RATIO & PROPORTION

SYNOPSIS - 1

RATIO

Suppose Meena's height is 135 cm and her sister Kamla's height is 150 cm.

We may write, $\frac{\text{Meena's height}}{\text{Kamla's height}} = \frac{135}{150} = \frac{9}{10}$

We say that the heights of Meena and Kamla are in the ratio 9:10.

The symbol ':' stands for 'is to'.

We define ratio as under.

Ratio: The ratio of two quantities of the same kind in the same units is the fraction that one quantity is of the other.

Thus, the ratio a is to b is the fraction $\frac{a}{b}$ written as $a:b$. In the ratio $a:b$, we call a as the first term or antecedent and b, the second term or consequent.

Thus, in the ratio 7:4, we have

First term or antecedent = 7, Second term or consequent = 4.

Facts About Ratio:

1. The ratio between two quantities of the same kind and in same units is obtained on dividing the first quantity by the second.

   Examples: (i) Ratio between 125 cm and 175 cm $\frac{125}{175} = \frac{5}{7} = 5:7$

   (ii) Ratio between 18 years and 24 years $= \frac{18}{24} = \frac{3}{4} = 3:4$

2. Ratio is a fraction. It has no unit.
3. The quantities to be compared to form a ratio should be of the same kind.
   We cannot have a ratio between 16 years and Rs. 40.
   Similarly, 25 cm and 200 gms cannot form a ratio.
4. To find a ratio between two quantities of the same kind, both the quantities should be taken in the same unit.
   Example: (i) Ratio between 75 gm and 1 kg
   = Ratio between 75 gm and 1000 gm

   $$\frac{75}{1000} = \frac{3}{40} = 3:40$$

   (ii) Ratio between 65 cm and 1 m = Ratio between 65 cm and 100 cm

   $$= \frac{65}{100} = \frac{13}{20} = 13:20$$

5. If each term of a ratio be multiplied or divided by the same non-zero number, the ratio remains the same.

Examples: (i) $3:4=\frac{3}{4}=\frac{3\times2}{4\times2}=\frac{6}{8}=6:8$ (ii) $8:12=\frac{8}{12}=\frac{8\div4}{12\div4}=\frac{2}{3}=2:3$

Ratio In Simplest Form (or in Lowest Terms)

A ratio a:b is said to be in simplest form, if H.C.F. of a and b is 1.

Examples: (i) The ratio 3:4 is in simlest form, since H.C.F. of 3 and 4 is 1.

(ii) The ratio 12:16 is not in simplest form, since H.C.F. of 12 and 16 is 4.

Rule: To convert a ratio a:b in simplest form, divide a and b by the H.C.F. of a and b.

Comparison of Ratios:

Since ratios are fractions, they can be comlpared similar to the way we compare fractions i.e. by converting them into equivalent like fractions, or by the cross product method.

Increase of Decrease in a Ratio:

Suppose a quantity increases or decreases in the ratio a:b.

Then, new quantity = $\frac{b}{a}$ of the original quantity.

WORK SHEET - 1

SINGLE ANSWER TYPE

1. If $A:B=5:7$ and $B:C=6:11$, then $A:B:C$ is.

1) $55:77:66$ 2) $30:42:77$ 3) $35:49:42$ 4) None of these

2. If $A:B=3:4$ and $B:C=8:9$, then $A:C$ is.

1) $1:3$ 2) $3:2$ 3) $2:3$ 4) $1:2$

3. If $A:B=8:15, B:C=5:8$ and $C:D=4:5$, then $A:D$ is equal to.

1) $2:7$ 2) $4:15$ 3) $8:15$ 4) $15:4$

4. If $2A=3B=4C$, then $A:B:C$ is.

1) $2:3:4$ 2) $4:3:2$ 3) $6:4:3$ 4) $20:15:2$

5. If $\frac{A}{3}=\frac{B}{4}=\frac{C}{5}$, then $A:B:C$ is.

1) $4:3:5$ 2) $5:4:3$ 3) $3:4:5$ 4) $20:15:2$

6. If $2A=3B$ and $4B=5C$, then $A:C$ is.

1) $4:3$ 2) $8:15$ 3) $15:8$ 4) $3:4$

7. The ratio of $4^{3.5}:2^5$ is same as.

1) $2:1$ 2) $4:1$ 3) $7:5$ 4) $7:10$

8. If $\frac{1}{5}:\frac{1}{x}=\frac{1}{x}:\frac{1}{125}$, then the value of x is.

1) 1.5 2) 2 3) 2.5 4) 3.5

9. If $x:y=5:2$, then $(8x+9y):(8x+2y)$ is.

1) 22:29 2) 26:61 3) 29:22 4) 61:26

10. If $(x:y)=2:1$, then $(x^2-y^2):(x^2+y^2)$ is.

1) 3:5 2) 5:3 3) 1:3 4) 3:1

11. If $x^2+4y^2=4xy$, then $x:y$ is.

1) 2:1 2) 1:2 3) 1:1 4) 1:4

12. If $\frac{x}{5}=\frac{y}{8}$, then $(x+5):(y+8)$ is equal to.

1) 3:5 2) 13:8 3) 8:5 4) 5:8

13. If $\frac{a}{3}=\frac{b}{4}=\frac{c}{7}$, then $\frac{a+b+c}{c}$ is equal to.

1) 7 2) 2 3) $\frac{1}{2}$ 4) $\frac{1}{7}$

14. If $(a+b):(b+c):(c+a)=6:7:8$ and $(a+b+c)=14$, then the value of c is

1) 6 2) 7 3) 8 4) 14

15. If Rs. 782 be divided into three parts, proportional to $\frac{1}{2}:\frac{2}{3}:\frac{3}{4}$, then the first part is.

1) Rs. 182 2) Rs. 190 3) Rs. 196 4) Rs. 204

16. Two numbers are in the ratio $1:2$ If 7 is added to both, their ratio changes to $3:5$. The greatest number is.

1) 24 2) 26 3) 28 4) 32

17. The ratio of three numbers is $3:4:5$ and the sum of their squares is 1250. The sum of the numbers is.

1) 30 2) 50 3) 60 4) 90

MULTI ANSWER TYPE

18. The Sum of two numbers is 1500/-. If the numbers are in the ratio 4 : 2, then the numbers are

1) 1000 2) 900 3) 500 4) 100

19. The sides of a triangle are in the ratio 2:3:4. If the perimeter is 189 cm, then the 3 sides measurements are

1) 42 cm 2) 63cm 3) 84 cm 4) 48cm

20. If the ratio of angles of a scalene triangle is 3 : 4 : 8 and the largest angle is 96^0, then the other two angles are__
1) 98^0 2) 48^0 3) 36^0 4) 94^0

21. The ratio of red balls, green balls and yellow balls in a bag is 5 : 3 : 2. If the number of yellow balls is 12, then the total number of balls is
1) 12 × 5 2) 90 3) 60 4) 15 × 6

REASONING ANSWER TYPE

22. *Statement I :* If x + 20 : x + 30 = 7 : 8, then the value of x is 50.

Statement II : If a : b = c : d, then $\frac{a}{b} = \frac{c}{d}$ and a × d = b × c.

1. Both Statements are true, Statement II is the correct explanation of Statement I.
2. Both Statements are true, Statement II is not correct explanation of Statement I.
3. Statement I is true, Statement II is false.
4. Statement I is false, Statement II is true.

23. *Statement I :* A gets 5 times as much as B and B gets 4 times as much as C. If you divide Rs.1000/- among A, B and C, then the share of A and B are Rs.800/- and Rs.160/-.

Statement II : If a certain sum Rs. P/- is divided in the ratio a : b : c, then the shares of

A and B are $\frac{a}{a+b+c} \times P$ and $\frac{b}{a+b+c} \times P$ respectively.

1. Both Statements are true, Statement II is the correct explanation of Statement I.
2. Both Statements are true, Statement II is not correct explanation of Statement I.
3. Statement I is true, Statement II is false.
4. Statement I is false, Statement II is true.

COMPREHENSION TYPE

In a cash box, the ratio of number of 50p, 25p and 10p coins is 5 : 9 : 4. If the total value of the coins is Rs.206/-, then

24. The value of 50 paise coins is____
1) Rs. 100/- 2) Rs. 110/- 3) Rs. 90/- 4) Rs. 80/-

25. The number of 10 paise coins are
1) 160 2) 170 3) 150 4) 180

26. The value of 25 paise coins is____
1) 80/- 2) 95/- 3) 90/- 4) 85/-

MATRIX MATCHING TYPE

27.

Column-I	Column-II
a) Rs. 150/- : Rs. 350/-	1) 1 : 5
b) Rs. 1 : 15 paise	2) 3 : 7
c) 2 scores : 3 dozens	3) 20 : 3
d) 240m : $1\frac{1}{5}$ km	4) 10 : 9
	5) 2 : 10

INTEGER ANSWER TYPE

28. Two numbers are in the ratio 7 : 3. If their difference is 324 then the sum of two numbers is_____

SYNOPSIS - 2

VARIOUS PROPERTIES OF RATIO

Types of Ratios :

1. In a ratio, order of terms is very important.
2. Since ratio is a fraction, the ratio will remain unchanged if each term of the ratio is multiplied or divided by the same non - zero number.

$$\frac{a}{b}=\frac{ma}{mb}=\frac{a\div m}{b\div m} \qquad m\neq 0$$

3. Ratio always exists between quantities of the same kind which are expressed in same units.
4. Ratio has no unit.
5. To compare two or more ratios, we either convert them to equivalent like fractions or convert them to the decimal form.
6. A ratio $a:b=\frac{a}{b}$ is in its lowest term if H.C.F. of a and b is 1.
7. If a quantity increases or decreases in the ratio a : b, then new quantity $=\frac{b}{a}$ of the original quanity. $\frac{b}{a}$ is called the multiplying ratio.
8. ***Compounded ratio :-*** The compounded ratio of the two ratios $a : b$ and $c : d$ is the ratio $ac : bd$, and that of $a : b$, $c : d$ and e:f is the $ace : bdf$.
9. ***Duplicate ratio :-*** The duplicate ratio of the ratio $a : b$ is the ratio $a^2 : b^2$
10. ***Triplicate ratio:-*** The triplicate ratio of the ratio $a : b$ is the ratio $a^3 : b^3$.
11. ***Sub duplicate ratio:-*** The sub duplicate ratio of the ratio $a : b$ is the ratio $\sqrt{a}:\sqrt{b}$. So, the sub duplicate ratio of the ratio $a^2 : b^2$ is the ratio $a : b$.
12. ***Sub triplicate ratio:-*** The sub triplicate ratio of the ratio $a : b$ is the ratio $\sqrt[3]{a}:\sqrt[3]{b}$.

    So, the sub triplicate ratio of the ratio $a^3 : b^3$ is the ratio $a : b$.
13. ***Reciprocal ratio:-*** The reciprocal ratio of the ratio $a : b$ $(a\neq 0, b\neq 0)$ is the ratio $\frac{1}{a}:\frac{1}{b}$

WORK SHEET - 2

SINGLE ANSWER TYPE

1. The sub duplicate ratio of 484 : 361 is_____
   1) 21 : 19 2) 22 : 18 3) 22 : 19 4) 22 : 17
2. The sub triplicate ratio of 1000 : 512 is___
   1) 5 : 2 2) 5 : 4 3) 5 : 8 4) 5 : 1
3. The receprocal ratio of $4:\frac{1}{9}$ is_____
   1) 36 : 1 2) 1 : 36 3) 1 : 6 4) 6 : 1
4. The reciprocal of compound ratio of 5 : 6 and 10 : 9 is___
   1) 25 : 27 2) 27 : 25 3) 9 : 4 4) None
5. If $\frac{x}{8}=\frac{y}{3}$, then triplicate ratio of x : y is___
   1) 512 : 64 2) 512 : 125 3) 512 : 27 4) 512 : 1
6. The compound ratio of 3x : 4y and $ab^2 : c^2$ and $c : b^2$ is
   1) 3ax : 4cy 2) 3cx : 4ay 3) cxy : 4cx 4) 3ac : 4xy
7. If $\frac{7x-4y}{3x+y}=\frac{5}{13}$, then $y^2 : x^2$ is____
   1) 9 : 16 2) 16 : 9 3) 3 : 4 4) 4 : 3
8. If A : B is the duplicate ratio of A + x : B + x, then
   1) $x^2 = A - B$ 2) $x^2 = A + B$ 3) $x^2 = AB$ 4) $x^2 = \frac{A}{B}$
9. If 2x : 3y be the duplicate ratio of 2x – m : 3y – m, then which of the following is correct?
   1) $m^2 = 2xy$ 2) $m^2 = 3xy$ 3) $m^2 = xy$ 4) $m^2 = 6xy$
10. If 25 is the duplicate ratio of $\frac{5n+4}{2n-1}$, then the value of n is
    1) $\frac{9}{5}$ 2) $\frac{1}{5}$ 3) 9 4) None
11. If x + y : x – y is equal to the duplicate ratio of 3 : 1 then
    1) 125 : 64 2) 25 : 16 3) 5 : 4 4) 8 : 1
12. The compound ratio of $x^2-y^2 : x^2+y^2$ and $x^4-y^4 : (x+y)^4$
    1) $\frac{(x-y)^2}{(x+y)^2}$ 2) $\frac{(x+y)^2}{(x-y)^2}$ 3) $\frac{x^2+y^2}{x^2-y^2}$ 4) $\frac{x^2-y^2}{x^2+y^2}$
13. The duplicate ratio of 25:4 is
    1) 5:2 2) 125:8 3) 625:16 4) 25:4
14. The triplicate ratio of 8:11 is
    1) 64:121 2) 512:2 3) 8:11 4) $3\sqrt{8} : 3\sqrt{11}$
15. The sub-duplicate ratio of 9:16 is
    1) 81:256 2) 27:64 3) 9:16 4) 3:4

16. The sub triplicate ratio of 343:729 is

1) 343:729 2) 7:9 3) 49:81 4) $\sqrt{343} : 27$

Key : 3, 2, 4, 2
Sol.

13. Duplicate ratio of a:b is $a^2 : b^2$

14. Triplicate ratio of $a : b$ is $a^3 : b^3$

15. Sub-duplicate ratio of a:b is $\sqrt{a} : \sqrt{b}$

16. Sub-triplicate ratio of a:b is $\sqrt[3]{a} : \sqrt[3]{b}$.

MULTI ANSWER TYPE

13. If a, b, c, d are in proportion then

1) $\frac{a}{b} = \frac{c}{d}$ 2) ad = bc 3) $d = \frac{bc}{a}$ 4) $b = \frac{ad}{c}$

14. If a, b, c, d are in proportion, then which of the following are true?
1) the 1st and 4th terms are called extremes.
2) the 1st and 4th terms are called means.
3) the 2nd and 3th terms are called means.
4) the 2nd and 3rd terms are called extremes.

15. Which of the following are in continued proportion ?
1) 20, 18, 5, 6 2) 3.6, 0.4, 4.5, 0.5 3) 51, 68, 85, 102 4) 1.5, 2.5, 3.6, 6

16. The compound ratio of duplicate ratio of 5 : 6; the reciprocal ratio of 25 : 32 and sub duplicate ratio of 81 : 64 is_____
1) 2 : 1 2) 3 : 3 3) 4 : 2 4) 1 : 1

REASONING ANSWER TYPE

17. *Statement I :* If 36, x, 16 are in continued proportion, then x = 36.

Statement II : If a, b, c are in continued proportion, then $b = \sqrt{ac}$.
1. Both Statements are true, Statement II is the correct explanation of Statement I.
2. Both Statements are true, Statement II is not correct explanation of Statement I.
3. Statement I is true, Statement II is false.
4. Statement I is false, Statement II is true.

18. *Statement I :* If $\frac{1}{9} : x :: \frac{1}{3} : \frac{1}{4}$, then $x = \frac{1}{12}$

Statement II : If a : b :: c : d then ab = cd
1. Both Statements are true, Statement II is the correct explanation of Statement I.
2. Both Statements are true, Statement II is not correct explanation of Statement I.
3. Statement I is true, Statement II is false.
4. Statement I is false, Statement II is true.

COMPREHENSION TYPE

A sum of money is divided among 160 males and some females in the ratio 16 : 21. Individually each male gets Rs. 4 and each famale gets Rs. 3.

19. The number of females are
1) 280 2) 198 3) 284 4) 270

20. The ratio of earnings of 15 males and 3 females is_____
1) 9 : 20 2) 20 : 9 3) 20 : 7 4) 20 : 3

21. If there were 60 less men and 120 more females, then the ratio males of females is_____
1) 4 : 1 2) 1 : 4 3) 3 : 4 4) 2 : 4

MATRIX MATCHING TYPE

22. 2a = 3b = 4c = 12

Column-I	Column-II
a) 4th proportional to a,b,c	1) 8/3
b) 3rd proportional to b, c	2) $2\sqrt{6}$
c) Mean proportional between a & b	3) 9/4
d) 3rd proportional to a, b	4) 2
	5) $\sqrt{24}$

SYNOPSIS - 3

PROPORTION

Proportion: A statement of equality of two ratios is called a proportion.

Example: We know that $18:45=2:5$.

We write it as 18:45 :: 2:5, where the symbol : : stands for 'is as'.

We say that 18, 45, 2, 5 are in proportion.

Thus, four quantities a, b, c, d are said to be in proportion if $a:b=c:d$

i.e. if $\frac{a}{b}=\frac{c}{d}$ i.e., if $ad=bc$

Facts About proportion:

1. In a proportion:
   (i) The first and fourth terms are called the extremes.
   (ii) The second and third terms are known as the means.
   (iii) Product of means = Product of extremes
2. If $a:b::c:d$ then d is called the fourth porportional to a,b,c.
3. If $a:b=b:c$, then we say that
   (i) a,b,c are in continued proportion.
   (ii) c is the third porportional to a and b.
   (iii) b is the mean proportion between a and c.

   Now, we have $:a:b=b:c\Rightarrow\frac{a}{b}=\frac{b}{c}$

$$\Rightarrow ac = b^2 \Rightarrow b = \sqrt{ac}$$

Hence, mean proportion between a and $c = \sqrt{ac}$.

Example:

Check whether the following quantities are in proportion or not:

(i) 20, 18, 5, 6 (ii) 3.6, 0.4, 4.5, 0.5

Sol. (i) We have : 20 : 18 $= \frac{20}{18} = \frac{10}{9}$. And $5:6 = \frac{5}{6}$

$\therefore 20:18 \neq 5:6$

Hence, 20, 18, 5, 6 are not in proportion.

Alternative Method:

Product of extreme terms $= 20 \times 6 = 120$.

Product of middle terms $= 18 \times 5 = 90$

Thus, product of extreme terms $\neq$ product of middle terms.

Hence, 20, 18, 5, 6 are not in proportion.

ii) $3.6:0.4 = \frac{3.6}{0.4} = 9$. And $4.5:0.5 = \frac{4.5}{0.5} = 9$

$\therefore 3.6:0.4 = 4.5:0.5$

Hence, 3.6, 0.4, 4.5, 0.5 are in proportion.

Alternative Method:

Product of extreme terms $= 3.6 \times 0.5 = 1.8$

Product of middle terms $= 0.4 \times 4.5 = 1.8$

Thus, product of extremes = product of means.

Hence, 3.6, 0.4, 4.5, 0.5 are in proportion.

WORK SHEET - 3

SINGLE ANSWER TYPE

1. If 1st, 2nd and 4th terms of a proportion are respectively 5.2, 3.9 and 3, then its third term is____

   1) 6 2) 2 3) 4 4) 3

2. If 16, x, 36 are in proportion, then the mean proportional is___

   1) 28 2) 26 3) 24 4) 22

3. If 15, 30, y are in proportion, then the third proportional is____

   1) 80 2) 70 3) 50 4) 60

4. If $2\frac{1}{2} : x = 12\frac{1}{2} : 6\frac{1}{4}$, then the value of x is __

   1) $\frac{5}{8}$ 2) $\frac{5}{2}$ 3) $\frac{5}{4}$ 4) $\frac{5}{16}$

5. The number that should be added to each of the numbers 8, 20, 12, 28 to make the new numbers proportional

1) 8 2) 6 3) 4 4) 2

6. Two number whose mean proportional is 28 and the third proportional is 224 are

1) 14, 28 2) 28, 56 3) 42, 56 4) 14, 56

7 The third proportional to x + y, 2x + 3y when x = 3, y = 2 is_____

1) $\frac{145}{7}$ 2) $\frac{142}{7}$ 3) $\frac{143}{7}$ 4) $\frac{144}{5}$

8. If b is the mean proportional of 9, 49; c is the third proportional to 7, 49 d is the fourth proportional to 14, 49, 35, then the 4th proportional to b, c, d is

1) $\frac{12015}{6}$ 2) $\frac{12005}{6}$ 3) $\frac{12025}{6}$ 4) $\frac{11535}{6}$

9. If $2x - 5 = \frac{y+4}{2} = z \div \frac{5}{2} = 5$, then to mean proportional of x + y and y + z is

1) $\sqrt{\frac{37\times11}{2}}$ 2) $\sqrt{\frac{37\times2}{11}}$ 3) $\sqrt{\frac{37}{2\times11}}$ 4) None

MULTI ANSWER TYPE

10. If x, 5, 10 and 5, 10, y are in proportion, then the value of x and y are

1) $x = 20, y = 2\frac{1}{2}$ 2) $x = \frac{5}{2}, y = 20$ 3) $x = 5\frac{1}{2}, y = 20$ 4) $x = 2\frac{1}{2}, y = 20$

11. If $a : c :: (a^2 + b^2) : (b^2 + c^2)$, then which of the following is corect?

1) $a^2 = bc$ 2) $\frac{b}{a} = \frac{c}{b}$ 3) $\frac{a}{b} = \frac{b}{c}$ 4) $b^2 = ac$

12. If the fourth proportion to 2.1m, 1.5m, 6.3m is 'x' and the third proportional to 1m 60cm, 40cm is 'y', then the mean proportion between x and y is _____

1) $\sqrt{4500}$cm 2) $30\sqrt{5}$cm 3) $30\sqrt{5}$m 4) $5\sqrt{30}$cm

13. The fourth proportion to 1.8, x, 2.4 is 6. The 3rd proportional to $\frac{1}{9}$ and $\frac{2}{3}$ is y and the mean proportion between $\frac{2}{3}$ and $\frac{8}{27}$ is z then the square root of the fourth proportional to x, y, z is

1) $\frac{8}{81}$ 2) $\sqrt{\frac{32}{81}}$ 3) $\frac{4\sqrt{2}}{9}$ 4) $\frac{2\sqrt{2}}{9}$

REASONING ANSWER TYPE

14. *Statement I :* 18, 45, 2, 5 are in proportion.
Statement II : Four quantities a, b, c, d are said to be in proportion if a : b = c : d.
1. Both Statements are true, Statement II is the correct explanation of Statement I.
2. Both Statements are true, Statement II is not correct explanation of Statement I.
3. Statement I is true, Statement II is false.
4. Statement I is false, Statement II is true.

15. *Statement I :* The fourth proportional to 3hrs 12min, 24min, 2min 8sec is 1min 6sec.
Statement II : If a:b: : c:d, then d is fourth proportional to a, b, c.
1. Both Statements are true, Statement II is the correct explanation of Statement I.
2. Both Statements are true, Statement II is not correct explanation of Statement I.
3. Statement I is true, Statement II is false.
4. Statement I is false, Statement II is true.

COMPREHENSION TYPE

If a : b = b : c, then we say that (i) a, b, c are in continued proportion, (ii) c is 3rd proportional to 'a' and 'b'. (iii) b is the mean proportion between 'a' and 'c'.

16. If 36, 24 and x are in continued proportion, then x = _____
1) 6 2) 26 3) 16 4) 106

17. The third proportional to 25 and 15 is _____
1) 35 2) 20 3) 9 4) 5

18. The mean proportion between 2.5 and 0.9 is
1) 15 2) 1.5 3) 0.15 4) 11.5

MATRIX MATCHING TYPE

19.

Column-I	Column-II
a) If 3.6 : x : : 0.4 : 0.5, then x =	1) 2
b) If x : 1.6 : : 2.1 : 8.4, then x =	2) $\frac{1}{12}$
c) If $\frac{1}{9} : x : : \frac{1}{3} : \frac{1}{4}$, then x =	3) 4.5
d) If 42 : 12 : : 7 : x, then x =	4) 0.4
	5) 0.083

INTEGER ANSWER TYPE

20. If x, 8, 16 are in proportion, then the value of x is_____

CUMULATIVE

SINGLE ANSWER TYPE

1. A school spends Rs.6000 per month towards wheat when the cost of the wheat is Rs.20 per kg. If the price goes up to Rs.25 per kg, then the amount of money spent on wheat is___ 1) 7600/-
   2) 7400/- 3) 7200/- 4) 7500/-

2. If $22\frac{1}{2}$ m of silk costs Rs. 675, then the cost of $6\frac{1}{4}$ metres is__
   1) Rs.186.5 2) Rs.188.5 3) Rs.187.5 4) Rs.182.5

3. If 15 post cards cost Rs.11.25, then cost of 36 post cards is___
   1) 28/- 2) 26/- 3) 27/- 4) 29/-

4. If 15 iron balls of the same size weight 10kg 50gms, then 4.690 kg is the weight of
   1) 5 2) 6 3) 7 4) 9

5. There are 120 students in a mess. The food is enough for 75 days. If 60 more students join the Mess, then the food will last for
   1) 60 2) 40 3) 50 4) 75

6. The amount of energy produced in human body is directly proportional to the amount of fats burnt. If burning of 24gms of fat energy produced 144 calories, then the amount of fats consumed to release 252 calories of energy is
   1) 48 gms 2) 36 gms 3) 42 gms 4) 40 gms

7. The pressure P exerted at any point on the base of a tank filled with liquid varies directly as the depth D of the liquid. The pressure exerted by the liquid 40 cms deep on the base of a tank is 80 grams/sq.cm. If the 25cm, then the pressure exerted is
   1) 100 gm/cm^2 2) 25 gm/cm^2 3) 75 gm/cm^2 4) 50 gm/cm^2

8. The distance d that an object will fall freely from rest varies directly as the square of times. An object fall 128metres in 4 seconds. If it falls in 16 seconds, then the height through where it will fall is
   1) 2048 m 2) 2046 m 3) 2044 m 4) 2042 m

9. 100 people can construct a bridge in 150 days. If the bridge has to be constructed in 50 days, then the number of extra men required to complete the bridge is
   1) 250 2) 150 3) 200 4) 225

10. A publisher prints 32 lines in each page and takes 400 pages to print the matter. If the number of pages are restricted to 320 pages, then the number of line s printed in each page is
    1) 40 2) 60 3) 50 4) 56

11. The rate of vibrations (n) of a wire in tension is inversely proportional to its length (l) when the length of the wire is 160 cm, the vibrations are 400 per second. If the length is 100 cm, then the number of vibrations is
    1) 650 2) 630 3) 640 4) 620

12. England team scored 8 runs per over (R) in 50 overs (O). If India has to win in 40 overs, then the number of runs to be scored by them to win the match is_____(runs/over)
1) 10 2) 20 3) 30 4) 40

MULTI ANSWER TYPE

13. A train travels at 150 kmph and takes 8 hours to reach the distance. If it travels at 225 kmph, then the time taken by it is
1) $6\frac{1}{3}$hrs 2) $4\frac{1}{3}$hrs 3) $5\frac{1}{3}$hrs 4) $\frac{16}{3}$hrs

14. y varies inversely as a and a = 24, when y = 6. If y = 108, then the value of a is
1) $\frac{1}{3}$ 2) $\frac{2}{3}$ 3) $\frac{4}{3}$ 4) $\frac{5}{3}$

15. The square of the period of oscillation (T^2) of a simple pendulum is directly proportional to the length *(l)* of the simple pendulum when T = 8, *l* = 49cm. If *l*= 64, then the value of T is
1) $\frac{64}{7}$ sec 2) $\frac{66}{7}$ sec 3) 9.143 sec 4) $9\frac{1}{7}$ sec

16. It is known that current (i) in circuit is inversely proportional to resistance (R). When the resistance is 20 ohms current is 8 amperes. If the resistance is 15 ohms, then the current flow in the circuit is
1) 10.33 amperes 2) $10\frac{2}{3}$ amperes 3) $10\frac{1}{3}$ amperes 4) 10.66 amperes

REASONING ANSWER TYPE

17. *Statement I :* If the cost of 15 Maths Olympiad books is Rs.1500, then the cost of 25 Maths Olympiad books is Rs.2500.
Statement II : If two variables x and y vary directly, then x = k . y
1. Both Statements are true, Statement II is the correct explanation of Statement I.
2. Both Statements are true, Statement II is not correct explanation of Statement I.
3. Statement I is true, Statement II is false.
4. Statement I is false, Statement II is true.

18. *Statement I :* In an army camp provisions are enough for 72 days for 800 people. If after 22 days, 400 people join the garrison, then the number of days provisions will last is 100/3 days
Statement II : Some workers working 10 hrs a day can complete the work in 60 days. If they work 15hours per day, then the number of days they take to complete the work is 40 days
1. Both Statements are true, Statement II is the correct explanation of Statement I.
2. Both Statements are true, Statement II is not correct explanation of Statement I.
3. Statement I is true, Statement II is false.
4. Statement I is false, Statement II is true.

COMPREHENSION TYPE

Two quantities 'x' and 'y' are in (1) Directly proportional, if x = ky. (2) Inversely proportional, if xy = k. Where k is proportionality constant.

19. Two quantities 'x' and 'y' are in directly proportional such that x = 102 and y = 170. Then proportionality constant, k = _____
    1) 0.6 2) 6 3) 60 4) 0.06
20. Given x = 20, y = 15 and $x \propto y$. If x = 4, then y = _____
    1) 16 2) 3 3) 9 4) 4
21. Given $x \propto \frac{1}{y}$, x = 185 and y = 4. If y = 10, then x = _____
    1) 76 2) 75 3) 74 4) 73

MATRIX MATCHING TYPE

22.

Column-I	Column-II
a) $x \propto y$ and x =9, when y =3. If y = 8, then x =___	1) 14
b) $x \propto y$ and x =9, when y =3. If x = 42, then y =____	2) 2
c) $y \propto \frac{1}{x}$ and x = 6, when y = – 3 If x = – 9, then y =	3) 24 ___
d) $y \propto \frac{1}{x}$ and x = 6, when y = – 3 If y = 2, then x = _____	4) – 9 5) 9

INTEGER ANSWER TYPE

23. If a lorry can carry 600 bags each weighing 8 kg. If each bag contains 12 kg, then the number of bags it can carry is_____
24. 80 horses can graze a field in 30 days. If there were 120 horses, then the number of days horse can graze it is_____

KEY & HINTS

WORK SHEET – 1 (KEY)

1) 2	**2)** 3	**3)** 2	**4)** 3	**5)** 3
6) 3	**7)** 2	**8)** 3	**9)** 3	**10)** 1
11) 1	**12)** 4	**13)** 2	**14)** 1	**15)** 4
16) 3	**17)** 3	**18)** 1,3	**19)** 1,2,3	**20)** 2,3
21) 1,3	**22)** 1	**23)** 1	**24)** 1	**25)** 1
26) 3	**27)** A-2 B-3 C-4 D-1,5	**28)** 810		

18. **Key: 1, 3,** Given $x + y = 1500$ $\quad x : y = 4 : 2$
$2y + y = 1500$ $\quad x / y = 4 / 2$
$3y = 1500$ $\quad x = 2y$
$y = 500$ $\quad x = 2(500)$
$x = 1000$

19. **Key: 1,2,3,** Given $a : b : c = 2 : 3 : 4 \Rightarrow a = 2x, b = 3x, c = 4x$
Since $a + b + c = 2x + 3x + 4x = 189cm$ $\quad \therefore a = 2(21) = 42$ cm
$\Rightarrow (2 + 3 + 4)x = 189$ $\quad b = 3(21) = 63cm$
$\Rightarrow 9x = 189$ $\quad c = 4(21) = 84cm$
$\Rightarrow x = 21cm$

20. **Key: 2,3,** Given, the ratio of angles of scelene triangle = 3 : 4 : 8
$\Rightarrow \angle A : \angle B : \angle C = 3 : 4 : 8 \Rightarrow \angle A = 3x, \quad \angle B = 4x \quad \angle C = 8x$
given largest angle $= 96^0 \Rightarrow 8x = 96^0 \quad \Rightarrow x = 12^0$

$\therefore \angle A = 3x = 3\left(12^0\right) = 36^0$ and $\therefore \angle B = 4x = 4\left(12^0\right) = 48^0$

21. **Key: 1,3,** Given, the ratio of red, green and yellow balls = 5 : 3 : 2
Number of red balls = 5x; Number of green balls = 3x
Number of yellow balls = 2x; Since the number of yellow balls = 12
$\Rightarrow 2x = 12$, then $x = 6$ $\therefore$ Total number of balls = 5x + 3x + 2x = 10x = 10(6)= 60

22. **Key: 1,** $\frac{x+20}{x+30} = \frac{7}{8} \Rightarrow 8x + 160 = 7x + 210 \Rightarrow x = 210 - 160 \quad \Rightarrow x = 50$

St(1) is true, Clearly st (2) is true and st(2) is correct explanation of st (1)

23. **Key: 1,** Clearly St(2) is true; St(1): Let C's share = x
$\therefore$ B's share = 4x A's share = 5 times B's share
$= 5(4x) = 20x$

Since p = 1000/- $\therefore$ A's share $= \frac{a}{a+b+c} \times p = \frac{20x}{20x+4x+x} \times 1000 = \frac{20x}{25x} \times 1000$
$= 800/-$

B's share $= \frac{b}{a+b+c} \times p = \frac{4x}{25x} \times 1000 = 160/-$ so st(1) is true and st(2) is correct explanation of st (1)

24. **Key: 1,**Given the ratio of 50p, 25p, 10p coins = 5 : 9 : 4
Number of 50p Coins = 5x; Number of 25p coins = 9x; Number of 10p coins = 4x
Since (5x) (50p) +(9x)(25p) +(4x)(10p) = 206

$$\Rightarrow 5x\left(\frac{1}{2}\right) + 9x\left(\frac{1}{4}\right) + 4x\left(\frac{1}{10}\right) = 206 \quad \Rightarrow x\left(\frac{5}{2} + \frac{9}{4} + \frac{4}{10}\right) = 206$$

$$\Rightarrow x\left(\frac{50 + 45 + 8}{20}\right) = 206 \qquad \Rightarrow x = \frac{20 \times 206}{103} = 40$$

Number of 50p coins = 5x = 5 × 40 = 200; Number of 25p coins = 9x = 9 × 40 = 360

Number of 10p coins = 4x = 4 × 40 = 160; Value of 50p coins = 5x × 50p
= 200 × 1/2 = 100

25. **Key: 1,** Number of 10 paise coins = 4x = 160

26. **Key: 3,** Value of 25 paise coins = 9x × 25p
= 360 × 1/4 = 90/-

27. **Key: $a \to 2, b \to 3, c \to 4, d \to 1,5$**

a) Rs 150 : Rs 350 = 150/350= 3 : 7

b) Rs 1:15 paise = 100 paise : 15paise. = 20/3 = 20 :3

c) 2 Scores : 3 dozens = 2(20) : 3(12)
= 40 : 36 = 10 : 9

d) 240m: $1\frac{1}{5}$ km = 240m : 6/5×1000m = 240 : 1200 = 2 : 10 = 1 : 5

28. **Key: 810,** Let the number be x and y

Since x : y = 7 : 3 and x – y = 324; $\frac{x}{y} = \frac{7}{3}$ and x – y = 324

$\Rightarrow x = \frac{7}{3}y$ and $\frac{7}{3}y - y = 324 \Rightarrow \left(\frac{7}{3} - 1\right)y = 324 = \frac{4}{3}y = 324$

$\Rightarrow \frac{4}{3}y = 324 \Rightarrow y = \frac{324 \times 3}{4} = 243$

$\therefore x = \frac{7}{3}(243) = 567 \Rightarrow x + y = 567 + 243 = 810$

WORK SHEET – 2 (KEY)

1) 3	2) 2	3) 2	4) 2	5) 3
6) 1	7) 2	8) 3	9) 4	10) 1
11) 1	12) 1	13) 1,2,3,4	14) 1,3	15) 2,4
16) 2,4	17) 4	18) 3	19) 1	20) 4
21) 2	22) A-4 B-3 C-2,5 D-1			

1. **Key: 3,** Sicne sub duplicate ratio of a : b is $\sqrt{a} : \sqrt{b}$

   Sub duplicate ratio of 484 : 361 = $\sqrt{484} : \sqrt{361}$ = 22 : 19

2. **Key: 2,** Since sub triplicate ratio of a : b is $\sqrt[3]{a} : \sqrt[3]{b}$

   $\therefore$ sub triplicate ratio of 1000 : 512 = $\sqrt[3]{1000} : \sqrt[3]{512}$

   $\Rightarrow \left(10^3\right)^{1/3} : \left(8^3\right)^{1/3}$ = 10 : 8 = 5 : 4

3. **Key: 2,** $4 : \frac{1}{9} = 36 : 1$ Reciprocal ratio of $4 : \frac{1}{9} = 1 : 36$

4. **Key: 2,** Compund raito of a : b and c : d is ac : bd
   The compound ratio of 5 : 6 and 10 : 9 is (5 × 10) : (6 × 9) = 50 : 54 = 25 : 27
   The reciprocal ratio of above compound ratio is 27: 25

5. **Key: 3,** Given $\frac{x}{8} = \frac{y}{3} \Rightarrow \frac{x}{y} = \frac{8}{3} \Rightarrow x : y = 8 : 3$

   The tiplicat ratio of x : y = $x^3 : y^3 = 8^3 : 3^3$ = 512 : 27

6. **Key: 1,** The compound ratio of a : b, c : d and e : f is ace: bdf
   The compound ratio of 3x : 4y , $ab^2 : c^2$ and c: b^2 = (3x) (ab^2) (c) : (4y) (c^2) (b^2) = 3xa : 4cy

7. **Key: 2,** Since $\frac{7x - 4y}{3x + y} = \frac{5}{13} \Rightarrow 91x - 52y = 15x + 5y \Rightarrow 76x = 57y \Rightarrow \frac{x}{y} = \frac{57}{76} = \frac{3}{4}$

   $y^2 : x^2 = \left(\frac{y}{x}\right)^2 = \left(\frac{4}{3}\right)^2 = 16 : 9$

8. **Key: 3,** Duplicate ratio of (A + x : B + x) is $(A+x)^2 : (B + x)^2$
   given that, the duplicate ratio is A : B

   $$= A : B = (A + x)^2 : (B + x)^2 \Rightarrow \frac{A}{B} = \left(\frac{A + x}{B + x}\right)^2$$

   $$\Rightarrow \frac{A}{B} = \frac{A^2 + x^2 + 2Ax}{B^2 + x^2 + 2Bx}$$

   $$\Rightarrow AB^2 + Ax^2 + 2ABx = BA^2 + Bx^2 + 2ABx \Rightarrow x^2 = AB$$

9. **Key: 4,** Duplicate ratio of (2x – m) : (3y – m) is $(2x – m)^2 : (3y – m)^2$

   Since 2x : 3y = $(2x – m)^2 : (3y –m)^2 \Rightarrow \frac{2x}{3y} = \left(\frac{2x - m}{3y - m}\right)^2 \Rightarrow \frac{2x}{3y} = \frac{4x^2 + m^2 - 4mx}{9y^2 + m^2 - 6my}$

   $\Rightarrow 18xy^2 + 2m^2x – 12mxy = 12x^2y + 3m^2y –12mxy \Rightarrow 6xy (2x –3y) = m^2(2x – 3y)$
   $\Rightarrow m^2 = 6xy$

10. **Key: 1,** Duplicate raito of $\frac{5n+4}{2n-1}$ is $(5n+4)^2 : (2n-1)^2$

Given $\Rightarrow$ 25 = $\left(\frac{5n+4}{2n-1}\right)^2$ $\Rightarrow 5 = \frac{5n+4}{2n-1}$ $\Rightarrow$ 10n – 5 = 5n + 4 $\Rightarrow$ 5n = 9 $\Rightarrow$ n = 9/5

11. **Key: 1,** Given x+y : x – y = 9 : 1 $\Rightarrow$ $\frac{x+y}{x-y} = 9$ $\Rightarrow$ x + y = 9x – 9y $\Rightarrow$ 8x= 10 y $\Rightarrow$ $\frac{x}{y} = \frac{5}{4}$

$\therefore x^3 : y^3 = \left(\frac{x}{y}\right)^3 = \left(\frac{5}{4}\right)^3 = \frac{125}{64}$

12. **Key: 1,** Compound ratio of a : b and c : d is ac :bd.
Compound ratio of $(x^2 - y^2)$: $(x^2 + y^2)$ and $x^4 - y^4$):$(x + y)^4$ is $\left(x^2-y^2\right)\left(x^4-y^4\right):\left(x^2+y^2\right)(x+y)^4$

$= \left(x^2-y^2\right)\left(x^2-y^2\right)\left(x^2+y^2\right):\left(x^2+y^2\right)(x+y)^2(x+y)^2$

$= (x+y)^2(x-y)^2 : (x+y)^2(x+y)^2 = (x-y)^2 : (x+y)^2$

13. **Key: 1,2,3,4**,Since a,b,c,d are in proportion, Then $\frac{a}{b} = \frac{c}{d} \Rightarrow ad = bc \Rightarrow d = \frac{bc}{a}$ and $b = \frac{ad}{c}$

14. **Key: 1,3,** Since a,b,c,d are in proprotion $\Rightarrow$ ad = bc
$\Rightarrow$ a and d are called extremes and b and c are called means
so, (i) 1st and 4th terms are extremes (ii) 2nd and 3rd terms are means

15. **Key: 2, 4,** If a, b, c, d are in continued proportion.
Then ad = bc
1) 20 × 6 = 18 × 5 $\Rightarrow$ 120 = 90 (False)
2) 3.6 × 0.5 = 0.4× 4.5 $\Rightarrow$ 1.8 = 1.8 (True)
3) 51 × 102= 68 × 85 $\Rightarrow$ 5202= 5780 (False)
4) 1.5 × 6 = 2.5 × 3.6 $\Rightarrow$ 9 = 9 (True)
There fore 3.6, 0.4, 4.5 and 0.5 are in continued proportion and 1.5, 2.5, 3.6 and 6 are also in continued proportion

16. **Key: 2, 4,** Duplicate ratio of 5 : 6 is 25 : 36
The reciprocal ratio of 25 :32 is 32 : 25
The sub duplicate ratio of 81 : 64 is $\sqrt{81} : \sqrt{64}$ = 9 : 8

The compound ratio of 25 : 36 , 32 : 25 and 9 : 8 is $=(25)(32)(9):(36)(25)(8)$
$=1:1$

17. **Key: 4,** Since 36, x, 16 are in continued proprotion $x=\sqrt{36\times16}\Rightarrow6\times4=24$
so St (1) is false but st(2) is true

18. **Key: 3,** a : b :: c : d $\Rightarrow$ ad = bc st (2) is false

st (1) $\frac{1}{9}:x::\frac{1}{3}:\frac{1}{4}\Rightarrow\left(\frac{1}{9}\right)\left(\frac{1}{4}\right)=(x)\left(\frac{1}{3}\right)\Rightarrow x=\frac{1}{12}$ St(1) is ture

19. **Key: 1,** Number of males = 160; Number of females = n(say)
Since, the ratio of amount of many among males and females = 16 : 21
The total amount of money among males = 16x

Since each male gets Rs. 4/-; $16x=160\times4\Rightarrow x=\frac{160\times4}{16}\Rightarrow$ 40/-

The total amount of many among females = 21x $\Rightarrow$ 21(40)$\Rightarrow$ 840/-
But each female gets Rs. 3/-;$\Rightarrow$ 3n = 840 $\Rightarrow$ n = 280
Number of females = 280

20. **Key: 4,** The ratio of earnings of 15 males and 3 females= (15×4) : (3 × 3)
= 60 : 9$\Rightarrow$ 20 : 3

21. **Key: 2,** If 60 men are less and 120 females are more
The new ratio of males and females = (160 – 60) : (280 + 120) = 100 : 400 = 1 : 4

22. **Key: $a\to4,b\to3,c\to(2,5),d\to1$** Since 2a = 3b = 4c =12 $\Rightarrow$a= 6, b = 4, c = 3

a) If a : b = c : d then d is 4th proortional of a,b,c $\Rightarrow$ 6 : 4 = 3 : d

$\Rightarrow \frac{6}{4}=\frac{3}{d}\Rightarrow$d=2

The 4th proportional of a, b, c is '2'

b) Let 'x' be 3rd proportinal to b, c $\Rightarrow$ b, c, x are in continued proportion

$\Rightarrow$ b : c = c : x $\Rightarrow$ 4 : 3 = 3 : x $\Rightarrow\frac{4}{3}=\frac{3}{x}\Rightarrow x=\frac{9}{4}$

c) Mean proportional between a and b = $\sqrt{ab}=\sqrt{6\times4}=\sqrt{24}=2\sqrt{6}$

d) Let 3rd proportinal to a,b, y
a, b, y are in continued proportion.

$\Rightarrow$ a : b = b : y; 6 : 4 = 4 : y $\Rightarrow\frac{6}{4}=\frac{4}{y}\Rightarrow y=\frac{8}{3}$

WORK SHEET – 3 (KEY)				
1) 3	2) 3	3) 4	4) 3	5) 3
6) 4	7) 4	8) 2	9) 1	10) 2,4
11) 2,3,4	12) 1,2	13) 2,3	14) 1	15) 4
16) 3	17) 3	18) 3	19) A-3 B-4 C-2,5 D-1	20) 4

1. **Key: 3,** Let the 3rd term be x $\Rightarrow$ $5.2:3.9 = x : 3$

$\Rightarrow 3.9 \times x = 5.2 \times 3 \Rightarrow x = \frac{5.2 \times 3}{3.9} \Rightarrow x = 4.$

2. **Key: 3,** $16 : x = x : 36 \Rightarrow 16 \times 36 = x \times x \Rightarrow x^2 = 576 \Rightarrow x^2 = \sqrt{576} \Rightarrow x = 24$

3. **Key: 4,** $15 : 30 = 30 : y \Rightarrow 15 \times y = 900 \Rightarrow y = \frac{900}{15} \Rightarrow y = 60$

4. **Key: 3,** $2\frac{1}{2} : x = 12\frac{1}{2} : 6\frac{1}{4} \Rightarrow$

$\frac{25}{2} \times x = \frac{5}{2} \times \frac{25}{4} \Rightarrow x = \frac{125}{8} \div \frac{25}{2} \Rightarrow x = \frac{125}{8} \times \frac{2}{25} \Rightarrow x = \frac{5}{4}$

5. **Key: 3,** Let the number added to be x $\Rightarrow$ $8+x : 20+x = 12+x : 28+x$

$\Rightarrow (8 + x)(28 + x) = (12 + x)(20 + x) \Rightarrow 224+8x+28x+x^2 = 240+12x+20x+x^2$

$\Rightarrow 36x - 32x + x^2 - x^2 = 240 - 224 \Rightarrow 4x = 16 \Rightarrow x = \frac{16}{4} \Rightarrow x = 4.$

6. **Key: 4,** Let the number be a, b given mean proportional of a,b is $\sqrt{ab} = 28$
Let 'c' be 3rd proportional ie c = 224, Since 'c' is 3rd proportinal of a, b

$\Rightarrow a : b = b : c \Rightarrow \frac{a}{b} = \frac{b}{c} \Rightarrow b^2 = ac \Rightarrow b^3 = abc \Rightarrow b^3 = (28)^2 (224) = (28)^2 \times (8 \times 28)$

$\therefore$ b = 56; Since $ab = (28)^2 \Rightarrow a(56) = (28)^2 \Rightarrow a(28 \times 2) = 28 \times 28 \Rightarrow a = 14$

$\therefore$ Required two numbers are 14 and 56

7. **Key: 4,** Since x = 3, y = 2

$\therefore$ x + y = 3 + 2 = 5 and 2x + 3y = 2(3) + 3(2) = 12;

Let 'a' 3rd proportional to (x + y), (2x + 3y)

$\Rightarrow$ (x+y) : (2x+3y) = (2x+3y) : a $\Rightarrow$ (5 : 12 = 12 : a $\Rightarrow \frac{5}{12} = \frac{12}{a} \Rightarrow a = \frac{144}{5}$

8. **Key : 2,** Since 'b' is the mean proportional of 9, 49 $\Rightarrow b = \sqrt{9 \times 49} = 3 \times 7 = 21 \Rightarrow b = 21$

Since 'c' is 3rd proportional to 7, 49 $\Rightarrow$ 7 : 49 = 49 : c $\Rightarrow \frac{\cancel{7}}{\cancel{49}_{7}} = \frac{49}{c} \Rightarrow c = 343$

Since 'd' is 4th proportional to 14, 49, 35 $\Rightarrow$ 14 : 49 = 35 : d $\Rightarrow$

$\cancel{14}^{2}\, d = \cancel{49}^{7} \times 35 \Rightarrow d = \frac{245}{2}$; Let 'x' be 4th proportional to b, c, d

$\Rightarrow$ b : c = d : x $\Rightarrow$ b × x = c × d $\Rightarrow x = \frac{c \times d}{b} = \frac{343 \times \left(\frac{245}{2}\right)}{21}$

$\Rightarrow x = \frac{343 \times 245}{21 \times 2} \Rightarrow x = \frac{12005}{6}$

9. **Key : 1,** Given $2x - 5 = \frac{y+4}{2} = z \div \frac{5}{2} = 5 \Rightarrow 2x - 5 = 5, \quad \frac{y+4}{2} = 5, \quad z \div \frac{5}{2} = 5$

$\Rightarrow 2x = 10, y + 4 = 10, \frac{z}{\left(\frac{5}{2}\right)} = 5 \Rightarrow x = 5, y = 6, z = \frac{25}{2}$

$\therefore x + y = 5 + 6 = 11; \quad y + z = 6 + \frac{25}{2} = \frac{37}{2}$

$\therefore$ Mean proportional of (x+y) (y + z) is $= \sqrt{(x+y)(y+z)} = \sqrt{11 \times \frac{37}{2}}$

$= \sqrt{\frac{11 \times 37}{2}}$

10. **Key: 2,4,** x : 5 = 5 : 10 $\Rightarrow 10x = 25 \Rightarrow x = \frac{25}{10} \Rightarrow x = \frac{5}{2}$

5 : 10 = 10 : y $\Rightarrow 5y = 100 \Rightarrow y = \frac{100}{5} \Rightarrow y = 20.$

11. **Key: 2,3,4,** Given a : c : : $(a^2 + b^2)$: $(b^2 + c^2) \Rightarrow a(b^2+c^2) = c(a^2 + b^2)$

$\Rightarrow ab^2 + ac^2 = a^2c + b^2c \Rightarrow ac^2 - a^2c = b^2c - b^2a \Rightarrow b^2 = ac \Rightarrow \frac{b}{a} = \frac{c}{b} \Rightarrow \frac{a}{b} = \frac{b}{c}$

12. **Key: 1,2,** Since 4th proportional to 2.1m, 1.5m, 6.3m is x.
$\Rightarrow$ 2.1m : 1.5m = 6.3m : x $\Rightarrow$ (2.1)x = (1.5) (6.3) $\Rightarrow$ $x = \frac{1.5 \times 6.3}{2.1} = 4.5m \Rightarrow x = 4.5m.$
Since the 3rd proportional to 1m 60cm, 40cm is y.
$\Rightarrow$ 1m 60cm : 40cm = 40cm : y $\Rightarrow$ 160cm : 40cm = 40cm : y $\Rightarrow$ y = 10cm.
$\therefore$ The mean proportion between 'x' and 'y' is
$\sqrt{xy} = \sqrt{4.5m \times 10cm} = \sqrt{450cm \times 10cm} = \sqrt{4500}\,cm = 30\sqrt{5}\,cm.$

13. **Key: 2,3,** Since 4th proportional to 1.8, x, 2.4 is 6. $\Rightarrow \frac{1.8}{x} = \frac{2.4}{6} \Rightarrow x = \frac{1.8 \times 6}{2.4} \Rightarrow x = \frac{9}{2}.$
Since 3rd proportional to $\frac{1}{9} \& \frac{2}{3}$ is y. $\Rightarrow \frac{1}{9} : \frac{2}{3} = \frac{2}{3} : y \Rightarrow y = 4.$
Since the mean proportion between $\frac{2}{3}$ and $\frac{8}{27}$ is z.
$\Rightarrow z = \sqrt{\frac{2}{3} \times \frac{8}{27}} = \sqrt{\frac{16}{81}} \Rightarrow z = \frac{4}{9}.$
$\therefore$ The 4th proportional to x, y, z is $\frac{y \times z}{x} = \frac{4 \times \left(\frac{4}{9}\right)}{\left(\frac{9}{2}\right)} = 4 \times \frac{4}{9} \times \frac{2}{9} = \frac{32}{81}$ $\therefore \sqrt{\frac{32}{81}} = \frac{4\sqrt{2}}{9}.$

14. **Key: 1,** Statement-1: 18, 45, 2,5 Now 18 : 45 $= \frac{18}{45}$ $\therefore$ 18 : 45 = 2 : 5.
$\Rightarrow$ 18, 45, 2, 5 are in proportion. $\Rightarrow$ St-1: is true
and clearly St-2 : is true. $\Rightarrow$ St-2: is correct explanation of st-1

15. **Key: 4,** Clearly St-2 is True.
St-1: 3 hrs 12min = (3×60)min + 12min = 192min = 192 × 60sec = 11520sec.
24min = 24 × 60sec = 1440sec. 2min 8sec = 2× 60sec + 8sec = 128sec.
Let 'x' sec be fourth proportional of 3hr 12min, 24min, 2min 8sec.
They 11520 : 1440=128 : x $\Rightarrow$ (11520)× (x) = 1440 × 128 $\Rightarrow$ $x = \frac{1440 \times 128}{11520} = 16sec.$
St-(1) is False.

16. **Key: 3,** Since 36, 24 and x are in continued proportion.
$\Rightarrow$ 36 : 24 = 24 : x $\Rightarrow$ 36x = 24 × 24 $\Rightarrow$ x = 16.

17. **Key: 3,** The third proportional to 25 and 15 is 'x' (say) $\Rightarrow$ 25 : 15 = 15 : x

$\Rightarrow \frac{25}{15}=\frac{15}{x} \Rightarrow x=9.$

18. **Key: 3,** The mean proportion between 2.5 and 0.9

is $\sqrt{(2.5)\times(0.9)}=(0.5)\times(0.3)=0.15.$

19. **Key: $a \to 3, b \to 4, c \to (2,5), d \to 1$**

a) 3.6 : x : : 0.4 : 0.5 $\Rightarrow$ (3.6) (0.5) = x (0.4) $\Rightarrow$ $x=\frac{(3.6)(0.5)}{(0.4)}=4.5.$

b) Since x : 1.6 : : 2.1 : 8.4 $\Rightarrow$ x(8.4) = (1.6) × (2.1) $\Rightarrow$ x = 0.4.

c) Since $\frac{1}{9}:x::\frac{1}{3}:\frac{1}{4} \Rightarrow \frac{1}{9}\times\frac{1}{4}=\frac{1}{3}\times x \Rightarrow x=\frac{3}{9\times4}=\frac{1}{12}=0.083.$

d) Since 42 : 12 : : 7 :x, $\Rightarrow$ 42 × x = 12 × 7 $\Rightarrow$ $x=\frac{12\times7}{42}=2.$

20. **Key: 4,** x, 8, 16 are in proportion $\Rightarrow$ x : 8 = 8 : 16 $\Rightarrow \frac{x}{8}=\frac{8}{16}=x=4$

CUMULATIVE (KEY)

1) 4	**2)** 3	**3)** 3	**4)** 3	**5)** 3
6) 3	**7)** 4	**8)** 1	**9)** 3	**10)** 1
11) 3	**12)** 1	**13)** 3,4	**14)** 3	**15)** 1,3,4
16) 2,4	**17)** 1	**18)** 2	**19)** 1	**20)** 2
21) 3	**22)** A-3 B-1 C-2 D-4	**23)** 400	**24)** 20	

1. **Key: 4,** Let money spent at 25/- per kg be x.

6000 : 20 = x : 25 $\Rightarrow$ 6000 × 25 = 20 × x $\Rightarrow x=\frac{6000\times25}{20}$ $\therefore x=7500$

2. **Key: 3,** x = $22\frac{1}{2}$m, x = $6\frac{1}{4}$m y = 675/- y = ?

$\Rightarrow \frac{x}{y} = k \Rightarrow \frac{45}{2 \times 675} = \frac{6\frac{1}{4}}{y} \Rightarrow \frac{1}{30} = \frac{25}{4y} \Rightarrow$ 4y = 25 × 30 $\Rightarrow y = \frac{25 \times 30}{4} \Rightarrow$ y = Rs.187.5.

3. **Key: 3,** $\frac{x}{y} = k \Rightarrow \frac{15}{11.25} = \frac{36}{y} \Rightarrow$ 15 × y = 36 × 11.25 $\Rightarrow y = \frac{36 \times 11.25}{15} \Rightarrow$ y = 27.00

4. **Key: 3**

$\frac{x}{y} = k \Rightarrow \frac{15}{10.050kg} = \frac{x}{4.690} \Rightarrow x \times \frac{10050}{1000} = \frac{4690}{1000} \times 15 \Rightarrow x = \frac{4690 \times 15}{1000} \times \frac{1000}{10050} \therefore x = 7.$

5. **Key: 3,** x=120, y = 75 days $\Rightarrow$ x = 120 + 60 = 180, y = ? $\Rightarrow$ k = 120 × 75 $\Rightarrow$ xy = k Now, 180 × y = 120 × 75 $\Rightarrow y = \frac{120 \times 75}{180}$ $\therefore$ y = 50 days

6. **Key: 3,** $\frac{x}{y} = k \Rightarrow$ x = 24gms, y = 144 calories, and now, y = 252 calories

$\Rightarrow \frac{24}{144} = \frac{x}{252} \Rightarrow$ 144 × x = 24 × 252 $\Rightarrow x = \frac{24 \times 252}{144} \therefore$ x = 42 gms.

7. **Key: 4,** Depth=d, Pressure = p; $\frac{d}{p} = k \Rightarrow \frac{40}{80} = \frac{25}{p} \Rightarrow p = \frac{80 \times 25}{40} \Rightarrow$ p=50 gms/ sq.cm

8. **Key: 1,** $\frac{d}{f^2} = k \Rightarrow \frac{128}{4^2} = k \Rightarrow \frac{128}{16} = k \Rightarrow k = 8 \Rightarrow \frac{d}{f^2} = k \Rightarrow \frac{d}{16^2} = k$

$\Rightarrow \frac{d}{256} = k \Rightarrow \frac{d}{256} = 8 \Rightarrow$ d = 8 × 256 $\Rightarrow$ d = 2048m

9. **Key: 3,** x = 100 people, y = 150 days $\Rightarrow$ xy = k $\Rightarrow$ 100 × 150 = k

y = 50 days, x = ? $\Rightarrow$ 100 × 150 = x × 50 $\Rightarrow x = \frac{100 \times 150}{50} = 300$

$\therefore$ The number of people required = 300 – 100 = 200

10. **Key: 1,** x = 400 pages, y = 32 lines $\Rightarrow$ x × y = k $\Rightarrow$ 400 × 32 = k
Here, x = 320 pages, y = ? $\Rightarrow$ xy = k

$\Rightarrow$ 320 × y = 32 × 400 $\Rightarrow y = \frac{32 \times 400}{320}$ $\therefore$y = 40 lines

11. **Key: 3,** *l* = 160 cm, n = 400; Here, *l* = 100 cm, n = ?

$\Rightarrow$ *l* × n = k $\Rightarrow$ 100 × n = 160 × 400 $\Rightarrow n = \frac{160 \times 400}{100} \therefore$ n = 640 vibrations

12. **Key: 1,** Runs per over i.e., R × O = k $\Rightarrow$ 8 × 50 = k $\Rightarrow$ R × 40 = 8 × 50

$\therefore$ R = $\frac{8\times 50}{40}$ = 10 runs/over

13. **Key: 3,4,** xy = k Given, x = 150 kmph and y = 8 hours $\Rightarrow$ 150 × 8 = k

Now, x = 225 kmph, y = ? $\Rightarrow$ xy = k $\Rightarrow$ 225 × y = 150 × 8 $\therefore$ y = $\frac{150\times 8}{225} = 5\frac{1}{3}$ hrs

14. **Key: 3,** a = 24, y = 6 We know ay = k $\Rightarrow$ 24 × 6 = k; Here, y = 108, a = ?

$\Rightarrow$ ay = k $\Rightarrow$ a × 108 = 24 × 6 $\Rightarrow$ a = $\frac{24\times 6}{108}$ $\therefore a = \frac{4}{3}$

15. **Key:1,3,4,** T = 8, T = ?; *l* = 49, *l* = 64 $\Rightarrow \frac{T^2}{l} = k \Rightarrow \frac{8^2}{49} = k \Rightarrow \frac{8^2}{49} = \frac{T^2}{64}$

$\Rightarrow$ 49 × T^2 = 8^2 × 64 $\Rightarrow T^2 = \frac{8^2\times 64}{49} \Rightarrow T = \frac{8\times 8}{7} \Rightarrow T = \frac{64}{7}$ seconds.

16. **Key: 2,4,** i = 8 amperes, R = 20 ohms Here, R = 15 ohms, i = ?

$\Rightarrow$ k = iR $\Rightarrow$ i × 15 = 8 × 20 $\Rightarrow$ i = $\frac{8\times 20}{15}$ $\therefore$ $i = 10\frac{2}{3}$ amperes

17. **Key: 1,** St-2 is True.

St-1: Given, the cost of 15 Maths Olympiad books = Rs.1500.

$\Rightarrow$ Each book cost = $\frac{1500}{15} = 100/-$

$\therefore$ The cost of 25 books = 25 × 100 = 2500/-

(Q cost and Books are in direct proportion).

18. **Key: 2,** st (1) :- x = 72 Days, y = 800 Armymen Here, x = ?, y = 1200

$\therefore$ Remaining days = 72 –22 = 50 days and Strength of army = 800 + 400 = 1200

$\Rightarrow$ xy = k $\Rightarrow$ y × 1200 = 50 × 800 $\therefore$ y = $\frac{50\times 800}{1200} = 33\frac{1}{3}$ days

St (2):- x = 10 hrs, y = 60 days; x = 15 hrs, y = ?; $\Rightarrow$ xy = k $\therefore$ y = $\frac{10\times 60}{15}$ = 40 days

19. **Key: 1,** Since $x \propto y \Rightarrow x = ky \Rightarrow 102 = k(170) \Rightarrow x = \frac{102}{170} = \frac{3}{5} = 0.6.$

20. **Key: 2,** Since $x \propto y \Rightarrow x = ky$ x = 20 $\Rightarrow$ y = 15 $\therefore k = \frac{x}{y} = \frac{20}{15} = \frac{4}{3}.$

If $x = 4 \Rightarrow y = \frac{x}{k} \Rightarrow y = \frac{4}{\left(\frac{4}{3}\right)} = 3.$

21. **Key: 3,** Since $x \propto \frac{1}{y} \Rightarrow xy = k$. Since x = 185, y = 4 $\Rightarrow$ K = 185 × 4 $\Rightarrow$ K = 740.

If y = 10, then $x = \frac{k}{y} \Rightarrow x = \frac{740}{10} \Rightarrow x = 74.$

22. **Key: $a \to 3, b \to 1, c \to 2, d \to 4$**

a) Since $x \propto y \Rightarrow x = ky$. Given x = 9, and y = 3. $\Rightarrow k = \frac{x}{y} = \frac{9}{3} = 3.$

If y = 8, then x = ky = 3 × 8 x = 24.

b) Since $x \propto y$ and x = 9, y = 3 $\Rightarrow k = \frac{x}{y} = \frac{9}{3} = 3.$ Given x = 42,

$\Rightarrow y = \frac{x}{k} = \frac{42}{3} \Rightarrow y = 14.$

c) Since $y \propto \frac{1}{x} \Rightarrow xy = k.$ Given x = 6, y = –3 $\Rightarrow$ k = –18. If x = –9

$\Rightarrow y = \frac{k}{x} = \frac{-18}{-9} = 2.$

d) Since $y \propto \frac{1}{x}$, x=6 and y = 3 $\Rightarrow$ k = -18. If y = 2 $\Rightarrow x = \frac{k}{y} = \frac{-18}{2} = -9.$

23. **Key: 400,** Given, x = 600 bags, y = 8 kg, We know xy = k $\Rightarrow$ 600 × 8 = k

Given, y = 12 kg, x = ? $\Rightarrow$ xy = k $\Rightarrow$ 12 × x = 600 × 8 $\Rightarrow$ $x = \frac{600 \times 8}{12} = 400$ bags

24. **Key: 20,** x = 80 horses, y = 30 days $\Rightarrow$ x = 120 horses, y = ?

$\Rightarrow$ xy = k $\Rightarrow$ 120 × y = 80 × 30 $\Rightarrow$ $y = \frac{80 \times 30}{120}$ $\therefore$ y = 20 days