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COIMBATORE–35

DEPARTMENT OF AEROSPACE ENGINEERING

19GET275 – VQAR 1
UNIT -1 QUANTITATIVE ABILITY I

Ratio Meaning

In certain situations, the comparison of two quantities by the method of division is very efficient. We can say that the comparison or simplified form of two quantities of the same kind is referred to as a ratio. This relation gives us how many times one quantity is equal to the other quantity. In simple words, the ratio is the number that can be used to express one quantity as a fraction of the other ones.

The two numbers in a ratio can only be compared when they have the same unit. We make use of ratios to compare two things. **The sign used to denote a ratio is ':'.**

A ratio can be written as a fraction, say 2/5. We happen to see various comparisons or say ratios in our daily life.

Hence, the ratio can be represented in three different forms, such as:

- a to b
- a : b
- a/b

Key Points to Remember:

- The ratio should exist between the quantities of the same kind
- While comparing two things, the units should be similar
- There should be significant order of terms
- The comparison of two ratios can be performed, if the ratios are equivalent like the fractions

Definition of Proportion

Proportion is an equation that defines that the two given ratios are equivalent to each other. In other words, the proportion states the equality of the two fractions or the ratios. In proportion, if two sets of given numbers are increasing or decreasing in the same ratio, then the ratios are said to be directly proportional to each other.

SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution**)**
COIMBATORE–35

DEPARTMENT OF AEROSPACE ENGINEERING

19GET275 – VQAR 1
UNIT -1 QUANTITATIVE ABILITY I

For example, the time taken by train to cover 100km per hour is equal to the time taken by it to cover the distance of 500km for 5 hours. Such as 100km/hr = 500km/5hrs.

Ratio and proportions are said to be faces of the same coin. When two ratios are equal in value, then they are said to be in **proportion**. In simple words, it compares two ratios. **Proportions are denoted by the symbol ':: ' or '=' .**

The proportion can be classified into the following categories, such as:

- Direct Proportion
- Inverse Proportion
- Continued Proportion

Now, let us discuss all these methods in brief:

Direct Proportion

The direct proportion describes the relationship between two quantities, in which the increases in one quantity, there is an increase in the other quantity also. Similarly, if one quantity decreases, the other quantity also decreases. Hence, if "a" and "b" are two quantities, then the direction proportion is written as a∝b.

Inverse Proportion

The inverse proportion describes the relationship between two quantities in which an increase in one quantity leads to a decrease in the other quantity. Similarly, if there is a decrease in one quantity, there is an increase in the other quantity. Therefore, the inverse proportion of two quantities, say "a" and "b" is represented by a∝(1/b).

Continued Proportion

Consider two ratios to be **a: b** and **c: d**.

SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution**)**
COIMBATORE–35

DEPARTMENT OF AEROSPACE ENGINEERING

19GET275 – VQAR 1
UNIT -1 QUANTITATIVE ABILITY I

Then in order to find the continued proportion for the two given ratio terms, we convert the means to a single term/number. This would, in general, be the LCM of means.

For the given ratio, the LCM of b & c will be bc.

Thus, multiplying the first ratio by c and the second ratio by b, we have

First ratio- ca:bc

Second ratio- bc: bd

Thus, the continued proportion can be written in the form of **ca: bc: bd**

Also, read:

- Direct And Inverse Proportion
- Ratio To Percentage

Ratio and Proportion Formula

Now, let us learn the Maths ratio and proportion formulas here.

Ratio Formula

Assume that, we have two quantities (or two numbers or two entities) and we have to find the ratio of these two, then the formula for ratio is defined as;

a: b ⇒ a/b

where a and b could be any two quantities.

Here, "a" is called the first term or **antecedent**, and "b" is called the second term or **consequent**.

SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution)
COIMBATORE–35

DEPARTMENT OF AEROSPACE ENGINEERING

19GET275 – VQAR 1
UNIT -1 QUANTITATIVE ABILITY I

Example: In ratio 4:9, is represented by 4/9, where 4 is antecedent and 9 is consequent.

If we multiply and divide each term of ratio by the same number (non-zero), it doesn't affect the ratio.

Example: 4:9 = 8:18 = 12:27

Also, read: Ratio Formula

Proportion Formula

Now, let us assume that, in proportion, the two ratios are **a:b** & **c:d.** The two terms **'b'** and **'c'** are called **'means or mean term,'** whereas the terms **'a'** and **'d'** are known as '**extremes or extreme terms.'**

a/b = c/d or a : b :: c : d

Example: Let us consider one more example of a number of students in a classroom. Our first ratio of the number of girls to boys is 3:5 and that of the other is 4:8, then the proportion can be written as:

3 : 5 :: 4 : 8 or 3/5 = 4/8

Here, 3 & 8 are the extremes, while 5 & 4 are the means.

Note: The ratio value does not affect when the same non-zero number is multiplied or divided on each term.

Important Properties of Proportion

The following are the important properties of proportion:

- Addendo – If a : b = c : d, then a + c : b + d
- Subtrahendo – If a : b = c : d, then a – c : b – d

SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution**)**
COIMBATORE–35

DEPARTMENT OF AEROSPACE ENGINEERING

19GET275 – VQAR 1
UNIT -1 QUANTITATIVE ABILITY I

- Dividendo – If a : b = c : d, then a – b : b = c – d : d
- Componendo – If a : b = c : d, then a + b : b = c+d : d
- Alternendo – If a : b = c : d, then a : c = b: d
- Invertendo – If a : b = c : d, then b : a = d : c
- Componendo and dividendo – If a : b = c : d, then a + b : a – b = c + d : c – d

Difference Between Ratio and Proportion

To understand the concept of ratio and proportion, go through the difference between ratio and proportion given here.

S.No	Ratio	Proportion
1	The ratio is used to compare the size of two things with the same unit	The proportion is used to express the relation of two ratios
2	It is expressed using a colon (:), slash (/)	It is expressed using the double colon (::) or equal to the symbol (=)
3	It is an expression	It is an equation
4	Keyword to identify ratio in a problem is "to every"	Keyword to identify proportion in a problem is "out of"

Fourth, Third and Mean Proportional

If a : b = c : d, then:

- d is called the fourth proportional to a, b, c.
- c is called the third proportion to a and b.
- Mean proportional between a and b is $\sqrt{(ab)}$.

Comparison of Ratios

If (a:b)>(c:d) = (a/b>c/d)

SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution**)**
COIMBATORE–35

DEPARTMENT OF AEROSPACE ENGINEERING

19GET275 – VQAR 1
UNIT -1 QUANTITATIVE ABILITY I

The compounded ratio of the ratios: (a : b), (c : d), (e : f) is (ace : bdf).

Duplicate Ratios

If a:b is a ratio, then:

- $a^2:b^2$ is a duplicate ratio
- $\sqrt{a}:\sqrt{b}$ is the sub-duplicate ratio
- $a^3:b^3$ is a triplicate ratio

Ratio and Proportion Tricks

Let us learn here some rules and tricks to solve problems based on ratio and proportion topics.

- If $u/v = x/y$, then $uy = vx$
- If $u/v = x/y$, then $u/x = v/y$
- If $u/v = x/y$, then $v/u = y/x$
- If $u/v = x/y$, then $(u+v)/v = (x+y)/y$
- If $u/v = x/y$, then $(u-v)/v = (x-y)/y$
- If $u/v = x/y$, then $(u+v)/(u-v) = (x+y)/(x-y)$, which is known as componendo -Dividendo Rule
- If $a/(b+c) = b/(c+a) = c/(a+b)$ and $a+b+ c \neq 0$, then $a = b = c$

Ratio and Proportion Summary

- Ratio defines the relationship between the quantities of two or more objects. It is used to compare the quantities of the same kind.
- If two or more ratios are equal, then it is said to be in proportion.
- The proportion can be represented in two different ways. Either it can be represented using an equal sign or by using a colon symbol.(i.e) a:b = c:d or a:b :: c:d

- If we multiply or divide each term of the ratio by the same number, it does not affect the ratio.
- For any three quantities, the quantities are said to be in continued proportion, if the ratio between the first and second quantity is equal to the ratio between the second and third quantity.
- For any four quantities, they are said to be in continued proportion, if the ratio between the first and second quantities is equal to the ratio between the third and fourth quantities

SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution**)**
COIMBATORE–35

DEPARTMENT OF AEROSPACE ENGINEERING

19GET275 – VQAR 1
UNIT -1 QUANTITATIVE ABILITY I

Ratio And Proportion Examples

Example 1:

Are the ratios 4:5 and 8:10 said to be in Proportion?

Solution:

4:5= 4/5 = 0.8 and 8: 10= 8/10= 0.8

Since both the ratios are equal, they are said to be in proportion.

Example 2:

Are the two ratios 8:10 and 7:10 in proportion?

Solution:

8:10= 8/10= 0.8 and 7:10= 7/10= 0.7

Since both the ratios are not equal, they are not in proportion.

Example 3:

Given ratio are-

a:b = 2:3

b:c = 5:2

c:d = 1:4

Find a: b: c.

Solution:

Multiplying the first ratio by 5, second by 3 and third by 6, we have

a:b = 10: 15

SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution**)**
COIMBATORE–35

DEPARTMENT OF AEROSPACE ENGINEERING

19GET275 – VQAR 1
UNIT -1 QUANTITATIVE ABILITY I

b:c = 15 : 6

c:d = 6 : 24

In the ratio's above, all the mean terms are equal, thus

a:b:c:d = 10:15:6:24

Example 4:

Check whether the following statements are true or false.

a] 12 : 18 = 28 : 56

b] 25 people : 130 people = 15kg : 78kg

Solution:

a] 12 : 18 = 28 : 56

The given statement is false.

12 : 18 = 12 / 18 = 2 / 3 = 2 : 3

28 : 56 = 28 / 56 = 1 / 2 = 1 : 2

They are unequal.

b] 25 persons : 130 persons = 15kg : 78kg

The given statement is true.

25 people : 130 people = 5: 26

15kg : 78kg = 5: 26

They are equal.

Example 5:

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(An Autonomous Institution**)**
COIMBATORE–35

DEPARTMENT OF AEROSPACE ENGINEERING
19GET275 – VQAR 1
UNIT -1 QUANTITATIVE ABILITY I

The earnings of Rohan is 12000 rupees every month and Anish is 191520 per year. If the monthly expenses of every person are around 9960 rupees. Find the ratio of the savings.

Solution:

Savings of Rohan per month = Rs (12000-9960) = Rs. 2040

Yearly income of Anish = Rs. 191520

Hence, the monthly income of Anish = Rs. 191520/12 = Rs. 15960.

So, the savings of Anish per month = Rs (15960 – 9960) = Rs. 6000

Thus, the ratio of savings of Rohan and Anish is Rs. 2040: Rs.6000 = 17: 50.

Example 6:

Twenty tons of iron is Rs. 600000 (six lakhs). What is the cost of 560 kilograms of iron?

Solution:

1 ton = 1000 kg
20 tons = 20000 kg
The cost of 20000 kg iron = Rs. 600000
The cost of 1 kg iron = Rs{600000}/ {20000}
= Rs. 30
The cost of 560 kg iron = Rs 30 × 560 = Rs 16800

Example 7:

The dimensions of the rectangular field are given. The length and breadth of the rectangular field are 50 meters and 15 meters. What is the ratio of the length and breadth of the field?

Solution:

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(An Autonomous Institution**)**
COIMBATORE–35

DEPARTMENT OF AEROSPACE ENGINEERING

19GET275 – VQAR 1
UNIT -1 QUANTITATIVE ABILITY I

Length of the rectangular field = 50 m

Breadth of the rectangular field = 15 m

Hence, the ratio of length to breadth = 50: 15

⇒ 50: 15 = 10: 3.

Thus, the ratio of length and breadth of the rectangular field is 10:3.

Example 8:

Obtain a ratio of 90 centimetres to 1.5 meters.

Solution:

The given two quantities are not in the same units.

Convert them into the same units.

1.5 m = 1.5 × 100 = 150 cm

Hence, the required ratio is 90 cm: 150 cm

⇒ 90: 150 = 3: 5

Therefore, the ratio of 90 centimetres to 1.5 meters is 3: 5.

Example 9:

There exists 45 people in an office. Out of which female employees are 25 and the remaining are male employees. Find the ratio of

a] The count of females to males.

b] The count of males to females.

Solution:

SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution**)**
COIMBATORE–35

DEPARTMENT OF AEROSPACE ENGINEERING

19GET275 – VQAR 1
UNIT -1 QUANTITATIVE ABILITY I

Count of females = 25

Total count of employees = 45

Count of males = 45 – 25 = 20

The ratio of the count of females to the count of males

= 25 : 20

= 5 : 4

The count of males to the count of females

= 20 : 25

= 4 : 5

Example 10:

Write two equivalent ratios of 6: 4.

Answer:

Given Ratio : 6: 4, which is equal to 6/4.

Multiplying or dividing the same numbers on both numerator and denominator, we will get the equivalent ratio.

$\Rightarrow (6 \times 2)/(4 \times 2) = 12/8 = 12: 8$

$\Rightarrow (6 \div 2)/(4 \div 2) = 3/2 = 3: 2$

Therefore, the two equivalent ratios of 6: 4 are 3: 2 and 12: 8

Example 11:

SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution**)**
COIMBATORE–35

DEPARTMENT OF AEROSPACE ENGINEERING

19GET275 – VQAR 1
UNIT -1 QUANTITATIVE ABILITY I

Out of the total students in a class, if the number of boys is 5 and the number of girls is 3, then find the ratio between girls and boys.

Solution:

The ratio between girls and boys can be written as 3:5 (Girls: Boys). The ratio can also be written in the form of factor like 3/5.

Example 12:

Two numbers are in the ratio 2 : 3. If the sum of numbers is 60, find the numbers.

Solution:

Given, 2/3 is the ratio of any two numbers.

Let the two numbers be 2x and 3x.

As per the given question, the sum of these two numbers = 60

So, 2x + 3x = 60

5x = 60

x = 12

Hence, the two numbers are;

2x = 2 x 12 = 24

and

3x = 3 x 12 = 36

24 and 36 are the required numbers.

SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution**)**
COIMBATORE–35

DEPARTMENT OF AEROSPACE ENGINEERING
19GET275 – VQAR 1
UNIT -1 QUANTITATIVE ABILITY I

Maths ratio and proportion are used to solve many real-world problems. Register with BYJU'S – The Learning App and get solutions for many difficult questions in easy methodology and followed by the step-by-step procedure.

Frequently Asked Questions on Ratios and Proportion

Q1

What is the ratio? Give an example.

A ratio is a mathematical expression written in the form of a:b, where a and b are any integers. It expresses a fraction. For example. 2:3 = ⅔.

Q2

What is a proportion? Give example

A proportion is a statement where two or more ratios are equivalent. For example, ⅔ = 4/6 = 6/9.

Q3

How to solve proportions with examples?

If a:b::c:d is a proportion, then;
a/b=c/d
ad=bc
Example: If ⅔=4/6, then,
2 x 6 = 3 x 4
12 = 12

Q4

What is the concept of ratios?

The concept of ratio defines us to compare two quantities while the proportion is an equation that shows that two ratios are equivalent

Q5

What are the two different types of proportions?

SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution**)**
COIMBATORE–35

DEPARTMENT OF AEROSPACE ENGINEERING
19GET275 – VQAR 1
UNIT -1 QUANTITATIVE ABILITY I

The two different types of proportions are:
Direct Proportion
Inverse Proportion
Q6

Can we express ratio in terms of fractions?

Yes, we can express ratio in terms of fractions. For example, 3: 4 can be expressed as 3/4.
Q7

What is the formula for ratio and proportion?

The formula for ratio is:
$x:y \Rightarrow x/y$, where x is the first term and y is the second term.
The formula for proportion is:
$p: q :: r : s \Rightarrow p/q = r/s$,
Where p and r are the first term in the first and second ratio
q and s are the second term and in the first and second ratio.
Q8

Find the means and extremes of the proportion 1: 2 :: 3: 4.

In the given proportion 1: 2 :: 3: 4,
Means are 2 and 3
Extremes are 1 and 4.