Framing Algebraic Expressions

EXERCISE 21

Question 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 P be the perimeter and / be the length, and b be the breadth.
P = 2 (l + b)
(ii) Let P be the perimeter and a be the side of the square.
P = 4a
(iii) Let A be the area of the square and a be the sides of the square.
$A = (a)^2$
(iv) Let S be the surface area and a be the edges of the cube.
$S = 6a^2$

Question 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) x + y – m
(ii) $\frac{xy}{m}$
(iii) 3n – 5m + 9p
(iv) 12xyz – 5mn
(v) p + 2r – s – (a + 3n + 4x)

Question 3.
Construct a formula for the following :
Total wages (₹ W) of a man whose basic wage is (₹ B) for t hours week plus (₹ R) per hour, if he Works a total of T hours.
Solution:
Wages for t hours = ₹ B
Wages for overtime = R(T – t)
=> Total wages = Wages for t hours + wages for overtime of (T – t) hours
=> ₹ W = ₹ B + ₹ R (T – t)

Question 4.
If x = 4, evaluate :
(i) 3x + 8

(ii) $x^2 - 2x$

(iii) $\frac{x^2}{2}$

Solution:

(i) $3x + 8$

$= (3 \times 4) + 8$

$= 12 + 8 = 20$

(ii) $x^2 - 2x$

$= (4)^2 - 2(4)$

$= (4 \times 4) - (2 \times 4)$

$= 16 - 8 = 8$

(iii) $\frac{x^2}{2}$

$= \frac{(4)^2}{2} = \frac{4 \times 4}{2} = \frac{16}{2} = 8$

Question 5.

If m – 6, evaluate :

(i) 5m – 6

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

(iii) $(2m)^2$

Solution:

(i) $5m - 6$

$= (5 \times 6) - 6$

$= 36 - 6 = 30$

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

$= 2\,(6)^2 + 3\,(6)$

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

$= 72 + 18 = 90$

(iii) $(2m)^2$

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

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

$= 12 \times 12 = 144$

Question 6.

If x = 4, evaluate :

(i) 12x + 7

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

(iii) $\frac{x^2}{8}$

Solution:

(i) $12x + 7$

$= (12 \times 4) + 7$

$= 48 + 7 = 55$.

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

$= (5 \times 4 \times 4) + 4\,(4)$

$= 80 + 16 = 96$.

(iii) $\frac{x^2}{8}$

$= \frac{(4)^2}{8} = \frac{4 \times 4}{8} = \frac{16}{8} = 2$

Question 7.

If m = 2, evaluate :

(i) 16m – 7

(ii) $15m^2 - 10m$

(iii) $\frac{1}{4} \times m^3$

Solution:

16m – 7

= (16 x 2) – 7

= 32 – 7 = 25

(ii) $15m^2 - 10m$

$= 15\,(2)^2 - 10(2)$

$= (15 \times 2 \times 2) - (10 \times 2)$

$= 60 - 20 = 40$.

(iii) $\frac{1}{4} \times m^3$

$= \frac{1}{4} \times (2)^3$

$= \frac{1}{4} \times 2 \times 2 \times 2$

$= \frac{1}{4} \times 8 = 2$

Question 8.

If x = 10, evaluate :

(i) 100x + 225
(ii) $6x^2 - 25x$
(iii) $\frac{1}{50} \times x^3$

Solution:

(i) $100x + 225$
$= (100 \times 10) + 225$
$= 1000 + 225 = 1225$

(ii) $6x^2 - 25x$
$= 6(10)^2 - 25(10)$
$= (6 \times 10 \times 10) - (25 \times 10)$
$= 600 - 250 = 350$

(iii) $\frac{1}{50} \times x^3$

$= \frac{1}{50} \times 10 \times 10 \times 10$

$= \frac{1}{50} \times 1000 = 20$

Question 9.

If a = – 10, evaluate :
(i) 5a
(ii) a^2
(iii) a^3

Solution:

(i)5a
= 5 x (-10) = -50

(ii) a^2
$= (-10)^2$
$= -10 \times (-10)$
$= 100$

(iii) $a^3 = a \times a \times a$
$= (-10)^3$
$= (-10) \times (-10) \times (-10)$
$= -1000$

Question 10.

If x = – 6, evaluate :
(i) 11x

(ii) $4x^2$
(iii) $2x^3$

Solution:

(i) $11x$
$= 11 \times (-6) = -66$

(ii) $4x^2$
$= 4 \times (-6) \times (-6)$
$= 4 \times 36 = 144$.

(iii) $2x^2$
$= 2 \times (-6)^3$
$= 2 \times (-6) \times (-6) \times (-6)$
$= 2 \times (-216) = -432$

Question 11.

If m = – 7, evaluate :
(i) 12m
(ii) $2m^2$
(iii) $2m^3$

Solution:

(i) $12m$
$= 12 \times (-7)$
$= -84$.

(ii) $2m^3$
$= 2 \times m \times m$
$= 2 \times (-7) \times (-7)$
$= 2 \times 49 = 98$

(iii) $2m^3$
$= 2 \times m \times m \times m$
$= 2 \times (-7) \times (-7) \times (-7)$
$= 2 \times (-343)$
$= -686$

Question 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:

Given, average of four quantities (A) = 6

and p = 3,q = 5, r = 7 and s = ?

$$\therefore \quad A = \frac{p+q+r+s}{4}$$

$$\Rightarrow \quad 6 = \frac{3+5+7+s}{4}$$

$$\Rightarrow \quad 6 \times 4 = 15 + s$$

$$\Rightarrow \quad s = 24 - 15 \qquad \Rightarrow s = 9$$

Question 13.

If a = 5 and b = 6, evaluate :

(i) 3ab

(ii) $6a^2b$

(iii) $2b^2$

Solution:

(i) $3ab$

$= 3 \times a \times b$

$= 3 \times 5 \times 6 = 90$

(ii) $6a^2 b$

$= 6 \times a \times a \times b$

$= 6 \times 5 \times 5 \times 6$

$= 900$

(iii) $2b^2$

$= 2 \times b \times b$

$= 2 \times 6 \times 6$

$= 72$

Question 14.

If x = 8 and y = 2, evaluate :

(i) 9xy

(ii) $5x^2y$

(iii) $(4y)^2$

Solution:

(i) $9xy$

$= 9 \times x \times y$

$= 9 \times 8 \times 2$

$= 144$

(ii) $5x^2 y$

$= 5 \times x \times x \times y$

$= 5 \times 8 \times 8 \times 2$

$= 640$

(iii) $(4y)^2$

$= 4 \times y \times 4 \times y$

$= 4 \times 2 \times 4 \times 2$

$= 8 \times 8 = 64$

Question 15.

If x = 5 and y = 4, evaluate :

(i) 8xy

(ii) $3x^2y$

(iii) $3y^2$

Solution:

(i) $8xy$

$= 8 \times x \times y$

$= 8 \times 5 \times 4$

$= 160$

(ii) $3x^2y$

$= 3 \times x \times x \times y$

$= 3 \times 5 \times 5 \times 4$

$= 300$

(iii) $3y^2$

$= 3 \times y \times y$

$= 3 \times 4 \times 4$

$= 48$

Question 16.

If y = 5 and z = 2, evaluate :

(i) 100yz

(ii) $9y^2z$

(iii) $5y^2$

(iv) $(5z)^3$

Solution:

(i) $100yz$

$= 100 \times y \times z$

$= 100 \times 5 \times 2$

$= 1000$

(ii) $9y^2z$

$= 9 \times y \times y \times z$

$= 9 \times 5 \times 5 \times 2$

$= 450$

(iii) $5y^2$

$= 5 \times y \times y$

$= 5 \times 5 \times 5$

$= 125$

(iv) $(5z)^3$

$= (5 \times z) \times (5 \times z) \times (5 \times z)$

$= 5 \times 2 \times 5 \times 2 \times 5 \times 2$

$= 10 \times 10 \times 10 = 1000$

Question 17.

If x = 2 and y = 10, evaluate :

(i) 30xy

(ii) $50xy^2$

(iii) $(10x)^2$

(iv) $5y^2$

Solution:

(i) $30xy$

$= 30 \times x \times y$

$= 30 \times 2 \times 10 = 600$

(ii) $50xy^2$

$= 50 \times x \times y \times y$

$= 50 \times 2 \times 10 \times 10$

$= 10000$

(iii) $(10x)^2$

$= (10 \times x) \times (10 \times x)$

$= 10 \times 2 \times 10 \times 2$

$= 400$

(iv) $5y^2$

$= 5 \times y \times y$

$= 5 \times 10 \times 10$

$= 500$

Question 18.

If m = 3 and n = 7, evaluate :

(i) 12mn

(ii) $5mn^2$

(iii) $(10m)^2$

(iv) $4n^2$

Solution:

(i) $12mn$

$= 12 \times m \times n$

$= 12 \times 3 \times 7$

$= 252$

(ii) $5mn^2$

$= 5 \times m \times n \times n$

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

$= 735$

(iii) $(10m)^2$

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

$= (10 \times 3) \times (10 \times 3)$

$= 30 \times 30 = 900$

(iv) $4n^2$

$= 4 \times n \times n$

$= 4 \times 7 \times 7$

$= 196$

Question 19.

If a = -10, evaluate :

(i) 3a – 2

(ii) a^2 + 8a

(iii) $\frac{1}{5}$ x a2

Solution:

(i) $3a - 2$

$= (3 \times a) - 2$

$= 3 \times (-10) - 2$

$= -30 - 2 = -32$

(ii) $a^2 + 8a$

$= (a \times a) + (8 \times a)$

$= (-10 \times (-10)) + (8 \times (-10))$

$= 100 + (-80)$

$= 100 - 80 = 20$

(iii) $\frac{1}{5} \times a^2$

$= \frac{1}{5} \times (a \times a)$

$= \frac{1}{5} \times (-10) \times (-10)$

$= \frac{1}{5} \times 100 = 20$

Question 20.

If x = -6, evaluate :

(i) $4x - 9$

(ii) $3x^2 + 8x$

(iii) $\frac{x^2}{2}$

Solution:

(i) $4x - 9$

$= (4 \times x) - 9$

$= (4 \times (-6)) - 9$

$= -24 - 9 = -33$

(ii) $3x^2 + 8x$

$= (3 \times x \times x) + (8 \times x)$

$= (3 \times (-6) \times (-6)) + (8 \times (-6))$

$= -108 + (-48)$

$= 60$

(iii) $\frac{x^2}{2}$

$= \frac{x \times x}{2}$

$= \frac{(-6) \times (-6)}{2}$

$= \frac{36}{2} = 18$

Question 21.

If m = -8, evaluate :

(i) 2m + 21

(ii) $m^2 + 9m$

(iii) $\frac{m^2}{4}$

Solution:

(i) $2m + 21$

$= 2 \times m + 21$

$= 2 \times (-8) + 21$

$= -16 + 21 = 5$

(ii) $m^2 + 9m$

$= (m \times m) + (9 \times m)$

$= (-8 \times -8) + (9 \times (-8))$

$= 64 + (-72)$

$= 64 - 72 = -8$

(iii) $\frac{m^2}{4} = \frac{m \times m}{4}$

$= \frac{(-8)^2}{4} = \frac{(-8) \times (-8)}{4}$

$= \frac{64}{4} = 16$

Question 22.

If p = -10, evaluate :

(i) 6p + 50

(ii) $3p^2 - 20p$

(iii) $\frac{p^2}{50}$

Solution:

(i) 6p + 50

= (6 x p) + 50

$= (6 \times (-10) + 50$

$= -60 + 50 = -10$

(ii) $3p^2 - 20p$

$= (3 \times p \times p) - (20 \times p)$

$= (3 \times (-10) \times (-10) - (20 \times (-10)$

$= 300 - (-200)$

$= 300 + 200 = 500$

(iii) $\frac{p^2}{50}$

$= \frac{p \times p}{50}$

$= \frac{(-10) \times (-10)}{50}$

$= \frac{100}{50} = 2$

Question 23.
If y = -8, evaluate :
(i) 6y + 53
(ii) $y^2 + 12y$
(iii) $\frac{y^3}{4}$
Solution:

(i) $6y + 53$
$= (6 \times y) + 53$
$= (6 \times (-8)) + 53$
$= -48 + 53$
$= 5$

(ii) $y^2 + 12y$
$= (y \times y) + (12 \times y)$
$= ((-8) \times (-8) + (12 \times (-8))$
$= 64 + (-96)$
$= -32$

(iii) $\frac{y^3}{4} = \frac{y \times y \times y}{4}$

$= \frac{(-8) \times (-8) \times (-8)}{4}$

$= \frac{-256}{4} = -64$

Question 24.
If x = 2 and 7 = -4, evaluate :
(i) 11xy
(ii) $5x^2y$
(iii) $(5y)^2$
(iv) 8x

Solution:

(i) $11xy$

$= 11 \times x \times y$

$= 11 \times 2 \times (-4)$

$= -88$

(ii) $5x^2y$

$= 5 \times x \times x \times y$

$= 5 \times 2 \times 2 \times (-4)$

$= -80$

(iii) $(5y)^2$

$= 5 \times y \times 5 \times y$

$= 5 \times (-4) \times 5 \times (-4)$

$= (-20) \times (-20)$

$= 400$

(iv) $8x^2$

$= 8 \times x \times x$

$= 8 \times 2 \times 2$

$= 32$

Question 25.

If m = 9 and n = -2, evaluate

(i) 4mn

(ii) $2m^2n$

(iii) $(2n)^3$

Solution:

(i) $4mn$

$= 4 \times m \times n$

$= 4 \times 9 \times (-2)$

$= -72$

(ii) $2m^2n$

$= 2 \times m \times m \times n$

$= 2 \times 9 \times 9 \times (-2)$

$= 2 \times 81 \times (-2)$

$= -324$

(iii) $(2n)^3$

$= (2 \times n) \times (2 \times n) \times (2 \times n)$

$= (2 \times (-2)) \times (2 \times (-2)) \times (2 \times (-2))$

$= (-4) \times (-4) \times (-4)$

$= -64$

Question 26.

If m = -8 and n = -2, evaluate :

(i) 12mn

(ii) $3m^2n$

(iii) $(4n)^2$

Solution:

(i) $12mn$

$= 12 \times m \times n$

$= 12 \times (-8) \times (-2)$

$= 192$.

(ii) $3m^2n$

$= 3 \times m \times m \times n$

$= 3 \times 64 \times (-2) = -384$.

(iii) $(4n)^2$

$= 4 \times n \times 4 \times n$

$= (4 \times (-2)) \times (4 \times (-2))$

$= (-8) \times (-8) = 64$

Question 27.

If x = -5 and y = -8, evaluate :

(i) 4xy

(ii) $2xy^2$

(iii) $4x^2$

(iv) $3y^2$

Solution:

(i) $4xy$

$= 4 \times x \times y$

$= 4 \times (-5) \times (-8) = 160$

(ii) $2xy^2$

$= 2 \times x \times y \times y$

$= 2 \times (-5) \times (-8) \times (-8)$

$= -10 \times 64$

$= -640$

(iii) $4x^2$

$= 4 \times x \times x$

$= 4 \times (-5) \times (-5)$

$= 100$.

(iv) $3y^2$

$= 3 \times y \times y = 3 \times (-8) \times (-8)$

$= 192$

Question 28.
Find T, if T = 2a – b, a = 7 and b = 3.
Solution:
T = 2a – b, a = 1 and b = 3
Put the value of a = 1, and b = 3 in above equation
T = (2 x 7) -3
T = 14 – 3 = 11
T = 11

Question 29.
From the formula $B = 2a^2 – b^2$, calculate the value of B when a = 3 and b = -1.
Solution:
$B = 2a^2 – b^2$
Put the values of a = 3 and b = -1 in above equation
$B = 2 \times (3)^2 – (-1)^2$
B = 18 – 1
B = 17
Value of B is = 17

Question 30.
The wages ₹ W of a man earning ₹ x per hour for t hours are given by the formula W = xt. Find his wages for working 40 hours at a rate of ₹ 39.45 per hour.
Solution:
T = 40 hours
x = ₹ 39.45
W = xt = 40 x 39.45
W = ₹ 1578

Question 31.
The temperature in Fahrenhiet scale is represented by F and the tempera¬ture in Celsius scale is represented by C. If $F = \frac{9}{5} \times C + 32$, find F when C = 40.
Solution:
$F = \frac{9}{5} \times C + 32$
Given, C = 40
$F = \frac{9}{5} \times 40 + 32 = 9 \times 8 + 32$
F = 104°