EVALUATION AND SUBSTITUTION

Summary

When letters in a formula are replaced by numbers, it's called substitution.

EXAMPLES:

1. *Find the value of* $\sqrt{x^2 + y^2}$ *when* $x = 8$ *and* $y = -6$

2. *Find the value of* $x^2 - x + 6$ *when* $x = -3$

3. *Find the value of* $2(4 + 3y) + y(3 - 2t)$ *when* $y = 2$ *and* $t = 3$

4. *Given that* $P = 200$, $r = 50$ *and* $n = 2$, *find the value of* $A = P\left(1 + \frac{r}{100}\right)^n$

5. *If* $a = 6$, $b = 8$, $c = 10$ *and* $s = 12$, *find the value of* $A = \sqrt{s(s-a)(s-b)(s-c)}$

6. *Given that* $v^2 = u^2 + 2as$, *find the values of* v *when* $u = 6$, $a = 3.5$ *and* $s = 4$.

7. *Given that* $a = 2$, $b = -4$ *and* $c = -6$, *find the values of* $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

8. *Given that* $y = \frac{17pr - 2r^2}{3pr}$, *find the value of* y *when* $p = r$.

9. *Given that* $a = 3$, $b = 4$ *and* $c = 5$, *find the value of* $A = \sqrt{s(s-a)(s-b)(s-c)}$, *where* $s = \frac{1}{2}(a + b + c)$.

OPERATIONS

Summary:

An operation is a rule connecting two terms using sign language.

EXAMPLES:

1. *Given that* $a^* b = ab^2$, *find the value of:*

(i) $1^* 3$

(ii) $(1^* 3)^* 2$

(iii) a *if* $a^* 3 = 63$

2. *Given that* $m \uparrow n = \frac{m^2 - n^2}{m + n}$, *find the value of:*

(i) $5 \uparrow 3$

(ii) $8 \uparrow (5 \uparrow 3)$

(iii) $9 \uparrow (6 \uparrow 2)$

(iv) $(12 \uparrow 4) \uparrow (7 \uparrow 2)$

3. *Given that* $p^* q = \frac{pq}{p + q}$, *find the value of:*

(i) $3^* (10^* 15)$

(ii) $6^* (20^* 30)$

(iii) $15^* (30^* 15)$

(iv) p *if* $p^* 3 = 2$

4. *Given that* $a \wedge b = ab - 5$, *find the value of* y *if* $3 \wedge y = 6 \wedge 4$

EER:

1. *Given that* $x \wedge y = x^y - y$, *find the value of:*

(i) $3 \wedge 2$

(ii) $(3 \wedge 2) \wedge 2$

2. *Given that* $a * b = \frac{a^2 + b^2 - 2ab}{a - b}$, *find the value of:*

(i) $4 * 3$

(ii) $8 * (4 * 3)$

3. *Given that* $a * b = \frac{a + b}{a - b}$, *find the value of* $(5 * 3) * -2$

4. *Given that* $m * n = \frac{m^2 + n^2}{10n}$, *find the value of:*

(i) $4 * -8$

(ii) $7 * (4 * -8)$

5. *Given that* $a * b = a^2 + \sqrt{ab}$, *find the value of* $(1 * 4) * 3$

6. *Given that* $a * b = \frac{a}{b} + \frac{b}{a}$, *find the value of* $\frac{1}{2} * \frac{2}{3}$

7. *Given that* $a * b = a^2 + \sqrt{3ab}$, *find the value of:*

(i) 3* 4

(ii) 5* (3* 4)

8. *Given that* $a * b = a^2 - 2b$, *find the value of:*

(i) −3* −4

(ii) y *if* ***y* 2 = 21***

9. *Given that* $a * b = a(b + 2)$, *find the value of:*

(i) 1* (2* 5)

(ii) y *if* ***4* y = 16***

COLLECTING LIKE TERMS

Summary

1. *In collecting like terms, the expression is re−arranged so that like terms are next to each other.*

2. *The products* xy *and* yx *are the same. Thus* xy *and* yx *are like terms.*

3. *Like terms with powers can be added or subtracted if the powers are the same. Thus* $4p + p^2$ *cannot be simplified because* $4p$ *and* p^2 *are not like terms.*

EXAMPLES:

Simplify the following expressions:

(i) $6x + 8 + x^2 - 2x + 2x^2 - 3$

(ii) $5 + 4x^2 - 3 + 2x + 3x^2 - 4x$

(iii) $3x^2 - 7 + 4x^3 - x^2 + 2$

(iv) 4p + 6pq − 2q + 8p − 11qp + 10q

REMOVING BRACKETS

Summary

1. *When removing brackets, each term inside the brackets is multiplied by the quantity outside the brackets.*

2. *If the sign in front of the bracket is negative, the signs inside the bracket are changed.*

EXAMPLES:

1. *Remove the brackets and simplify the following expressions:*

(i) 3(x + 2) + 2(x − 4) ***(ii) 2(4x − 2) − (5x − 3)*** ***(iii) 4(1 − 2x) − 3(6x − 5)***

(iv) 5(3x + 2) − 2(4p + 3) ***(v) 4x(x + 2) + x(x − 4)*** ***(vi) 3x(5 + 2x) − 2x(3x −7)***

(vii) a(b + c) − 2b(c + a) + c(a + b) ***(viii)*** $4x\left(1-\frac{2}{x}\right)+5(2x-3)$

EER:

1. *Remove the brackets and simplify the following expressions:*

(i) 2(5a + 3b)+3(a − 2b)
(ii) 4(1 − 2x) − 3(3x − 4)
(iii) 4(1 − 2x) − 3(3x − 4)
(iv) 3(x + 1) + 2(x + 4)
(v) 5((4y − 9) − (10y −5))
(vi) 9(2x + 3) − 3(5x+1)
(vii) −4(a − 3b) −3(−3a − b)
(viii) 2p(q + r) − p(3q − 2r)
(ix) 2x(x + 3) + x(x − 2)
(x) 5[4(y − 4) + 15] − [2(5y − 3)+1]

SOLVING LINEAR EQUATION

Summary:

1. *An equation consists of two expressions separated by an equal sign*

2. *In solving linear equations the following apply:*

(i) *When moving any term from one side of the equation to the other, its sign changes*

(ii) *If the equation contains brackets, first remove the brackets and then workout*

(iii) *If the equation contains fractions, multiply each term by the* ***LCM*** *of the denominators to remove the fractions*

EXAMPLES:

1. *Solve for* ***x*** *in the following equations:*

(i) $6x - 22 = 3x - 10$ ***(ii)*** $2(3x - 6) = 3(5 + x)$

(iii) $5 - 2(x - 1) = 4(3 - x) - 2x$ ***(iv)*** $(5x - 4) - (3x - 1) = 3$

(v) $(8x + 3) - 3(x - 1) = x - 2$

2. *Solve for* ***x*** *in the following equations:*

(i) $\frac{3x - 6}{31x - 22} = \frac{1}{13}$ ***(ii)*** $\frac{2}{x + 3} = \frac{3}{5 - x}$

3. *Given that* $(7x - 5) : (2 + 4x) = 8:7$, *find the value of* ***x***

4. *Solve for* ***x*** *in the following equations:*

(i) $\frac{2x - 3}{2} - \frac{5 - x}{4} = \frac{x}{3}$ ***(ii)*** $\frac{x - 3}{4} + \frac{x - 1}{5} - \frac{x - 2}{3} = 1$

(iii) $\frac{2x - 1}{9} - \frac{x - 1}{4} = 0$ ***(iv)*** $\frac{5x - 4}{8} - \frac{x - 3}{5} = \frac{x + 6}{4}$

(v) $\frac{5x - 4}{7} - \frac{1}{2} = \frac{3x - 1}{14}$ ***(vi)*** $\frac{3}{5}(5x - 4) = 1 - \frac{2}{5}(x - 1)$

(v) $(x - 1) = \frac{3}{4}(x + 1) - \frac{1}{2}$

(vi) $\frac{1}{3}(x - 1) - \frac{1}{4}(x - 2) = 1$

EER:

1. *Solve for* ***x*** *in the following equations:*

(i) $4(2x + 3) = 31 - 3(x - 1)$ **(ii)** $15(x - 7) - 3(x - 9) + 5(x + 6) = 0$

(iii) $10 - 2(x - 4) = 2(x - 1) - 6x$ **(iv)** $5(x - 1) = 3(2x - 5) - (1 - 3x)$

(v) $9 - 2(x - 5) = x + 10$

2. *Solve for* ***x*** *in the following equations:*

(i) $\frac{8x - 5}{7x + 1} = -\frac{4}{5}$ (ii) $\frac{7}{2 + 4x} = \frac{8}{7x - 5}$

3. *Given that* $(x + 3) : x = 8:5$, *find the value of* ***x***

4. *Given that* $(x + 5) : 2 = 18:3$, *find the value of* ***x***

5. *Solve for* ***x*** *in the following equations:*

(i) $\frac{x + 7}{6} - \frac{3x - 2}{3} = \frac{2x + 3}{3}$ (ii) $\frac{x - 1}{3} - \frac{x - 2}{4} = 1$

(iii) $\frac{3x - 1}{5} - \frac{x}{7} = 3$ (iv) $4 - \frac{x - 3}{2} = 3$

(v) $\frac{x}{3} - \frac{x - 2}{2} = \frac{7}{3}$ (vi) $\frac{x}{2} = 3 + \frac{x}{3}$

(vii) $\frac{x}{2} - \frac{1}{4} = \frac{x}{3} + \frac{1}{2}$ (viii) $\frac{x}{2} + \frac{x}{3} = x - 7$

WORD PROBLEMS ON LINEAR EQUATION

Summary:

In solving word problems on linear equation, read the problem carefully and form an equation using the conditions given in the problem

EXAMPLES:

1. *Find two numbers such that one exceeds the other by* ***9*** *and their sum is* ***25***

Soln:

If the numbers are x *and* $(x + 9)$,

$\Rightarrow x + (x + 9) = 25$

$x = 8$

$\Rightarrow (x + 9) = 8 + 9 = 17$

$\therefore$ *The numbers are* ***8*** *and* ***17***

2. *The length of a rectangle is twice its width. If the perimeter of the rectangle is* ***72m,*** *find the length and width of the rectangle*

Soln:

If the width = x

$\Rightarrow$ *length =* $2x$

If $2(l + w) = 72$

$\Rightarrow 2(2x + x) = 72$

$x = 12m$

$\therefore$ *Width =* $12m$, *length =* $2(12) = 24m$

3. *The sum of three consecutive multiples of* ***5*** *is* ***90.*** *Find these multiples*

Soln:

If the multiples are x, $(x + 5)$ *and* $(x + 10)$,

$\Rightarrow x + (x + 5) + (x + 10) = 90$

$x = 25$

$\Rightarrow (x + 5) = 25 + 5 = 30, \quad (x + 10) = 25 + 10 = 35$

$\therefore$ *The multiples are* **25, 30** *and* **35**

4. *Three−fifth of a number is* **4** *more than one−half of the number. Find the number*

Soln:

If the required number = **N**

$\Rightarrow \frac{3}{5}N - \frac{1}{2}N = 4$

$\therefore N = 40$

5. *The denominator of a fraction is greater than its numerator by* **3.** *If the numerator is increased by 7 and the denominator is decreased by* **1,** *the fraction becomes* $\frac{3}{2}$. *Find the original fraction*

Soln:

If the original fraction = $\frac{x}{x+3}$

$\Rightarrow \frac{x+7}{x+2} = \frac{3}{2}$

$\Rightarrow x = 8$

$\therefore$ *Original fraction =* $\frac{8}{8+3} = \frac{8}{11}$

6. *In a multiple choice test of* **90** *questions, each correct answer carries* **5** *marks and each wrong answer leads to a loss of* **2** *marks. If a student scored a total of* **387** *marks from the test, find how many questions were answered correctly*

Soln:

If the correct answers = ***x,*** *then wrong answers =* ***(90 − x)***

⇒ ***correct score − incorrect score = total score***

⇒ ***5 x − 2(90 − x) = 387***

x = 81

7. *The length of a rectangle is* ***4m*** *less than* ***3*** *times its width. If the perimeter of the rectangle is* ***32m,*** *find the length and width of the rectangle*

Soln:

If the width = ***x***

⇒ *length =* ***3x − 4***

If 2(l + w) = 32

⇒ *2(3x − 4 + x) = 32*

x = 5m

∴ *Width =* ***5,*** *length = 3(5) − 4 =* ***11m***

8. *A man is* ***24*** *years older than his son. In two years time, his age will be twice the age of his son. Find the present age of the son*

Soln:

Son's present age = ***x,*** *Father's present age =* ***x + 24***

⇒ *After two years, Son's age =* ***x + 2,*** *Father's age =* ***x + 26***

⇒ *x + 26 = 2(x + 2)*

∴ ***x = 22 years***

9. *Tom's present age is two−fifth of his father's age. After* ***8*** *years he will be one−half of his father's age then. Find how old is his father*

Soln:

Father's present age = x*, Tom's present age =* $\frac{2}{5}x$

$\Rightarrow$ *After* 8 *years, Father's age =* $x + 8$ *Tom's age =* $\frac{2}{5}x + 8$

$\Rightarrow \frac{2}{5}x + 8 = \frac{1}{2}(x + 8)$

$\therefore x = 40$ **years**

10. *The sum of the present ages of a man and his son is* 60 *years. Six years ago, the man's age was* 5 *times the son's age. Find the son's present age*

Soln:

Son's present age = x*, Father's present age =* $60 - x$

$\Rightarrow$ *Six years ago, Son's age =* $x - 6$*, Father's age =* $(60 - x) - 6 = 54 - x$

$\Rightarrow 54 - x = 5(x - 6)$

$\therefore x = 14$ **years**

11. *The sum of the present ages of a man and his son is* 45 *years. Five years ago, the product of their ages was* 4 *times the man's age at that time. Find their present ages*

Soln:

Son's present age = x*, Father's present age =* $45 - x$

$\Rightarrow$ *Five years ago, Son's age =* $x - 5$*, Father's age =* $(45 - x) - 5 = 40 - x$

$\Rightarrow (x - 5)(40 - x) = 4(40 - x)$

$\Rightarrow (x - 5) = 4$

$\Rightarrow x = 9$ **years**

$\therefore$ *Son's age* $= 9$ **years,** *Father's age* $= 45 - 9 = 36$ **years**

12. *Ten years ago, a man's age was thrice as old as his son. In ten years time, the man's age will be twice as old as his son. Find their present ages*

Soln:

Ten years ago, Son's age $= x$, *Father's age* $= 3x$

$\Rightarrow$ *Son's present age* $= x + 10$, *Father's present age* $= 3x + 10$

After 10 *years, Son's age* $= x + 20$, *Father's age* $= 3x + 20$

$\Rightarrow$ $3x + 20 = 2(x + 20)$

$\Rightarrow$ $x = 20$ **years**

$\therefore$ *Son's present age* $= 20 + 10 = 30$ **years,** *Father's age* $= 3(20) + 10 = 70$ **years**

13. *Tom is* 9 *years older than Bob. In ten years time Tom will be twice as old as Bob was* 10 *years ago. Find Bob's present age*

Soln:

Bob's present age $= x$, *Tom's present age* $= x + 9$

$\Rightarrow$ *In ten years, Tom's age* $= (x + 9) + 10 = x + 19$,

Ten years ago, Bob's age $= (x - 10)$

$\Rightarrow$ $x + 19 = 2(x - 10)$

$\therefore$ $x = 39$ **years**

14. *A man said to his son, "I was as old as you are at present at the time of your birth". If the man's age is* 38 *years now, find the son's age* 5 *years ago*

Soln:

Son's present age $= x$,

x *years ago, father's age* $= 38 - x$

⇒ $38 - x = x$

⇒ $x = 19$ years

∴ 5 years ago, son's age = $19 - 5 = 14$ years

15. *The ratio between two numbers is* **7:5.** *If the difference between them is* **48,** *find the numbers*

Soln:

If the common ratio is **x,**

⇒ *The ratio* $7 : 3 = 7x:3x$ **(***The ratio* $7x:3x$ *simplifies to* **7:3)**

⇒ *The numbers are* $7x$ *and* $3x$

⇒ $7x - 3x = 48$

$x = 12$

∴ $7x = 7(12) = 84$, $3x = 3(12) = 36$

Thus the numbers are **84** *and* **36**

16. *Tom is* **6** *years older than Bob. The ratio between the present ages of Tom and Bob is* **7:5.** *Find their present ages*

Soln:

The ratio $7 : 5 = 7x:5x$

⇒ *Tom's present age =* $7x$, *Bob's present age =* $5x$

⇒ $7x - 5x = 6$

$x = 3$

∴ *Tom's age* $= 7(3) = 21$ **years,** *Bob's age* $= 5(3) = 15$ **years**

METHOD II

Bob's age = x

Tom's age = $x + 6$

$\Rightarrow \quad \frac{x + 6}{x} = \frac{7}{5}$

$\Rightarrow \quad x = 15$

$\therefore$ *Bob's age =* ***15 years,*** *Tom's age = 15 + 6* ***= 21 years***

17. *The present ages of Tom and Bob are in the ratio of* ***5:4.*** *In three years time, the ratio of their ages will become* ***11:9****respectively. Find Bob's present age*

Soln:

The ratio $5 : 4 = 5x:4x$

$\Rightarrow$ *Tom's present age =* $5x$, *Bob's present age =* $4x$

$\Rightarrow$ *After* 3 *years, Tom's age =* $5x + 3$, *Bob's age =* $4x + 3$

$\Rightarrow \quad \frac{5x + 3}{4x + 3} = \frac{11}{9}$

$\Rightarrow \quad x = 6$

$\therefore$ *Bob's present age = 4(6)* $= 24$ ***years***

18. *Four years ago****,*** *the ratio of the ages of Tom and Bob was* ***3:2.*** *In six years time, the ratio of their ages will become* ***14:11*** *respectively. Find Bob's present age*

Soln:

*Four years ago****,*** *Tom's age =* $3x$, *Bob's age =* $2x$

$\Rightarrow$ *Tom's present age =* $3x + 4$, *Bob's present age =* $2x + 4$

After 6 *years****,*** *Tom's age =* $(3x + 4) + 6 = 3x + 10$,

Bob's age = $(2x + 4) + 6 = 2x + 10$

$$\Rightarrow \frac{3x + 10}{2x + 10} = \frac{14}{11}$$

$\Rightarrow x = 6$

$\therefore$ *Bob's present age* $= 2(6) + 4 =$ **16 years**

19. *The present ages of Tom, Bob and Ben are in the ratio* ***4:7:9.*** *Eight years ago,* *the sum of their ages was* ***76.*** *Find their present ages*

Soln:

Tom's present age = $4x$, *Bob's age =* $7x$, *Ben's age =* $9x$

$\Rightarrow$ ***8*** *years ago,* *Tom's age =* $4x - 8$, *Bob's age =* $7x - 8$, *Ben's age =* $9x - 8$

$\Rightarrow (4x - 8) + (7x - 8) + (9x - 8) = 76$

$\Rightarrow x = 5$

$\therefore$ *Tom's present age* $= 4(5) =$ **20 years,** *Bob's age* $= 7(5) =$ **35 years**

Ben's age $= 9(5) =$ **45 years**

20. *Ten years ago, the ratio of the ages of Tom, Bob and Ben was* ***2:3:7.*** *The sum of their present ages is* ***90.*** *Find Bob's present age*

Soln:

Ten years ago, *Tom's age =* $2x$, *Bob's age =* $3x$, *Ben's age =* $7x$

$\Rightarrow$ *Tom's present age =* $2x + 10$, *Bob's age =* $3x + 10$, *Ben's age =* $7x + 10$

$\Rightarrow (2x + 10) + (3x + 10) + (7x + 10) = 90$

$\Rightarrow x = 5$

$\therefore$ *Bob's present age* $= 3(5) + 10 =$ **25 years**

EER:

1. *Find two numbers such that one exceeds the other by* ***11*** *and their sum is* ***73***

2. *The sum of three consecutive multiples of* ***4*** *is* ***444.*** *Find these multiples*

3. *The cost of two tables and three chairs is* ***Shs 705,000.*** *If the table costs* ***Shs 40,000*** *more than the chair, find the cost of each table and a chair*

4. *The length of a rectangle is* ***4*** *times its width. If the perimeter of the rectangle is* ***80m,*** *find the length and width of the rectangle*

5. *Three−fourth of a number is more than one−fourth of a number by* ***2.*** *Find the number*

6.*The numerator of a fraction is* ***5*** *less than its denominator. If* ***2*** *is added to both the numerator and denominator, the fraction becomes* $\frac{4}{5}$. *Find the original fraction*

7. *In a multiple choice test of* ***30*** *questions, each correct answer carries* ***5*** *marks and each wrong answer leads to a loss of* ***2*** *marks. If a student scored a total of* ***80*** *marks from the test, find how many questions were answered correctly*

8.*The numerator of a fraction is* ***1*** *less than its denominator. If the numerator is decreased by* ***2*** *and the denominator is increased by* ***3,*** *the fraction becomes* $\frac{1}{4}$. *Find the original fraction*

9.*The numerator of a fraction is* ***3*** *less than its denominator. If the numerator is tripled and the denominator is increased by* ***7,*** *the resulting fraction is* $\frac{3}{2}$. *Find the original fraction*

10. *The sum of the ages of* ***5*** *children born at intervals of* ***3*** *years each is* ***50*** *years. Find the age of the youngest child*

11. *The present ages of* ***P, Q*** *and* ***R*** *are in the ratio* ***4:7:9.*** *Eight years ago, the sum of their ages was* ***56.*** *Find their present ages*

12. *A man is* ***4*** *times as old as his son. Five years ago, the man was* ***9*** *times as old as his son. Find the man's present age*

13. *Tom is* ***4*** *times as old as Bob. In* ***4*** *years time, the sum of their ages will be* ***43*** *years. Find Tom's present age*

14. *Five years ago, a man's age was seven times as old as his son. In five years time, the man's age will be thrice as old as his son. Find their present ages*

15. *In* ***15*** *years time, Tom's age will be* ***6*** *times his age* ***5*** *years back. Find his present age*

16. *Tom is* ***12*** *years younger than Bob. The ratio between the present ages of Tom and Bob is* ***2:5.*** *Find their present ages*

17. *Ten years ago,* ***P*** *was twice as old as* ***Q.*** *The ratio between the present ages of* ***P*** *and* ***Q*** *is* ***4:3.*** *Find their present age*

18. *Six years ago, Tom was thrice as old as Bob. In six years time, Tom will be one and a third times as old as Bob. Find Bob's present age*

19. *The present ages of Tom and Bob are in the ratio* ***4:3.*** *In six years time, Tom's age will be* ***26*** *years. Find Bob's present age*

20. *The present ages of Tom and Bob are in the ratio* ***11:5.*** *If the difference between their ages is* ***24*** *years, find their present ages*

21. *The present ages of a man and his son are in the ratio* ***4:1.*** *If the product of their ages is* ***196*** *years, find the ratio of their ages in* ***5*** *years time*

22. *The ratio between the present ages of* ***P*** *and* ***Q*** *is* ***2:5.*** *In eight years time, their ages will be in the ratio* ***1:2.*** *Find their present ages*

23. *Six years ago, the ratio of the ages of Tom and Bob was* ***6:5.*** *In four years time, the ratio of their ages will become* ***11:10*** *respectively. Find Bob's present age*

24. *The ages of two people differ by* ***16*** *years. Six years ago, the elder one was* ***3*** *times as old as the younger one. Find the elder's present age*

ALGEBRAIC FRACTIONS

Summary:

(i) *A fraction with any letter in its numerator or denominator is called an algebraic fraction*

(ii) *A fraction is undefined* ***(meaningless)*** *when its denominator is equal to zero.*

(iii) *To reduce an algebraic fraction in its simplest form, factorization is sometimes necessary*

EXAMPLES:

1. *Find the value of* ***x*** *that makes the fraction* $\frac{5x + 9}{4x - 12}$ *undefined*

2. *Find the values of* ***x*** *for which the fraction* $\frac{3x + 4}{x^2 - 25}$ *is undefined*

3. *Find the values of* ***x*** *for which the fraction* $\frac{5x}{2x^2 - 18}$ *is undefined*

4. *Express the following as a single fraction:*

(i) $\frac{x}{3} + \frac{x}{4} + \frac{x}{5}$

(ii) $\frac{x - 2}{4} + \frac{2}{5}$

(iii) $\frac{3x - 5}{10} + \frac{2x - 3}{15}$

(iv) $\frac{x - 5}{3} - \frac{x - 2}{4}$

(v) $3(x + 2) - \frac{4x - 5}{4}$

(vi) $\frac{2x - 5}{5} - \frac{3x + 2}{4} + \frac{7x + 15}{10}$

5. *Reduce the following fractions to their lowest form:*

(i) $\frac{3xy^2}{6x^2y}$ ***(ii)*** $\frac{18x^2y}{27xy^2z}$ ***(iii)*** $\frac{(x\ +\ 5)(x-1)}{(x\ +\ 3)(x+5)}$ ***(iv)*** $\frac{(2x-1)^5}{(2x-1)^3}$

(v) $\frac{x^5(x+1)^2}{x^3(x+1)^8}$ ***(vi)*** $\frac{12x}{20x+8}$ ***(vii)*** $\frac{27x+15}{9x}$ ***(viii)*** $\frac{3x-6}{(x\ +\ 5)(x-2)}$

(ix) $\frac{2x+4}{3x+6}$ ***(x)*** $\frac{5-3x}{3x-5}$ ***(xi)*** $\frac{3x}{x^2-5x}$ ***(xii)*** $\frac{5x-x^2}{(x\ +\ 2)(x-5)}$

(xiii) $\frac{(x\ +\ 4)(x-3)}{3x-x^2}$ ***(xiv)*** $\frac{12abc-4a^2bc^2}{8abc^2}$

(i) Soln:

$$\frac{3xy^2}{6x^2y} = \frac{3x\cdot y\cdot y}{6x\cdot x\cdot y} = \frac{y}{2x}$$

6. *Simplify the following fractions as far as possible:*

(i) $\frac{3a^2b}{2b^3c} \times \frac{2c^2}{5a^3} \div \frac{6ac}{10b^2}$ ***(ii)*** $\frac{a^2}{(2a)^2} \times \frac{(3b)^2}{27a} \div 3b$

(iii) $\frac{7a}{2a+14} \times \frac{3a+21}{9a}$ ***(iv)*** $\frac{y^2\ +\ 3y}{6y^2} \div \frac{5y+15}{4}$

LCM OF ALGEBRAIC EXPRESSIONS

Summary:

*The **LCM** of given expressions is obtained as follows**:***

***(i)** Determine the prime factor form of each expression*

(ii)**The product of each factor with the highest power is the required **LCM

EXAMPLES:

***1.** Find the **LCM** of $16y^3$ and $24y^5$*

Soln:

$16y^3 = 2^4 \times y^3$

$24y^5 = 2^3 \times 3 \times y^5$

$LCM = 2^4 \times 3 \times y^5$

$= 48y^5$

***2.** Find the **LCM** of $8a^2bc^3$ and $20ac^4$*

Soln:

$8a^2bc^3 = 2^3 \times a^2 \times b \times c^3$

$20ac^4 = 2^2 \times 5 \times a \times c^4$

$LCM = 2^3 \times 5 \times a^2 \times b \times c^4$

$= 40a^2bc^4$

3. Find the **LCM** *of* $4a^2b,\ 6ab$ *and* $8ab^3$

Soln:

$4a^2b = 2^2 \times a^2 \times b$

$6ab = 2 \times 3 \times a \times b$

$8ab^3 = 2^3 \times a \times b^3$

$LCM = 2^3 \times 3 \times a^2 \times b^3$

$= 24a^2b^3$

4. Find the **LCM** *of* $y(y+2)$ *and* $(y+2)(y-3)$

Soln:

$y(y+2) = y \times (y+2)$

$(y+2)(y-3) = (y+2) \times (y-3)$

$LCM = y \times (y+2) \times (y-3)$

$= y(y+2)(y-3)$

5. Find the **LCM** *of* $(y-5)(y+3)$ *and* $(y+3)^2$

Soln:

$(y-5)(y+3) = (y-5) \times (y+3)$

$(y + 3)^2 = 1 \times (y+3)^2$

$LCM = (y - 5) \times (y+3)^2$

$= (y-5)(y+3)^2$

6. Find the **LCM** *of* $ab(a-b)$, $4(a-b)$ *and* $6(a-b)^2$

Soln:

$ab(a-b) = a \times b \times (a-b)$

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

$6(a-b)^2 = 2 \times 3 \times (a-b)^2$

$LCM = 2^2 \times 3 \times a \times b \times (a-b)^2$

$= 12ab(a-b)^2$

7. Simplify the following fractions as far as possible:

(i) $\frac{2}{3x} + \frac{1}{2x} + \frac{3}{4x}$ *(ii)* $\frac{4}{5x} + \frac{2}{x^2} - \frac{1}{3x}$ *(iii)* $2 + \frac{3}{x+1}$

(iv) $x - \frac{5}{x}$ *(v)* $\frac{5}{x-3} - \frac{1}{x}$ *(vi)*

$\frac{3}{x+2} + \frac{2}{x-1}$ *(vii)* $\frac{5x}{x-1} - \frac{2x}{x+1}$ *(viii)* $\frac{13x+1}{2x+1} - \frac{7x-2}{2x+1}$

(ix) $\frac{2x^2}{x+4} + \frac{8}{x+4}$ *(x)* $\frac{9-5x}{3x-2} - \frac{7-2x}{3x-2}$ *(xi)*

$\frac{3x}{(x-2)(x+5)} - \frac{6}{(x-2)(x+5)}$

(xii) $\frac{2}{x(x+2)} + \frac{3}{(x+2)(x-3)}$

(xiii) $\frac{2x}{(x-3)(x+3)} - \frac{1}{(x+3)} - \frac{2}{(x-3)}$

EER:

1. *Find the values of* x *that make the fraction* $\frac{14x}{x^2-9}$ *undefined*

2. *Find the values of* x *for which the fraction* $\frac{5x+3}{9x^2-4}$ *is undefined*

3. *Find the values of* x *for which the fraction* $\frac{10x}{x^2-4}$ *is undefined*

4. *Find the* **LCM** *of* $6a^2b^3c^2$, $20ab^2c^5$ *and* $18a^4b^2c$

5. *Find the* **LCM** *of* $ab(a-b)^2$, $6a^2(a-b)$ *and* $8(a-b)^3$

6. *Simplify as far as possible:* $\frac{6x^2y}{13p^2q} \times \frac{39q^2r}{18y^2z} \div \frac{x^2p^2}{yqr}$

7. *Express* $1 - \frac{2x}{5} + \frac{x}{8}$ *as a single fraction*

8. *Express* $\frac{x+3}{3} - \frac{x-7}{4} + \frac{x-5}{2}$ *as a single fraction*

9. *Express* $4x - \left(\frac{3x+y}{8} - \frac{3x+y}{4}\right)$ *as a single fraction*

10. *Express* $\frac{3}{x+1} - \frac{x+4}{(x+1)(x-2)}$ *as a single fraction*

11. *Given that* $y = \frac{7}{x-2} - \frac{x+5}{(x-1)(x-2)}$, *express* y *in the form* $\frac{a}{x+b}$.

Hence find the value of x *for which* y *is undefined*

12. *Express* $\frac{2}{x+5} + \frac{1}{x-3} - \frac{5}{(x+5)(x-3)}$ *as a single fraction*

13. *Express* $\frac{4}{x+5} + \frac{1}{x-2} - \frac{7}{(x+5)(x-2)}$ *as a single fraction*

14. *Reduce the following fractions to their lowest form:*

(i) $\frac{14a^2bc}{42ab^3c^4}$ (ii) $\frac{-6mn^4}{-24m^5n^2}$ (iii) $\frac{(x+3)(x-7)}{6(x+3)}$ (iv) $\frac{4(p+7)}{(p+7)^3}$

(v) $\frac{x+2}{(x+5)(x+2)}$ (vi) $\frac{6m}{m^2-4m}$ (vii) $\frac{2x+10}{x^2+5x}$ (viii) $\frac{x-5}{5-x}$

(ix) $\frac{3x-x^2}{(x+5)(x-3)}$ (xi) $\frac{15a^2bc^2-12abc}{18abc^2}$

15. *Simplify the following fractions as far as possible:*

(i) $\frac{x-1}{x+2} \div \frac{5(x-1)}{x+3}$ (ii) $\frac{14a^2bc}{42ab^3c^4}$

(iii) $\frac{3a}{6a+6b} \times \frac{a+b}{5a^2}$ (iv) $\frac{5y+25}{y^3} \div \frac{2y+10}{7y}$

16. *Simplify the following fractions as far as possible:*

(i) $\frac{1}{x} + \frac{2}{x^2} - \frac{1}{x^3}$ (ii) $3 + \frac{2}{x+2}$ (iii) $x - \frac{5}{x}$

(iv) $\frac{3}{x-3} - \frac{2}{x}$ (v) $\frac{6}{x-1} + \frac{3}{x+1}$ (vi) $\frac{5x}{x-1} - \frac{2x}{x+1}$

(vii) $\frac{6x+1}{x-3} - \frac{4x-2}{x-3}$ (viii) $\frac{3x^2}{x+2} + \frac{6}{x+2}$ (ix) $\frac{9-5x}{3x-2} - \frac{7-2x}{3x-2}$