Objective: **Complete iGCSE questions on working with probability.**
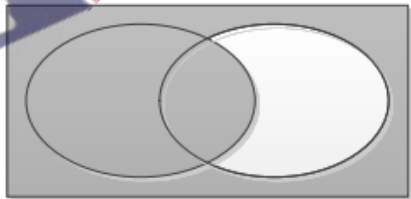
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(c) Two students who play the guitar are chosen at random.

Find the probability that they both also play the piano.

(d) On the Venn diagram, shade the region $P \cup G'$.

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9	(a)	11		1	
	(b)	$\dfrac{7}{23}$ oe		1	
	(c)	$\dfrac{110}{182}$ oe		3	**M2** for $\dfrac{their\,(a)}{their(a)+3} \times \dfrac{their\,(a)}{their(a)}$ or **M1** for a single product of fractions with first fraction $\dfrac{}{th}$
	(d)			1	

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Question	Answer	Mark	Part Marks
14 (a) (i)	$\left(\dfrac{x}{x+y}\right)^2$ oe final answer	2	**B1** for $\dfrac{x}{x+y}$
(ii)	$2 \times \dfrac{xy}{(x+y)^2}$ oe final answer	3	**M2** for $\dfrac{x}{(x+y)} \times \dfrac{y}{(x+y)}$ oe or **B1** for $\dfrac{y}{x+y}$ seen
(b) (i)	$\dfrac{x(x-1)}{(x+y)(x+y-1)}$ oe final answer	3	**B2** for $\dfrac{x-1}{x+y-1}$ or **B1** for $x+y-1$ seen
(ii)	$2 \times \dfrac{xy}{(x+y)(x+y-1)}$ oe final answer	3	**M2** for $\dfrac{x}{(x+y)} \times \dfrac{y}{(x+y-1)}$ oe or **B1** for $\dfrac{y}{x+y-1}$ seen

(c) One of these students is chosen at random.

Find the probability that this student studies English and mathematics but not technology.

.... [2]

(d) Two of the 56 students are chosen at random.

Find the probability that they both study technology.

.... [2]

(e) A student who studies mathematics is chosen at random.
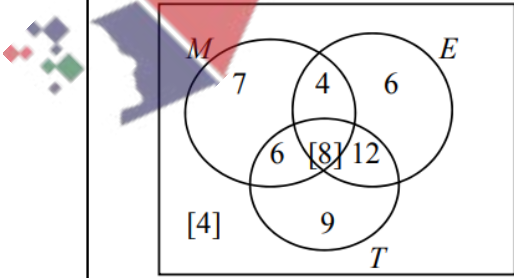
Find the probability that this student also studies technology but not English.

.... [2]

(f) Two students who study English are chosen at random.

Find the probability that they both study mathematics but not technology.

.... [3]

8(a)	Correct values inside circles	3	**B2** for 4 or 5 regions correct **B1** for 2 or 3 regions correct
8(b)(i)	17	1	**FT** *their* diagram
8(b)(ii)	11	1	**FT** *their* diagram

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8(c)	$\dfrac{4}{56}$ oe	2	FT *their* 4
			M1 for $\dfrac{their\,4}{k}$ ($k > their$ 4) or $\dfrac{p}{56}$ ($p < 56$)
8(d)	$\dfrac{1190}{3080}$ oe	2	**M1** for $\dfrac{35}{56} \times \dfrac{34}{55}$
8(e)	$\dfrac{6}{25}$ oe	2	FT *their* 6
			M1 for $\dfrac{their\,6}{k}$ ($k > their$ 6) or $\dfrac{p}{25}$ ($p < 25$)
8(f)	$\dfrac{12}{870}$ oe	3	**M2** for $\dfrac{their\,4}{30} \times \dfrac{(their\,4)-1}{29}$ (*their* 4 < 30)
			or **M1** for $\dfrac{a}{30} \times \dfrac{a-1}{29}$ (*their a* < 30)

11 A farmer sorts the grapefruit he grows into sizes, according to their diameter.
The diameters, d cm, of 170 grapefruit are shown in the table.

Size	Small	Medium	Large	Very Large
Diameter (d cm)	$9 < d \leqslant 10$	$10 < d \leqslant 12$	$12 < d \leqslant 14$	$14 < d \leqslant 17$
Frequency	10	50	65	45

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11(c)(i)	$\dfrac{198}{2873}$ oe	2	**M1** for $\dfrac{45}{170} \times \dfrac{44}{169}$
11(c)(ii)	$\dfrac{100}{2873}$ oe	3	**M2** for $\dfrac{10}{170} \times \dfrac{50}{169} + \dfrac{50}{170} \times \dfrac{10}{169}$ oe
			or **M1** for $\dfrac{10}{170} \times \dfrac{50}{169}$

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(d) Two of these students are chosen at random.
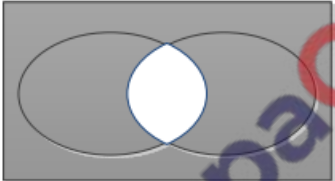
Find the probability that they both like football.

.... [2]

| 9(g) | | 1 | |

7(a)	$\dfrac{6}{30}$ oe	2	**M1** for $\dfrac{3}{6} \times \dfrac{2}{5}$ oe
7(b)	$\dfrac{12}{30}$ oe	3	**M2** for $\dfrac{2}{6} \times \dfrac{3}{5} \times 2$ oe or **M1** for $\dfrac{2}{6} \times \dfrac{3}{5}$ oe
7(c)	$\dfrac{28}{30}$ oe	2	**M1** for $1 - \dfrac{2}{6} \times \dfrac{1}{5}$ oe

8(a)	Fully correct tree diagram	3	**B1** for each column correct of 0.9 and 0.1 correctly placed (L &R) 0.8 and 0.2 correctly placed (S) 0.7 and 0.3 correctly placed (W)
8(b)	0.504	2	**M1** for $0.9 \times 0.8 \times 0.7$
8(c)	0.398	4	**M3** for $0.9 \times 0.8 \times 0.3 + 0.9 \times 0.2 \times 0.7$ $+ 0.1 \times 0.8 \times$ or **M2** for 2 of above products or **M1** for 1 of above products

5(a)	72	2	**M1** for $\dfrac{12}{60} \times 360$
5(b)	$\dfrac{1}{4}$ oe	1	
5(c)(i)	$\dfrac{4}{59}$ oe	3	**M2** for $\dfrac{12}{60} \times \dfrac{10}{59} + \dfrac{10}{60} \times \dfrac{12}{59}$ oe or **M1** for $\dfrac{12}{60} \times \dfrac{10}{59}$ or $\dfrac{10}{60} \times \dfrac{12}{59}$ so

| 5(c)(ii) | $\dfrac{303}{590}$ oe | 3 | **M2** for $1 - \left(\dfrac{42}{60} \times \dfrac{41}{59} \right)$ oe

 or $\dfrac{18}{60} \times \dfrac{42}{59} + \dfrac{42}{60} \times \dfrac{18}{59} + \dfrac{18}{60} \times \dfrac{17}{59}$

 or **M1** for $\dfrac{18}{60} \times \dfrac{42}{59}$ or $\dfrac{42}{60} \times \dfrac{18}{59}$ or $\dfrac{18}{60}$

 or $\dfrac{42}{60} \times \dfrac{41}{59}$ |

(ii) Jono attends school on 200 days.

Find the expected number of days that Jono is late.

.... [

3(a)	0.3	3	B1
	0.8		B1
	0.05 and 0.95		B1
3(b)(i)	0.155 oe	3	**M2** for $0.7 \times 0.2 + their\ 0.3 \times their\ ($
			or **M1** for 0.7×0.2 or $their\ 0.3 \times the$
3(b)(ii)	31	1	**FT** $200 \times their$ **(i)**

(c) Three students from Class 1 are chosen at random.

Calculate the probability 3 girls are chosen.

....

3(a)(i)	$\frac{19}{120}$ oe	1	
3(a)(ii)	$\frac{3}{4}$ oe	1	
3(b)	$\frac{13}{60}$ oe	2	**M1** for $\frac{k}{16+19+12+13}$
3(c)	$\frac{13}{145}$ or $\frac{2184}{24360}$ oe	3	**M2** for $\frac{14}{30} \times \frac{13}{29} \times \frac{12}{28}$ or **M1** for $14 \times 13 \times 12$ oe seen or $30 \times 29 \times 28$ oe seen

8(a)(i)	0.3 0.9 and 0.1 0.2 and 0.8	3	**B1** for each

8(a)(ii)	0.69 oe	3	**M2** for $0.7 \times 0.9 + 0.3 \times 0.2$ or **M1** for one correct product
8(b)(i)	25	1	
8(b)(ii)	$\frac{42}{870}$ oe	3	**M2** for $\frac{7}{30} \times \frac{6}{29}$ or **M1** for $\frac{p}{q} \times \frac{p-1}{q-1}$

(b) Two of the girls are chosen at random.

Calculate the probability they both prefer tennis.

.... [2]

(c) Two of the students who prefer athletics are chosen at random.

Calculate the probability that one is a boy and one is a girl.

.... [3]

8   The number of people living in each house in a street of 100 houses is recorded.
     The results are shown in the table.

Number of people	Frequency
1	5
2	16
3	28
4	32
5	17
6	2

S1

(b) Two of the houses are selected at random.

Find the probability that

(i) both had exactly one person living in them,

....

8(a)(i)	5	1	
8(a)(ii)	4	1	
8(a)(iii)	3.46	2	**M1** for $\dfrac{\sum fx}{100}$
8(b)(i)	$\dfrac{20}{9900}$ oe	2	**M1** for $\dfrac{5}{100} \times \dfrac{4}{99}$ oe
8(b)(ii)	$\dfrac{896}{9900}$	3	**M2** for $\dfrac{16}{100} \times \dfrac{28}{99} + \dfrac{28}{100} \times \dfrac{16}{99}$ or **M1** for one of the above pr
8(b)(iii)	$\dfrac{9558}{9900}$	2	**M1** for $1 - \dfrac{19}{100} \times \dfrac{18}{99}$ oe

**(ii)** one had exactly 2 people living in it and the other had exactly 3 people living in it,

....

(iii) at least one house had fewer than 5 people living in it.

....

5(a)(i)	$\frac{12}{50}$ oe	1	
5(a)(ii)	$\frac{16}{50}$ oe	1	
5(a)(iii)	$\frac{7}{50}$ oe	1	
5(b)	$\frac{42}{600}$ oe	2	**M1** for $\frac{7}{25}$ soi
5(c)	$\frac{24}{42}$ oe	3	**M2** for $\left(\frac{4}{7}\times\frac{3}{6}\right)+\left(\frac{3}{7}\times\frac{4}{6}\right)$ or **M1** for $\frac{4}{7}\times\frac{3}{6}$ or $\frac{3}{7}\times\frac{4}{6}$
5(d)	$\frac{792}{117600}$ or $\frac{33}{4900}$ oe	4	**M3** for $\left(\frac{2}{50}\times\frac{12}{49}\times\frac{11}{48}\right)+\left(\frac{12}{50}\times\frac{2}{49}\times\frac{11}{48}\right)$ $+\left(\frac{11}{50}\times\frac{12}{49}\times\frac{2}{48}\right)$ oe or **M2** for any two products or **M1** for any one of above pro

(d) Three of the 50 students are chosen at random.

Calculate the probability that one is a boy and two are girls and they all prefer swimming.

....
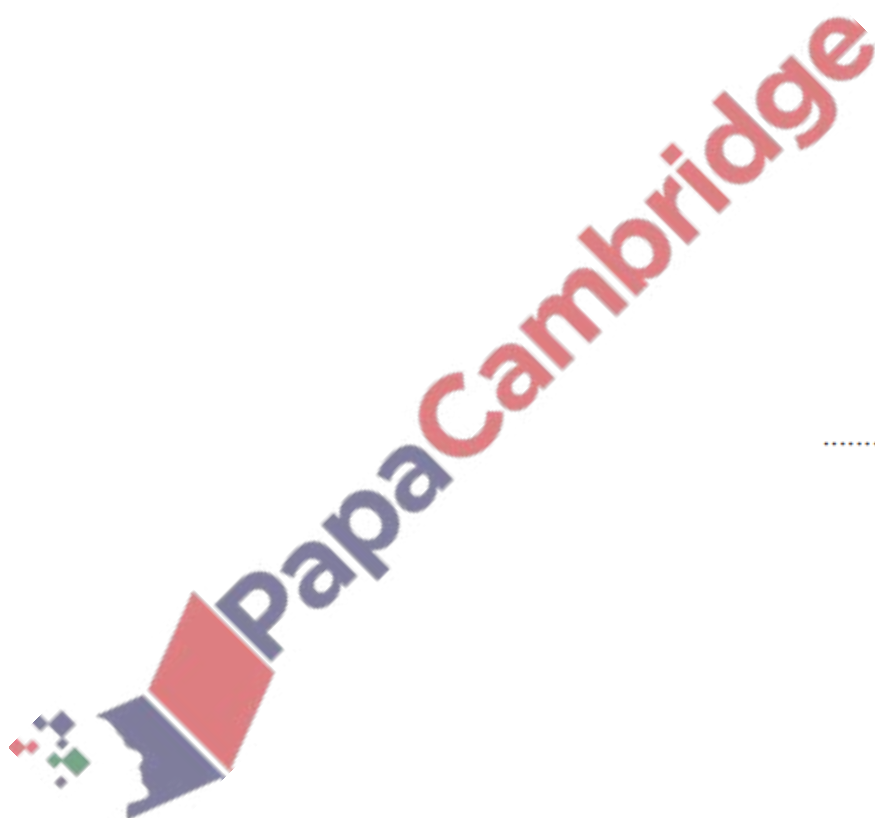
5   Fifty students, 25 boys and 25 girls, were asked which sport they prefer.
     The results are shown in the table.

	Athletics	Football	Swimming	Tennis
Boy	4	9	2	10
Girl	3	3	12	7

(a) A student is selected at random.

     Calculate the probability that the student chosen is

     (i)   a girl who prefers swimming,

     .... [1]

     (ii) a boy who **does not** prefer football,

     .... [1]

     (iii) a student who prefers athletics.

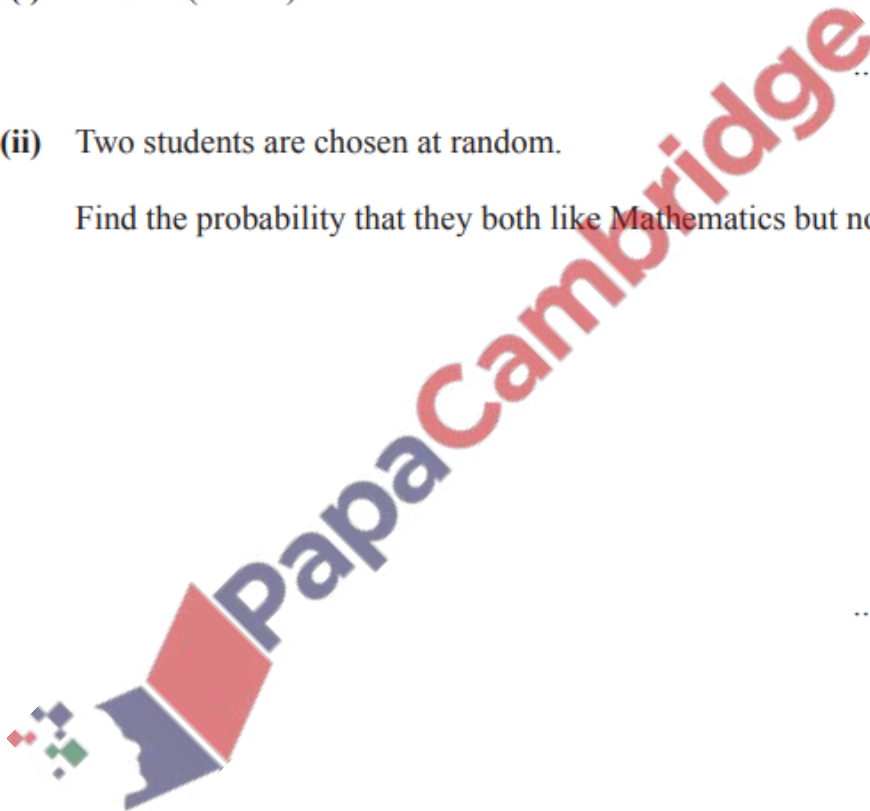   .... [1]

(b) 30 students are asked if they like Mathematics (*M*) and if they like English (*E*).
The Venn diagram shows the number of students in each subset.
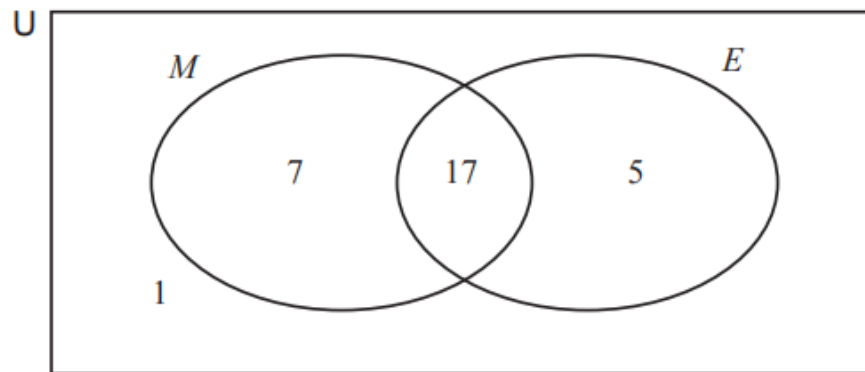
(i) Find   n($M \cup E'$).

....

(ii) Two students are chosen at random.

Find the probability that they both like Mathematics but not English.

....

8 **(a)** When the weather is fine, the probability that Sara goes to the park is 0.9 .
When the weather is not fine, the probability that Sara goes to the park is 0.2 .

On any day, the probability that the weather is fine is 0.7 .

(i) Complete the tree diagram.

Weather   Park

0.7

Fine

.... Sara goes

.... Sara does not go

.... Not fine

.... Sara goes

.... Sara does not go
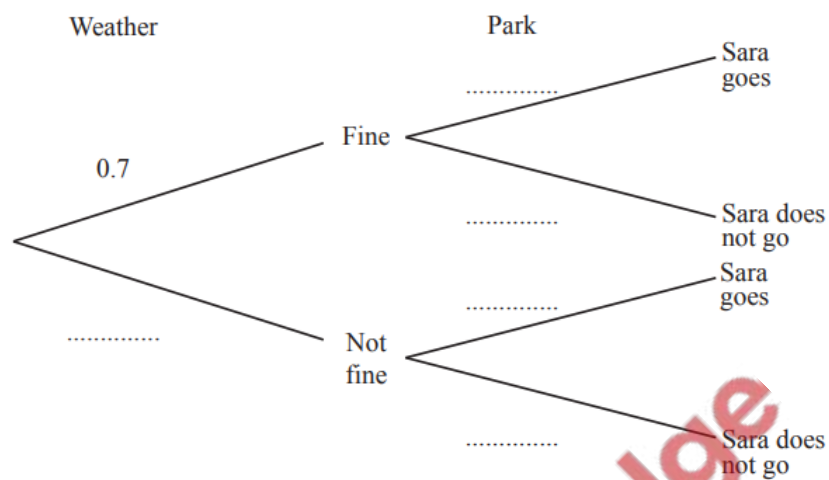
[3]

(ii) Find the probability that, on any day, Sara goes to the park.

.... [3]

3 There are 120 students at a school.
There are 30 students in each class.
The number of boys and the number of girls in each class is shown in the table.

	Class 1	Class 2	Class 3	Class 4
Boys	16	19	12	13
Girls	14	11	18	17

(a) A student is chosen at random from the 120 students.

Calculate the probability that the student chosen is

(i) a boy from Class 2,

....

(ii) **not** from Class 3.

....

(b) A boy is chosen at random.

Calculate the probability that he is from Class 4.

....

3 Jono walks to school when the weather is fine.
When the weather is not fine, Jono takes the bus.

If Jono walks to school, the probability that he is late is 0.2 .
If Jono takes the bus, the probability that he is late is 0.05 .

On any day, the probability that the weather is fine is 0.7 .

(a) Complete the tree diagram.
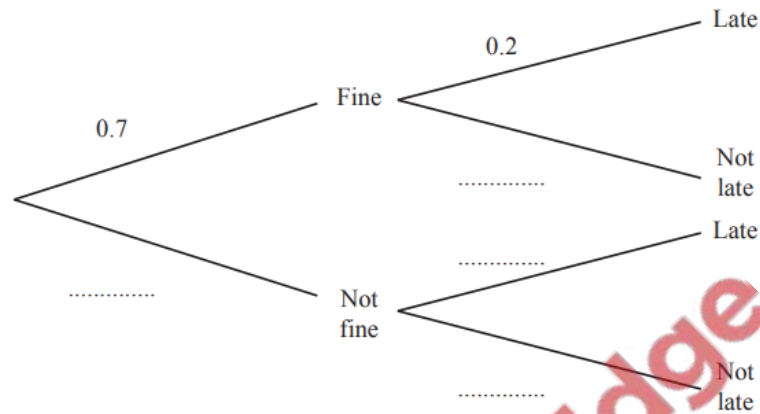
[3]

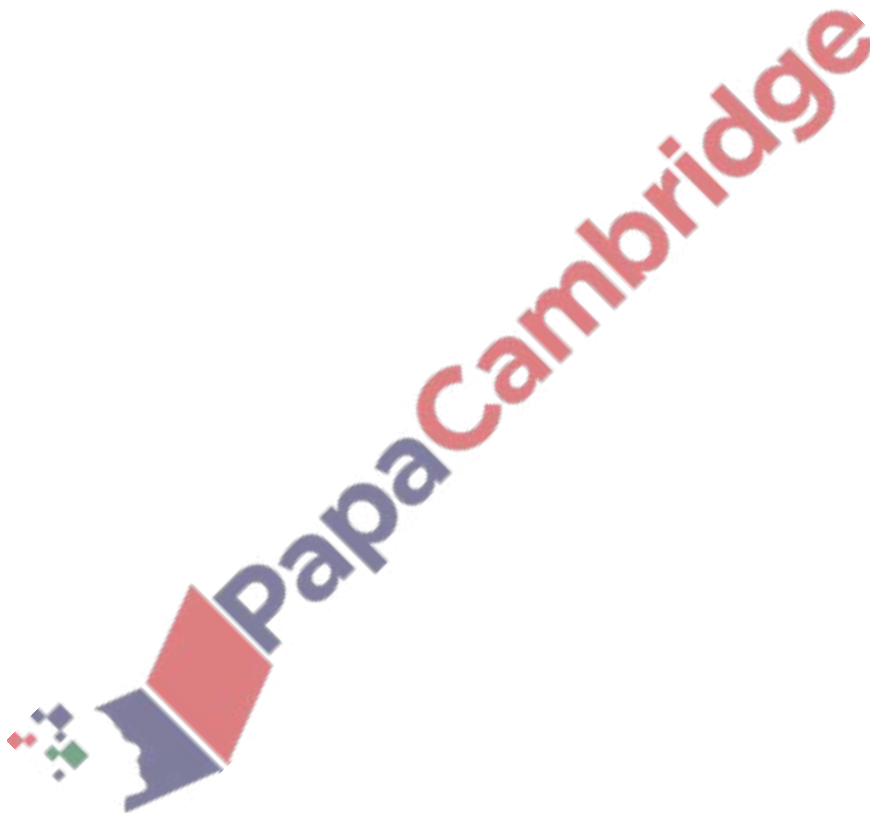**(b) (i)** Find the probability that, on any day, Jono is late.

.... [3]

(c) Jian chooses two of the 60 people at random.

    (i) Find the probability that one of them says Drama and the other says Game Show.

        ....

    (ii) Find the probability that at least one person says Sport.

        ....

5 Jian asks 60 people what their favourite type of television programme is.

These are the results.

Type of programme	Number of people
Factual	15
Sport	18
Drama	12
Game Show	10
Other	5

(a) Jian draws a pie chart to show these results.

Calculate the sector angle for Drama.

....

(b) Jian chooses one of the 60 people at random.

Write down the probability that the person says Factual.

....

(b) To pass the whole examination Rashid has to pass all three tests.

Calculate the probability that he passes the whole examination.

.... [2]

(c) If Rashid only fails one test, he can take that test again.

Calculate the probability that Rashid needs to take one test again.

.... [4]
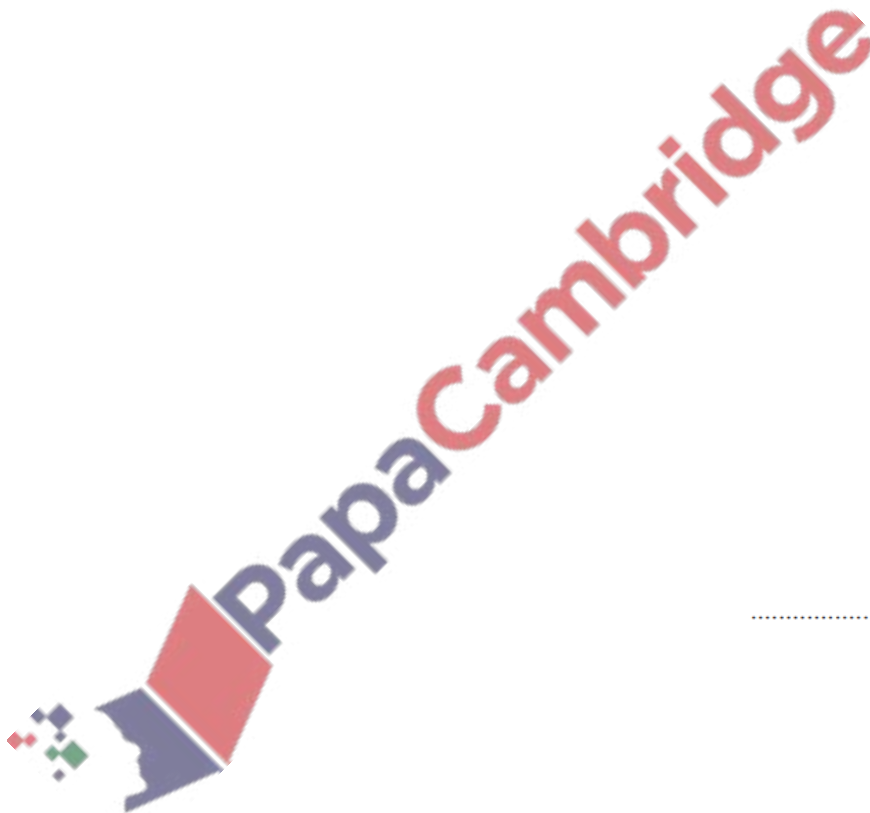
8 Rashid takes a language examination that has three tests.

The probability that Rashid passes the Listening and Reading test is 0.9 .
The probability that Rashid passes the Speaking test is 0.8 .
The probability that Rashid passes the Writing test is 0.7 .

(a) Complete the tree diagram to show the probabilities of passing (P) and failing (F) each part.

Listening   Speaking   Writing
and Reading

[3]
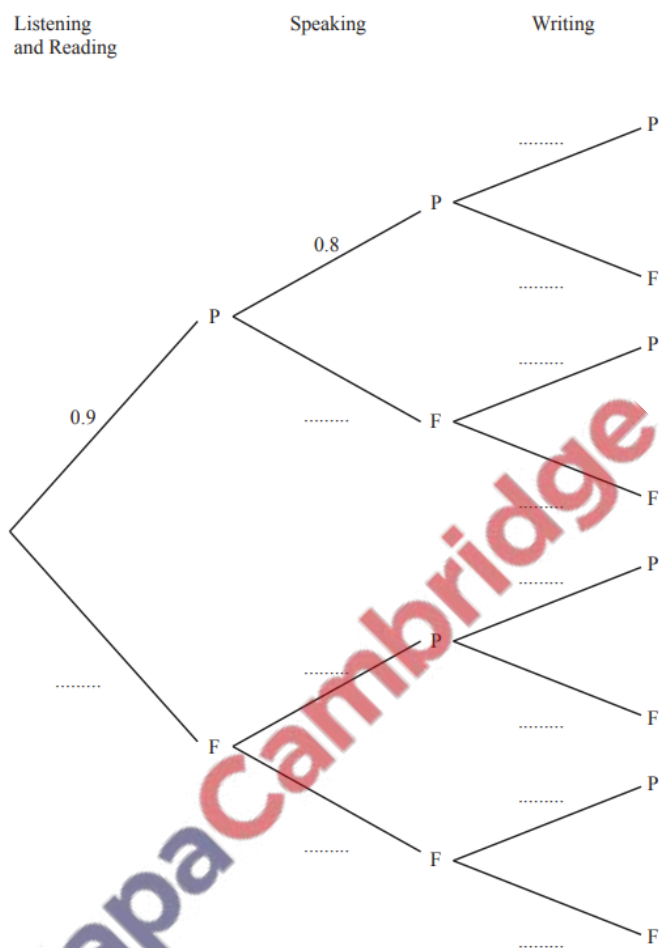
(c) the total value of the two coins is more than 2 cents.

....

7

| 1 cent | 1 cent | 5 cents | 10 cents | 10 cents | 10 cents |
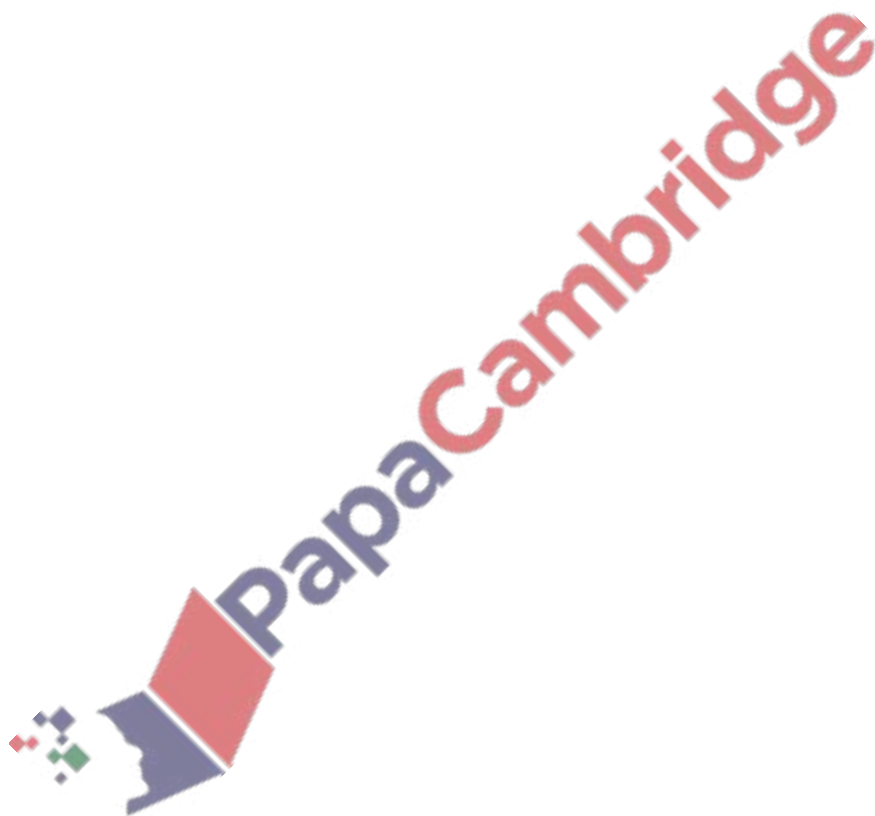
The diagram shows coins of values 1 cent, 5 cents and 10 cents.
Two of these coins are chosen at random.

Find the probability that
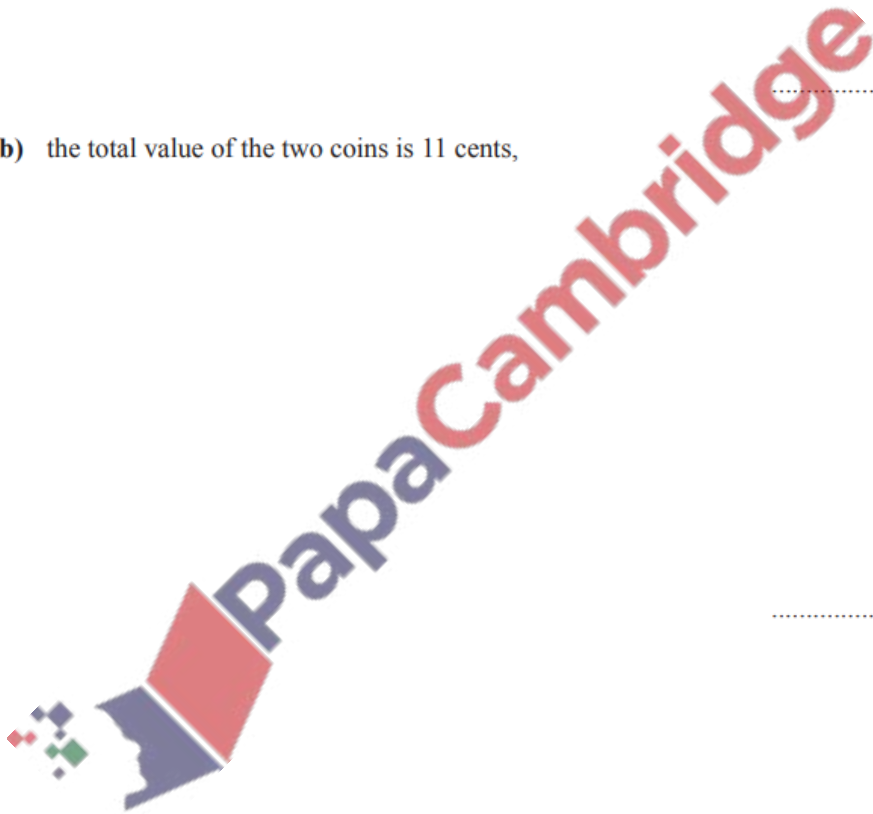
(a) each coin has a value of less than 10 cents,

.... [2]

(b) the total value of the two coins is 11 cents,

.... [3]

|			
9(a)	15, 7, 12 correctly placed	2	**B1** for two correctly placed or **M1** for $41 - (40 - 6)$ seen oe or correc equation
9(b)(i)	7	1	**FT** *their* Venn diagram
9(b)(ii)	28	1	**FT** *their* Venn diagram
9(c)	15	1	**FT** *their* Venn diagram
9(d)	$\dfrac{462}{1560}$ oe	2	**M1** for $\dfrac{22}{40} \times \dfrac{21}{39}$
9(e)(i)	$\dfrac{7}{19}$	1	**FT** *their* Venn diagram
9(e)(ii)	$\dfrac{168}{342}$ oe	3	**M2** for $\dfrac{their\,7}{19} \times \dfrac{their\,12}{18} + \dfrac{their\,12}{19} \times \dfrac{thei}{18}$ or **M1** for one of these products
9(f)	8	3	**M2** for $\dfrac{their\,7 + n}{40 + n} = \dfrac{5}{16}$ oe or **M1** for at least two trials

(f) Another n students take part in the survey.
They all like both baseball and football.
A student is then chosen at random from the $(40 + n)$ students.

The probability that a student likes both football and baseball is $\frac{5}{16}$.

Find the value of n.

$n =$ ....

(g)
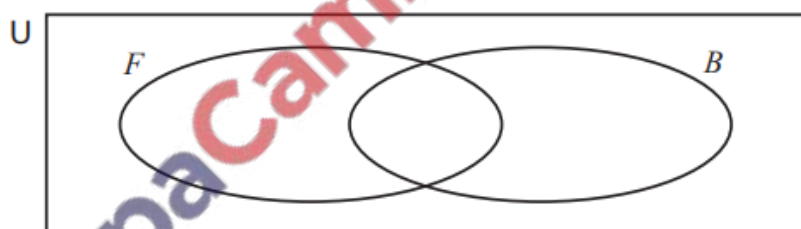
On the Venn diagram, shade the region $F' \cup B'$.

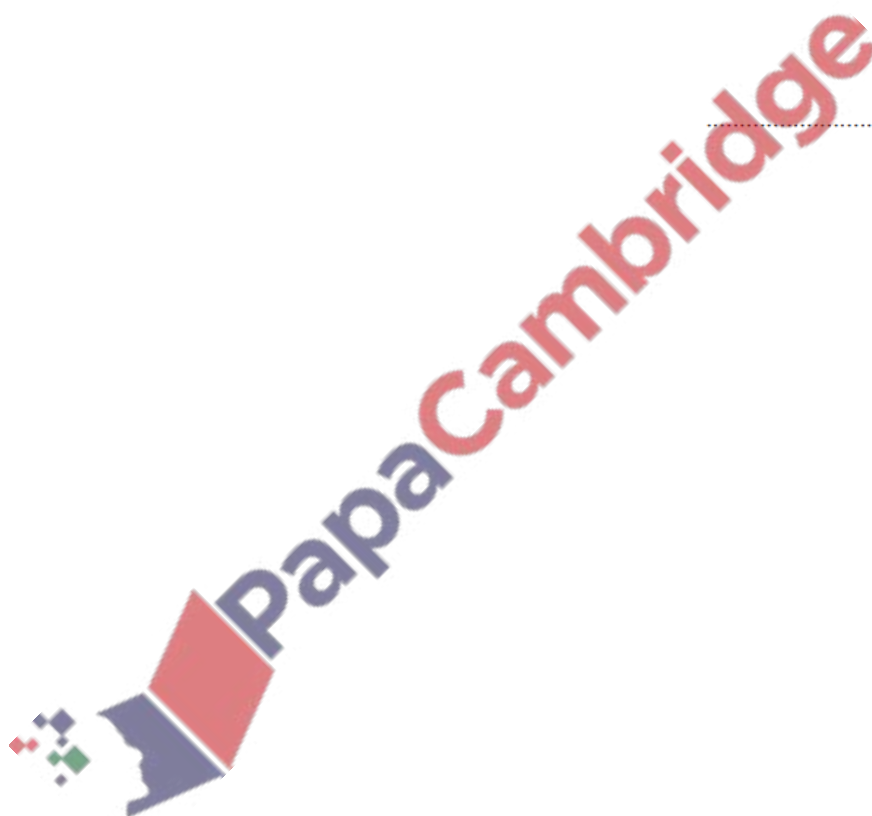**(e) (i)** One of the 19 students who like baseball is chosen at random.

Find the probability that this student also likes football.

.... [1]

(ii) Two of the 19 students who like baseball are chosen at random.

Find the probability that one likes football and one does not like football.

.... [3]

9 In a survey, 40 students are asked if they like football, F, and if they like baseball, B.
22 like football, 19 like baseball and 6 do not like either football or baseball.

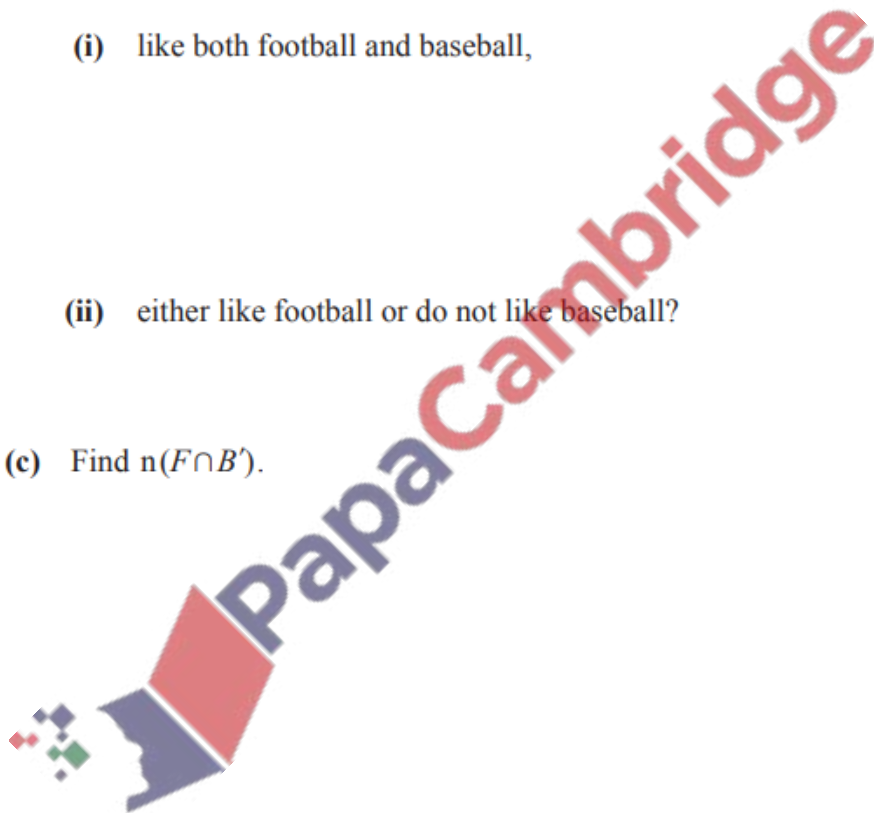**(a)** Complete the Venn diagram to show this information.
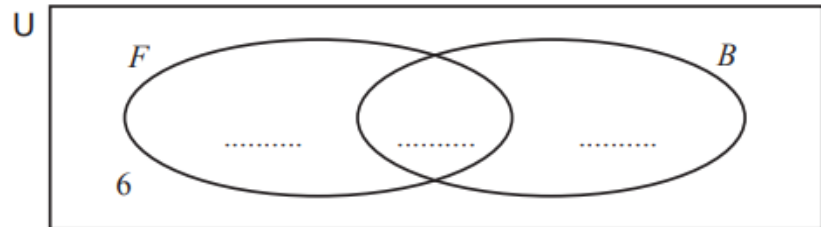
(b) How many of these students

(i) like both football and baseball,

....

(ii) either like football or do not like baseball?

....

(c) Find n$(F \cap B')$.

....

(c) Two of the 170 grapefruit are chosen at random.

Calculate the probability that

(i) they are both Very Large,

.... [2]

(ii) one is Small and the other is Medium.

.... [3]
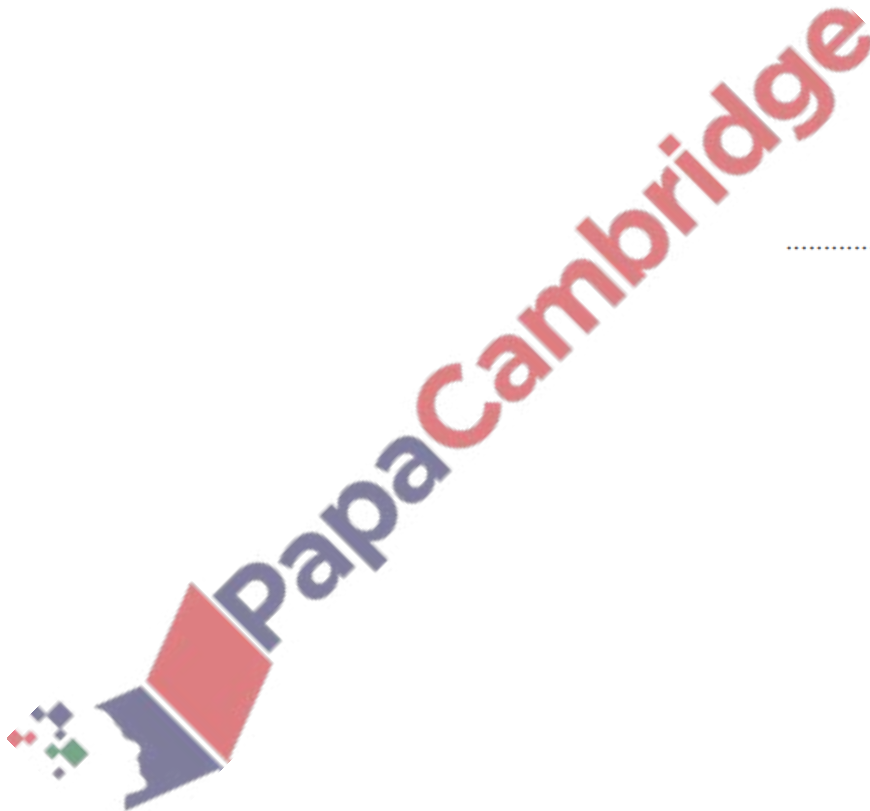
8 The Venn diagram shows the sets M, E and T.
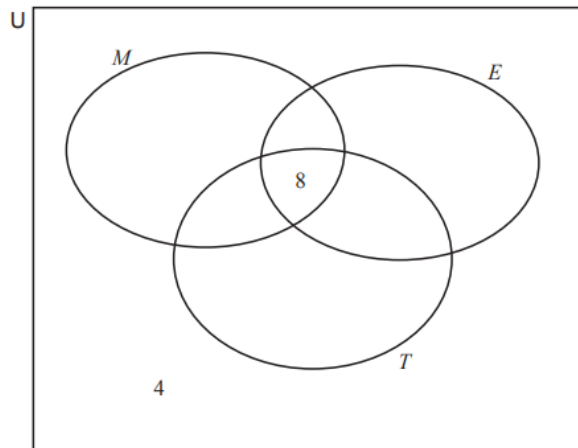
$U = \{\text{students at a school}\}$
$M = \{\text{students who study mathematics}\}$
$E = \{\text{students who study English}\}$
$T = \{\text{students who study technology}\}$

$\quad n(M \cap E \cap T) = 8$

$\quad n(M \cup E \cup T)' = 4$

$\quad n(M \cap E) = 12, \quad n(M \cap T) = 14 \quad \text{and } n(E \cap T) = 20$

$\quad n(M) = 25, \quad n(E) = 30, \quad n(T) = 35 \quad \text{and } n(U) = 56$

(a) Complete the Venn diagram. [3]

(b) Find

　　(i) $n(M \cap (E' \cup T'))$,

　　... [1]

　　(ii) $n(M \cap T')$.

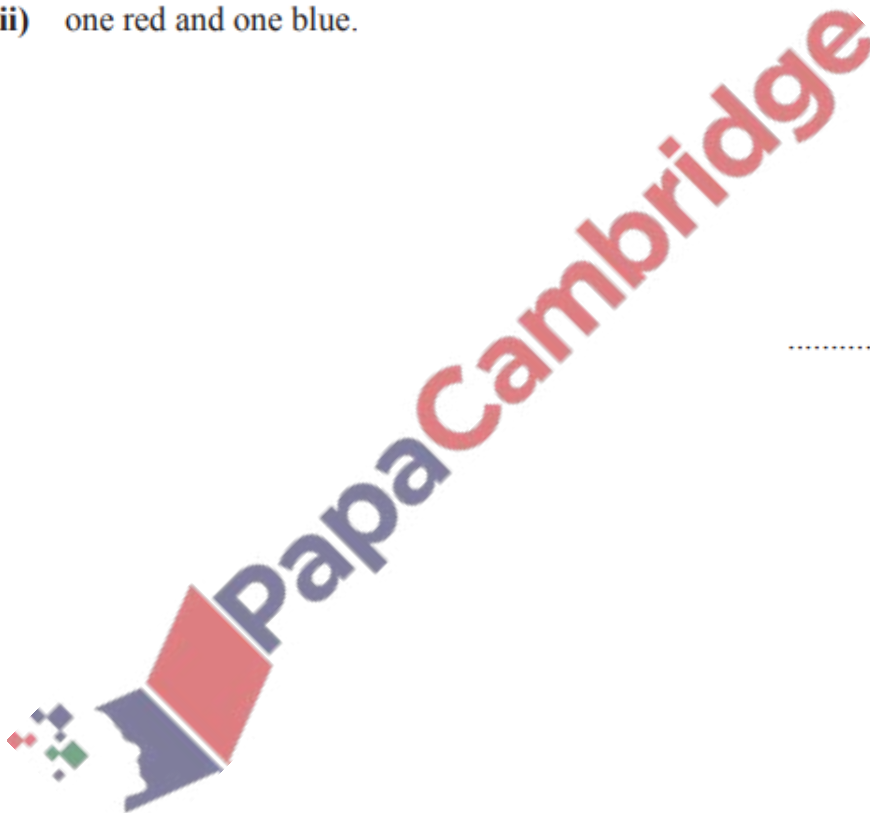　　... [1]

(b) Magda chooses a ball at random from the bag and does not replace it.
She then chooses a ball from the bag a second time.

Find the probability, in terms of x and y, that the two balls chosen are

(i) both red,

....

(ii) one red and one blue.

....

14 In this question, give all your answers as single fractions in terms of x and y.
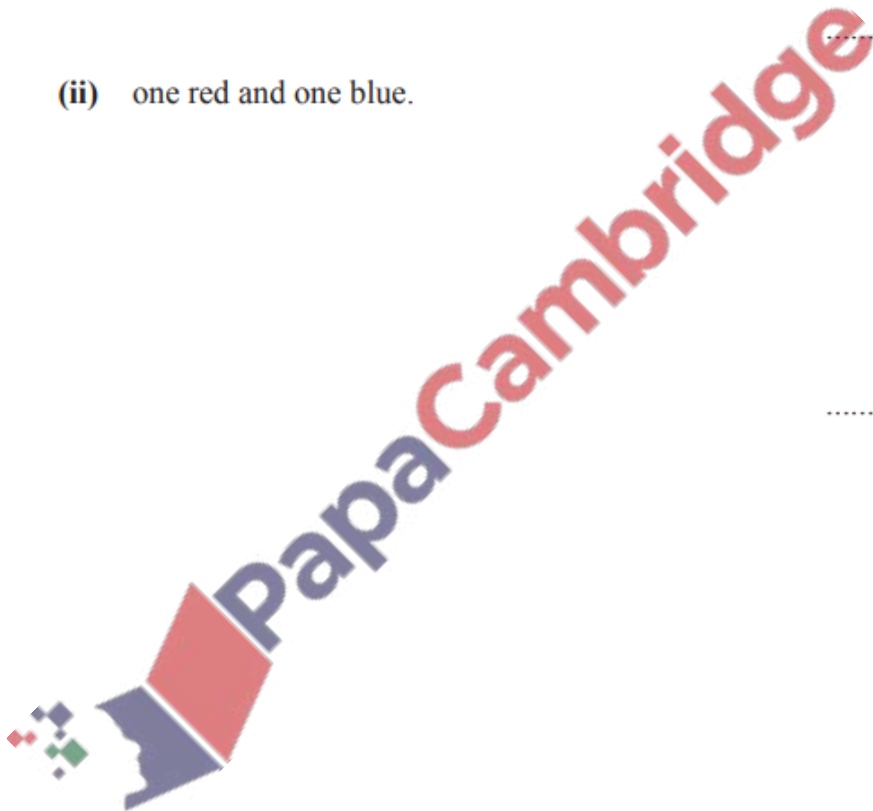
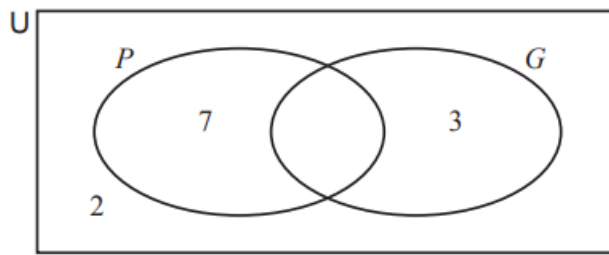A bag contains x red balls and y blue balls.

(a) Rosario chooses a ball at random from the bag, notes its colour and replaces it in the bag. He then chooses a ball from the bag a second time, notes its colour and replaces it in the ba

Find the probability, in terms of x and y, that the two balls chosen are

(i) both red,

(ii) one red and one blue.

9

The Venn diagram shows the following information.

U = {students in a music group}   P = {students who play the piano}   G = {students who play the guitar}

$$n(P \cup G)' = 2 \qquad n(P \cap G') = 7 \qquad n(G \cap P') = 3.$$

(a) $n(U) = 23$

Find $n(P \cap G)$.

.... [1]

(b) A student is chosen at random from the music group.

Find the probability that this student plays the piano but does not play the guitar.

.... [1]