EXERCISE 21

1. Write in the form of an algebraic expression:
(i) Perimeter (P) of a rectangle is two times the sum of its length (l) and its breadth (b).
(ii) Perimeter (P) of a square is four times its side.
(iii) Area of a square is square of its side.
(iv) Surface area of a cube is six times the square of its edge.
Solution:
(i) Let us assume the length be l, breadth be b and perimeter be P. Then the algebraic expression for the given statement is written as,
$P = 2 (l + b)$
(ii) Let us assume the side be s and area be A. Then the algebraic expression for the given statement is written as,
$P = 4s$
(iii) Let us assume the side be s and area be A. Then the algebraic expression for the given statement is written as,
$A = (s)^2$
(iv) Let us assume the surface area be S and edge be a. Then the algebraic expression for the given statement is written as,
$S = 6(a)^2$

2. Express each of the following as an algebraic expression:
(i) The sum of x and y minus m.
(ii) The product of x and y divided by m.
(iii) The subtraction of 5m from 3n and then adding 9p to it.
(iv) The product of 12, x, y and z minus the product of 5, m and n.
(v) Sum of p and 2r – s minus sum of a and 3n + 4x.
Solution:
(i)The algebraic expression for the given sentence is given below
$x + y – m$
(ii) The algebraic expression for the given sentence is given below
xy / m
(iii) The algebraic expression for the given sentence is given below
$3n – 5m + 9p$
(iv) The algebraic expression for the given sentence is given below
$12xyz – 5mn$
(v) The algebraic expression for the given statement is given below
$p + 2r – s – (a + 3n + 4x)$

3. Construct a formula for the following:
Total wages (Rs W) of a man whose basic wage is (Rs B) for t hours week plus (Rs R) per hour, if he works a total of T hours.
Solution:
The wages for t hours is Rs 8.
The wages for overtime is R(T – t)
Hence, the total wages is calculated as given below,
W = B + R(T – t)

4. If x = 4, evaluate:
(i) 3x + 8
(ii) $x^2 – 2x$
(iii) $x^2 / 2$
Solution:
(i) 3x + 8
The value of 3x + 8 for x = 4 is calculated as below
Now, substituting x = 4 in the given equation, we get
3x + 8 = 3 × 4 + 8
= 12 + 8
= 20
Therefore, the value of 3x + 8 for x = 4 is 20
(ii) $x^2 – 2x$
The value of $x^2 – 2x$ for x = 4 is calculated as below
Now, substituting x = 4 in the given equation, we get
$x^2 – 2x = 4^2 – 2 × 4$
= 16 – 8
= 8
Therefore, the value of $x^2 – 2x$ for x = 4 is 8
(iii) $x^2 / 2$
The value of $x^2 / 2$ for x =4 is calculated as below
$x^2 / 2 = 4^2 / 2$
= 16 / 2
= 8
Therefore, the value of $x^2 / 2$ for x = 4 is 8

5. If m – 6, evaluate:
(i) 5m – 6
(ii) $2m^2 + 3m$
(iii) $(2m)^2$

Solution:

(i) $5m - 6$

The value of $5m - 6$ for $m = 6$ is calculated as below

Now, substituting the value of $m = 6$ in the given equation, we get

$5m - 6 = 5 \times 6 - 6$

$= 30 - 6$

$= 24$

Hence, the value of $5m - 6$ for $m = 6$ is 24

(ii) $2m^2 + 3m$

The value of $2m^2 + 3m$ for $m = 6$ is calculated as below

Now, substituting the value of $m = 6$ in the given equation, we get

$2m^2 + 3m = 2(6)^2 + 3(6)$

$= 2 \times 36 + 3 \times 6$

$= 72 + 18$

$= 90$

Hence, the value of $2m^2 + 3m$ for $m = 6$ is 90

(iii) $(2m)^2$

The value of $(2m)^2$ for $m = 6$ is calculated as below

Now, substituting the value of $m = 6$ in the given equation, we get

$(2m)^2 = (2 \times 6)^2$

$= 12^2$

$= 144$

Hence, the value of $(2m)^2$ for $m = 6$ is 144

6. If x = 4, evaluate:

(i) $12x + 7$

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

(iii) $x^2 / 8$

Solution:

(i) $12x + 7$

The value of $12x + 7$ for $x = 4$ is calculated as follows,

Substituting the value of $x = 4$ in the given equation, we get

$12x + 7 = 12 \times 4 + 7$

$= 48 + 7$

$= 55$

Therefore, the value of $12x + 7$ for $x = 4$ is 55

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

The value of $5x^2 + 4x$ for $x = 4$ is calculated as follows,

Substituting the value of $x = 4$ in the given equation, we get

$5x^2 + 4x = 5 \times 4^2 + 4 \times 4$
$= 5 \times 16 + 16$
$= 80 + 16$
$= 96$
Therefore, the value of $5x^2 + 4x$ for x = 4 is 96
(iii) $x^2 / 8$
The value of $x^2 / 8$ for x = 4 is calculated as follows,
$x^2 / 8 = 4^2 / 8$
We get,
$= 16 / 8$
$= 2$
Therefore, the value of $x^2 / 8$ for x = 4 is 2

7. If m = 2, evaluate:
(i) 16m – 7
(ii) $15m^2 – 10m$
(iii) $1 / 4 \times m^3$
Solution:
(i) 16m – 7
The value of 16m – 7 for m = 2 is calculated as below,
$16m – 7 = 16 \times 2 – 7$
$= 32 – 7$
We get,
$= 25$
Hence, the value of 16m – 7 for m = 2 is 25
(ii) $15m^2 – 10m$
The value of $15m^2 – 10m$ for m = 2 is calculated as below,
$15m^2 – 10m = 15 \times 2^2 – 10 \times 2$
$= 15 \times 4 – 20$
$= 60 – 20$
We get,
$= 40$
Hence, the value of $15m^2 – 10m$ for m = 2 is 40
(iii) $1 / 4 \times m^3$
The value of $1 / 4 \times m^3$ for m = 2 is calculated as below,
$1 / 4 \times m^3 = 1 / 4 \times 2^3$
We get,
$= 1 / 4 \times 8$
$= 2$

Hence, the value of $1 / 4 \times m^3$ for m = 2 is 2

8. If x = 10, evaluate:
(i) 100x + 225
(ii) $6x^2 – 25x$
(iii) $1 / 50 \times x^3$
Solution:
(i) 100x + 225
The value of 100x + 225 for x = 10 is calculated as follows,
$100x + 225 = 100 \times 10 + 225$
$= 1000 + 225$
We get,
= 1225
Therefore, the value of 100x + 225 for x = 10 is 1225
(ii) $6x^2 – 25x$
The value of $6x^2 – 25x$ for x = 10 is calculated as follows,
$6x^2 – 25x = 6 \times 10^2 – 25 \times 10$
$= 6 \times 100 – 250$
$= 600 – 250$
We get,
= 350
Therefore, the value of $6x^2 – 25x$ for x = 10 is 350
(iii) $1 / 50 \times x^3$
The value of $1 / 50 \times x^3$ for x = 10 is calculated as follows,
$1 / 50 \times x^3 = 1 / 50 \times 10^3$
$= 1 / 50 \times 1000$
We get,
= 20
Therefore, the value of $1 / 50 \times x^3$ for x = 10 is 20

9. If a = - 10, evaluate:
(i) 5a
(ii) a^2
(iii) a^3
Solution:
(i) 5a
The value of 5a for a = - 10 is calculated as shown below,
$5a = 5 \times (- 10)$
We get,

= - 50
Therefore, the value of 5a for a = -10 is – 50
(ii) a^2
The value of a^2 for a = -10 is calculated as shown below,
$a^2 = (- 10)^2$
= 100
Therefore, the value of a^2 for a = - 10 is 100
(iii) a^3
The value of a^3 for a = - 10 is calculated as shown below,
$a^3 = (- 10)^3$
= - 1000
Therefore, the value of a^3 for a = - 10 is – 1000

10. If x = - 6, evaluate:
(i) 11x
(ii) $4x^2$
(iii) $2x^3$
Solution:
(i) 11x
The value of 11x for x = - 6 is calculated as follows,
$11x = 11 \times (-6)$
We get,
= - 66
Hence, the value of 11x for x = - 6 is – 66
(ii) $4x^2$
The value of $4x^2$ for x = - 6 is calculated as follows,
$4x^2 = 4 \times (-6)^2$
We get,
$= 4 \times 36$
= 144
Hence, the value of $4x^2$ for x = - 6 is 144
(iii) $2x^3$
The value of $2x^3$ for x = - 6 is calculated as follows,
$2x^3 = 2 \times (-6)^3$
We get,
$= 2 \times (-216)$
= - 432
Hence, the value of $2x^3$ for x = - 6 is – 432

11. If m = - 7, evaluate:
(i) 12m
(ii) $2m^2$
(iii) $2m^3$
Solution:
(i) 12m
The value of 12m for m = - 7 is calculated as below,
12m = 12 × (- 7)
We get,
= - 84
Therefore, the value of 12m for m = - 7 is – 84
(ii) $2m^2$
The value of $2m^2$ for m = - 7 is calculated as below,
$2m^2 = 2 \times (-7)^2$
We get,
= 2 × 49
= 98
Therefore, the value of $2m^2$ for m = - 7 is 98
(iii) $2m^3$
The value of $2m^3$ for m = - 7 is calculated as below,
$2m^3 = 2 \times (-7)^3$
We get,
= 2 × (- 343)
= - 686
Therefore, the value of $2m^3$ for m = - 7 is – 686

12. Find the average (A) of four quantities p, q, r and s. If A = 6, p = 3, q = 5 and r = 7; find the value of s.
Solution:
The average of four quantities p, q, r and s is calculated as,
A = (p + q + r + s) / 4
Substituting the given values in the above expression, we get
6 = (3 + 5 + 7 + s) / 4
6 × 4 = 3 + 5 + 7 + s
24 = 15 + s
s = 24 – 15
We get,
s = 9
Hence, the value of s is 9

13. If a = 5 and b = 6, evaluate:
(i) 3ab
(ii) $6a^2b$
(iii) $2b^2$
Solution:
(i) 3ab
The value of 3ab for a = 5 and b = 6 is calculated as follows,
$3ab = 3 \times a \times b$
$= 3 \times 5 \times 6$
We get,
= 90
Therefore, the value of 3ab if a = 5 and b = 6 is 90
(ii) $6a^2b$
The value of $6a^2b$ for a = 5 and b = 6 is calculated as follows,
$6a^2b = 6 \times a \times a \times b$
$= 6 \times 5 \times 5 \times 6$
We get,
$= 6 \times 25 \times 6$
= 900
Therefore, the value of $6a^2$ if a = 5 and b = 6 is 900
(iii) $2b^2$
The value of $2b^2$ for a = 5 and b = 6 is calculated as follows,
$2b^2 = 2 \times b \times b$
$= 2 \times 6 \times 6$
$= 2 \times 36$
= 72
Therefore, the value of $2b^2$ if a = 5 and b = 6 is 72

14. If x = 8 and y = 2, evaluate:
(i) 9xy
(ii) $5x^2y$
(iii) $(4y)^2$
Solution:
(i) 9xy
The value of 9xy for x = 8 and y = 2 is calculated as follows,
$9xy = 9 \times x \times y$
$9xy = 9 \times 8 \times 2$
9xy = 144
Hence, the value of 9xy for x = 8 and y = 2 is 144

(ii) $5x^2y$
The value of $5x^2y$ for x = 8 and y = 2 is calculated as follows,
$5x^2y = 5 \times x \times x \times y$
$= 5 \times 8 \times 8 \times 2$
$= 640$
Hence, the value of $5x^2y$ for x = 8 and y = 2 is 640
(iii) $(4y)^2$
The value of $(4y)^2$ for x = 8 and y = 2 is calculated as follows,
$(4y)^2 = (4 \times 2)^2$
$= (8)^2$
$= 64$
Hence, the value of $(4y)^2$ for x = 8 and y = 2 is 64

15. If x = 5 and y = 4, evaluate:
(i) 8xy
(ii) $3x^2y$
(iii) $3y^2$
Solution:
(i) 8xy
The value of 8xy for x = 5 and y = 4 is calculated as follows,
$8xy = 8 \times x \times y$
$= 8 \times 5 \times 4$
$= 160$
Therefore, the value of 8xy for x = 5 and y = 4 is 160
(ii) $3x^2y$
The value of $3x^2y$ for x = 5 and y = 4 is calculated as follows,
$3x^2y = 3 \times x \times x \times y$
$= 3 \times 5 \times 5 \times 4$
$= 15 \times 20$
$= 300$
Therefore, the value of $3x^2y$ for x = 5 and y = 4 is 300
(iii) $3y^2$
The value of $3y^2$ for x = 5 and y = 4 is calculated as follows,
$3y^2 = 3 \times y \times y$
$= 3 \times 4 \times 4$
$= 48$
Therefore, the value of $3y^2$ for x = 5 and y = 4 is 48

16. If y = 5 and z = 2, evaluate:
(i) 100yz
(ii) $9y^2z$
(iii) $5y^2$
(iv) $(5z)^3$
Solution:
(i) 100yz
The value of 100yz for y = 5 and z = 2 is calculated as below,
$100yz = 100 \times y \times z$
$= 100 \times 5 \times 2$
$= 100 \times 10$
$= 1000$
Hence, the value of 100yz for y = 5 and z = 2 is 1000
(ii) $9y^2z$
The value of $9y^2z$ for y = 5 and z = 2 is calculated as below,
$9y^2z = 9 \times y \times y \times z$
$= 9 \times 5 \times 5 \times 2$
We get,
$= 45 \times 10$
$= 450$
Hence, the value of $9y^2z$ for y = 5 and z = 2 is 450
(iii) $5y^2$
The value of $5y^2$ for y = 5 and z = 2 is calculated as below,
$5y^2 = 5 \times y \times y$
$= 5 \times 5 \times 5$
We get,
$= 125$
Hence, the value of $5y^2$ for y = 5 and z = 2 is 125
(iv) $(5z)^3$
The value of $(5z)^3$ for y =5 and z = 2 is calculated as below,
$(5z)^3 = (5 \times z)^3$
$= (5 \times 2)^3$
$= (10)^3$
$= 1000$
Hence, the value of $(5z)^3$ for y = 5 and z = 2 is 1000

17. If x = 2 and y = 10, evaluate:
(i) 30xy
(ii) $50xy^2$
(iii) $(10x)^2$
(iv) $5y^2$
Solution:
(i) 30xy
The value of 30xy for x = 2 and y = 10 is calculated as follows,
$30xy = 30 \times x \times y$
$= 30 \times 2 \times 10$
$= 600$
Therefore, the value of 30xy for x = 2 and y = 10 is 600
(ii) $50xy^2$
The value of $50xy^2$ for x = 2 and y = 10 is calculated as follows,
$50xy^2 = 50 \times x \times y \times y$
$= 50 \times 2 \times 10 \times 10$
$= 10000$
Therefore, the value of $50xy^2$ for x = 2 and y = 10 is 10000
(iii) $(10x)^2$
The value of $(10x)^2$ for x = 2 and y = 10 is calculated as follows,
$(10x)^2 = (10 \times x)^2$
$= (10 \times 2)^2$
We get,
$= (20)^2$
$= 400$
Therefore, the value of $(10x)^2$ for x = 2 and y = 10 is 400
(iv) $5y^2$
The value of $5y^2$ for x = 2 and y = 10 is calculated as follows,
$5y^2 = 5 \times y \times y$
$= 5 \times 10 \times 10$
$= 5 \times 100$
$= 500$
Therefore, the value of $5y^2$ for x = 2 and y = 10 is 500

18. If m = 3 and n = 7, evaluate:
(i) 12mn
(ii) $5mn^2$
(iii) $(10m)^2$
(iv) $4n^2$

Solution:

(i) 12mn

The value of 12mn for m = 3 and n = 7 is calculated as follows,

$12mn = 12 \times m \times n$

$= 12 \times 3 \times 7$

$= 252$

Hence, the value of 12mn for m = 3 and n = 7 is 252

(ii) $5mn^2$

The value of $5mn^2$ for m = 3 and n = 7 is calculated as follows,

$5mn^2 = 5 \times m \times n^2$

$= 5 \times 3 \times 7^2$

$= 5 \times 3 \times 7 \times 7$

$= 735$

Hence, the value of $5mn^2$ for m = 3 and n = 7 is 735

(iii) $(10m)^2$

The value of $(10m)^2$ for m = 3 and n = 7 is calculated as follows,

$(10m)^2 = (10 \times m)^2$

$= (10 \times 3)^2$

$= (30)^2$

$= 900$

Hence, the value of $(10m)^2$ for m = 3 and n = 7 is 900

(iv) $4n^2$

The value of $4n^2$ for m = 3 and n = 7 is calculated as follows,

$4n^2 = 4 \times n^2$

$= 4 \times 7^2$

$= 4 \times 7 \times 7$

$= 196$

Hence, the value of $4n^2$ for m = 3 and n = 7 is 196

19. If a = - 10, evaluate:

(i) 3a – 2

(ii) $a^2 + 8a$

(iii) $1 / 5 \times a^2$

Solution:

(i) 3a - 2

The value of 3a – 2 for a = - 10 is calculated as follows,

$3a – 2 = 3 \times (- 10) – 2$

We get,

$= - 30 – 2$

= - 32
Therefore, the value of 3a – 2 for a = - 10 is – 32
(ii) $a^2 + 8a$
The value of $a^2 + 8a$ for a = - 10 is calculated as follows,
$a^2 + 8a = (- 10)^2 + 8 \times (- 10)$
= 100 – 80
= 20
Therefore, the value of $a^2 + 8a$ for a = - 10 is 20
(iii) $1 / 5 \times a^2$
The value of $1 / 5 \times a^2$ for a = - 10 is calculated as follows,
$1 / 5 \times a^2 = 1 / 5 \times (- 10)^2$
= 1 / 5 × 100
We get,
= 20
Therefore, the value of $1 / 5 \times a^2$ for a = - 10 is 20

20. If x = - 6, evaluate:
(i) 4x – 9
(ii) $3x^2 + 8x$
(iii) $x^2 / 2$
Solution:
(i) 4x - 9
The value of 4x – 9 for x = - 6 is calculated as follows,
4x – 9 = 4 × (- 6) – 9
= - 24 – 9
= - 33
Hence, the value of 4x – 9 for x = - 6 is – 33
(ii) $3x^2 + 8x$
The value of $3x^2 + 8x$ for x = - 6 is calculated as follows,
$3x^2 + 8x = 3 \times (- 6)^2 + 8 \times (- 6)$
We get,
= 3 × 36 – 48
= 108 – 48
= 60
Hence, the value of $3x^2 + 8x$ for x = - 6 is 60
(iii) $x^2 / 2$
The value of $x^2 / 2$ for x = - 6 is calculated as follows,
$x^2 / 2 = (- 6)^2 / 2$
We get,

= 36 / 2
= 18
Hence, the value of x^2 / 2 for x = - 6 is 18