Exercise 3.1

1. Express the following as ratio a:b and as a fraction in its simplest (lowest) form.

(i) Rs. 750, Rs. 1250

$$750 : 1250$$
$$\frac{750}{10} : \frac{1250}{10}$$
$$\frac{75}{5} : \frac{125}{5}$$
$$\frac{15}{5} : \frac{25}{5}$$
$$3 : 5 \quad = \frac{3}{5}$$

(ii) 450cm, 3m

$$450\text{cm} : 3\text{x}100\text{ cm}$$
$$\frac{450}{10} : \frac{300}{10}$$
$$\frac{45}{5} : \frac{30}{5}$$
$$\frac{9}{3} : \frac{6}{3}$$
$$3 : 2 \quad = \frac{3}{2}$$

(iii) 4kg , 2kg 750gm

$$4\text{x}1000\text{gm} : 2\text{x}1000\text{gm} + 750\text{gm}$$
$$\frac{4000}{10} : \frac{2750}{10}$$
$$\frac{400}{5} : \frac{275}{5}$$
$$\frac{80}{5} : \frac{55}{5}$$
$$16 : 11 \quad = \frac{16}{11}$$

(iv) 27min. 30 sec , 1 hour

$$27\text{x}60\text{sec}+30\text{sec} : 1\text{x}60\text{x}60\text{ sec}$$
$$\frac{1650}{10} : \frac{3600}{10}$$
$$\frac{165}{5} : \frac{360}{5}$$
$$\frac{33}{3} : \frac{72}{3}$$
$$11 : 24 \quad = \frac{11}{24}$$

(v) 75° , 225°

$$75^\circ : 225^\circ$$
$$\frac{75}{5} : \frac{225}{5}$$
$$\frac{15}{5} : \frac{45}{5}$$
$$\frac{3}{3} : \frac{9}{3}$$
$$1 : 3 \quad = \frac{1}{3}$$

Q. 2: In a class of 60 students, 25 students are girls and remaining students are boys. Compute the ratio of

Total students = 60

Girls = 25

Boys = 60 – 25 = 35

(i) Boys to total students

Boys	:	Total Students
35	:	60
$\frac{35}{5}$	:	$\frac{60}{5}$
7	:	12

(ii) Boys to girls

Boys	:	Girls
35	:	25
$\frac{35}{5}$	:	$\frac{25}{5}$
7	:	5

Q. 3: If $3(4x - 5y) = 2x - 7y$, find the ratio x: y.

$3(4x - 5y) = 2x - 7y$

$12x - 15y = 2x - 7y$

Dividing by y on both sides

$12\frac{x}{y} - 15\frac{y}{y} = 2\frac{x}{y} - 7\frac{y}{y}$

$12\frac{x}{y} - 15 = 2\frac{x}{y} - 7$

$12\frac{x}{y} - 2\frac{x}{y} = -7 + 15$

$10\frac{x}{y} = 8$

$\frac{x}{y} = \frac{8}{10}$

$\frac{x}{y} = \frac{4}{5}$

$x: y = 4: 5$

Q. 4: Find the value of p, if the ratios $2p + 5 : 3p + 4$ and $3: 4$ are equal.

$\frac{2p+5}{3p+4} = \frac{3}{4}$

$4(3p + 5) = 3(p + 4)$

$12p + 20 = 3p + 12$

$12p - 3p = 12 - 20$

$9p = -8$

$p = \frac{-8}{9}$

Q. 5: If the ratios $3x + 1 : 6 + 4x$ and $2: 5$ are equal. Find the value of x.

$\frac{3x+1}{6+4x} = \frac{2}{5}$

$5(3x + 1) = 2(6 + 4x)$

$15x + 5 = 12 + 8x$

$$15x - 8x = 12 - 5$$
$$7x = 7$$
$$x = 1$$

Q. 6: Two numbers are in ratio $5:8$. If 9 is added to each number, we get a new ratio $8:11$. Find the numbers

Let the 1st No $= x$

and the 2nd No $= y$

According to first condition

$$x : y = 5:8$$
$$\frac{x}{y} = \frac{5}{8} \text{ ---------- (i)}$$

According to 2nd condition

$$x + 9 : y + 9 = 8:11$$
$$\frac{x+9}{y+9} = \frac{8}{11}$$
$$11(x + 9) = 8(y + 9)$$
$$11x + 99 = 8y + 72$$
$$11x - 8y = 72 - 99$$
$$11x - 8y = -27$$

Putting the value of x from equation (i)

$$11\left(\frac{5}{8}y\right) - 8y = -27$$
$$\frac{55y}{8} - 8y = -27$$
$$\frac{55y - 64y}{8} = -27$$
$$\frac{-9y}{8} = -27$$
$$y = -27 \times \frac{8}{-9}$$
$$y = 24$$

Putting the value of y in equation (i)

$$\frac{x}{y} = \frac{5}{8}$$
$$\frac{x}{24} = \frac{5}{8}$$
$$x = \frac{5}{8} \times 24$$
$$x = 15$$

So,

The 1st No $= x = 15$

The 2nd No $= y = 24$

Q. 7: If 10 is added in each number of the ratio $4:13$, we get $1:2$. What are the numbers?

Let the 1st No $= x$

and the 2nd No $= y$

According to first condition

$$x : y = 4:13$$

$$\frac{x}{y} = \frac{4}{13} \text{ ---------- (i)}$$

According to 2nd condition

$$x + 10 : y + 10 = 1:2$$

$$\frac{x+10}{y+10} = \frac{1}{2}$$

$$2(x + 10) = 1(y + 10)$$

$$2x + 20 = y + 10$$

$$2x - y = 10 - 20$$

$$2x - y = -10$$

Putting the value of x from equation (i)

$$2\left(\frac{4}{13}y\right) - y = -10$$

$$\frac{8y}{13} - y = -10$$

$$\frac{8y-13y}{13} = -10$$

$$\frac{-5y}{13} = -10$$

$$y = -10 \times \frac{13}{-5}$$

$$y = 26$$

Putting the value of y in equation (i)

$$\frac{x}{y} = \frac{4}{13}$$

$$\frac{x}{26} = \frac{4}{13}$$

$$x = \frac{4}{13} \times 26$$

$$x = 8$$

So,

The 1st No $= x = 8$

The 2nd No $= y = 26$

Q. 8: Find the cost of 8kg of mangoes, if 5kg of mangoes cost Rs. 250

let the cost of 8kg of mangoes be x-rupees

$$8kg : 5kg :: Rs.x : Rs.250$$

$$8kg : 5kg = Rs.x : Rs.250$$

Product of extremes = Product of means

$$8 \times 250 = 5x$$

$$\frac{8\times250}{5} = x$$

$$x = Rs.400$$

Q. 9: If $a : b = 7:6$, find the value of $3a + 5b : 7b - 5a$

As given that $a : b = 7:6$ or

$$\frac{a}{b} = \frac{7}{6}$$

Now

$$3a + 5b : 7b - 5a = \frac{3a+5b}{7b-5a}$$

Dividing numerator and denominator by b

$$= \frac{\frac{3a+5b}{b}}{\frac{7b-5a}{b}}$$

$$= \frac{3\left(\frac{a}{b}\right)+5\left(\frac{b}{b}\right)}{7\left(\frac{b}{b}\right)-5\left(\frac{a}{b}\right)}$$

$$= \frac{3\left(\frac{a}{b}\right)+5}{7-5\left(\frac{a}{b}\right)}$$

As $\frac{a}{b} = \frac{7}{6}$ so,

$$= \frac{3\left(\frac{7}{6}\right)+5}{7-5\left(\frac{7}{6}\right)}$$

$$= \frac{\frac{7}{2}+5}{7-\frac{35}{6}}$$

$$= \frac{\frac{7+10}{2}}{\frac{42-35}{6}}$$

$$= \frac{\frac{17}{2}}{\frac{7}{6}}$$

$$= \frac{17}{2} \times \frac{6}{7}$$

$$= \frac{51}{7} = 51:7$$

Q. 10: Complete the following

(i) If $\frac{24}{7} = \frac{6}{x}, then\ 4x = 7$

(ii) If $\frac{5a}{3x} = \frac{15b}{y}, then\ ay = 9bx$

(iii) If $\frac{9pq}{2lm} = \frac{18p}{5m}, then\ 5q = 4l$

Q. 11: Find x in the following proportions.

(i) $3x - 2 : 4 :: 2x + 3 : 7$

Product of extremes = Product of means

$$(3x-2)7 = 4(2x+3)$$
$$21x - 14 = 8x + 12$$
$$21x - 8x = 12 + 14$$
$$13x = 26$$
$$x = 2$$

(ii) $\frac{3x-1}{7} : \frac{3}{5} :: \frac{2x}{3} : \frac{7}{5}$

Product of extremes = Product of means

$$\left(\frac{3x-1}{7}\right)\frac{7}{5} = \frac{3}{5}\left(\frac{2x}{3}\right)$$
$$\frac{3x-1}{5} = \frac{2x}{5}$$
$$3x - 1 = 2x$$
$$x = 1$$

(iii) $\frac{x-3}{2} : \frac{5}{x-1} :: \frac{x-1}{3} : \frac{4}{x+4}$

Product of extremes = Product of means

$\left(\frac{x-3}{2}\right)\frac{4}{x+4} = \frac{5}{x-1}\left(\frac{x-1}{3}\right)$

$\frac{2x-6}{x+4} = \frac{5}{3}$

$3(2x-6) = 5(x+4)$

$6x-18 = 5x+20$

$6x-5x = 20+18$

$x = 38$

(iv) $p^2+pq+q^2 : x :: \frac{p^3-q^3}{p+q} : (p-q)^2$

Product of extremes = Product of means

$(p^2+pq+q^2)(p-q)^2 = x \times \frac{p^3-q^3}{p+q}$

$(p^2+pq+q^2)(p-q)(p-q) = x \times \frac{p^3-q^3}{p+q}$

$(p^3-q^3)(p-q) = x \times \frac{p^3-q^3}{p+q}$

$(p^3-q^3)(p-q) \times \frac{p+q}{p^3-q^3} = x$

$x = (p-q)(p+q)$

$x = p^2-q^2$

(v) $8-x : 11-x :: 16-x : 25-x$

Product of extremes = Product of means

$(8-x)(25-x) = (11-x)(16-x)$

$200-8x-25x+x^2 = 176-11x-16x+x^2$

$200-33x+x^2 = 176-27x+x^2$

$-33x+x^2+27x-x^2 = 176-200$

$-6x = -24$

$x = 4$