

# NUMBERS

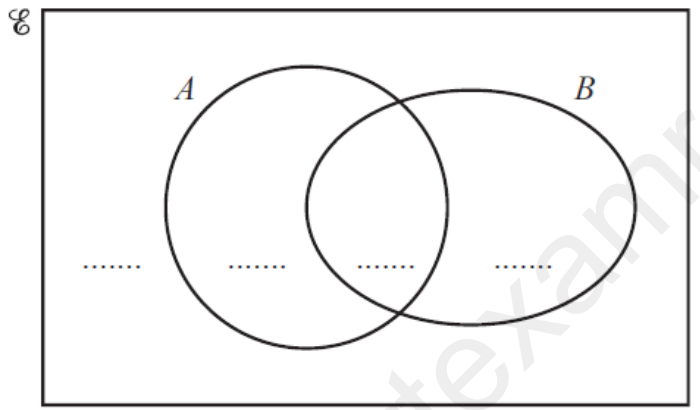
## VENN DIAGRAMS

In general:

- Venn diagram uses overlapping circles or other shapes to illustrate the logical relationships between two or more sets of items.
- A rectangle represents the universal set.
- The portion bounded by the circle represents a set.

Example:

The universal set is represented by the rectangle and the symbol "E" and the sets by the symbol A, B,C etc.



### Elements:

$$E = \{1,2,3,4,5,6,7,9,11,16\}$$

$$P = \{2,3,5,7,11\}$$

$$S = \{1,4,9,16\}$$

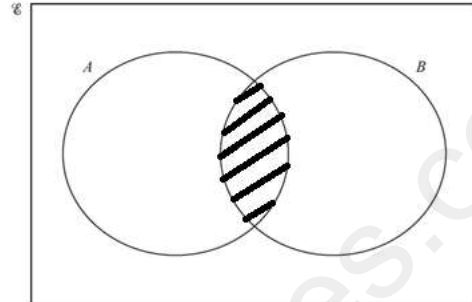
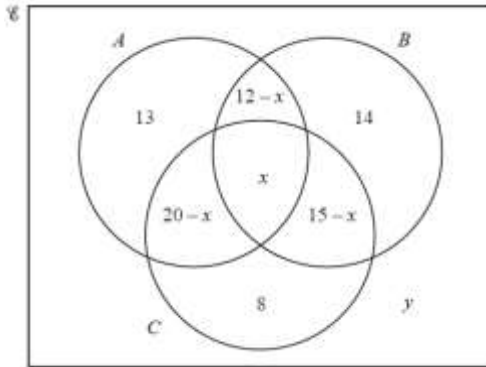
$$M = \{3,6,9\}$$

- 2,3,5,7,11 are the elements of set P
- 1,4,9,16 are the elements of set S
- 3,6,9 are elements of set M
- 1,2,3,4,5,6,7,9,11,16 are elements of the universal set "E"

Note: All elements are enclosed in Braces { } and separated by commas

## Intersection of a set: Symbol : $\cap$

**EXAMPLE:**

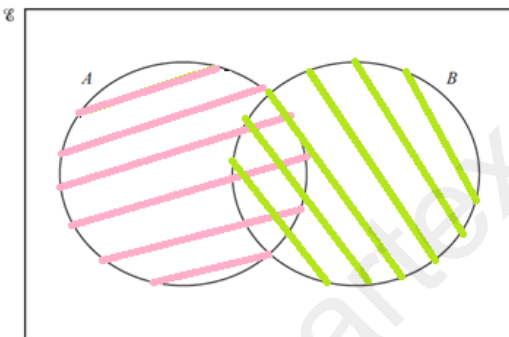


Intersection ( region common to both the sets) and is the shaded region

Element " x " represents the intersection of the three sets , namely; A , B and C.

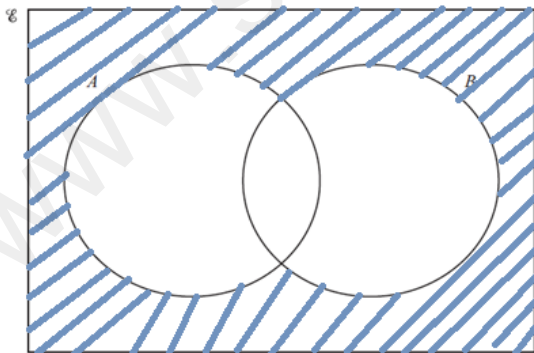
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## Union of a set : Symbol: $\cup$



Union is everything that is shaded

## Complement of a set : $(A \cup B)'$

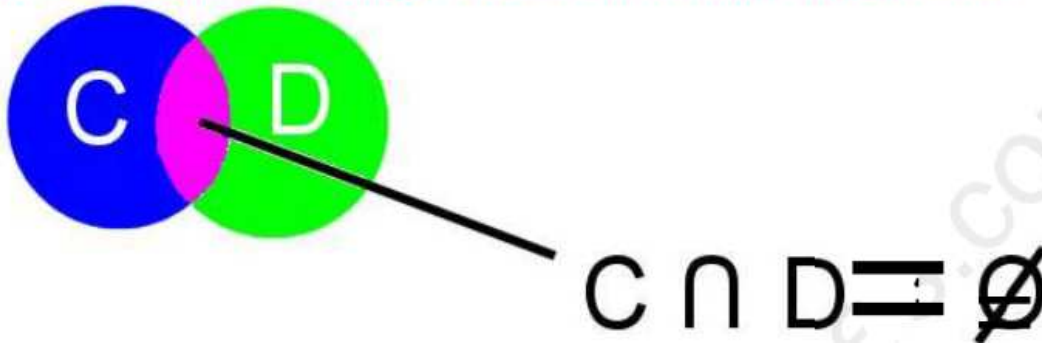


In simple terms, complement of  $(A \cup B)$  means everything that is not in  $(A \cup B)$

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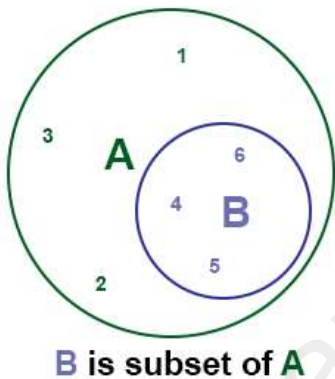
**Empty set : Symbol:  $\emptyset$  . Empty set does not contain any elements**



**An empty set does not contain any element. So in the above intersection of C and D, there were no common elements, so this intersection was an empty set.**

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**Subsets** If **all the elements of one set B are also elements of another set A**, then B is said to be a subset of A. This is written as  $B \subseteq A$



Similarly,  $A \not\subseteq B$  implies that A is not a subset of B.

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## **Superset**

If a set X is a subset of Y, then Y is said to be a superset of X.

This is written as  $X \subseteq Y$

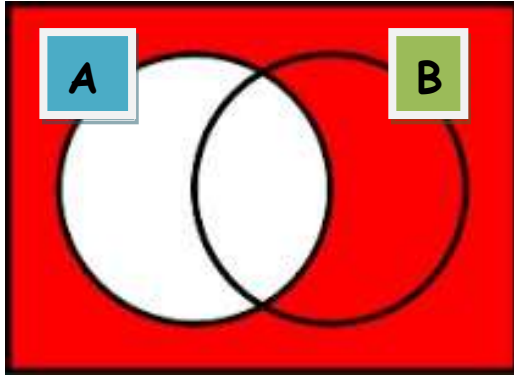
Note:

Every set is its own subset and superset.

The empty set is a subset of all sets.  $\emptyset$

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**Complement of a set: Following figure shows A compliment. It means everything that is not contained in set A.( Hence note that circle A has been left completely unshaded)**

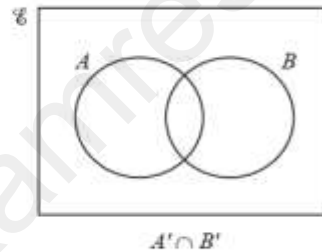
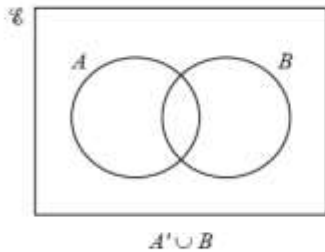


**APPLICATION BASED QUESTIONS:**

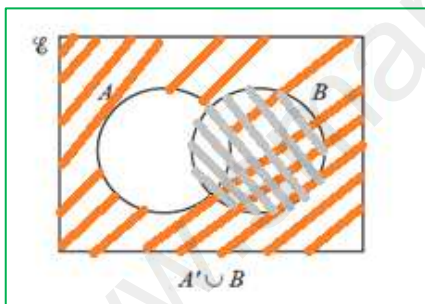
**Shading**

1 Shade the required region on each Venn diagram.

0580/22/M/J/13

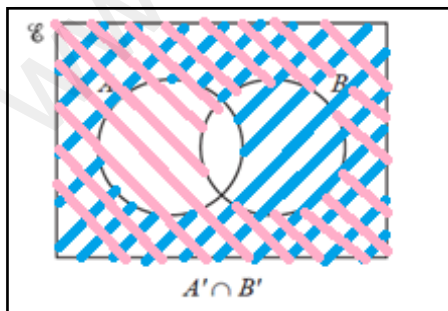


**Solution:**

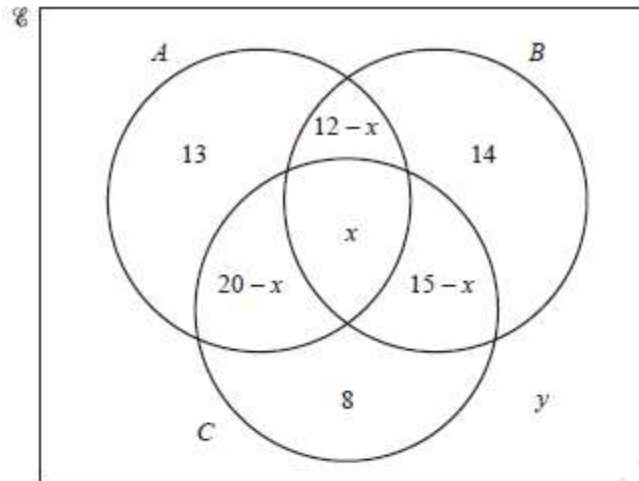


**Example:**

**Method:** Shade A' with sloping lines pointing in one direction and then Shade B with sloping lines pointing in the other direction. All the coloured regions represent the solution



**Method:** Shade A' with sloping lines pointing in one direction and then Shade B' with sloping lines pointing in the other direction. The overlapping coloured region of both the lines ( The criss-cross region) is the required answer region .



The Venn diagram shows the number of elements in sets  $A$ ,  $B$  and  $C$ .

(a)  $n(A \cup B \cup C) = 74$

Find  $x$ .

We have been asked to find the union of all the three sets:

Simple add all the values in the sets and equate them to

$$(13) + (12-x) + (x) + (20-x) + (14) + (15-x) + (8) = 74$$

$$82 - 2x = 74$$

$$2x = 82 - 74 \quad ; \quad x = 8/2 = 4$$

Answer(a)  $x =$  .....  ..... [2]

(b)  $n(E) = 100$

Find  $y$ .

Since  $E = [\text{elements of } A + B + C] + [\text{outside them}] = 74$

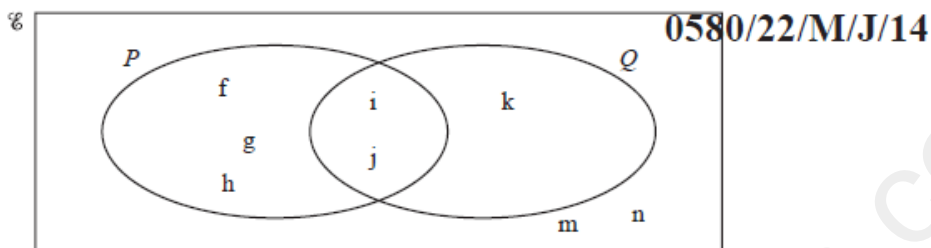
$$74 + y = 100$$

$$\Rightarrow y = 100 - 74 = 26$$

Answer(b)  $y =$  .....  ..... [1]

**Interpret the given Venn diagrams:**

22



(a) Use the information in the Venn diagram to complete the following.

(i)  $P \cap Q = \{ \dots \}$

Only those elements which are in the overlapping region.

(ii)  $P' \cup Q = \{ \dots \}$

List all elements of both the mentioned sets

(iii)  $n(P \cup Q) = \dots$

Write the number of all elements in the union

(d) Use a set notation symbol to complete the statement.

$\{f, g, h\} \dots P$

[1]

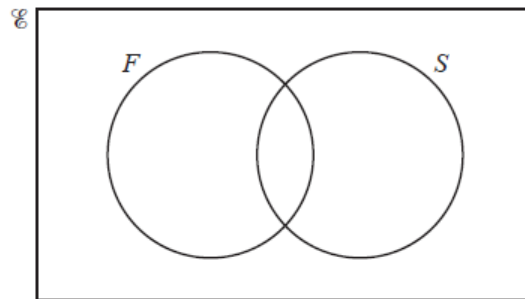
**Note: P' includes all those elements not present in P**

22	(a)	$i, j$
		$i, j, k, m, n$
		2

(d)  $\{ \dots \} \subset \text{ or } \subseteq P$

## Calculations based on Venn diagrams

16 (a) In this part, you may use this Venn diagram to help you answer the questions.



0580/23/M/J/15

In a class of 30 students, 25 study French ( $F$ ), 18 study Spanish ( $S$ ).  
One student does not study French or Spanish.

(i) Find the number of students who study French and Spanish.

14

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

Note : Total students=30

Assume that "x" students study both subjects.

So:

Students studying only: French=25-x

Spanish=18-x

so:

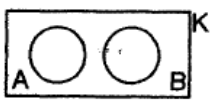
(Studying French)+ (Studying Spanish) +(Studying Spanish +French) +(Neither French/Spanish)=30

$$1 + 25 - x + x + 18 - x = 30$$

Do it yourself:

3 Three sets  $A$ ,  $B$  and  $K$  are such that  $A \subset K$ ,  $B \subset K$  and  $A \cap B = \emptyset$ .  
Draw a Venn diagram to show this information.

0580/2/O/N/02

3		2	<b>B1</b> for A,B disjoint <b>B1</b> for A,B subsets of K
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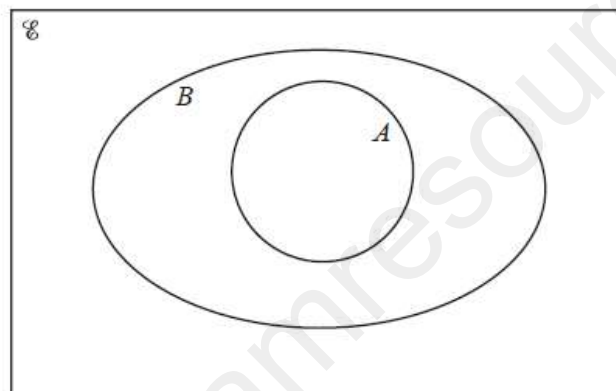
11  $\mathcal{U} = \{40, 41, 42, 43, 44, 45, 46, 47, 48, 49\}$

$A = \{\text{prime numbers}\}$

$B = \{\text{odd numbers}\}$

0580/02/O/N/04

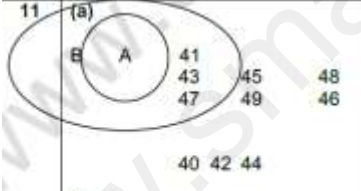
(a) Place the 10 numbers in the correct places on the Venn diagram.



[2]

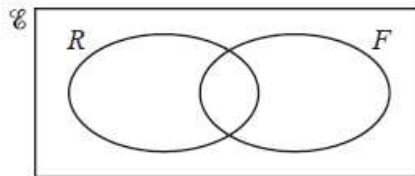
(b) State the value of  $n(B \cap A')$ .

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

11	(a)		2*	<b>B1</b> One region correct The numbers must be completely inside the correct region
	(b) 2		1√	Count the numbers in the region between A and B Not 45, 49



17



0580/23/O/N/11

In the Venn diagram,  $\mathcal{E} = \{\text{students in a survey}\}$ ,  $R = \{\text{students who like rugby}\}$  and  $F = \{\text{students who like football}\}$ .

$$n(\mathcal{E}) = 20$$

$$n(R \cup F) = 17$$

$$n(R) = 13$$

$$n(F) = 11$$

(a) Find

(i)  $n(R \cap F)$ ,

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

(ii)  $n(R' \cap F)$ .

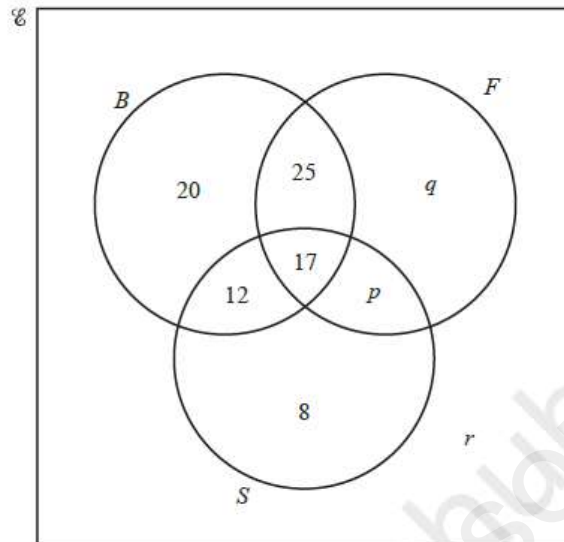
Answer(a)(ii) ..... [1]

17	(ii) 7	1	
	(ii) 4	1	
(b)	$\frac{7}{13}$	1ft	Ft their Venn diagram or their (a)(i)/13

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

The Venn diagram shows the results.

0580/04/O/N/08



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]

9 (a)	$(p =) 5$ cao, $(q =) 12$ cao $(r =) 1$ ft	<b>B1</b> <b>B1</b> <b>B1ft</b>	Accept in correct order if no labels ft for $r = 18 - \text{their } p - \text{their } q$ provided $r$ not negative
(b) (i)	17 cao	<b>B1</b>	
(ii)	12 cao	<b>B1</b>	
(c) (i)	26 cao	<b>B1</b>	
(ii)	57 ft	<b>B1ft</b>	ft 45 + their $q$

2 (a)  $x$  is an integer.

$$\mathcal{U} = \{x: 1 \leq x \leq 10\}$$

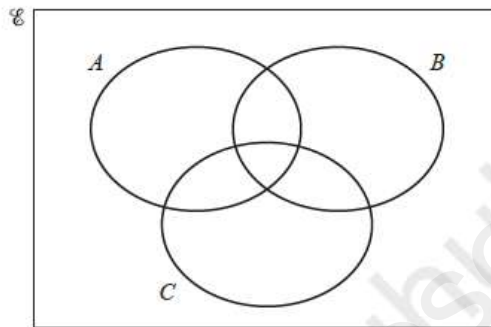
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$$A = \{x: x \text{ is a factor of } 12\}$$

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

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

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



[3]

(ii) Use set notation to complete each statement.

$$6 \dots\dots\dots A$$

$$A \cap B \cap C = \dots\dots\dots$$

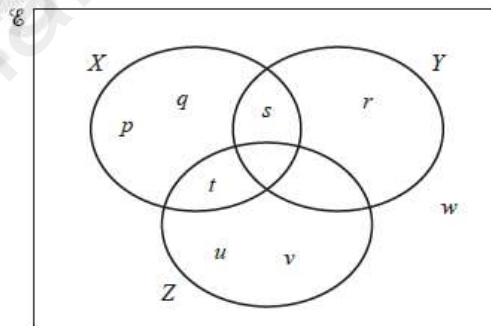
$$A \cap A' = \dots\dots\dots$$

[3]

(iii) Find  $n(B)$ .

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

(b)



(i) Use set notation to complete the statement.

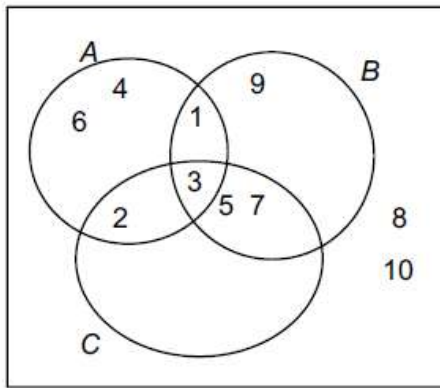
$$\{u, v\} \dots\dots\dots Z$$

[1]

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

[1]

2 (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

$\emptyset$  or {}

1

(iii) 5

**1FT**

FT *their* set B on diagram

(b) (i)  $\subset$

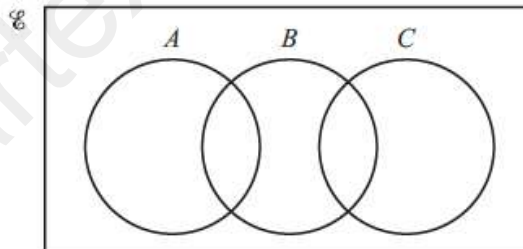
1

10

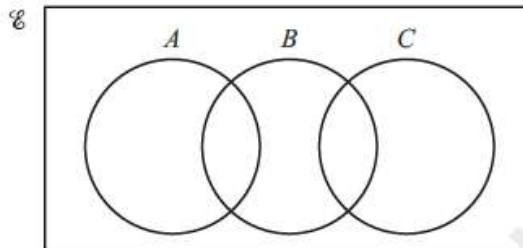
8 On the Venn diagrams shade the regions

0580/02/J/07

(a)  $A' \cap C'$ ,

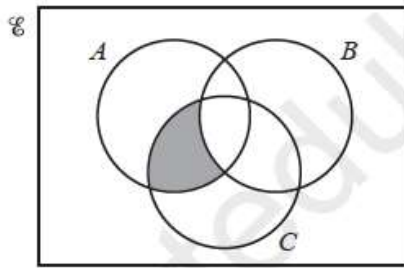


(b)  $(A \cup C) \cap B$ .



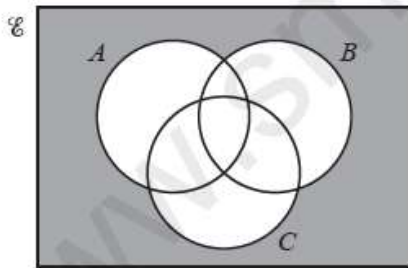
[1]

[1]

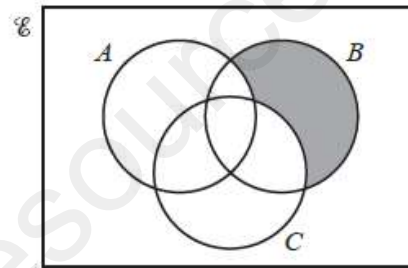


The shaded area in the diagram shows the set  $(A \cap C) \cap B'$ .

Write down the set shown by the shaded area in each diagram below.



.....



.....

[2]

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*End of lesson*  
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*Happy Learning*  
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