# Ratio

## Key Stage 4 Revision Programme

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|---|---|
| Pupil Name | |
| Handbook Designed by | Dr. Gholami |

# Timetable and Assignment Submission

## Timetable – Tutorials

| Tutorial | Date | Time | Location |
|---|---|---|---|
| 1 (Baseline assessment) | | | W229, HABS |
| 2 | | | W229, HABS |
| 3 | | | W229, HABS |
| 4 | | | W229, HABS |
| 5 | | | W229, HABS |
| 6 (Final assessment) | | | W229, HABS |
| 7 (Feedback) | | | W229, HABS |

## Timetable – Homework Assignments

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|---|---|---|
| Tutorial 1 | | |
| Tutorial 2 | | |
| Tutorial 3 | | |
| Tutorial 4 | | |
| Tutorial 5 | | |

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# Course Rationale

The concept of ratio is of considerable importance not only to mathematicians but also in many other fields of knowledge (finance, architecture) and basic life skills such as grocery shopping, cooking and sharing.

Throughout this revision course we will expand our understanding of ratio concept, solve problems in mathematical and non-mathematical concepts. We will focus our attention on ratio topics that are generally quite challenging to most pupils. We strive to master the ratio topics through practicing the various skills and applications needed for GCSE.

By end of this course, you will make connections with other topics of your maths curriculum due to the development of analytical mathematical reasoning and greater appreciation of mathematics.

# Subject Vocabulary

| Word | Definition | In a sentence |
|---|---|---|
| Ratio | | |
| Proportion | | |
| Percentage | | |
| Simplify | | |
| Share | | |
| Equivalent ratio | | |
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# Tutorial 1 – Ratio

## What is the Purpose of Tutorial 1?

- Pre-SEF
- Baseline assessment

# Tutorial 2 – Ratio

## What is the Purpose of Tutorial 2?

A: Review Key Stage 3 Ratio

- To be able to share an amount into a simple ratio
- To be able to split an amount in to a ratio with 3 shares

B: To be able to collect information to solve ratio problems in non-mathematical context when one amount is given

### Starter

Discussion: What does ratio mean?

**Objective A: Review Key stage 3 ratio**

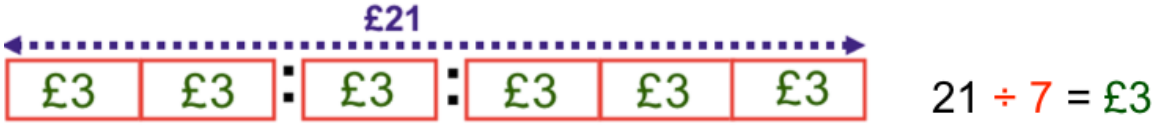
### Worked Example 1:

Split £30 into the ratio 2 : 3

Answer: £12 : £18

### Worked Example 2:

Split £21 into the ratio 2: 1: 4




Answer: £6: £3: £9

**Practice A: Share an amount to a given ratio**

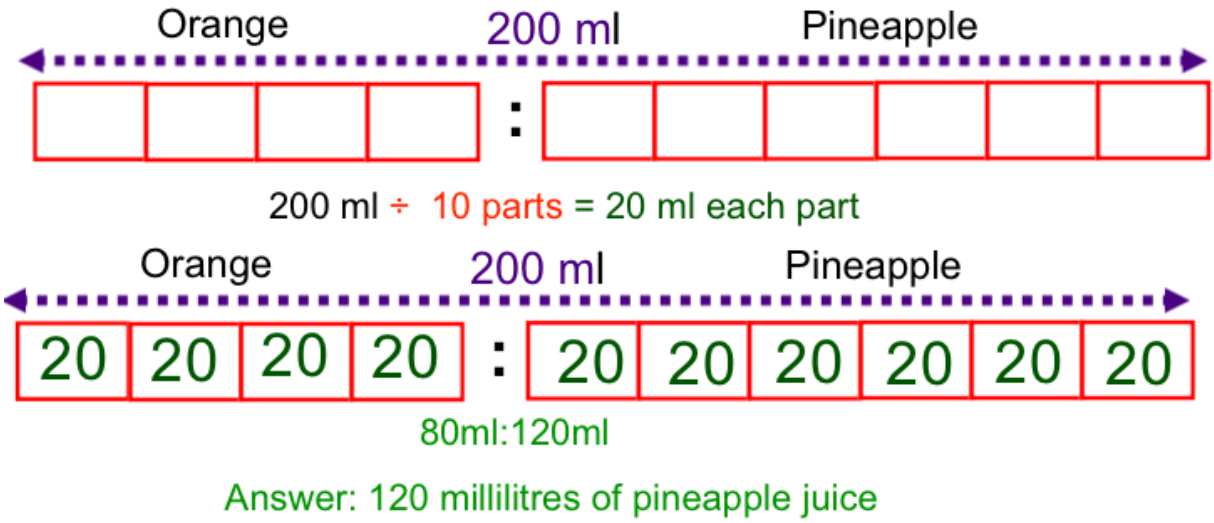
| | |
|---|---|
| 1) 24 in the ratio 1 : 5 | 7) 45 in the ratio 3 : 2 |
| 2) 32 in the ratio 3 : 5 | 8) 68 in the ratio 1 : 3 |
| 3) 27 in the ratio 1 : 2 | 9) 96 in the ratio 2 : 4 |
| 4) 25 in the ratio 2 : 3 | 10) 120 in the ratio 2 : 8 |
| 5) 24 in the ratio 2 : 4 | 11) 350 in the ratio 3 : 4 |
| 6) 48 in the ratio 1 : 3 | 12) 460 in the ratio 3 : 7 |

| | |
|---|---|
| 1) 121 in the ratio 4 : 2: 5<br>2) 180 in the ratio 8 : 3: 1<br>3) 240 in the ratio 2 : 3: 3 | 4) 720 in the ratio 3: 1: 2<br>5) 56 in the ratio 5: 2 : 1<br>6) 990 in the ratio 3: 4: 2 |

**Objective B: To be able to collect information to solve ratio problems in non-mathematical context**

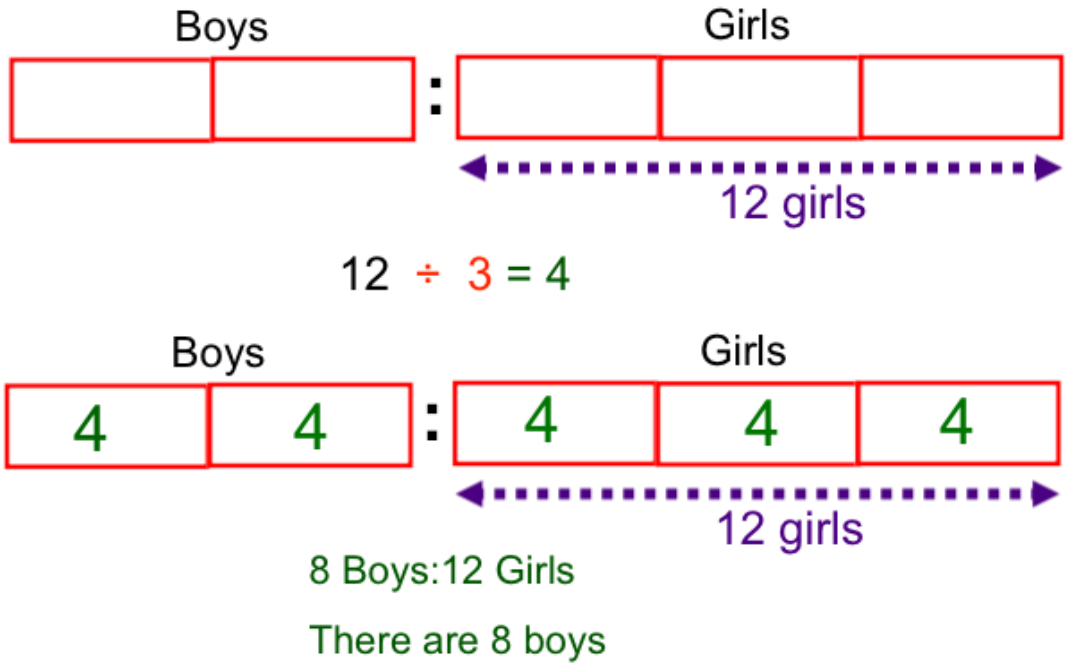
## Worked Example 1:

A drink is made by mixing 4 parts of orange juice with 6 parts of pineapple juice.
How many millilitres of pineapple juice would you need to make 200 millilitres of drink?




## Worked Example 2:

The ratio of boys to girls is 2:3. If there are 12 girls, how many boys are there?



**Practice B: To be able to collect information to solve ratio problems in non-mathematical context**

1) Ali is going to make chocolate. There are just three ingredients: chocolate, peanut butter and sugar, mixed in the ratio 4 : 2 : 3 respectively.
How much of each ingredient will he need to make 450 g of mixture?

2) Joshima and Sara share £300 between them. They decide that it should be shared so that Joshima gets £3 for every £2 that Sara receives.
How much does Sara get?

3) To make biscuits you need butter and flour in the ratio 1:3. Jane has 180g of flour.
How much butter does she need to make biscuits?

4) Money is split between Alex, Beth and Clare in the ratio 2:5:9. Beth gets £35.
How much does Alex and Clare receive?

5) Green paint is made by mixing 3 parts of yellow paint with 2 parts of blue paint.
How many tins of yellow paint would you need to make 10 tins of blue?

6) In a bag, the ratio of green to blue marbles is 2:3. If there are 8 green marbles, how many blue marbles are there?

7) Mr A, Ms B and Ms C own 4, 5 and 6 parts of a business. They share the profits according to how many parts of the business they own.
If Ms C gets £216 how much profit did the business make?

**Assessment: To be able to collect information to solve ratio problems in non-mathematical context**

Sara shares £32 between Adnan and Toby according to the ratio 5:3. How much money does Toby receive?

A. £4 B. £8 C: £12 D. £20

# Tutorial 3

## What is the Purpose of Tutorial 3?

A: To be able to collect information to solve ratio problems in non-mathematical context when the difference of amounts is given
B: To be able to collect information to solve problems that involve finding percentages, fractions and ratios

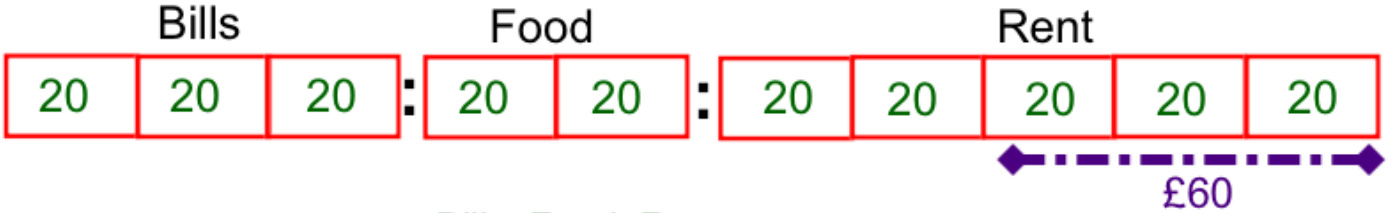
**Starter**

**Objective A: To be able to collect information to solve ratio problems in non-mathematical context when the difference of amounts is given**

### Worked Example 1:

Alex spends his income on bills, food and rent in the ratio 3: 2: 5. He spends £60 more on rent than he does on bills. What is his total income?

£60 ÷ 3 = £20




Bills: Food: Rent

£60: £40 : £100

Total income is 60 +40+100= £200

**Practice A: To be able to collect information to solve ratio problems in non-mathematical context when the difference of amounts is given**

1) Alice and Robbie share their income in the ratio 2:5. Robbie has £150 more income than Alice. How much does Alice earn a week?

2) The ratio of girls to boys in the class is 3:2. There are 5 more girls in the class than boys. How many people are in the class?

3) Tim, Matt and Ali share a box of pens in the ratio 3:1:2. Tim has 8 more pens than Matt How many pens has Ali got?

4) Frank, Mary and Seth shared some sweets in the ratio 4:5:7. Seth got 18 more sweets than Frank. Work out the total number of sweets they shared.

5) Hannah spends her income on rent, bills and food in the ratio 5:1:2
She spends £270 less on food than she does on rent. What is her total income?

**Assessment A: To be able to collect information to solve ratio problems in non-mathematical context when the difference of amounts is given**

1) Houda, Rafia and Alex share a box of pencils in the ratio 6:2:4
Houda has 12 more pencils than Alex.
How many pencils has Rafia got?

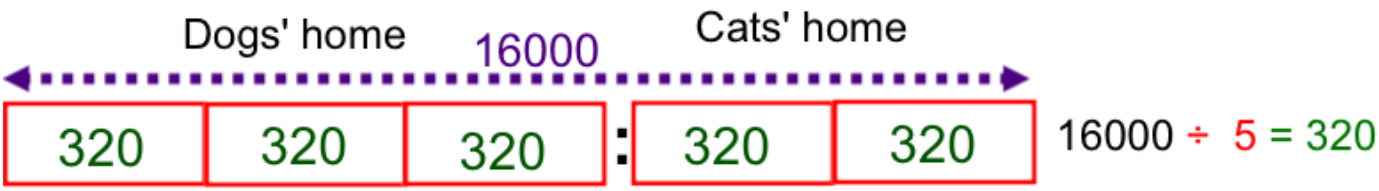
2) Money is split between Ali and Bernard in the ratio 5:3. Ali gets £12 more than Bernard. How much does Bernard receive?

**Objective B: To be able to collect information to solve problems that involve finding percentages, fractions and ratios**

## Worked Example 1:

Bill gives away £20000 to help animals. He gives 20% of the £20000 to a donkey sanctuary. He shares the rest of the £20000 between a dogs' home and a cats' home in the ratio 3 : 2
How much money does Bill give to the cats' home?

20000- 4000= £16000




£960: £640

Answer: Bill gives £640 to the cats' home

**Practice B: To be able to collect information to solve problems that involve finding percentages, fractions and ratios**

1) A supermarket car park has 200 spaces. 10% of the spaces are for staff. The other spaces are for disabled people, for parents and for other customers in the ratio 1 : 2: 7

Paul is going to paint a sign for each of the spaces for staff, for disabled people and for parents. He is not going to paint signs for the spaces for other customers.

Work out the total number of spaces Paul is going to paint a sign for.

2) Each day a company posts some small letters and some large letters.

The company posts all the letters by first class post.

The tables show information about the cost of sending a small letter by first class post and the cost of sending a large letter by first class post.

One day the company wants to post 200 letters.

The ratio of the number of small letters to the number of large letters is 3:2

70% of the large letters weigh 0-100 g.

The rest of the large letters weigh 101-250 g.

Work out the total cost of posting the 200 letters by first class post.

**Small Letter**

| Weight | First Class Post |
|---|---|
| 0–100 g | 60p |

**Large Letter**

| Weight | First Class Post |
|---|---|
| 0–100 g | £1.00 |
| 101–250 g | £1.50 |
| 251–500 g | £1.70 |
| 501–750 g | £2.50 |

**Assessment B: To be able to collect information to solve problems that involve finding percentages, fractions and ratios**

1) 60 children go to a nursery.

The ratio of girls to boys is 3 : 2

The children go to the nursery either in the morning or in the afternoon.

3/4 of the children go to the nursery in the morning.

The rest of the children go to the nursery in the afternoon.

7 boys go to the nursery in the afternoon.

Work out how many girls go to the nursery in the morning.

# Tutorial 4

## What is the Purpose of Tutorial 4?

A: To write ratios as percentage
B: To be able to collect information to combine two ratios into a triple ratio
C: To be able to collect information to split proportions into ratios

**Starter**

**Objective A: To write ratios as percentage**

**Worked Example 1:**

Write ratios as percentage

Write this ratio as a percentage

3 : 2

Percent is out of 100

Split 100% in the ratio 3:2

3 + 2 = 5
100 ÷ 5 = 20
20 x 3 = 60

60% : 40%

3 + 2 = 5
100 ÷ 5 = 20
20 x 2 = 40

**Practice A:** To write ratios as percentage

Write the ratios below as percentages.

1) 1 : 3
2) 2 : 3
3) 5 : 2 : 3
4) 6 : 4
5) 4 : 1
6) 1 : 9

**Objective B:** To be able to collect information to combine two ratios into a triple ratio.

## Worked Example 1:

The ratio of j : k = 3 : 2 and k : l = 5:1 find the ratio j : k : l

Give your answer in its simplest form

j : k

3 : 2

x5 x5

15 : 10

k : l

5 : 1

x2 x2

10 : 2

Both have k in common

We have to use equivalent ratios to make them match

LCM of 2 and 5 is 10

j : k : l

15 : 10 : 2

**Practice B:** To be able to collect information to combine two ratios into a triple ratio.

1) Given that a:b = 8:5 and b:c = 3:4 find the ratio a:b:c. Give your answer in its simplest form.

2) Given that x:y = 1:2 and y:z = 7:5 find the ratio x:y:z. Give your answer in its simplest form.

3) On a farm the number of cows and the number of sheep are in the ratio 6 : 5. The number of sheep and the number of pigs are in the ratio 2 : 1
The total number of cows, sheep and pigs on the farm is 135. How many sheep are there on the farm?

4) On a street the number of blue cars and the number of red cars are in the ratio 2:3. The number of silver cars to red cars is 4:5. The total number of cars on the street is 74.
How many silver cars are on the street?

5) At a concert the ratio of men to women is 5 : 3. The ratio of women to children is 7 : 4. Show that more than half of the people at the concert are men.

**Assessment B:** To be able to collect information to combine two ratios into a triple ratio.

In a village the number of houses and the number of flats are in the ratio 7 : 4
The number of flats and the number of bungalows are in the ratio 8 : 5
There are 50 bungalows in the village.
How many houses are there in the village?

**Practice C:** To be able to collect information split proportions into ratios

1) Ann and Bob share an amount in the ratio 3 : 2 Ann gave a half of her share to Colin. Bob gave a tenth of his share to Colin. What percentage of the amount did Colin receive?

2) Mo spends his income on rent, food & entertainment in the ratio 3 : 2 : 5 He spends money on food for breakfast, lunch & dinner in the ratio 1 : 3 : 6
What percentage of her income is spent on dinner?

3) On a school trip the ratio of the number of teachers to the number of students is 1: 9. The ratio of the number of male students to the number of female students is 3 : 2.
Work out what percentage of all the people on the trip are female students.

4) During a game, players can win and lose counters. At the start of the game Rob, Tim and Zak share the counters in the ratio 5 : 6 : 9
At the end of the game Rob, Tim and Zak share the same number of counters in the ratio 7 : 9 : 9.
Show that Zak ends the game with fewer counters than he started with.

5) Two building sites sharing bricks in the ratio 1:4.
The first building site gives 10% of its bricks to a third building site.
The second building site gives 15% of its bricks to the third building site.
What percentage of the bricks does the third building site now have?

**Assessment C:** To be able to collect information split proportions into ratios

In a company, the ratio of the number of men to the number of women is 7:3
40% of the men are under the age of 25
10% of the women are under the age of 25
What percentage of all the people in the company are under the age of 25?

# Tutorial 5

## What is the Purpose of Tutorial 5?

A: To be able to collect information to express ratios as fractions in non-mathematical contexts.
B: To be able to collect information to solve problems in a non mathematical context involving ratios

### Starter

### Worked Example:

All students study either French or Spanish. The ratio of boys to girls is $3:4$. Of the girls, the ratio studying French to those studying Spanish is $2:1$.

What fraction of the students are girls studying Spanish?

The easiest method is to <u>turn the ratios in fractions</u>.

(a) What fraction of students are girls? 4 parts out of 7 → $\frac{4}{7}$

(b) What fraction of girls study Spanish? 1 part out of 3 → $\frac{1}{3}$

(c) Therefore what fraction of the students are girls studying Spanish?

$\frac{1}{3}$ of the $\frac{4}{7}$ of the students are Spanish-speaking girls.

$$\frac{1}{3} \text{ of } \frac{4}{7} = \frac{1}{3} \times \frac{4}{7} = \frac{4}{21}$$

Recall that we can replace the word 'of' with × when dealing with fractions of amounts.

**Practice A:** To be able to collect information to express rations as fractions in non-mathematical contexts

1) The ratio of boys to girls at a party is 1:2. Of the boys, a quarter brought a present with them. What fraction of attendees are boys who brought a present?

2) At the Battersea Bake-off, prize money is awarded for 1st, 2nd and 3rd places in the ratio 3:2:1. Last year Mrs Keat and Mr Jewell shared third prize equally. What fraction of the total prize money did Mrs Keat receive?

3) All students study either French or Spanish. The ratio of boys to girls is 3:4. Of the girls, the ratio studying French to those studying Spanish is 2:1. What fraction of the students are girls studying Spanish?

4) Only blue vans and white vans are made in a factory. The ratio of blue vans to white vans is 4:3. The ratio of small blue vans to large blue vans is 3:5. What fraction of the vans in the factory are large blue vans?

5) Colin, Dave and Emma share some money. Colin gets 3/10 of the money. Emma and Dave share the rest of the money in the ratio 3:2. What fraction of the money does Dave receive?

6) Shapes are black and white, and are circles or squares. The ratio of circles to squares is 2:3. Of the circles, the ratio of black to white is 4:5. Of the squares, the ratio of black to white is 5:2. What fraction of the shapes are black?

## Worked Example:

Jamie and Alastair share some sweets in the ratio 7 : 5. Jamie gives 2 sweets to Alastair. The ratio of sweets is now 13 : 11. How many sweets did each initially have?

Let Jamie have $7x$ sweets and Alastair have $5x$ sweets.

After Jamie gives 2 sweets to Alastair, Jamie has $7x - 2$ and Alastair has $5x + 2$.

Therefore:

$$13 : 11 = 7x - 2 : 5x + 2$$

$$\frac{7x-2}{13} = \frac{5x+2}{11}$$

If $a : b = c : d$ then $\frac{c}{a} = \frac{d}{b}$

$$11(7x-2) = 13(5x+2)$$
$$77x - 22 = 65x + 26$$
$$12x = 48$$
$$x = 4$$

Cross-multiply.

Therefore, Jamie had 7x4= 28 sweets and Alastair had 5x4=20

**Practice B:** To be able to collect information to solve problems in a non-mathematical context involving ratios.

1) There are between 25 and 35 students in a class. The ratio of boys to girls is 4 : 7. How many students are in the class?

2) There are only blue, green and red pens in a box. The ratio of the number of blue pens to the number of green pens is 2 : 5. The ratio of the number of green pens to the number of red pens is 4 : 1. There are less than 100 pens in the box. What is the greatest possible number of red pens in the box?

3) The ration of the number of boys to girls at a party is 3:4. Six boys leave the party. The ratio of the number of boys to girls at the party is now 5:8. Work out the number of girls at the party.

4) Javier and Carmen share some money in the ratio 5 : 6. When each are given £4 more, the ratio of the money they have is now 6 : 7. How much money did each initially have?

5) My fruit basket contains apples and oranges. The ratio of apples to oranges in the basket is 3: 8. When I remove one apple the ratio changes to 1 : 3. How many oranges are in the basket?

6) A large pan contains a mixture of oil and water. After 2 litres of water are added to the original contents of the pan, the ratio of oil to water is 1 : 2. However, when 2 litres of oil are added to the new mixture, the ratio becomes 2 : 3.
Find the original ratio of oil to water in the pan.

**Assessment B:** To be able to collect information to solve problems in a non-mathematical context involving ratios.

Anne, Becky and Charlotte had sums of money in the ratio 7:6:5. One of them gave £9 to one of the others and this changed the ratio (in the same order of names) to 6:5:4. The total sum of money remained the same; what was it?

# Tutorial 6 – Final Assessment

# Tutorial 7 - Feedback

## What is the Purpose of Tutorial 7?

- To receive feedback on final assessments.
- To share examples of best practice with the other pupils in your group.
- To write targets for improvement in school lessons.
- To reflect on the programme including what was enjoyed and what was challenging.

## Final assessment feedback

| What I did well… | What I could have improved on… |
|---|---|
| • | • |
| • | • |
| • | • |

| My target for future work is… |
|---|
| |

## Reflecting on Uni Pathways

| What did you most enjoy about Uni Pathways? |
| --- |
| • <br>• <br>• |

| What did you find challenging about the programme? | How did you overcome these challenges? |
| --- | --- |
| • <br>• <br>• | • <br>• <br>• |

# Notes

# Notes

# Ratio

## Key Stage 4 Programme

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