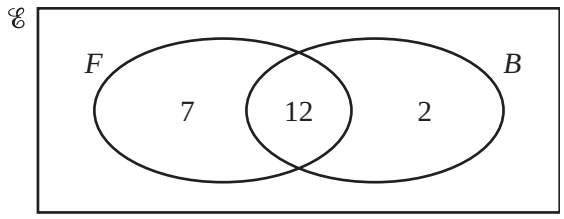
1 **(a)** All 24 students in a class are asked whether they like football and whether they like basketball. Some of the results are shown in the Venn diagram below.



$\mathscr{E}$ = {students in the class}.
F = {students who like football}.
B = {students who like basketball}.

(i) How many students like both sports? [1]

(ii) How many students do not like either sport? [1]

(iii) Write down the value of n($F \cup B$). [1]

(iv) Write down the value of n($F' \cap B$). [1]

(v) A student from the class is selected at random.
What is the probability that this student likes basketball? [1]

(vi) A student who likes football is selected at random.
What is the probability that this student likes basketball? [1]

(b) Two students are selected at random from a group of 10 boys and 12 girls.
Find the probability that

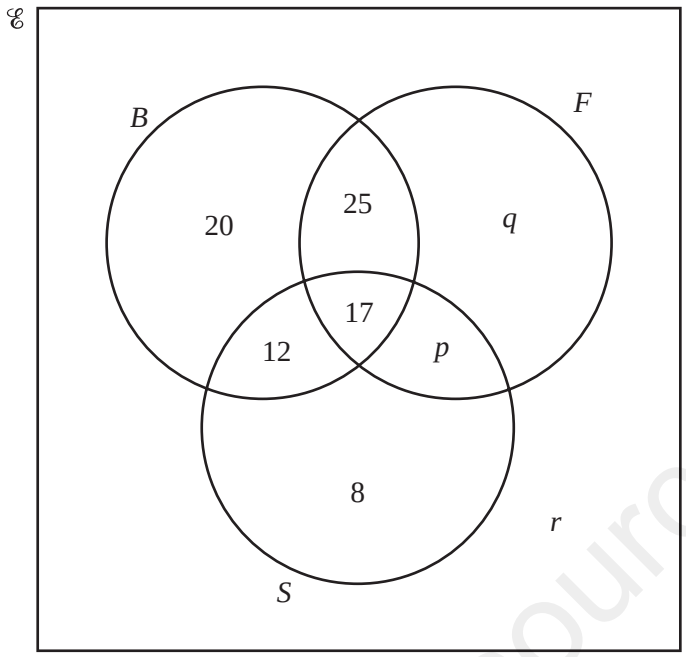
(i) they are both girls, [2]

(ii) one is a boy and one is a girl. [3]

(a)(i)	12	**B1**		
(ii)	3	**B1**		
(iii)	21	**B1**		
(iv)	2	**B1**		
(v)	$^{14}/_{24}$ o.e	**B1**	Accept probabilities as fractions/decimals/%	
(vi)	$^{12}/_{19}$ o.e.	**B1**		
(b)(i)	$^{12}/_{22} \times {}^{11}/_{21}$	**M1**		
	$^{132}/_{462}$ o.e. (0.286)	**A1**	2/7 in simplest form	www2
(ii)	$^{10}/_{22} \times {}^{12}/_{21}$	**M1**		
	their $^{10}/_{22} \times {}^{12}/_{21} \times 2$ o.e.	**M1**		
	$^{240}/_{462}$ o.e.(0.519)	**A1**	40/77 in simplest form	www3
				[11]

2 In a survey, 100 students are asked if they like basketball (B), football (F) and swimming (S).

The Venn diagram shows the results.



42 students like swimming.

40 students like exactly one sport.

(a) Find the values of p, q and r. [3]

(b) How many students like

(i) all three sports, [1]

(ii) basketball and swimming but not football? [1]

(c) Find

(i) $n(B')$, [1]

(ii) $n((B \cup F) \cap S')$. [1]

(d) One student is chosen at random from the 100 students.
Find the probability that the student

(i) only likes swimming, [1]

(ii) likes basketball but not swimming. [1]

(e) Two students are chosen at random from those who like basketball.

Find the probability that they each like exactly one other sport. [3]

(a)	(p =) 5 cao, (q =) 12 cao (r =) 1 ft	**B1** **B1** **B1ft**	Accept in correct order if no labels ft for $r = 18 -$ *their* $p -$ *their* q provided r not negative
(b) (i)	17 cao	**B1**	
(ii)	12 cao	**B1**	
(c) (i)	26 cao	**B1**	
(ii)	57 ft	**B1ft**	ft 45 + *their* q
(d) (i)	$\frac{8}{100}$ oe isw	**B1**	
(ii)	$\frac{45}{100}$ oe isw	**B1**	
(e)	Any fraction with denominator 74 seen $\frac{37}{74} \times \frac{36}{73}$ $\frac{18}{73}$ oe isw cao	**B1** **M1** **A1**	ft *their* fraction i.e. one taken off each part $\frac{k}{l} \times \frac{k-1}{l-1}$ N.B $\frac{1}{2} \times \frac{36}{73}$ gets **B1M1** $\frac{1332}{5402}$ www3 (if decimal then 0.247 or better) Do not accept ratio or in words **[12]**

3 **(a)** $\mathscr{E}$ = {25 students in a class}

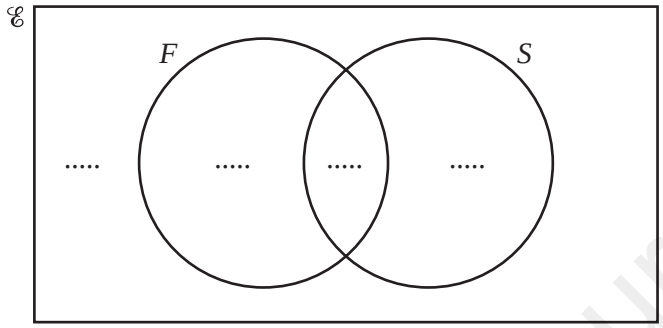
F = {students who study French}

S = {students who study Spanish}

16 students study French and 18 students study Spanish.

2 students study neither of these.

(i) Complete the Venn diagram to show this information.



[2]

(ii) Find n(F').

Answer(a)(ii) ..... [1]

(iii) Find n($F \cap S$)′.

Answer(a)(iii) ..... [1]

(iv) One student is chosen at random.

Find the probability that this student studies both French and Spanish.

Answer(a)(iv) ..... [1]

(v) Two students are chosen at random without replacement.

Find the probability that they both study only Spanish.

Answer(a)(v) ..... [2]

(b) In another class the students all study at least one language from French, German and Spanish.

No student studies all three languages.

The set of students who study German is a proper subset of the set of students who study French.

4 students study both French and German.

12 students study Spanish but not French.

9 students study French but not Spanish.

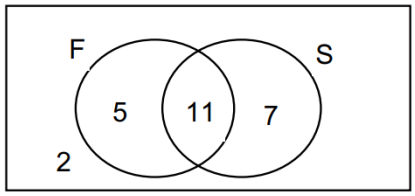
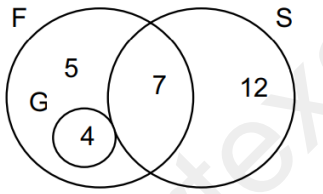
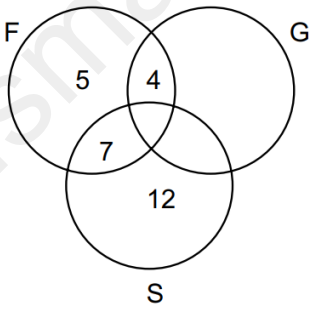
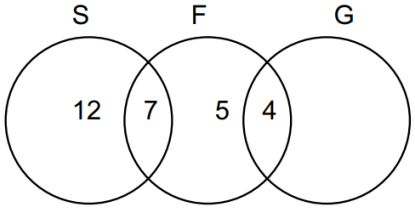
A total of 16 students study French.

(i) Draw a Venn diagram to represent this information.

[4]

(ii) Find the total number of students in this class.

Answer(b)(ii) ..... [1]

	(a) (i) 	**2**	**B1** for 2 outside of circles in diagram or all three of 5, 11, 7 correctly placed
	(ii) 9	**1ft**	ft *their* 2 + *their* 7
	(iii) 14	**1**	
	(iv) $\frac{11}{25}$	**1ft**	ft *their* 11 from diagram / 25
	(v) $\frac{42}{600}$ oe $= \frac{7}{100}$	**2ft**	isw incorrect cancelling ft *their* 7 from diagram for numerator **M1** for $\frac{their7}{25} \times \frac{their(7-1)}{24}$ After 0 scored, **SC1** for $\frac{their7}{25} \times \frac{their(7)}{25}$
	(b) (i)   	**4**	**B1** for any correct diagram with blanks or zeros where needed and labelled unambiguously **B1** for 4 in correct place **B1** for 12 in correct place **B1** for 5 and 7 in correct place
	(ii) 28	**1ft**	Correct or ft from *their* diagram

4 **(a)** x is an integer.

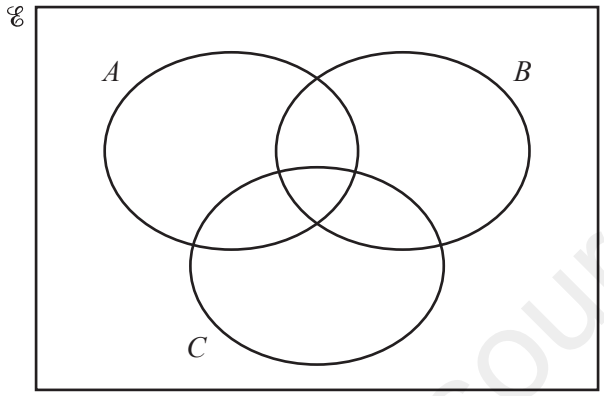
$\mathscr{E} = \{x: 1 \leqslant x \leqslant 10\}$

$A = \{x: x \text{ is a factor of } 12\}$

$B = \{x: x \text{ is an odd number}\}$

$C = \{x: x \text{ is a prime number}\}$

(i) Complete the Venn diagram to show this information.



[3]

(ii) Use set notation to complete each statement.

6 ..... A

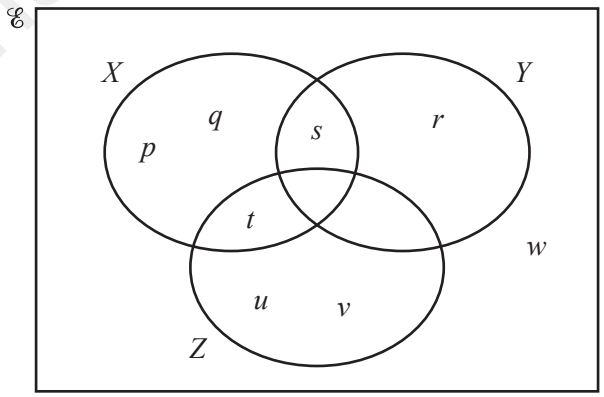
$A \cap B \cap C =$ .....

$A \cap A' =$ ..... [3]

(iii) Find n(B).

Answer(a)(iii) ..... [1]

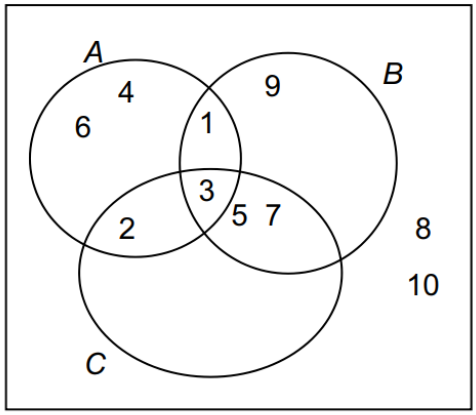
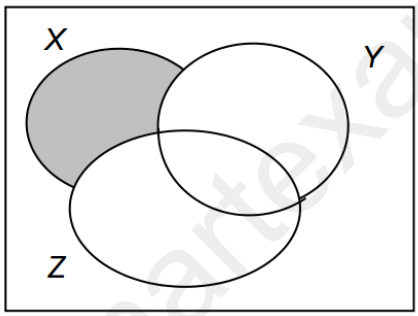
(b)



(i) Use set notation to complete the statement.

$\{u, v\}$ ..... Z [1]

(ii) Shade $X \cap (Z \cup Y)'$. [1]

(a) (i)		**3**	**B2** for 8 or 9 numbers correct **B1** for 6 or 7 numbers correct
(ii)	$\in$ cao	**1**	
	{3}	**1FT**	FT *their* intersection of all 3 sets – *their* diagram
	$\varnothing$ or {}	**1**	
(iii)	5	**1FT**	FT *their* set *B* on diagram
(b) (i)	$\subset$	**1**	
(ii)		**1**	