Set Language and Notation

1. List the members of the following sets.
   (a) {Even numbers between 1 and 9}
   (b) {Factors of 18}
   (c) {Months which do not contain the letter "r"}
   (d) {Square numbers less than 100}

2. $\mathscr{E}$ = {Positive integers less than 20} P = {11, 13, 15, 17}
   Q = {12, 14, 16} R = {Multiples of 4}

   (a) List the members of
   (i) R (ii) $P \cup Q$ (iii) $Q \cap R$

   (b) What is the set $P \cap R$?

3. $\mathscr{E}$ = {The books in St John's library} M = {Mathematics books}
   P = {Paperback books} T = {Travel books}

   (a) Describe the set $M \cap P$. (b) What is the set $M \cap T$?
   (c) One book in St John's library has the title '*Explore*'. Given that '*Explore*' $\in M \cup T$, what can you say about the book '*Explore*'?

4. $\mathscr{E}$ = {Polygons} B = {Shapes with two equal sides}
   A = {Three-sided shapes} C = {Shapes with two parallel sides}

   (a) What is the mathematical name for the members of $A \cap B$?
   (b) Which of the following are true?
   (i) Kite $\in A$. (ii) Trapezium $\in C$. (iii) $A \cap C = \emptyset$.

5. R = {Positive odd numbers less than 10} T = {Prime numbers}
   S = {Multiples of 3 between 4 and 20}

   (a) List the elements of
   (i) $R \cup S$, (ii) $R \cap S$.
   (b) You are told that $x \in R \cap T$. Write down all possible values of x.
   (c) Is it true that $S \cap T = \emptyset$? Explain your answer.

6. $A = \{x: x \text{ is a factor of } 12\}$ B = {prime numbers less than 12}
   List the elements of:
   (i) $A \cap B'$ (ii) $A' \cap B$ (iii) $A \cup B$

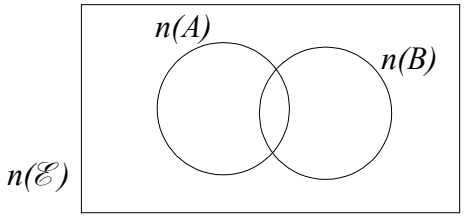
7. $\mathscr{E}$ = {Integers from 0 to 20} $A = \{x: 0 < x < 9\}$
B = {Even numbers} C = {Multiples of 5}

(a) List the members of $A \cap B'$
(b) Find the value of $n(A \cup C)$.
(c) Complete the statement $A \cap B \cap C = \ldots$.
(d) Is it true that $(A \cap C') \subset B$? Explain your answer.

8. $\mathscr{E}$ = {Positive integers less than 15}
E = {Even numbers} M = {Multiples of 3}

(a) Draw a Venn diagram and fill in each member of $\mathscr{E}$ in the correct region.
(b) Write down the value of $n(E \cap M')$.

9.



$\mathscr{E}$ is the set of students in a class. A is the set of students who study Art, and B the set of students who study Biology. There are 28 students in the class, of whom 13 study Art. Of the 18 students who study Biology, 11 do not study Art.
Copy the diagram above, and fill in the number of students in each section of the diagram. How many students study neither Biology nor Art?

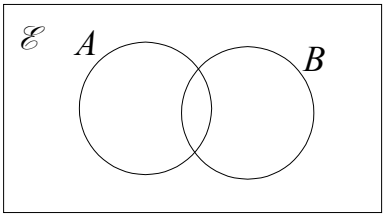
10. In a group of households, x have both a video recorder and a DVD player. 75 households have a video recorder, and 40 have a DVD player. 10 households have neither. Draw a diagram like that in Q9 and fill in (in terms of x) each area of the diagram. If there are 90 houses altogether, find x

11. There are 30 people in a group. 17 own a car. 11 own a bicycle. 5 do not own either a car or a bicycle.
Find how many people in this group own a car but not a bicycle.

12. (a) For each of the following situations, draw a Venn diagram showing the sets $\mathscr{E}$, A and B:
(i) $A \cap B = \varnothing$ (ii) $A \cap B = B$ (iii) $A \cap B' = A$
(b) Which two of these statements are equivalent?
(c) Write statements (ii) and (iii) using a $\subset$ sign.

13. (a) Draw a Venn diagram showing three overlapping sets, A, B and C. Shade the region representing $A \cap B \cap C'$.
(b) Repeat part (a) for the region $A \cap (B \cup C)$
(c) Repeat part (a) for the region $A \cup (B \cap C)$
(d) Repeat part (a) for the region $A \cap (B \cup C')$

14.



Make two copies of this Venn diagram.
(a) On one diagram draw a circle to represent set C, such that $C \subset A$ and $C \cap B' = C$.
(b) On the other diagram draw a circle to represent set D such that $D \subset A'$, $D \cap B \neq \emptyset$ and $D \cup B \neq D$.

15. Draw a Venn diagram with circles representing three sets, A, B and C, such that all the following are true:
$A \cap C \neq \emptyset$, $A \cap C' \neq \emptyset$ and $B \subset (A \cup C)'$

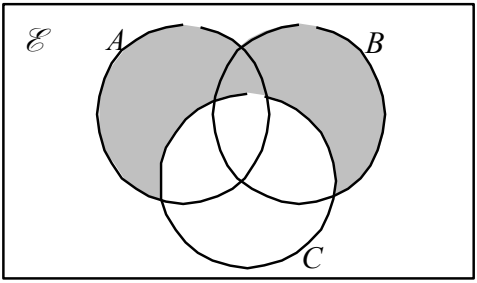
16. $\mathscr{E} = \{x: x \text{ is an integer and } 1 < x < 30\}$
$A = \{\text{Multiples of } 3\}$ $B = \{\text{Multiples of } 4\}$
(a) Find the value of $n(A \cap B)$.

(b) Copy the Venn diagram given in question 14, to represent sets A and B
Set $C = \{\text{Odd numbers}\}$
(i) Draw on the Venn diagram a circle correctly positioned to represent set C.
(ii) Shade the region $A \cap (B \cup C)'$.
(ii) Write down all the values of x such that $x \in A \cap (B \cup C)'$.

17. $\mathscr{E} = \{\text{Quadrilaterals}\}$ $P = \{\text{Parallelograms}\}$
$K = \{\text{Kites}\}$ $S = \{\text{Squares}\}$

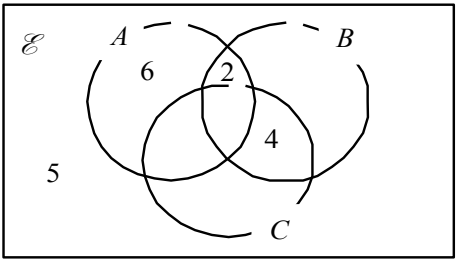
(a) What is the mathematical name for a member of $P \cap K$?
(b) Complete the statement $P \cup S = \ldots$.
(c) Draw a Venn diagram showing sets P, K and S.

18.



Use set notation to describe the shaded region.

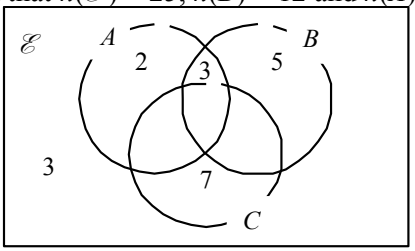
19. In the Venn diagram, the numbers of elements in several regions are shown. You are also given that $n(A) = 15$, $n(B) = 12$ and $n(C) = 20$.



(a) Let $n(A \cap B \cap C) = x$. Write this on the diagram, and fill in each of the other empty regions with an expression in terms of x

(b) Given that $n(\mathscr{E}) = 35$, find x.

20. In the Venn diagram, the numbers of elements in several regions are shown. You are also given that $n(\mathscr{E}) = 25$, $n(B) = 12$ and $n(A) = 8$.



(a) Find $n(B \cap C)$.

(b) Find $n(A \cap C \cap B')$.

21. There are 40 members in a sports club. 2 play all three sports. 23 play squash. 24 play tennis. 18 play golf. 14 play squash and tennis. 8 play tennis and golf. 1 member makes the refreshments and does not play any sport. How many play squash and golf?