Classwork Challenge: Binomial Probabilities (Set 3)

Pearson Edexcel International A Level Statistics 2

Instructions: Answer all questions, showing clear working where appropriate. You may use a calculator. These questions are based on calculating specific probabilities within a binomial distribution.

1. **Direct Application of the Binomial Probability Formula** A random variable X follows a binomial distribution $X \sim B(15, 0.2)$.
   (a) Write down the binomial probability formula for $P(X = x)$.
   (b) Using the formula, calculate $P(X = 3)$, giving your answer to 4 decimal places.

2. **Real-World Scenario: Quality Control** In a manufacturing process, it is known that 8% of items produced are defective. A quality control inspector randomly selects a sample of 12 items.
   (a) Define a suitable binomial distribution to model the number of defective items in the sample, stating its parameters.
   (b) Calculate the probability that exactly 1 item in the sample is defective, giving your answer to 4 decimal places.

3. **Real-World Scenario: Customer Preferences** A survey indicates that 60% of customers prefer product A over product B. If 10 customers are randomly selected, let C be the number of customers who prefer product A.
   (a) Find the probability that exactly 7 of the selected customers prefer product A.
   (b) Find the probability that exactly 3 of the selected customers do *not* prefer product A.

4. **Probability for a Specific Number of Successes and Failures** An unbiased coin is tossed 8 times. Let H be the number of heads obtained.
   (a) Calculate the probability of obtaining exactly 5 heads.
   (b) Calculate the probability of obtaining exactly 3 tails.

5. **Binomial Probability with Different Parameters** A student is taking a multiple-choice quiz with 10 questions. Each question has 5 possible answers, only one of which is correct. The student answers all questions randomly.
   (a) What is the probability that the student answers exactly 4 questions correctly? Give your answer to 4 decimal places.
   (b) What is the probability that the student answers exactly 6 questions incorrectly? Give your answer to 4 decimal places.