ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- a 12 page answer book;
- a Formula Booklet;
- a calculator;
- statistical tables (Murdoch and Barnes or RND/WJEC Publications).

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Answer **all** questions.

Sufficient working must be shown to demonstrate the **mathematical** method employed.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

1. The events *A* and *B* are such that

$$P(A) = 0{\cdot}3, \ P(B) = 0{\cdot}4, \ P(A \cup B) = 0{\cdot}5.$$

   (a) Determine whether or not *A* and *B* are independent. [3]

   (b) Evaluate $P(A|B')$. [3]

2. The random variable X has the binomial distribution $B(n, p)$. Given that the mean and the standard deviation of X are both equal to 0·9, find the value of n and the value of p. [5]

3. A bag contains 9 coloured balls, of which 3 are red, 3 are blue and 3 are yellow. Huw selects 3 of these balls at random, without replacement. Calculate the probability that he selects

   (a) 1 ball of each colour, [3]

   (b) 2 balls of the same colour and 1 ball of a different colour. [4]

4. In a junior football match, it may be assumed that the number of goals scored in any interval of length t minutes has a Poisson distribution with mean $0{\cdot}1t$.
   Without the use of tables, find the probability that the number of goals scored in the first 15 minutes of play is

   (a) 2, [3]

   (b) more than 2. [3]

5. A zoologist is studying a certain breed of dog.

   (a) He knows from past experience that the probability of a newly born puppy being female is 0·55. He selects a random sample of 20 newly born puppies. Calculate the probability that the number of females in the sample is

   (i) exactly 12,

   (ii) between 8 and 16 (both inclusive). [8]

   (b) The probability of a newly born puppy being yellow is 0·05. Use an approximating distribution to find the probability that less than 5 out of a random sample of 60 newly born puppies are yellow. [3]

6. A purse contains three fair coins and one double-headed coin. A coin is selected at random from the purse and tossed.

(a) Find the probability that a head is obtained. [3]

(b) Given that a head is obtained,

(i) determine the probability that the double-headed coin was selected,

(ii) find the probability that a head will be obtained if the selected coin is tossed a second time. [6]

7. The probability distribution of the discrete random variable X is given by

x	1	2	3	4	5
$P(X = x)$	0·1	0·3	θ	0·2	0·4 − θ

(a) State the range of possible values of the constant θ. [1]

(b) State the range of possible values of $E(X)$. [3]

(c) Given that Var(X) = 1·5, determine the value of θ. [8]

8. Ann and Brenda each have a calculator which can generate a single digit random number from the set {1, 2, 3, 4, 5, 6, 7, 8}. They each generate a random number on their calculator.

(a) Find the probability that the two numbers are equal. [2]

(b) Find the probability that the sum of the two numbers is 12. [3]

(c) Given that the sum of the two numbers is 12, find the probability that the two numbers are equal. [2]

9. The continuous random variable X has cumulative distribution function F given by

$$F(x) = 0 \qquad \text{for } x < 0,$$
$$F(x) = 2x^3 - x^6 \qquad \text{for } 0 \leqslant x \leqslant 1,$$
$$F(x) = 1 \qquad \text{for } x > 1.$$

(a) (i) Determine $P(0{\cdot}4 \leqslant X \leqslant 0{\cdot}6)$.

(ii) Find the median of X. [6]

(b) (i) Find an expression for $f(x)$, valid for $0 \leqslant x \leqslant 1$, where f denotes the probability density function of X.

(ii) Calculate $E(X^3)$. [6]

END OF PAPER