6.1 RATIO AND PROPORTION

How ratios are written
There are two ways of writing ratios;
If a and b are any two numbers then we can write the two numbers in any of the following ways:
(i)   a : b   (ii) $\frac{a}{b}$

- The quantities in a ratio must be expressed in the same units.
- The order of the quantities in a ratio must be followed strictly.

- **Worked examples:**

6.1.   Simplify the ration 40 : 24

Solution:

40 : 24 = $\frac{40}{8}$: $\frac{24}{8}$ by dividing by 8 on both sides

∴ 40 : 24 = 5 : 3

6.2.   Simplify the ratio 10cm : 2m

Solution:

1m = 100cm

2m = (2 x 100)cm   : By converting m to cm

   = 10cm = 200cm

$\frac{10cm}{10cm}$: $\frac{200cm}{10cm}$ By dividing by 10cm on both sides

∴   10cm : 2m = **1:20**

6.3.   Express the ratio 2 weeks : 8 days in its simplest from

Solution:

1 week = 7 days
2 weeks = (2 x 7) days   : By converting a week to days)

        = 1 4 days

:. 14 days : 8 days

:. $\underline{14}$: $\underline{8}$ By dividing by 2 on both sides
   2 2

:. 2 weeks : 8 days = 7 : 4

6.4.   Simplify the ratio 0.36 : 0.24

    Solution:
    0.36 : 0.24 = $\underline{36}$: $\underline{24}$ By writing 0.36 and 0.24 as fractions
                100   100

    $\underline{36}$ x 100   : $\underline{24}$ x 100   : By multiplying 100 on both sides to
    100   100   to eliminate the denominator.

    $\underline{36}$: $\underline{24}$: By Dividing by 12 on both sides
    12   12
    :. 0.36 : 0.24 = 3 : 2

6.5   Simplify 1 ½:6

    Solution :
    1 ½ : 6 = 3/2:6   By 1 ½ as an improper fraction.

    3/2 x 2 : 6x2   : By multiplying 2 on both sides.

    =3/3 : 12/3   :By dividing both sides by 3

    1 ½ :6: = 1:4

6.6   Simplify the ratio 8:1.5

    Solution:
    8 x 10: 1.5 x 10   :By multiplying 10 on both sides to eliminate
                  the decimal point

    = 80/5 : 15/5   :By dividing 5 on both sides

    8:1.5 = 16: 3

6.7   The ratio of the marks scored by two students is 4.5. If the higher mark is 60, find the
    lower mark.
    Solution:

Lower mark : higher mark = 4: 5

Lower mark = 4/5 : By writing the in fractional form.
higher mark

Lower mark = 4/5 : By substituting 60 for higher mark.
  60

Lower mark x 60 = 4 x 60 : By multiplying 60 on both sides.
60 5

Lower mark = 4 x 60 **= 48**
      8

Lower mark x 60 = 4 x 60 : By multiplying 60 on both
60 5 sides.

Lower mark = 48 x 60 = 48

:. The lower mark = 48

6.8 There are 25 Doctors in a Hospital of 450 patients. Find the Doctor to patient ration in its simplest form.

Solution:
Doctor: patient = No. of Doctors : No. of patients.
= 25 : 450

= 25 : 450 By dividing 25 on both sides
  25 25

:. Doctor : Patient = 1 : 8

6.10 In certain company the ratio of men to women is 4.5. If there are 280 men. How many women are there?

Solution:
Keep the order of the quantities in the ration men : women = 4 : 5
Men = 4 : by writing the quantities in fraction form.
Women 5

280 x 5 = 4 x women : by cross multiplying.
1400 = 4 x women
  4 4

350 = women

∴ There are 350 women in the company.

6.11   Increase 270 in the ratio 4: 3

Solution:
New amount : original amount = 4: 3

$\dfrac{\text{New amount}}{\text{Original amount}} = : \dfrac{4}{3}$ by writing the quantities in a fractional form.

$\dfrac{\text{New amount}}{270} = \dfrac{4}{3}$:   by multiplying 270 for original amount.

New amount x 270 = 4 x 270 :   by multiplying 270 on both sides to eliminate it from L.H.S.

New amount = 4 x 90

∴ New amount = 360

6.12.   Decrease 33000 in the ration 5:6

Solution:
New amount : original amount = 5 : 6

$\dfrac{\text{New amount}}{\text{Original amount}} = \dfrac{5}{6}$: by writing the quantities in a fractional form.

$\dfrac{\text{New amount}}{33000} = \dfrac{5}{6}$: by substituting 33000 for original amount.

$\dfrac{\text{New amount}}{33000} = \dfrac{5}{6}$: by substituting 33000 on both sides to eliminate it form L.H.S

New amount = 27500

6.13.   Two friends invest Shs 15,000 and Shs 30,000 in a business. At the end of the -year, they get Shs. 63,000 as profit. Find how much each get if they are to share the profits according to how much each invested.

Solution:
Let the two shares be A and B.
          write the amount they invested in ration from.
          A. B = 15,000 : 30,000

$$\frac{15000}{15000} : \frac{30000}{15000}$$: by dividing 15000 on both sides in order to simplify.

:. A : B = 1 : 2.

Method 1;
Now let one share be x.

A gets **X** x 1 shares.

and B gets X x 2 shares.

But total share = 63,000/=

:. **X** + 2**X**   63,000

$$\frac{3X}{3} = \frac{63,000}{3}$$:   by dividing 3 on both sides.

X = 21,000/=

:. A gets 21,000/=
and B gets 21,000 **x 2 42,000/=**

Method II:
A : B = 1 : 2 from above.
Total of the quantities in ration = 1 + 2 = 3

:. A's share $= \frac{1}{3}$ x 63,000/=

= 21,000/=

and B's share = 2/3 x 63,000

= 42,000/=.

6.14. Three people invest 90,000/=, 60,000/= in business respectively. How should they share out the profits of 90,000/=

Solution:
Let the three shares be A,B and C respectively such that A:B :C =90,000 :60,000: 30000.

$$\frac{90000}{30000} : \frac{60000}{30000} : \frac{30000}{30000}$$: by dividing 30000 all through to simplify.

A : B : C =3 : 2 : 1

Method 1
Let one share be **y.**

A gets 3 x y = 3y shares.

B gets 2 x y =2y shares.
But total of the shares = total profits

3y +2y = y = 90,000

$\frac{6y}{6}$ = $\frac{90,000}{6}$: by dividing both sides.

y = **15,000/=**

A gets 3 x 15,000 = **45,000/=**
B gets 2 x 15,000 = **30,000/=**
and C gets 1 x 15,000 = **15,000/=**

Method 11:
A : B : C =3 : 2 : 1 from above.
Total of the quantities in ratio = 3 + 2 + 1 = 6

A's share = $\frac{3}{6}$ x 90,000/=

= **45,000/=**

B's share = $\frac{2}{6}$ x 90,000/=

= 30,000/=

And C's share = $\frac{1}{6}$ x 90,000

= **15,000/=.**

6.15 A sum of money is divided in two parts in the ration 4 : 7. What will be the amount if the difference between the larger and smaller share is 6,000/=.

Solution:

Method I:

Let the two people be A and B and one share be x.
Such that A's share = 4 x X = 4x shares
And B's share = 7 x X = 7xshare.

But large share – smaller share + 6,000
$\qquad$ 7x – 4x = 6000 :by substitution 7x and 4x for large and small shares
$\qquad\qquad\qquad$ respectively

$\qquad$ $\dfrac{3x}{3}$ = $\dfrac{6000}{3}$ $\qquad$:by dividing 3 on both sides.

$\qquad$ X = 2,000/=

$\qquad$ = 8,000/=

$\quad$ And B = 7 x 2,000
$\qquad$ **= 14,000/=**

Method II:
Let the amount to be shared be m.
Total of the quantities in the ration = 4 + 7 = 11.
If A and B are two people sharing them

A will get $\underline{4}$ x m = $\dfrac{4m}{11}$ (smaller share)
$\quad$ 11

But $\dfrac{7m}{11}$ - $\dfrac{4m}{11}$ = 6,000

$\dfrac{7m}{11}$ x 11 = $\dfrac{4m}{11}$ x 11 = 6,000 x 11 $\qquad$:by multiplying 11 by all the terms in the
$\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ express

7m – 4m = 66,000

$\quad$ $\dfrac{3m}{3}$ = $\dfrac{66000}{3}$ $\qquad\qquad\qquad$: by dividing 3 on both sides

$\quad$ **m = 22,000/=**

∴ A will get $\dfrac{4 \times 22,000}{11}$

$\qquad$ **= 8,000/=**

And B will get $\underline{7}$ x 22,000

11

= 14,000/=

6.16. A plot of land is divided into two portions in the ration 3:8 such that the difference
between the larger plot and smaller plot is 2000 hectares. Find the size of the two
portions.

Solution:

- Let the size of the plot land be x hectares and the size of the portions be A and B
respectively.
- Total of quantities in the ration = 3 + 8 = 11

   Such that A = $\frac{3x}{11}$ hectares.

   and B = $\frac{8x}{11}$ hectares

But the larger portion – smaller portion = 2,000 hectares.

$$\frac{8x}{11} - \frac{3x}{11} = 22,000$$

$$\frac{8x}{11} \times 11 - \frac{3x}{11} \times 11 = 2,000 \times 11 \quad \text{by multiplying all the terms by 11}$$

$$5x - 3x = 22,000$$

$$\frac{5x}{5} = \frac{22,000}{5} \quad \text{:by dividing 5 on both sides.}$$

X = 4,400

∴ A = $\frac{3}{11}$ x 4,400

= 1,200 hectares.

and B = $\frac{8}{11}$ x 4,400

= 3,200 hectares.

6.17. If A : B = 3 : 4 and B : C = 1 : 2, find A : B : C

Solution

- the two ratios can be combined by making the B's number the same in both ratios.
- we do this by finding the L. C.M of 4 in the first ration and 1 in the second ratio.
:. L.C.M of 1 and 4 = 4
:. we multiply the first ratio by 1 and the second ration by 4.
- i.e A : B = (3 : 4)x1 = 3 x 1 : 4 x 1 = 3 : 4 ------------------------------ (i)
        B : C = (1 : 2)x4   = 1 x 4 : 2 x 4 = 4 ; 8 ------------------------------ (ii)

- the ratios in (i) and (ii) may now be combined to give A : B : c = 3 : 4 : 8

6.18.   If P : Q = 5 : 6 and Q : R = 4 : 7, find P : Q : R.

Solution:
- the two ratios can be combined by making the Q's number the same in both ratios.
- we do this by findind the L.C. M of 6 in the first ratio and 4 in the second ratio.

2	6	4
2	3	2
3	3	1
	1	1

:. L.C. M of 6 and 4 = 2 x 2 x 3 = 12

 We multiply the first ration by 2 to make a 6 equal to 12 and multiply the second ratio by 3 to make a 4 equal to 12.

 P:Q = (5:6)x2 = 5x2:6x2 = 10:12---------------(i)
 Q:R = (4:7)x3 = 4x3:7x3 = 12:21--------------(ii)

 i.e the ratios in (i) and (ii) above may now be combined.
 Hence P : Q :   R   = 10 : 12 : 21.

6.19.   If D : E = 5 : 4 and E : F = 2 : 3, Find D : E : F.

Solution:
- the two ratios can be combined by making the E's number the same in the two rations.
- we do this by finding the L.C.M of 4 and 2.

    i.e.

```
2 | 4 | 2
-------------
2 | 2 | 1
-------------
  | 1 | 1
```

:. L.C.M of 4 and 2 2 = 2 x 2 x 4

- we multiply the first ration by 1 in order to retain the value of 4 for E and multiply
  the second ration by 2 in order to make the 2 equal to 4.
:. D : E = (5 : 4)x1 = 5 x 1 : 4 x 1 = 5 : 4   -------------- (i)
   and E : F = (2:3) = 2 x 2 : 3 x 2 = 4 : 6 ----------------(ii)

 the ratios in (i) and (ii) above may now be combined.
 Hence D : E : F = 5 : 4 : 6.

6.20.   If A : B = 3 : 5 and B : C = 4 : 7 , find A : B : C.

Solution:
-   the two ratios can be combined by making the B's number in the two ratios.
-   We do this by finding the L.C.M of 5 in the first ratio and in the second ratio.

```
4 | 4 | 5
4 | 1 | 5
5 | 1 | 1
```

L.C.M of 4 and 5 = 4 x 5 = 20.

- we multiply the first ratio by 4 in order to make the B's number equal to 20 and
multiply the second ratio by 5 in order to make the B's number equal to 20.
.e. A : B = (3 : 5)x4 = 3 X 4 : 5 X 4   = 12 : 20 ……………..(i)
and B : C =(4:7)x5 =   4 X 5 : 7 X 5 =20 :   35 ……………..(i)

the ratios in (i) and (ii) above may now be combined.

Miscellaneous Exercise 6.0:

1.   a)   20 : 32   b)   16 : 80 c)   12 : 16 d)   12 : 28

2.   a)   4 : 24   b)   25 : 15 :30   c)   4cm :1m   d)   1:2:3

3. a) 1.25 : 4 :3   b) 51/2 : 31/2   c) 0.54 :0.27   d) 1/2 : 1/8

4. a) 5 : 4   b) 5 : 4   c) 1.5 : 1.25   d) 0.5 : 8

Divide the following amounts in the ratio shown;

5. a) 2,000 in the ratio 3: 2   b) 600 in the ratio 1: 2 : 3

6. a) 12,000 in the ratio 1: 2   b) 0.98 in the ratio 4.4 : 6.8

7. a) 22,000 in the ratio 5 : 4 : 2   b) 24.56 in the ratio 4 :5 : 8

8. a) 10,000 in the ratio 2 : 3   b) 4,3300 in the ratio 2 : 3 : 4

9. A certain type of concrete is made of cement power and sand in the ratio

    3; 5. What weight of each would be needed to the following weights of dry mix?
    a)   24kg   b)   48kg   c)   800kg

10. 900kg of alloy contains 200kg of Copper and Zinc.
        a) Write the ratio of the weight of Zinc in its simplest form.
        b) What weights of Copper and Zinc would be needed for the following
            weights of alloy.
            (i)   5 tones   (ii)   5kg   (iii)   45kg

11. Three football funs win 100,000/= on the football pools. They agree to share this
     sum in the same ratio as their weekly stake; 2: 3: 5. How much does each receive?

12.   A sum of money is divided in the ratio 3 : 4 : 7.Whhat will be the two amounts if the
     difference between the larger and smaller is 92,000/=

13. A piece of land is divided in the ratio 9: 12: 13. Find the difference between the
     largest and smallest in 1,300 hectares.

14. If A : B : = 7 : 2 and B : C = 8 : 13. find A : B : C

15. If P :Q = 3 : 7 AND q : r = 21: 5. find P :Q :R

16. If A: B : C = 3 : 7 find A : B and = B: C

6.2   PROPORTION:

- Under this topic we shall look at the following:
  (i)   direct proportion
  (ii)   inverse (indirect proportion)

- **Direct proportion:**
  -In this case when one quality increases the other must also increase.
  -and if one quantity decreases, the other must also decrease.

- **Worked Examples:**
6.21   The cost of one 8 textbooks is 40,000/=.Find the cost of 6 textbooks.

Solution:

Method 1 (unitary method)

8 text books   ⟶   40,000/=

$\dfrac{8 \text{ text books}}{8}$ ⟶ $\dfrac{40,000/=}{8}$: by dividing 8 on both sides.

                    =   **5,000/=**

1 book   -   5,000/=

:. 6 books   ⟶   6 x 5,000/=

                =   **30,000/=**

Method II
- the number of textbooks has decrease in the ration 6 : 8.
- The cost will also decrease in the ration 6 : 8
  The cost of 6 text books = $\dfrac{6}{8}$ x 40, 000/=
                                = **30,000/=**

6.22   A woman can walk 24km in 6 hours. How long will she take to walk 8km.

Solution :

Method   1 (unitary method)
24km   ⟶   6hours

$\dfrac{24km}{24}$ ⟶ $\dfrac{6hours}{24}$: by dividing 24 on both sides.

1km $\longrightarrow$ $\dfrac{1}{4}$ hours

∴ 8km $\longrightarrow$ ($\dfrac{1}{4}$ x 8)

          = **2 hours**

Method II

The distance has decreased in the ration 8 : 24 or 1 : 3.
The time must also decrease in the same ration 1 : 3

∴ Time taken to walk 8km = $\dfrac{1}{3}$ x 6 hours

               = **2 hours**

6.23. A factory can produce 72 bicycles in 9 days. How many bicycles can if produce in 10 days?

Solution:

Method 1 (Unitary method)

9 days $\longrightarrow$ 72 bicycles

$\dfrac{9 \text{ days}}{9}$ $\longrightarrow$ $\dfrac{72 \text{ bicycles}}{9}$: by dividing 9 on both sides.

1 day $\longrightarrow$ 8 bicycles

∴ 10 days $\longrightarrow$ (10 x 8) bicycles

          = 80 bicycles

6.24. A class can plant 1,000 flowers in 4 hours. How many hours can it plant in 7 hours.

Solution:

Method 1 (Unitary method)

4 hours $\longrightarrow$ 1,000 flowers

$\dfrac{4 \text{ hours}}{4}$ $\longrightarrow$ $\dfrac{1,000}{4}$ flowers   :by dividing 4 on both sides.

1 hour $\longrightarrow$ 250 flowers

∴ 7 hours $\longrightarrow$ (7 x 250) flowers

= **1750 flowers.**

Method II
The time has increased in the ration 7 : 4.
The number of flowers to be planted must also in the same ratio 7 : 4.
In 7 hours a class can plant = 7 x 1000) flowers
                                          4

                    = **1750 flowers.**

6.25. A businessman took 45 million shillings to the bank. The bankers counted the
       money in 2 hours. How long working at the same rate would they have to take to
       count 60 million shillings.

       Solution:
       Method 1 (unitary method)

       45m ⟶ 2hours

       45m ⟶ 2 hours   : by dividing 45 on both sides.
       ___   ___
       45   45

       1m ⟶ 2 hours
                    45

                = **2²/₃ hours.**

       Method II
       The amount of money has increased in the ratio 60 : 45 or 4:3.
       The time must also increase in the same ratio 4 : 3.

       ∴ Time taken to count 60m = (4 x 2) hours
                                          3
                    = 2⅔ hours

   • **Inverse Proportion**
      In this case if one quantity increases then the other decreases.
      And if one quantity decreases then the other increases.

   • **Worked examples:**

6.26. 8 workers can dig a piece of land in 15 hours. How long will 6 workers take to dig the
       same piece of land?

Solution:

Method I (unitary method)

8 workers ⟶ 15 hours ------------------- (i)

1 worker ⟶ (8 x 15) hours : by dividing (i) by 8 on L.H.S and multiplying by 8 on R.H.S.

∴ 6 workers ⟶ 120 hours by dividing 120 by 6

= **20hours.**

Method II
The number of workers has decreased in the ratio 6:8
The time taken will increase in the ratio 8:6
Therefore 6 workers will take = 8/6 x 15(hours)
= **20hrs.**

Method I
90km/hr ⟶ 8hrs
1km/hr ⟶ $\frac{90 \times 8 hrs}{144}$:by dividing by 144

= $\frac{720hrs}{144}$

= **5hrs.**

Method II
The speed has increased in the ratio 144 : 90 or 8 : 5.
The time will decrease in the ratio 5 : 8.
∴ At 144km/hr time taken will be = (⅝ x 8) hours
= **5 hours.**

b) Method I

90 km/hr ⟶ 8hours

1 km/hr ⟶ (90 x 8) hours.

∴ 80 km/hr = $\frac{720}{80}$ hours

= **9 hours.**

Method II
The speed has decreased in the ratio 80 : 90 or 8 : 9.
The time will increase in the ratio 9 : 8.

:. At 80 km/hr time taken will be = ($\frac{9}{8}$ x 8)hour

= **9 hour.**

6.27. 14 machines can produce 6,000 soft drink in 50 minutes. How many machines will be needed to produce the soft drink in ;
a) 25min.   b) 2hrs 10min.

Solution:

a) Method I
    50 min ———→ 14 machines.
    1min ——→ (50 x 14) machines   : by multiplying 50 by 14.
   :. 25min ———→ $\frac{(50 \times 14)}{25}$ machines   : by dividing by 25

= **28 machines.**

Method II
The time taken has decreased in the ratio 25: 50 or 1:2.
The number of machines must increase in the ration 2 : 1
:. The number of machines will be = ($\frac{2}{1}$ x 14) machines

= **28 machines.**

b) Method I
    50 min ——→ 14 machines.
    1 min   (50 x 14) machines
    Convert 2 hrs 10min in minutes.
    1 hour ——→ 60 minutes
    2 hours ———→ (60 x 2) minutes
          = 120 minutes.

:. 2 hrs 10 min   = 120 min + 10 min

         = 130 min.

130 min = $\frac{(50 \times 14)}{130}$ machines : by dividing by 130

= **5.38**

Hence 5 machines will be required to produce Soft drink in 2 hrs 10 min.
N.B: Ignore the decimal part because, we can not have a fraction of a machine.

Method II
The time has increased in the ratio 130 : 50 or 13 : 5.

The number of machines must decrease in the ration 5: 13

∴. The number of machines will be $= (\frac{5}{13} \times 14)$ machines

$$= 5.38$$

Hence 5 machines will be required.

- **Miscellaneous worked examples**

6.29. 6 machines working for 8 hours a day can dig a water reservoir in 10 days. How many days would it take with:
a)   4 machines working for 5 hours a day.
b) 8 machines working for 12 hours a day.

Solution:

a) Let the number of days required be x.

work to be done. $=$ 6 x 8 x 10   machine – hours – days

$$\frac{4 \times 5 \times X}{4 \times 5} \quad = \quad \frac{6 \times 8 \times 10}{5 \times 5} \quad \text{:by dividing by 24 on both sides}$$

$$X = 24 \text{ days.}$$

b) let the number of days required be m

work to be done $= 6 \times 10$ machines - hours - days

8 x 12 *m* $=$ 480

$$\frac{96m}{96} \qquad = \frac{480}{96} \qquad\qquad \text{: by dividing on both sides by 96}$$

$$m = 5 \text{ days.}$$

6.30. A building company employs 6 workers to work at the rate of 8 hours in order to complete a certain building in 10days. Find how many workers would be required if they were to work for:
a)   15 days working at a rate of 4 hours a day?
b)   16 days working at a rate of 6 hours a day?

Solution:

a) Let the number of workers be q

work to be done   = 6 x 8 x 10

$\frac{60q}{60}$ = $\frac{480}{60}$: by dividing by 60 on both sides

q = 8 men

b) Let the number of workers be H
   work to be done   =   6 x 8 x 10 men - hour - days
   H x 6 x 16   =   480
   $\frac{96 H}{96}$ = $\frac{480}{96}$
                              H = 5men

6.31. A and B are two water taps such that tap A takes 6 hours to fill a certain container, tap B
       takes 4 hours to fill the same container, find how long would two taps take to fill the
       container if used together.
       Solution:

       The fraction of the container filled by Tap A in 1 hour = $\frac{1}{6}$ and

       The fraction of the container filled by Tap B 1 hour   = $\frac{1}{4}$

       Both taps would take   = (1 ÷ $\frac{5}{12}$) hours

                                   = (1 x 12)   : by multiplying by the reciprocal of $\frac{5}{12}$

                                   = 2.4 hours

6.32. 20 men can do a piece of work in 15 hours. How will they take if after 8 hrs they are
       joined by 5 other men.
       Solution:
       No. of men – hour required to do the piece of work.

       = 20 x 15

       = 300

       No. of men – hour of work left after 8 hours   300 – 20 x 8
                                                      = 140

       No. of hour – hours required to complete the work   = $\frac{140}{20 + 8}$

$$= \textbf{5 hours}$$

∴ Total No. of hours required $= 8$ hours $+ 5$ hours

$$= \textbf{13 hours.}$$

6.33. 10 students can dig a school flower garden in 16 hours. How long will they take if after 12 hours they are joined by 9 other students.

Solution:
No. of student – hour required to dig the flower garden $= 10 \times 16$

$$= 160$$

No. of student – hour of work left after 12 hours $160 - 10 \times 12$
$$= 40$$

No. of hours required to complete the work $= \dfrac{40}{10 + 9}$

$$= \textbf{2.11 hours}$$

∴ Total No. of hours required $= \textbf{12 hours} + \textbf{2.11 hours}$

$$= \textbf{14.11 hours.}$$

6.34. A and B are two students such that student A takes 20 min to sweep a certain classroom and B takes 25 min to sweep the same class. How long will they take to sweep the class both working together?

Solution:
In one minute A sweeps $= \dfrac{1}{20}$ of the class.

In one minute B sweeps $= \dfrac{1}{25}$ of the class

In one minute both sweep $= \left(\dfrac{1}{20} + \dfrac{1}{25} \right)$ of the class.

$$= \dfrac{9}{100} \text{ of the class}$$

∴ The no. of minutes required if they if they are to sweep together $= \left(1 \div \dfrac{9}{100} \right)$ hours

$= \left(1 \times \dfrac{100}{9} \right)$ hrs : by multiplying by the reciprocal of $\dfrac{9}{100}$

= 11.11 minutes.

6.35. The map of a school is drawn to the scale of 1 : x. On this map a sports ground is represented by a rectangle measuring 3.75cm long and 1.2 cm wide. Find the value of x if the actual area of the sports ground is 36km^2.

Solution:
Area of sports ground on the map = 3.75 x 1.2

= 4.5cm^2

But 1 km = 100,000cm : by converting cm to km.

∴ 1 km2 = 1 x 10^5 cm^2.

$$4.5 \text{ cm2} = \frac{4.5\text{cm}^2}{1 \times 10^5 \text{ cm}^2} \text{ X } \frac{1\text{Km}^2}{= 1\text{km}^2}$$

$$= 4.5 \text{ cm2} = \frac{4.5 \text{ x } 100}{1 \times 10^5 \text{ cm2}}$$

$$= \frac{4.5 \text{ x } 10^o \text{ cm}^2}{1 \text{ x } 10^5}$$

= 4.5 x 10⁻⁵km²

Actual area sport ground = 36km^2

∴ Area scale factor = $\underline{\text{Actual area on ground}}$.
                          Area on the map.

$$= \frac{36}{4.5 \text{ x } 10^{-5}}$$

= **8 x 10⁵**

A.S.F = (L.S.F)^2 :by formula

L.S.F = 8 x 105

Hence x = **894.4272**

6.36. Moses left Shs. 22,o50,00 million in his will to be shared between his wife and, daughter and son in the ratio 2:3:4. His wife decided to divide her share equally between her daughter and son.

Determine how much finally did the son and daughter get.

Solution:

Total number of shares $= 2 + 3 + 4$

$$= 9$$

Wife's share $= \dfrac{2}{9} \times 22,050,000/=$

Wife's share divided by 2 $= \dfrac{4,900,000/=}{2}$

$$= \mathbf{2,450,000/=}$$

Daughter's share $= 2,450,000 + \dfrac{3}{9} \times 22,050,00$

$$= 2,450,000 + 7,350,000$$
$$= 9,800,000/=$$

Son's share $= 2,450,000 + \dfrac{4}{9} \times 22,050,00$

$$= 2,450,000 + 9,800,000$$
$$= 12,250,000/=$$

6.37.   Two quantities A and B are such B varies inversely as the square of A. Given that B = 16 when a = 4, Find the value of A when B = 9.

Solution:

$B \propto \dfrac{1}{A^2}$ (This is the statement B varies inversely as the square of A)

α = the symbol of proportionality.

$B = \dfrac{1}{A^2} \times K$:By multiplying K the constant on the R.H.S to eliminate the symbol of proportionality

.

 B = 16 when A = 4

∴ $16 = \dfrac{K}{4^2}$: by substituting 16 and 4 for B and A respectively

$16 \times 16 = \dfrac{K \times 16}{16}$: by eliminating 16 on both sides to eliminate from R.H.S

  K = 256

Hence B = $\underline{256}$

$$A^2$$

When $B = 9$, $\therefore$ $P = \dfrac{256}{A^2}$

$9\ A2 = \dfrac{256}{A^2}\ \text{x}\ A^2$: by multiplying A^2 on both sides in order to eliminate it from the R.H.S

$\dfrac{9A^2}{9} = \dfrac{256}{9}$ by dividing by 9 ob both sides.

$A^2 = 28.4$
$\sqrt{A^2} = \sqrt{28.4}$: by taking square root on both sides.

$A = 5.3$

MISCELLANEOUS EXERCISE 6.1

1. An athlete can run 16km in 8min. Find how long would it would take to run:
    (a) 8 km   (b) 32km   (c) 40km

2. A student carried out an experiment in a Chemistry lab and found out that 12kg of a certain chemical produced 180cm of gas. How much gas will be produced by the following weights:

3. A taxi takes 6 hours to make a journey at 70mk/h. Find how long would it take at the following speeds:
    (a) 60km/h   (64km/h   (c) 32km/h

4. A businessman can pay his electricity bill by paying 15,000/= per week for 6 weeks. How long would he take to pay if he increased his weekly payments by:

    (a) 400   (b) 64km/h   (c) 32/h

5. A group of 10 workers working at a rate of 6 hours a day can slash a certain compound in 4 days. Find how many days it would take with:
    (a) 8 workers working for 3 hours a day.

    (b) 2 workers working for 2 hours a day.

6. Three water taps P,Q and R are such tap P takes 5 hours to fill a certain tank, tap Q takes 3 hours and tap R takes 7 hours to fill the same tank. Find how long it would take all the three taps to fill the tank if used together.

7. 5 men wish to prepare a field for Athletics competitions and they can do this in 3 hours. How long will they take if after ½

8. 10 workers can organize the sitting arrangement in a certain hall where a big

    conference is to take place for 4 hours. How long will then take if hour they are joined by 6 other workers.

9. Two outlets M and N can empty a water tank in 18min and 24min respectively. How long will it take if both are used together?.

10. Two sisters one aged 18 years and the other 10 years do a certain piece of work together for 5 hours. The elder sister working along takes 9 hours to complete the work. How long will the younger one take when she works alone?