the other bulbs. The probability that all 4 bulbs in a pack work is 0.6561

You may use $(p + q)^4 = p^4 + 4p^3q + 6p^2q^2 + 4pq^3 + q^4$

a. Show that $p = 0.9$ (1)

b. Work out the probability that a pack has at most one faulty bulb. (2)

c. A shop buys 500 packs. Work out an estimate for the number of these packs with two or more faulty bulbs. (1)

(4 marks)

4 A garden centre sells sunflower seeds in trays of 5. Each seed germinates with probability 0.8. The number of seeds that germinate in a tray is modelled with a binomial distribution.

You may use $(p + q)^5 = p^5 + 5p^4q + 10p^3q^2 + 10p^2q^3 + 5pq^4 + q^5$

a. Work out the probability that exactly 4 of the seeds in a tray germinate. (2)

b. Work out the probability that at least 4 of the seeds in a tray germinate. Give your answer correct to 3 decimal places. (2)

c. The 5 seeds in a tray share the same soil and are watered together. Explain why a binomial distribution may not be a suitable model. (1)

(5 marks)

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5 Mei shoots 3 arrows at a target. Each arrow hits the target with probability p, independently of the other arrows. The probability that at least one of the 3 arrows hits the target is 0.973

You may use $(p + q)^3 = p^3 + 3p^2q + 3pq^2 + q^3$

a. Show that $p = 0.7$ (2)

b. Work out the probability that exactly 2 of the 3 arrows hit the target. (2)

c. Mei says, "The most likely result is that all 3 arrows hit the target." Is Mei right? Give a reason for your answer. (1)

(5 marks)

End of questions | Total 21 marks

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