



MATHS

BOOKS - SELINA MATHS (ENGLISH)

RATIO AND PROPORTION (INCLUDING PROPERTIES AND USES)

Exercise 7 A

1. If $a : b = 5 : 3$, find : $\frac{5a - 3b}{5a + 3b}$.



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2. If $x : y = 4 : 7$, find the value of $(3x + 2y) : (5x + y)$.



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3. If $a : b = 3 : 8$, find the value of $\frac{4a + 3b}{6a - b}$.

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4. If $(a - b) : (a + b) = 1 : 11$ find the ratio $(5a + 4b + 15) : (5a - 4b + 3)$.

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5. Find the number which bears the same ratio to $\frac{7}{33}$ that $\frac{8}{21}$ does to $\frac{4}{9}$.

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6. If $\frac{m+n}{m+3n} = \frac{2}{3}$, find : $\frac{2n^2}{3m^2+mn}$.

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7. Find $\frac{x}{y}$, when $x^2 + 6y^2 = 5xy$.

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8. If the ratio between 8 and 11 is the same as the ratio of $2x - y$ to $x + 2y$, find the value of $\frac{7x}{9y}$.

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9. Divide Rs. 1, 290 into A , B and C such that A is $\frac{2}{5}$ of B and $B:C = 4:3$.

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10. A school has 630 students. The ratio of the number of boys to the number of girls is 3:2. This ratio changes to 7:5 after the admission of 90 new students. Find the number of newly admitted boys.



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11. What quantity must be subtracted from each term of the ratio 9:17 to make it equal to 1:3?



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12. The monthly pocket money of Ravi and Sanjeev are in the ratio 5:7. Their expenditures are in the ratio 3:5. If each saves

Rs. 80 every month, find their monthly pocket money.



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13. The work done by $(x - 2)$ men in $(4x + 1)$ days and the work done by $(4x + 1)$ men in $(2x - 3)$ days are in the ratio 3 : 8.

Find the value of x .



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14. The bus fare between two cities is increased in the ratio 7 : 9.

Find the increase in the fare, if :

(i) the original fare is Rs.245,

(ii) the increased fare is Rs.207.



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15. By increasing the cost of entry ticket to a fair in the ratio 10:13, the number of visitors to the fair has decreased in the ratio 6:5. In what ratio has the total collection increased or decreased ?



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16. In a basket, the ratio between the number of oranges and the number of apples is 7:13. If 8 oranges and 11 apples are eaten, the ratio between the number of oranges and the number of apples becomes 1:2, Find the original number of oranges and the original number of apples in the basket.



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17. In a mixture of 126kg of milk and water, milk and water are in the ratio 5:2. How much water must be added to the mixture to make this ratio 3:2?



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18. (a) If $A : B = 3 : 4$ and $B : C = 6 : 7$, find :

(i) $A : B : C$

(ii) $A : C$

(b) If $A : B = 2 : 5$ and $A : C = 3 : 4$, find : $A : B : C$.



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19. (i) If $3A = 4B = 6C$, find : $A : B : C$.

(ii) If $2a = 3b$ and $4b = 5c$, find: $a : c$.



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20. Find the compound ratio of :

(i) $2 : 3$, $9 : 14$ and $14 : 27$.

(ii) $2a : 3b$, $mm : x^2$ and $x : n$.

(iii) $\sqrt{2} : 1$, $3 : \sqrt{5}$ and $\sqrt{20} : 9$.



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21. Find duplicate ratio of:

(i) $3 : 4$

(ii) $3\sqrt{3} : 2\sqrt{5}$



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22. Find triplicate ratio of :

(i) 1 : 3

(ii) $\frac{m}{2} : \frac{n}{3}$



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23. Find sub-duplicate ratio of :

(i) 9 : 16

(ii) $(x - y)^4 : (x + y)^6$



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24. Find sub-triplicate ratio of :

(i) 64 : 27

(ii) $x^3 : 125y^3$



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25. Find the reciprocal ratio of :

(i) 5 : 8

(ii) $\frac{x}{3} : \frac{y}{7}$



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26. If $(x + 3) : (4x + 1)$ is the duplicate ratio of 3 : 5, find the value of x .



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27. If $m : n$ is the duplicate ratio of $(m + x) : (n + x)$, show that:

$$x^2 = mn$$



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28. If $(3x - 9) : (5x + 4)$ is the triplicate ratio of $3 : 4$, find the value of x .



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29. Find the ratio compounded of the reciprocal ratio of $15 : 28$, the sub-duplicate ratio of $36 : 49$ and the trilicate ratio of $5 : 4$.



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30. (a) If $r^2 = pq$, show that $p : q$ is the duplicate ratio of $(p + r) : (q + r)$.

(b) If $(p - x) : (q - x)$ be the duplicate ratio of $p : q$ then show

that : $\frac{1}{p} + \frac{1}{q} = \frac{1}{r}$.





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Exercise 7 B

1. Find the fourth proportional to :

(i) 1.5, 4.5 and 3.5

(ii) $3a$, $6a^2$ and $2ab^2$



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2. Find the third proportional to :

(i) $2\frac{2}{3}$ and 4

(ii) $a - b$ and $a^2 - b^2$



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3. Find the mean proportional between :

(i) $6 + 3\sqrt{3}$ and $8 - 4\sqrt{3}$

(ii) $a - b$ and $a^3 - a^2b$.



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4. If $x + 5$ is the mean proportion between $x + 2$ and $x + 9$:

find the value of x .



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5. If x^2 , 4 and 9 are in continued proportion, find x .



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6. What number must be added to each of the numbers 6, 15, 20 and 43 to make them proportional ?



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7. (i) If a, b, c are in continued proportion, show that :

$$\frac{a^2 + b^2}{b(a + c)} = \frac{b(a + c)}{b^2 + c^2}.$$

(ii) If a, b, c are in continued proportion and $a(b - c) = 2b$,

prove that :

$$a - c = \frac{2(a + b)}{a}.$$

(iii) If $\frac{a}{b} = \frac{c}{d}$ show that :

$$\frac{a^3c + ac^3}{b^3d + bd^3} = \frac{(a + c)^4}{(b + d)^4}.$$



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8. What least number must be subtracted from each of the numbers 7, 17 and 47 so that the remainders are in continued proportion ?

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9. If y is the mean proportional between x and z , show that $xy + yz$ is the mean proportional between $x^2 + y^2$ and $y^2 + z^2$.

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10. If q is the mean proportional between p and r , show that :

$$pqr(p + q + r)^3 = (pq + qr + pr)^3.$$

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11. If three quantities are in continued proportion, show that the ratio of the first to the third is the duplicate ratio of the first to the second.

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12. If y is the mean proportional between x and z , prove that :

$$\frac{x^2 - y^2 + z^2}{x^{-2} - y^{-2} + z^{-2}} = y^4.$$

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13. Given four quantities a, b, c and d are in proportion. Show that :

$$(a - c)b^2 : (b - d)cd = (a^2 - b^2 - ab) : (c^2 - d^2 - cd)$$

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14. Find two numbers such that the mean proportional between them is 12 and the third proportional to them is 96.

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15. Find the third proportional to $\frac{x}{y} + \frac{y}{x}$ and $\sqrt{x^2 + y^2}$

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16. If $p : q = r : s$, then show that : $mp + nq : q = mr + ns : s$.

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17. If $p+r=mq$ and $\frac{1}{q} + \frac{1}{s} = \frac{m}{r}$, then prove that : $p:q=r:s$.



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Exercise 7 C

1. If $a : b = c : d$, prove that :

(i) $5a + 7b : 5a - 7b = 5c + 7d : 5c - 7d$.

(ii) $(9a + 13b)(9c - 13d) = (9c + 13d)(9a - 13b)$.

(iii) $xa + yb : xc + yd = b : d$



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2. If $a : b = c : d$, prove that :

$$(6a + 7b)(3c - 4d) = (6c + 7d)(3a - 4b).$$



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3. Given, $\frac{a}{b} = \frac{c}{d}$, prove that :

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

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4. If $\frac{5x + 6y}{5u + 6v} = \frac{5x - 6y}{5u - 6v}$: then prove that $x : y = u : v$.

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5. If $(7a + 8b)(7c - 8d) = (7a - 8b)(7c + 8d)$:

prove that $a : b = c : d$.

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6. (i) If $x = \frac{6ab}{a + b}$, find the value of :

$$\frac{x + 3a}{x - 3a} + \frac{x + 3b}{x - 3b}$$

(ii) $a = \frac{4\sqrt{6}}{\sqrt{2} + \sqrt{3}}$, find the value of :

$$\frac{a + 2\sqrt{2}}{a - 2\sqrt{2}} + \frac{a + 2\sqrt{3}}{a - 2\sqrt{3}}.$$

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7.

If

$$(a + b + c + d)(a - b - c + d) = (a + b - c - d)(a - b + c - d)$$

,

prove that: $a : b = c : d$.

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8. If $\frac{a - 2b - 3c + 4d}{a + 2b - 3c - 4d} = \frac{a - 2b + 3c - 4d}{a + 2b + 3c + 4d}$, show that $2ad = 3bc$.

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9. If $(a^2 + b^2)(x^2 + y^2) = (ax + by)^2$, prove that : $\frac{a}{x} = \frac{b}{y}$.

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10. If a, b and c are in continued proportion, prove that :

$$(i) \frac{a^2 + ab + b^2}{b^2 + bc + c^2} = \frac{a}{c} \quad (ii) \frac{a^2 + b^2 + c^2}{(a + b + c)^2} = \frac{a - b + c}{a + b + c}.$$

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11. Using properties of proportion, solve for x :

$$(i) \frac{\sqrt{x+5} + \sqrt{x-16}}{\sqrt{x+5} - \sqrt{x-16}} = \frac{7}{3}$$
$$(ii) \frac{\sqrt{x+1} + \sqrt{x-1}}{\sqrt{x+1} - \sqrt{x-1}} = \frac{4x-1}{2}.$$
$$(iii) \frac{3x + \sqrt{9x^2 - 5}}{3x - \sqrt{9x^2 - 5}} = 5.$$

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12. If $x = \frac{\sqrt{a+3b} + \sqrt{a-3b}}{\sqrt{a+3b} - \sqrt{a-3b}}$ prove that :

$$3bx^2 - 2ax + 3b = 0.$$

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13. Using the properties of proportion, solve for x, given

$$\frac{x^4 + 1}{2x^2} = \frac{17}{8}.$$

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14. If $x = \frac{\sqrt{m+n} + \sqrt{m-n}}{\sqrt{m+n} - \sqrt{m-n}}$, express n in the terms of x and m .

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15. If $\frac{x^3 + 3xy^2}{3x^2y + y^3} = \frac{m^3 + 3mn^2}{3m^2n + n^3}$, show that : $nx = my$.



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Exercise 7 D

1. If $a : b = 3 : 5$, find :

$$(10a + 3b) : (5a + 2b)$$



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2. If $5x + 6y : 8x + 5y = 8 : 9$, find : $x : y$.



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3. If $(3x - 4y) : (2x - 3y) = (5x - 6y) : (4x - 5y)$, find $x : y$.



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4. Find the :

(i) duplicate ratio of $2\sqrt{2} : 3\sqrt{5}$

(ii) triplicate ratio of $2a : 3b$,

(iii) sub-duplicate ratio of $9x^2a^4 : 25y^6b^2$

(iv) sub-triplicate ratio of $216 : 343$

(v) reciprocal ratio of $3 : 5$

(vi) ratio compounded of the duplicate ratio of $5 : 6$, the reciprocal ratio of $25 : 42$ and the sub-duplicate ratio of $36 : 49$.



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5. Find the value of x , if :

(i) $(2x + 3) : (5x - 38)$ is the duplicate ratio of $\sqrt{5} : \sqrt{6}$.

(ii) $(2x + 1) : (3x + 13)$ is the sub-duplicate ratio of $9 : 25$.

(iii) $(3x - 7) : (4x + 3)$ is the sub-triplicate ratio of $8 : 27$.



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6. What quantity must be added to each term of the ratio $x : y$ so that it may become equal to $c : d$?



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7. A woman reduces her weight in the ratio $7 : 5$. What does her weight become if originally it was 84 kg?



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8. If $15(2x^2 - y^2) = 7xy$, find $x : y$, if x and y both are positive.

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9. Find the :

(i) fourth proportional to $2xy$, x^2 and y^2 .

(ii) third proportional to $a^2 - b^2$ and $a + b$.

(iii) mean proportion to $(x - y)$ and $(x^3 - x^2y)$

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10. Find two numbers such that the mean proportional between them is 14 and third proportional to them is 112.

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11. If x and y be unequal and $x : y$ is the duplicate ratio of $x + z$ and $y + z$, prove that z is Mean proportional between x and y .

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12. If $x = \frac{2ab}{a+b}$, find the value of: $\frac{x+a}{x-a} + \frac{x+b}{x-b}$.

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13. If $(4a + 9b)(4c - 9d) = (4a - 9b)(4c + 9d)$, prove that :
 $a : b = c : d$.

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14. If $\frac{a}{b} = \frac{c}{d}$, show that :

$$(a + b) : (c + d) = \sqrt{a^2 + b^2} : \sqrt{c^2 + d^2}$$



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15. There are 36 members in a student council in a school and the ratio of the number of boys to the number of girls is 3:1. How many more girls should be added to the council so that the ratio of number of boys to the number of girls may be 9:5?



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16. If $7x - 15y = 4x + y$, find the value of $x:y$. Hence, use componendo and dividendo to find the values of :

$$(i) \frac{9x + 5y}{9x - 5y}$$

$$(ii) \frac{3x^2 + 2y^2}{3x^2 - 2y^2}$$



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17. If $(4m + 3n)/(4m - 3n) = (7)/(4)$ use properties of proportion to find :

$$(i) m : n$$

$$(ii) \frac{2m^2 - 11n^2}{2m^2 + 11n^2}.$$



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18. If x, y, z are in continued proportion, prove that :

$$\frac{(x + y)^2}{(y + z)^2} = \frac{x}{z}.$$



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19. Given $x = \frac{\sqrt{a^2 + b^2} + \sqrt{a^2 - b^2}}{\sqrt{a^2 + b^2} - \sqrt{a^2 - b^2}}$.

Use componendo and dividendo to prove that :

$$b^2 = \frac{2a^2x}{x^2 + 1}.$$

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20. If $\frac{x^2 + y^2}{x^2 - y^2} = 2\frac{1}{8}$, find :

(i) $\frac{x}{y}$

(ii) $\frac{x^3 + y^3}{x^3 - y^3}$

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21. Using componendo and dividendo, find the value of x if

$$\frac{\sqrt{3x + 4} + \sqrt{3x - 5}}{\sqrt{3x + 4} - \sqrt{3x - 5}} = 9.$$

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22. If $x = \frac{\sqrt{a+1} + \sqrt{a-1}}{\sqrt{a+1} - \sqrt{a-1}}$, using properties of proportion

show that

$$x^2 - 2ax + 1 = 0$$

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23. Given $\frac{x^3 + 12x}{6x^2 + 8} = \frac{y^3 + 27y}{9y^2 + 27}$. Using componendo and dividendo find $x : y$.

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24. If $\frac{x}{a} = \frac{y}{b} = \frac{z}{c}$ show that $\frac{x^3}{a^3} + \frac{y^3}{b^3} + \frac{z^3}{c^3} = \frac{3xyz}{abc}$

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25. If b is the mean proportion between a and c , show that :

$$\frac{a^4 + a^2b^2 + b^4}{b^4 + b^2c^2 + c^4} = \frac{a^2}{c^2}$$

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26. If $\frac{7m + 2n}{7m - 2n} = \frac{5}{3}$ use properties of proportion to find

(i) $m : n$

(ii) $\frac{m^2 + n^2}{m^2 - n^2}$

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27. (i) If x and y both are positive and $(2x^2 - 5y^2) : xy = 1 : 3$,

find $x : y$.

(ii) Find x , if $16 \left(\frac{a - x}{a + x} \right)^3 = \frac{a + x}{a - x}$.

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Questions

1. If $(3a + 2b) : (5a + 3b) = 18 : 29$. Find $a : b$.

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2. if $a : b = 5 : 3$, find $(5a + 8b) : (6a - 7b)$.

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3. Two numbers are in the ratio $3 : 5$. If 8 is added to each number, the ratio becomes $2 : 3$. Find the numbers.

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4. (i) What quantity must be added to each term of the ratio $8:15$ so that it becomes equal to $3:5$?

(ii) What quantity must be subtracted from each term of the ratio $a:b$ so that it becomes $c:d$?



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5. The work done by $(x - 3)$ men in $(2x + 1)$ days and the work done by $(2x + 1)$ men in $(x + 4)$ days are in the ratio $3:10$. Find the value of x .



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6. When the fare of a certain journey by an airliner was increased in the ratio $5:7$ the cost of the ticket for the journey became Rs. 1.421. Find the increase in the fare.



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7. In a regiment, the ratio of number of officers to the number of soldiers was 3:31 before a battle. In the battle 6 officers and 22 soldiers were killed. The ratio between the number of officers and the number of soldiers now is 1:13. Find the number of officers and soldiers in the regiment before the battle.



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8. if $\frac{a}{b+c} = \frac{b}{c+a} = \frac{c}{a+b}$ and $a + b + c = 0$: show that each given ratio is equal to -1 .



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9. if $\frac{a}{b+c} = \frac{b}{c+a} = \frac{c}{a+b}$ and $a + b + c \neq 0$, show that each given ratio is equal to $\frac{1}{2}$.



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10. Find the compound ratio of :

(i) $3a : 2b$, $2m : n$ and $4x : 3y$

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



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11. Find the ratio compounded of the duplicate ratio of 5 : 6, the reciprocal ratio of 25 : 42 and the sub-triplicate ratio of 216 : 343.



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12. Find : (i) the fourth proportional to 3, 6 and 4.5.

(ii) the mean proportional between 6.25 and 0.16.

(iii) the third proportional to 1.2 and 1.8.



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13. Quantities a , 2, 10 and b are in continued proportion, find the values of a and b .



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14. What number should be subtracted from each of the numbers 23, 30, 57 and 78, so that the remainders are in proportion?



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15. What should be added to each of the numbers 13, 17 and 22 so that the resulting numbers are in continued proportion ?

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16. if $(a^2 + c^2)$, $(ab + cd)$ and $(b^2 + d^2)$ are in continued proportion, prove that a, b, c and d are in proportion.

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17. if $p:q::r$, prove that $p:r = p^2:q^2$.

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18. if $a \neq b$ and $a:b$ is the duplicate ratio of $a+c$ and $b+c$, prove that ' c ' is the mean proportional between ' a ' and ' b '.



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19. if $a+c = mb$ and $\frac{1}{b} + \frac{1}{d} = \frac{m}{c}$, prove that a, b, c and d are in proportion.



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20. if q is the mean proportional between p and r , prove that :

$$p^2 - q^2 + r^2 = q^4 \left(\frac{1}{p^2} - \frac{1}{q^2} + \frac{1}{r^2} \right).$$



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21. if a, b, c and d are in proportion, prove that :

$$(i) \frac{a - b}{c - d} = \sqrt{\frac{3a^2 + 8b^2}{3c^2 + 8d^2}}$$

$$(ii) \left(\frac{5a^2 + 12c^2}{5b^2 + 12d^2} \right) = \sqrt{\frac{3a^4 - 7c^4}{3b^4 - 7d^4}}$$



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22. 6 is the mean proportion between two numbers x and y and 48 is third proportion to x and y . Find the numbers.



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23. if $\frac{8x + 13y}{8x - 13y} = \frac{9}{7}$, find $x : y$.



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24. if $a : b = e : d$, show that :

$$3a + 2b : 3a - 2b = 3c + 2d : 3c - 2d.$$

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25. if $\frac{8a - 5b}{8c - 5d} = \frac{8a + 5b}{8c + 5d}$, prove that $\frac{a}{b} = \frac{c}{d}$.

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26. if $p = \frac{4xy}{x + y}$, find the value of $\frac{p + 2x}{p - 2x} + \frac{p + 2y}{p - 2y}$.

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27. if $a : b = c : d$ prove that :

$$(a^2 + ac + c^2) : (a^2 - ac + c^2) = (b^2 + bd + d^2) : (b^2 - bd + d^2)$$

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28. if x, y and z are in continued proportion, prove that :

$$x^2 - y^2 : x^2 + y^2 = x - z : x + z.$$

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29. Using the properties of proportion, solve the following equation for x :

$$\frac{x^3 + 3x}{3x^2 + 1} = \frac{341}{91}$$

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30. if $x = \frac{\sqrt{3a+2b} + \sqrt{3a-2b}}{\sqrt{3a+2b} - \sqrt{3a-2b}}$ prove that :

$$bx^2 - 3ax + b = 0$$

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