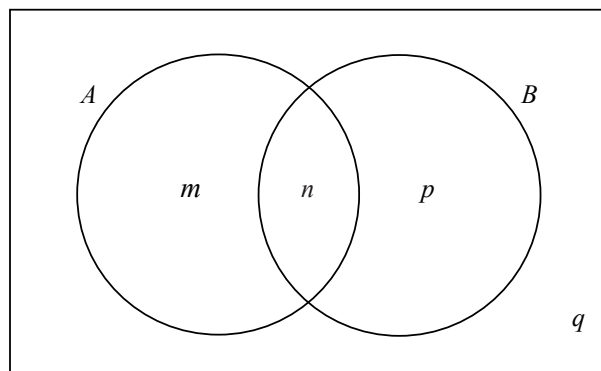**2.**   *[Maximum mark: 6]*

The Venn diagram below shows events A and B where $P(A) = 0.3$, $P(A \cup B) = 0.6$ and $P(A \cap B) = 0.1$. The values m, n, p and q are probabilities.

(a)   (i)   Write down the value of n.

    (ii)   Find the value of m, of p, and of q.   *[4 marks]*

(b)   Find $P(B')$.   *[2 marks]*

Turn over

*Do **NOT** write on this page.*

9. *[Maximum mark: 14]*

José travels to school on a bus. On any day, the probability that José will miss the bus is $\frac{1}{3}$.
If he misses his bus, the probability that he will be late for school is $\frac{7}{8}$.
If he does not miss his bus, the probability that he will be late is $\frac{3}{8}$.
Let E be the event "he misses his bus" and F the event "he is late for school".
The information above is shown on the following tree diagram.
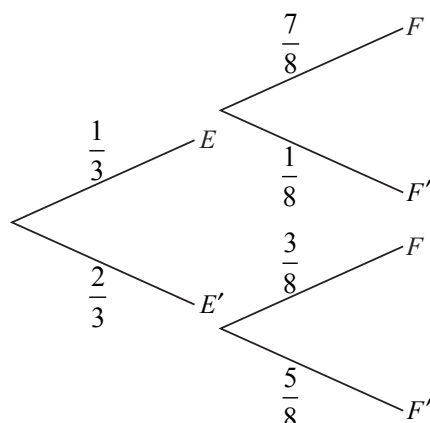
(a) Find

   (i) $P(E \cap F)$;

   (ii) $P(F)$. *[4 marks]*

(b) Find the probability that

   (i)   José misses his bus and is not late for school;

   (ii)   José missed his bus, given that he is late for school. *[5 marks]*

The cost for each day that José catches the bus is 3 euros. José goes to school on Monday and Tuesday.

(c) **Copy** and complete the probability distribution table. *[3 marks]*

X (cost in euros)	0	3	6
$P(X)$	$\frac{1}{9}$		

(d) Find the expected cost for José for both days. *[2 marks]*

4. *[Maximum mark: 7]*

The probability distribution of a discrete random variable X is given by

$$P(X = x) = \frac{x^2}{14}, \ x \in \{1,\, 2,\, k\}, \text{ where } k > 0.$$

(a) Write down $P(X = 2)$.   *[1 mark]*

(b) Show that $k = 3$.   *[4 marks]*

(c) Find $E(X)$.   *[2 marks]*

Turn over

5. *[Maximum mark: 6]*

Consider the events A and B, where $P(A) = 0.5$, $P(B) = 0.7$ and $P(A \cap B) = 0.3$.

The Venn diagram below shows the events A and B, and the probabilities p, q and r.
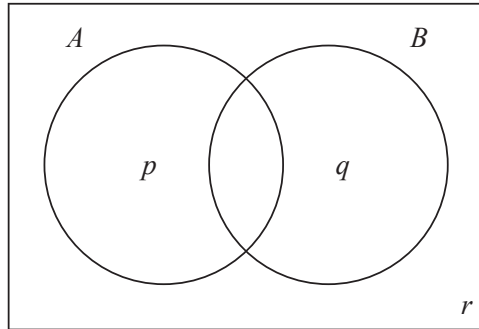
(a)   Write down the value of

   (i) p;

   (ii) q;

   (iii) r.   *[3 marks]*

(b)   Find the value of $P(A \mid B')$.   *[2 marks]*

(c)   Hence, or otherwise, show that the events A and B are **not** independent.   *[1 mark]*

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Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

SECTION A

*Answer **all** questions in the boxes provided. Working may be continued below the lines if necessary.*

1.   *[Maximum mark: 7]*

The ages of people attending a music concert are given in the table below.

Age	$15 \le x < 19$	$19 \le x < 23$	$23 \le x < 27$	$27 \le x < 31$	$31 \le x < 35$
Frequency	14	26	52	52	16
Cumulative Frequency	14	40	92	p	160

(a)   Find p.   *[2 marks]*

The cumulative frequency diagram is given below.
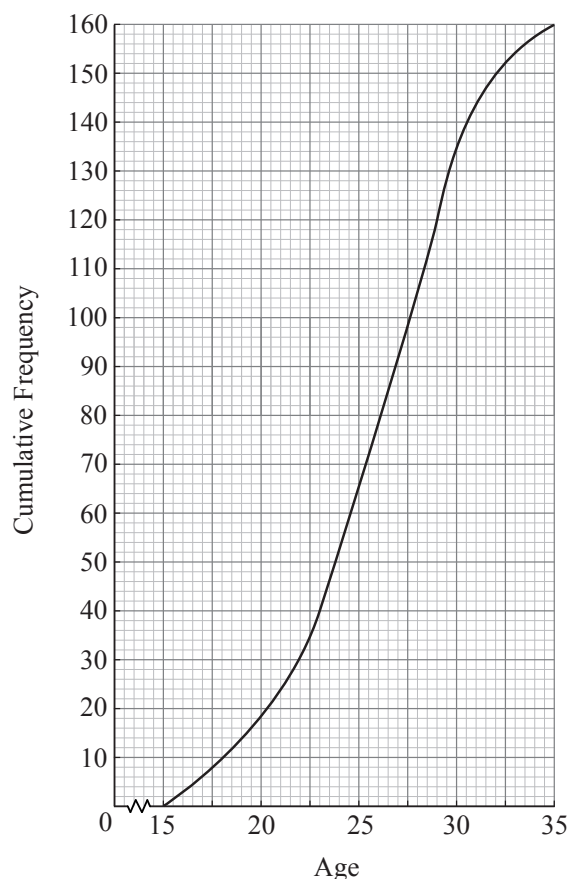
(This question continues on the following page)

(Question 1 continued)

(b)   Use the diagram to estimate

    (i)   the 80th percentile;

    (ii)   the interquartile range.   *[5 marks]*

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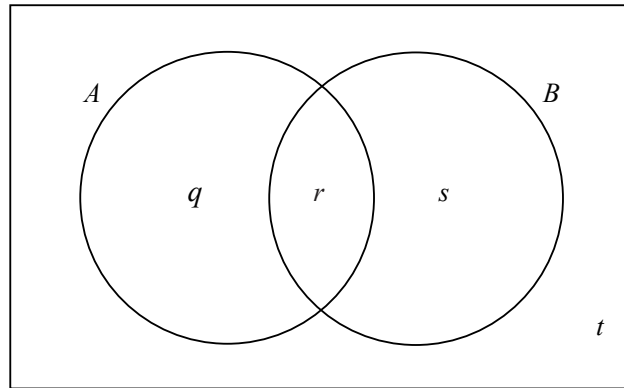
4.   *[Maximum mark: 7]*

Events A and B are such that $P(A) = 0.3$, $P(B) = 0.6$ and $P(A \cup B) = 0.7$.

The values q, r, s and t represent probabilities.

(a)   Write down the value of t.   *[1 mark]*

(b)   (i)   Show that $r = 0.2$.

      (ii)   Write down the value of q and of s.   *[3 marks]*

(c)   (i)   Write down $P(B')$.

      (ii)   Find $P(A|B')$.   *[3 marks]*

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Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

SECTION A

*Answer **all** questions in the boxes provided. Working may be continued below the lines if necessary.*

1. *[Maximum mark: 5]*

The cumulative frequency curve below represents the marks obtained by 100 students.
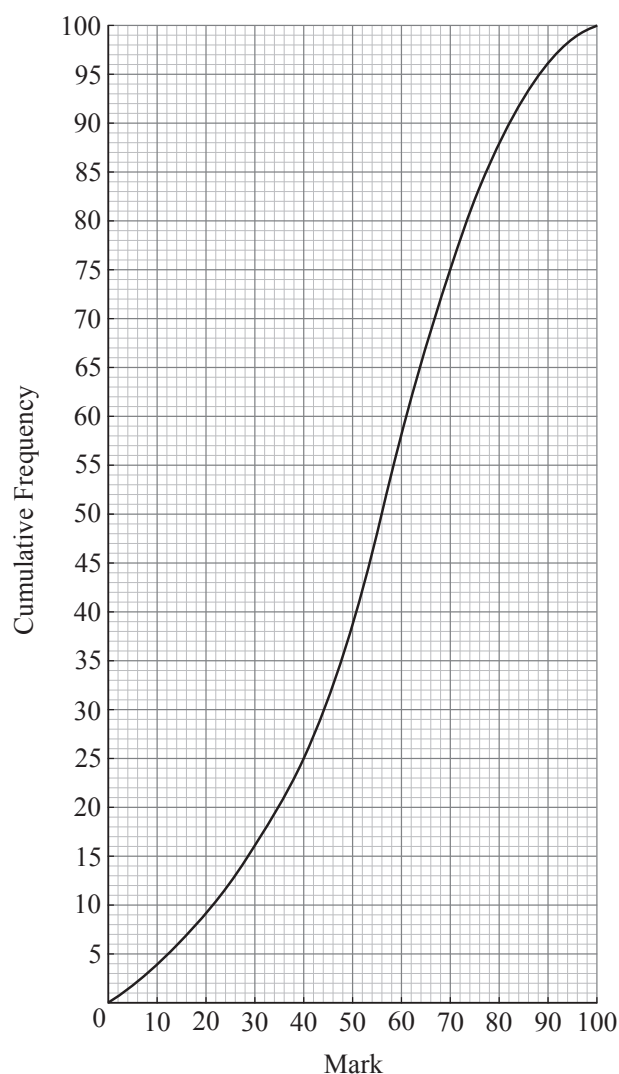
(This question continues on the following page)

(Question 1 continued)

(a)   Find the median mark. *[2 marks]*

(b)   Find the interquartile range. *[3 marks]*

4. *[Maximum mark: 8]*

The random variable X has the following probability distribution, with $P(X > 1) = 0.5$.

x	0	1	2	3
$P(X = x)$	p	q	r	0.2

(a)   Find the value of r.   *[2 marks]*

(b)   Given that $E(X) = 1.4$, find the value of p and of q.   *[6 marks]*

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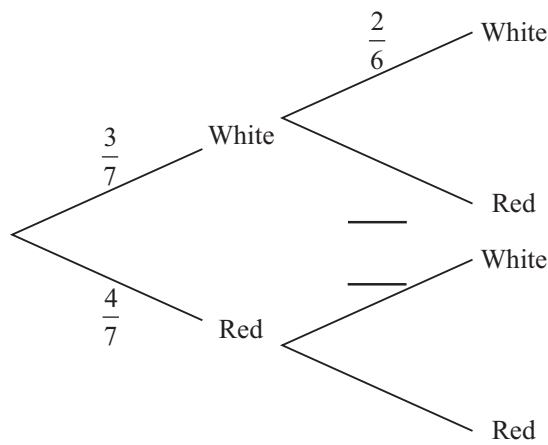
*Do **NOT** write solutions on this page.*

9. *[Maximum mark: 14]*

Bag A contains three white balls and four red balls. Two balls are chosen at random without replacement.

(a) (i) **Copy** and complete the following tree diagram. *(Do **not** write on this page.)*

(ii) Find the probability that two white balls are chosen. *[5 marks]*

Bag B contains four white balls and three red balls. When two balls are chosen at random without replacement from bag B, the probability that they are both white is $\frac{2}{7}$.

A standard die is rolled. If 1 or 2 is obtained, two balls are chosen without replacement from bag A, otherwise they are chosen from bag B.

(b) Find the probability that the two balls are white. *[5 marks]*

(c) Given that both balls are white, find the probability that they were chosen from bag A. *[4 marks]*

Turn over

Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

Section A

Answer **all** questions in the boxes provided. Working may be continued below the lines if necessary.

1. [Maximum mark: 6]

A discrete random variable X has the following probability distribution.

x	0	1	2	3
$P(X=x)$	$\dfrac{3}{10}$	$\dfrac{4}{10}$	$\dfrac{2}{10}$	p

(a) Find p. [3]

(b) Find $E(X)$. [3]

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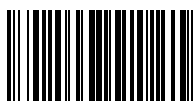. . . . .

Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

Section A

Answer **all** questions in the boxes provided. Working may be continued below the lines if necessary.
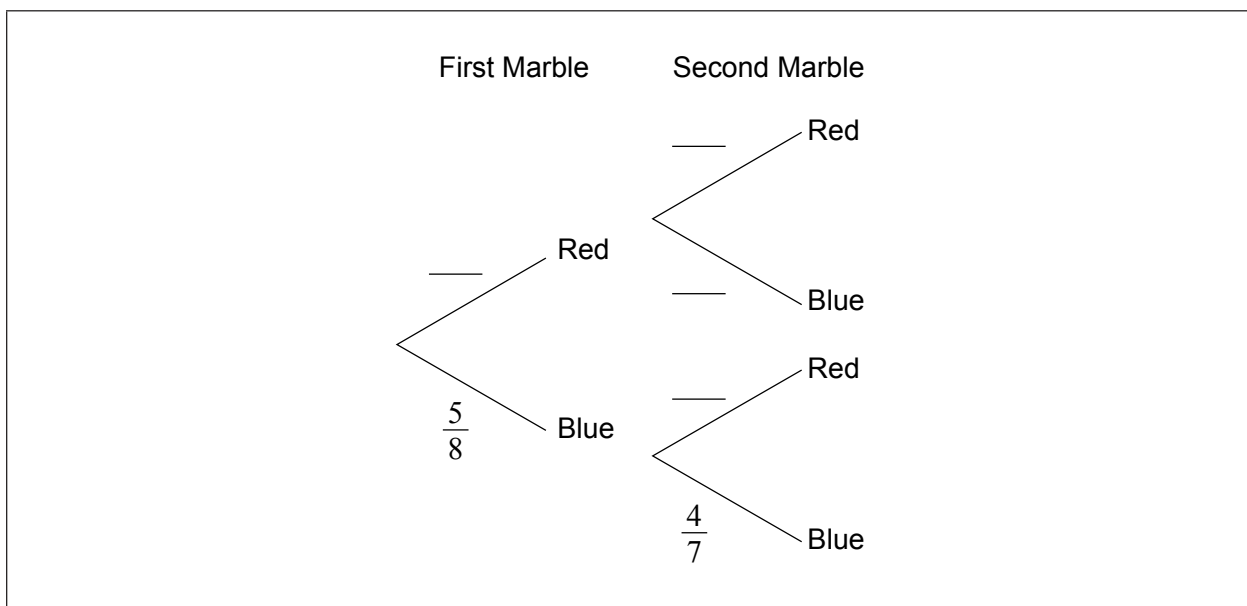
1. [Maximum mark: 6]

A bag contains eight marbles. Three marbles are red and five are blue. Two marbles are drawn from the bag without replacement.

(a) Write down the probability that the first marble drawn is red. [1]

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(b) Complete the following tree diagram. [3]

First Marble   Second Marble

_____ Red

Red

_____ Blue

_____ Red

$\frac{5}{8}$ Blue

$\frac{4}{7}$ Blue

(c) Find the probability that both marbles are blue. [2]

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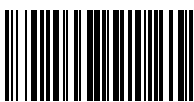...

3.   [Maximum mark: 6]

The following cumulative frequency diagram shows the lengths of 160 fish, in cm.
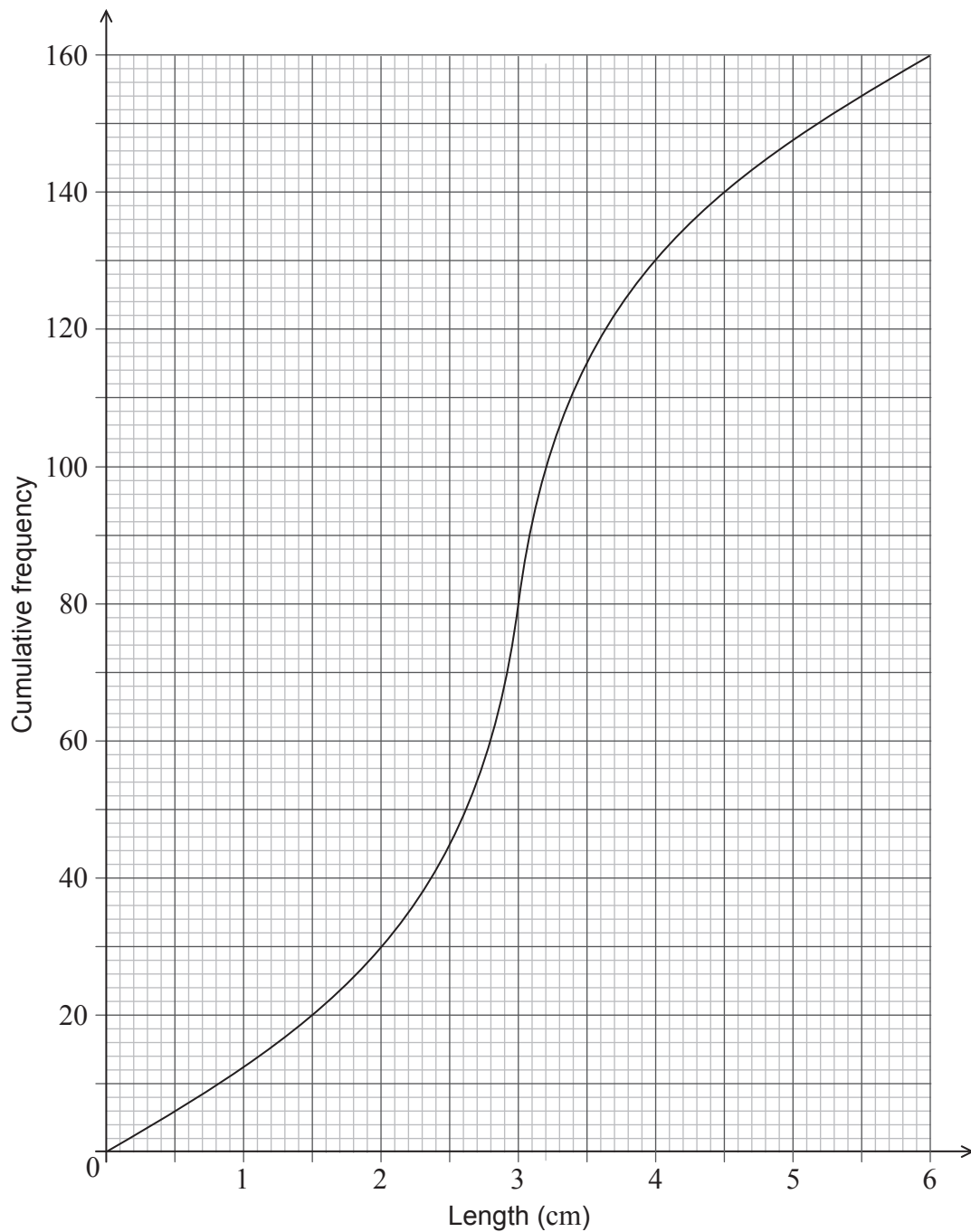
(This question continues on the following page)

(Question 3 continued)

(a)   Find the median length.   [2]

The following frequency table also gives the lengths of the 160 fish.

Length x cm	$0 \leq x \leq 2$	$2 < x \leq 3$	$3 < x \leq 4.5$	$4.5 < x \leq 6$
Frequency	p	50	q	20

(b)   (i)   Write down the value of p.

         (ii)   Find the value of q.   [4]

Turn over

7. [Maximum mark: 7]

A bag contains black and white chips. Rose pays $10 to play a game where she draws a chip from the bag. The following table gives the probability of choosing each colour chip.

Outcome	black	white
Probability	0.4	0.6

Rose gets no money if she draws a white chip, and gets k if she draws a black chip. The game is fair. Find the value of k.

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