

**1. Find the ratio of the following in the simplest form:****(i) 5.60 and 2.40****Solution:-**Given numbers can be written as,  $5.60/2.40$ 

Now, shifting the decimal points we get,

$$= 560/240$$

$$= 56/24$$

$$= 28/12$$

... [because dividing both by 2]

$$= 14/6$$

... [because dividing both by 2]

$$= 7/3$$

... [because dividing both by 2]

Therefore, ratio of the given number is 7: 3.

**(ii) 432 and 120****Solution:-**Given numbers can be written as,  $432/120$ 

$$= 432/120$$

$$= 216/60$$

... [because dividing both by 2]

$$= 108/30$$

... [because dividing both by 2]

$$= 54/15$$

... [because dividing both by 2]

$$= 18/5$$

... [because dividing both by 3]

Therefore, ratio of the given number is 18: 5.

**(iii) ₹ 5.40 and 180 paise****Solution:-**Given numbers can be written as,  $5.40/180$ 

We know that, ₹ 1 = 100 paise

So, ₹ 5.40 = 540 paise

$$= 540/180$$

$$= 54/18$$

$$= 3/1$$

... [because dividing both by 3]

Therefore, ratio of the given number is 3: 1.

**(iv)  $a^4 + b^4$  and  $a^3 - b^3$** **Solution:-**

Given question can be written as,

$$= (a^4 + b^4)/(a^3 - b^3)$$

We know that,  $a^4 + b^4 = (a - b)(a^3 + ab^2 + a^2b + b^3)$

Then,  $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

So,  $[(a - b)(a^3 + ab^2 + a^2b + b^3)] / [(a - b)(a^2 + ab + b^2)]$   
 $= (a^3 + ab^2 + a^2b + b^3) / (a^2 + ab + b^2)$

Therefore, ratio of the given terms is  $(a^3 + ab^2 + a^2b + b^3) : (a^2 + ab + b^2)$ .

v.  $x^2 + 4x + 4$  and  $x^2 - x - 6$

**Solution:-**

Given question can be written as,

$$\begin{aligned} &= (x^2 + 4x + 4) / (x^2 - x - 6) \\ &= (x + 2)^2 / [(x - 3)(x + 2)] \\ &= (x + 2) / (x - 3) \end{aligned}$$

Therefore, ratio of the given terms is  $(x + 2) : (x - 3)$

**2. If a: b = 4: 7, find the following**

**(i)  $(5a + 2b) / (5a - 2b)$**

**Solution:-**

From the question it is given that,

$$a: b = 4: 7$$

$$a/b = 4/7$$

$$(5a + 2b) / (5a - 2b)$$

Now, divide both numerator and denominator by 'b' we get,

$$\begin{aligned} &= [(5a/b) + (2b/b)] / [(5a/b) - (2b/b)] \\ &= [(5a/b) + 2] / [(5a/b) - 2] \end{aligned}$$

Now, substitute the value of a and b we get,

$$\begin{aligned} &= [(5(4/7)) + 2] / [(5(4/7)) - 2] \\ &= ((20/7) + 2) / ((20/7) - 2) \\ &= 34/6 \\ &= 17/3 \end{aligned}$$

**(ii)  $(6a - b) / (a + 3b)$**

**Solution:-**

From the question it is given that,

$$a: b = 4: 7$$

$$a/b = 4/7$$

$$(6a - b) / (a + 3b)$$

Now, divide both numerator and denominator by 'b' we get,

$$= [(6a/b) - (b/b)] / [(a/b) + (3b/b)]$$

$$= [(6a/b) - 1]/[(a/b) + 3]$$

Now, substitute the value of a and b we get,

$$\begin{aligned} &= [(6(4/7)) - 1]/[(4/7) + 3] \\ &= ((24/7) - 1)/((4/7) + 3) \\ &= 17/25 \end{aligned}$$

**(iii)  $(5a - 4b)/(2a - 3b)$**

**Solution:-**

From the question it is given that,

$$a : b = 4 : 7$$

$$a/b = 4/7$$

$$(5a - 4b)/(2a - 3b)$$

Now, divide both numerator and denominator by 'b' we get,

$$\begin{aligned} &= [(5a/b) - (4b/b)]/[(2a/b) - (3b/b)] \\ &= [(5a/b) - 4]/[(2a/b) - 3] \end{aligned}$$

Now, substitute the value of a and b we get,

$$\begin{aligned} &= [(5(4/7)) - 4]/[(2(4/7)) - 3] \\ &= ((20/7) - 4)/((8/7) - 3) \\ &= -8/-13 \\ &= 8/13 \end{aligned}$$

**3. If  $m : n = 3 : 8$ , find the value of  $(3m + 2n) : (5m + n)$**

**Solution:-**

From the question it is given that,

$$m : n = 3 : 8$$

$$m/n = 3/8$$

$$(3m + 2n)/(5m + n)$$

Now, divide both numerator and denominator by 'n' we get,

$$\begin{aligned} &= [(3m/n) + (2n/n)]/[(5m/n) + (n/n)] \\ &= [(3m/n) + 2]/[(5m/n) + 1] \end{aligned}$$

Now, substitute the value of m and n we get,

$$\begin{aligned} &= [(3(3/8)) + 2]/[(5(3/8)) + 1] \\ &= ((9/8) + 2)/((15/8) + 1) \\ &= 25/23 \end{aligned}$$

Therefore, the value of  $(3m + 2n) : (5m + n) = 25 : 23$

**4. A man's monthly income is ₹ 5,000. He saves every month a minimum of ₹ 800. Find**

the ratio of his:

(i) Annual expenses to annual income.

(ii) Monthly savings to monthly expenses.

**Solution:-**

From the question it is given that,

Monthly income of a man = ₹ 5,000

Every month man saves ₹ 800

(i) Annual expenses to annual income,

Annual income = monthly income  $\times$  12

$$= ₹ 5,000 \times 12$$

$$= ₹ 60,000$$

Then, monthly expenses = ₹ 5,000 – 800

$$= ₹ 4,200$$

Annual expenses = monthly expenses  $\times$  12

$$= ₹ 4,200 \times 12$$

$$= ₹ 50,400$$

Annual expenses/Annual income = 50,400/60,000

$$= 504/600$$

$$= 21/25$$

Therefore, Annual expenses: annual income = 21: 25

(ii) Monthly savings to monthly expenses,

Monthly expenses = ₹ 5,000 - ₹ 800 = ₹ 4,200

Then, monthly savings/monthly expenses = 800/4,200

$$= 8/42$$

$$= 4/21$$

Therefore, monthly savings: monthly expenses = 4: 21.

**5. If  $a + b : a - b = 11 : 8$ ; find the value of  $a : b$**

**Solution:-**

From the question it is given that,  $a + b : a - b = 11 : 8$ .

$$(a + b)/(a - b) = 11/8$$

By cross multiplication we get,

$$8(a + b) = 11(a - b)$$

$$8a + 8b = 11a - 11b$$

Transposing we get,

$$11b + 8b = 11a - 8a$$

$$19b = 3a$$

$$19/3 = a/b$$

$$a : b = 19 : 3$$

**6. If  $p : q = 2 : 5$ ,  $q : r = 4 : 3$ , then find  $p : r$**

**Solution:-**

From the question it is given that,  $p : q = 2 : 5$ ,  $q : r = 4 : 3$

$$\text{So, } p/q = 2/5$$

$$q/r = 4/3$$

$$(p/q) \times (q/r) = (2/5) \times (4/3)$$

By simplification we get,

$$p/r = 8/15$$

Therefore, the value of  $p : r = 8 : 15$

**7. If  $a : e = 5 : 12$ ,  $e : i = 8 : 3$  and  $i : u = 9 : 16$ , then find  $a : u$**

**Solution:-**

From the question it is given that,  $a : e = 5 : 12$ ,  $e : i = 8 : 3$  and  $i : u = 9 : 16$

$$\text{So, } a/e = 5/12$$

$$e/i = 8/3$$

$$i/u = 9/16$$

$$(a/e) \times (e/i) \times (i/u) = (5/12) \times (8/3) \times (9/16)$$

By simplification we get,

$$a/u = 10/16$$

$$a/u = 5/8$$

Therefore, the value of  $a : u = 5 : 8$

**8. Find the compounded ratio of the following:**

**(i) 15 : 16 and 8 : 5**

**Solution:-**

Given ratio can be written as,

$$15/16 \text{ and } 8/5$$

$$= 15/16 \times 8/5$$

$$= (15 \times 8)/(16 \times 5)$$

$$= (3 \times 1)/(2 \times 1)$$

$$= 3/2$$

Therefore, the compounded ratio of 15 : 16 and 8 : 5 is 3 : 2.

**(ii)  $(a^2 - b^2) : (a^2 + b^2)$  and  $(a^4 - b^4) : (a + b)^4$**

**Solution:-**

Given ratio can be written as,

$$(a^2 - b^2)/(a^2 + b^2) \text{ and } (a^4 - b^4)/(a + b)^4$$

$$= (a^2 - b^2)/(a^2 + b^2) \times (a^4 - b^4)/(a + b)^4$$

We know that,  $(a^2 - b^2) = (a + b)(a - b)$

$$= ((a + b)(a - b))/(a^2 + b^2) \times ((a^2 + b^2)(a^2 - b^2))$$

$$= ((a - b)(a + b)(a - b)(a + b))/((a + b)^2(a + b)^2)$$

$$= (a - b)^2/(a + b)^2$$

Therefore, the compounded ratio is  $(a - b)^2 : (a + b)^2$ .

**(iii) 3: 5, 7: 9 and 15: 28**
**Solution:-**

Given ratio can be written as,

$$3/5, 7/9 \text{ and } 15/28$$

$$= 3/5 \times 7/9 \times 15/28$$

$$= (3 \times 7 \times 15)/(5 \times 9 \times 28)$$

$$= (1 \times 1 \times 3)/(1 \times 3 \times 4)$$

$$= (1 \times 1 \times 1)/(1 \times 1 \times 4)$$

$$= 1/4$$

Therefore, the compounded ratio is 1: 4.

**(iv)  $\sqrt{8}$ : 4, 3:  $\sqrt{5}$  and  $\sqrt{20}$ :  $\sqrt{27}$** 
**Solution:-**

Given ratio can be written as,

$$\sqrt{8}/4, 3/\sqrt{5} \text{ and } \sqrt{20}/\sqrt{27}$$

$$= \sqrt{8}/4 \times 3/\sqrt{5} \times \sqrt{20}/\sqrt{27}$$

$$= 2\sqrt{2}/4 \times 3/\sqrt{5} \times 2\sqrt{5}/3\sqrt{3}$$

$$= \sqrt{2}/\sqrt{3}$$

Therefore, the compounded ratio is  $\sqrt{2} : \sqrt{3}$ .

**(v)  $(m - n) : (m + n)$ ,  $(m + n)^2 : (m^2 + n^2)$  and  $(m^4 - n^4) : (m^2 - n^2)^2$** 
**Solution:-**

Given ratio can be written as,

$$(m - n)/(m + n), (m + n)^2/(m^2 + n^2) \text{ and } (m^4 - n^4)/(m^2 - n^2)^2$$

$$= (m - n)/(m + n) \times (m + n)^2/(m^2 + n^2) \times (m^4 - n^4)/(m^2 - n^2)^2$$

$$= (m - n)/(1) \times (m + n)/(m^2 + n^2) \times ((m^2 + n^2)(m^2 - n^2))/(m^2 - n^2)^2$$

By simplification we get,

$$= 1/1$$

Therefore, the compounded ratio is 1 : 1.

**9. Find the duplicate ratio of the following:**

**(i)  $\sqrt{10} : \sqrt{14}$**

**Solution:-**

$$\begin{aligned}\text{Given, } \sqrt{10} : \sqrt{14} \\ &= (\sqrt{10})^2 : (\sqrt{14})^2 \\ &= 10 : 14 \\ &= 10/14 \\ &= 5/7\end{aligned}$$

Therefore, duplicate ratio is 5 : 7.

**(ii)  $3\sqrt{2a} : 2\sqrt{3a}$**

**Solution:-**

$$\begin{aligned}\text{Given, } 3\sqrt{2a} : 2\sqrt{3a} \\ &= (3\sqrt{2a})^2 : (2\sqrt{3a})^2 \\ &= 18a : 12a \\ &= 18a/12a \\ &= 3/2\end{aligned}$$

Therefore, duplicate ratio is 3 : 2.

**(iii)  $2/3 : 4/9$**

**Solution:-**

$$\begin{aligned}\text{Given, } 2/3 : 4/9 \\ &= (2/3)^2 : (4/9)^2 \\ &= 4/9 : 16/81 \\ &= (4/9) \times (81/16) \\ &= (4 \times 81)/(9 \times 16) \\ &= (1 \times 9)/(1 \times 4) \\ &= 9/4\end{aligned}$$

Therefore, duplicate ratio = 9 : 4

**(iv)  $(a + b) : (a^2 - b^2)$**

**Solution:-**

$$\text{Given, } (a + b) : (a^2 - b^2)$$

$$\begin{aligned} &= (a + b)^2 : (a^2 - b^2)^2 \\ &= (a + b)^2 / ((a + b)^2(a - b)^2) \\ &= 1/(a - b)^2 \end{aligned}$$

Therefore, duplicate ratio = 1: (a - b)<sup>2</sup>

**10. Find the triplicate ratio of the following:**

**(i) 3: 5**

**Solution:-**

Given, 3: 5

$$\begin{aligned} &= 3^3 : 5^3 \\ &= 27: 125 \end{aligned}$$

Therefore, triplicate ratio is 27: 125

**(ii) 2√5 : 5√2**

**Solution:-**

Given, 2√5 : 5√2

$$\begin{aligned} &= (2\sqrt{5})^3 : (5\sqrt{2})^3 \\ &= (8 \times 5\sqrt{5}) / (125 \times 2\sqrt{2}) \end{aligned}$$

By simplification,

$$= 4\sqrt{5}: 25\sqrt{2}$$

Therefore, triplicate ratio = 4√5: 25√2

**(iii) √15 : √18**

**Solution:-**

Given, √15: √18

$$\begin{aligned} &= (\sqrt{15})^3 : (\sqrt{18})^3 \\ &= 15\sqrt{5}: 18 \times 3\sqrt{2} \\ &= 5\sqrt{15}: 18\sqrt{2} \end{aligned}$$

Therefore, triplicate ratio is 5√15: 18√2

**(iv)  $\sqrt[3]{(ab)^2} : \sqrt[3]{(a^2b)}$**

**Solution:-**

Given,  $\sqrt[3]{(ab)^2} : \sqrt[3]{(a^2b)}$

By simplification we get,

$$\begin{aligned} &= (\sqrt[3]{(ab)^2})^3 : (\sqrt[3]{(a^2b)})^3 \\ &= ab^2 : a^2b \\ &= b: a \end{aligned}$$



Therefore, triplicate ratio is b: a

**11. Find the sub – duplicate ratio of the following:**

**(i)  $x^6: y^4$**

**Solution:-**

$$\begin{aligned}\text{Given, } x^6: y^4 & \\ &= \sqrt{x^6}: \sqrt{y^4} \\ &= (x^6)^{1/2}: (y^4)^{1/2} \\ &= x^3: y^2\end{aligned}$$

Therefore, sub - duplicate ratio is  $x^3:y^2$

**(ii)  $63m^2: 28n^2$**

**Solution:-**

$$\begin{aligned}\text{Given, } 63m^2: 28n^2 & \\ &= \sqrt{63m^2}: \sqrt{28n^2} \\ &= 3\sqrt{7}m: 2\sqrt{7}n \\ &= 3m: 2n\end{aligned}$$

Therefore, sub – duplicate ratio is  $3m: 2n$

**(iii)  $1/16: 1/36$**

**Solution:-**

$$\begin{aligned}\text{Given, } 1/16: 1/36 & \\ &= \sqrt{1/16}: \sqrt{1/36} \\ &= \frac{1}{4}: \frac{1}{6} \\ &= \left(\frac{1}{4}\right) / \left(\frac{1}{6}\right) \\ &= \left(\frac{1}{4}\right) \times \left(\frac{6}{1}\right) \\ &= \frac{3}{2}\end{aligned}$$

Therefore, sub – duplicate ratio is  $3: 2$

**(iv)  $9a^2/5: 25a^2/3$**

**Solution:-**

$$\begin{aligned}\text{Given, } 9a^2/5: 25a^2/3 & \\ &= \sqrt{9a^2/5}: \sqrt{25a^2/3} \\ &= 3a(1/\sqrt{5}): 5a(1/\sqrt{3}) \\ &= 3\sqrt{3}: 5\sqrt{5}\end{aligned}$$

Therefore, sub – duplicate ratio is  $3\sqrt{3}: 5\sqrt{5}$ .

**12. Find the sub – triplicate ratio of the following:**

**(i) 512: 216**

**Solution:-**

$$\begin{aligned}\text{Given, } 512: 216 & \\ &= \sqrt[3]{512} : \sqrt[3]{216} \\ &= (8^3)^{1/3} : (6^3)^{1/3} \\ &= 8: 6 \\ &= 8/6 \\ &= 4/3\end{aligned}$$

Therefore, sub – triplicate ratio is 4: 3.

**(ii)  $m^3n^6$ :  $m^6n^3$**

**Solution:-**

$$\begin{aligned}\text{Given, } m^3n^6: m^6n^3 & \\ &= \sqrt[3]{(m^3n^6)} : \sqrt[3]{(m^6n^3)} \\ &= (m^3n^6)^{1/3} : (m^6n^3)^{1/3} \\ &= mn^2: m^2n \\ &= mn^2/m^2n \\ &= n/m\end{aligned}$$

Therefore, sub – triplicate ratio is n: m.

**(iii)  $125a^3$ :  $343b^6$**

**Solution:-**

$$\begin{aligned}\text{Given, } 125a^3: 343b^6 & \\ &= \sqrt[3]{(125a^3)} : \sqrt[3]{(343b^6)} \\ &= (125a^3)^{1/3} : (343b^6)^{1/3} \\ &= 5a: 7b^2\end{aligned}$$

Therefore, sub – triplicate ratio is 5a: 7b<sup>2</sup>.

**(iv)  $64m^3/729n^3$ :  $216m^3/27n^3$**

**Solution:-**

$$\begin{aligned}\text{Given, } 64m^3/729n^3: 216m^3/27n^3 & \\ &= \sqrt[3]{(64m^3/729n^3)} : \sqrt[3]{(216m^3/27n^3)} \\ &= (64m^3/729n^3)^{1/3} : (216m^3/27n^3)^{1/3}\end{aligned}$$

By simplification we get,

$$\begin{aligned}&= 4m/9n: 6m/3n \\ &= (4m/9n) \times (3n/6m)\end{aligned}$$

$$= 2/9$$

Therefore, sub – triplicate ratio is 2: 9.

**13. Find the reciprocal ratio of the following:**

**(i) 17/45: 51/27**

**Solution:-**

Given ratio, 17/45: 51/27

The reciprocal of the given ratio is 45/17: 51/27

$$= (45/17) \times (51/27)$$

$$= (45/1) \times (3/27)$$

$$= (45/1) \times (1/9)$$

$$= 5/1$$

Therefore, reciprocal of the ratio is 5: 1

**(ii) 1/45: 1/54**

**Solution:-**

Given ratio, 1/45: 1/54

The reciprocal of the given ratio is 45/1: 54/1

$$= 45: 54$$

$$= 45/54$$

$$= 5/6$$

Therefore, reciprocal of the ratio is 5: 6

**(iii)  $a^3b^2$ :  $a^2b^3$**

**Solution:-**

Given ratio,  $a^3b^2$ :  $a^2b^3$

The reciprocal of the given ratio is  $1/a^3b^2$ :  $1/a^2b^3$

$$= (1/a^3b^2) \times (a^2b^3/1)$$

$$= b: a$$

Therefore, reciprocal of the ratio is b: a

**(iv)  $81pq^2$ :  $54p^2q$**

**Solution:-**

Given ratio,  $81pq^2$ :  $54p^2q$

The reciprocal of the given ratio  $1/81pq^2$ :  $1/54p^2q$

$$= (1/81pq^2) \times (54p^2q/1)$$

By simplification we get,

$$= 2p/3q$$

Therefore, reciprocal of the ratio is  $2p: 3q$

**14. Which of the following ratios is greater?**

**(i) 3: 5 and 2: 11**

**Solution:-**

Given ratio can be written as,  $3/5$  and  $2/11$

Then,

$$3 \times 11 > 2 \times 5$$

$$33 > 10$$

Therefore,  $3: 5 > 2: 11$

So, 3: 5 is greater.

**(ii) 2: 3 and 13: 19**

**Solution:-**

Given ratio can be written as,  $2/3$  and  $13/19$

Then,

$$2 \times 19 < 3 \times 13$$

$$38 < 39$$

Therefore,  $2: 3 < 13: 19$

So, 13: 19 is greater.

**(iii) 5: 8 and 7: 10**

**Solution:-**

Given ratio can be written as,  $5/8$  and  $7/10$

Then,

$$5 \times 10 < 8 \times 7$$

$$50 < 56$$

Therefore,  $5: 8 < 7: 10$

So, 7: 10 is greater.

**(iv)  $(5/2): (15/4)$  and  $(5/3): (11/6)$**

**Solution:-**

Given ratio,  $(5/2): (15/4)$  and  $(5/3): (11/6)$ .

$$(5/2): (15/4) = (5/3) \times (4/15) = 2/3$$

$$(5/3): (11/6) = (5/3) \times (6/11) = 10/11$$

Consider,  $2/3 : 10/11$

$$2 \times 11 < 3 \times 10$$

$$22 < 30$$

$$2: 3 < 10: 11$$

$$5/2 : 15/4 < 5/3 : 11/6$$

Therefore,  $5/3: 11/6$  is greater.

**15. Two numbers are in the ratio 7: 10. If 8 is added to each number, the ratio becomes 3: 4. Find the numbers.**

**Solution:-**

From the question it is given that,

Two numbers are in the ratio 7: 10.

Let us assume the two numbers be  $7y$  and  $10y$ .

$$\text{Then, } (7y + 8)/(10y + 8) = \frac{3}{4}$$

$$28y + 32 = 30x + 24$$

$$2y = 8$$

$$y = 8/2$$

$$y = 4$$

$$\text{So, } 7y = 7 \times 4 = 28$$

$$10y = 10 \times 4 = 40$$

Therefore, the two numbers are 28 and 40.