EXERCISE 11A

1. Separate constant terms and variable terms from the following:
8, x, 6xy, 6 + x, - $5xy^2$, $15az^2$, 32z/ xy, y^2/ 3x
Solution:

The constant term is 8.
The variable terms are x, 6xy, 6 + x, - $5xy^2$, $15az^2$, 32z/ xy, y^2/ 3x.

2. For each expression, given below, state whether it is a monomial, binomial or trinomial:
(i) 2x ÷ 15
(ii) ax + 9
(iii) $3x^2$ × 5x
(iv) 5 + 2x – 3b
(v) 2y – 7/2z ÷ x
(vi) 3p × q ÷ z
(vii) 12z ÷ 5x + 4
(viii) 12 – 5z – 4
(ix) a^3 -$3ab^2$ × c
Solution:

(i) 2x ÷ 15 = 2x/15
It has one term and hence it is a monomial.

(ii) ax + 9
It has two terms and hence it is a binomial.

(iii) $3x^2$ × 5x = $15x^3$
It has one term and hence it is a monomial.

(iv) 5 + 2x – 3b
It has three terms and hence it is a trinomial.

(v) 2y – 7/2z ÷ x = 2y – 7z/3x
It has two terms and hence it is a binomial.

(vi) 3p × q ÷ z = 3pq/z
It has one term and hence it is a monomial.

(vii) 12z ÷ 5x + 4 = 12z/5x + 4
It has two terms and hence it is a binomial.

(viii) 12 – 5z – 4 = 8 – 5z
It has two terms and hence it is a binomial.

(ix) a^3 -$3ab^2$ × c = a^3 – $3ab^2c$
It has two terms and hence it is a binomial.

3. Write the coefficient of:
(i) xy in -3axy

(ii) z^2 in p^2yz^2
(iii) mn in – mn
(iv) 15 in $-15p^2$
Solution:

(i) xy in -3axy
The coefficient of xy in -3axy = -3a

(ii) z^2 in p^2yz^2
The coefficient of z^2 in p^2yz^2 = p^2y

(iii) mn in – mn
The coefficient of mn in – mn = -1

(iv) 15 in $-15p^2$
The coefficient of 15 in $-15p^2$ = $-p^2$

4. For each of the following monomials, write its degree:
(i) 7y
(ii) $–x^2y$
(iii) xy^2z
(iv) $-9y^2z^3$
(v) $3m^3n^4$
(vi) $-2p^2q^3r^4$
Solution:

(i) The degree of 7y is 1.

(ii) The degree of $–x^2y$ = 2 + 1 = 3

(iii) The degree of xy^2z = 1 + 2 + 1 = 4

(iv) The degree of $-9y^2z^3$ = 2 + 3 = 5

(v) The degree of $3m^3n^4$ = 3 + 4 = 7

(vi) The degree of $-2p^2q^3r^4$ = 2 + 3 + 4 = 9

5. Write the degree of each of the following polynomials:
(i) $3y^3 – x^2y^2 + 4x$
(ii) $p^3q^2 – 6p^2q^5 + p^4q^4$
(iii) $-8mn^6 + 5m^3n$
(iv) $7 – 3x^2y + y^2$
(v) 3x – 15
(vi) $2y^2z + 9yz^3$
Solution:

(i) The degree of $3y^3 – x^2y^2 + 4x$ is 4
x^2y^2 is the term which has the highest degree.

(ii) The degree of $p^3q^2 – 6p^2q^5 + p^4q^4$ is 8
p^4q^4 is the term which has the highest degree.

(iii) The degree of $-8mn^6 + 5m^3n$ is 7
$-8mn^6$ is the term which has the highest degree.

(iv) The degree of $7 – 3x^2y + y^2$ is 3
$– 3x^2y$ is the term which has the highest degree.

(v) The degree of $3x – 15$ is 1
$3x$ is the term which has the highest degree.

(vi) The degree of $2y^2z + 9yz^3$ is 4
$9yz^3$ is the term which has the highest degree.

6. Group the like terms together:
(i) $9x^2$, xy, $-3x^2$, x^2 and $-2xy$
(ii) ab, $-a^2b$, $-3ab$, $5a^2b$ and $-8a^2b$.
(iii) 7p, 8pq, -5pq, -2p and 3p
Solution:

(i) $9x^2$, xy, $-3x^2$, x^2 and $-2xy$
$9x^2$, $-3x^2$ and x^2 are like terms
xy and $-2xy$ are like terms.

(ii) ab, $-a^2b$, $-3ab$, $5a^2b$ and $-8a^2b$
$-a^2b$, $5a^2b$ and $-8a^2b$ are like terms
ab and $– 3ab$ are like terms.

(iii) 7p, 8pq, -5pq, -2p and 3p
7p, -2p and 3p are like terms
8pq and -5pq are like terms.

7. Write the numerical coefficient of each of the following:
(i) y
(ii) – y
(iii) $2x^2y$
(iv) $-8xy^3$
(v) $3py^2$
(vi) $-9a^2b^3$
Solution:

(i) The numerical coefficient of y is 1.

(ii) The numerical coefficient of – y is – 1.

(iii) The numerical coefficient of $2x^2y$ is 2.

(iv) The numerical coefficient of $-8xy^3$ is -8.

(v) The numerical coefficient of $3py^2$ is 3.

(vi) The numerical coefficient of $-9a^2b^3$ is -9.

8. In $-5x^3y^2z^4$; write the coefficient of:
(i) z^2
(ii) y^2
(iii) yz^2
(iv) x^3y
(v) $–xy^2$
(vi) $-5xy^2z$
Also, write the degree of the given algebraic expression.
Solution:

(i) The coefficient of z^2 is $-5x^3y^2z^2$.

(ii) The coefficient of y^2 is $-5x^3z^4$.

(iii) The coefficient of yz^2 is $-5x^3yz^2$.

(iv) The coefficient of x^3y is $-5yz^4$.

(v) The coefficient of $–xy^2$ is $5x^2z^4$.

(vi) The coefficient of $-5xy^2z$ is x^2z^3.

So the degree of the given algebraic expression = 3 + 2 + 4 = 9.

EXERCISE 11B

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1. Fill in the blanks:
(i) 8x + 5x = …….
(ii) 8x – 5x = ……
(iii) $6xy^2 + 9xy^2$ = …….
(iv) $6xy^2 – 9xy^2$ = …….
(v) The sum of 8a, 6a and 5b = …….
(vi) The addition of 5, 7xy, 6 and 3xy = ……..
(vii) 4a + 3b – 7a + 4b = …….
(viii) – 15x + 13x + 8 = ……..
(ix) $6x^2y + 13xy^2 – 4x^2y + 2xy^2$ = ……
(x) $16x^2 – 9x^2$ = ……. and $25xy^2 – 17xy^2$ = ……
Solution:

(i) 8x + 5x = 13x

(ii) 8x – 5x = 3x

(iii) $6xy^2 + 9xy^2 = 15xy^2$

(iv) $6xy^2 – 9xy^2 = -3xy^2$

(v) The sum of 8a, 6a and 5b = 14a + 5b
It can be written as
8a + 6a + 5b = 14a + 5b

(vi) The addition of 5, 7xy, 6 and 3xy = 11 + 10xy
It can be written as
5 + 7xy + 6 + 3xy = 11 + 10xy

(vii) 4a + 3b – 7a + 4b = 7b – 3a
It can be written as
4a + 3b – 7a + 4b = (4 – 7)a + (3 + 4)b
= -3a + 7b

(viii) – 15x + 13x + 8 = 8 – 2x
It can be written as
-15x + 13x + 8 = (-15 + 13) x + 8 = -2x + 8

(ix) $6x^2y + 13xy^2 – 4x^2y + 2xy^2 = 2x^2y + 15xy^2$
It can be written as
$6x^2y + 13xy^2 – 4x^2y + 2xy^2 = (6 – 4)\ x^2y + (13 + 2)\ xy^2$
$= 2x^2y + 15xy^2$

(x) $16x^2 – 9x^2 = 7x^2$ and $25xy^2 – 17xy^2 = 8xy^2$

2. Add:
(i) -9x, 3x and 4x
(ii) $23y^2$, $8y^2$ and $– 12y^2$

(iii) 18pq, -15pq and 3pq
Solution:

(i) -9x, 3x and 4x
It can be written as
= -9x + 3x + 4x
So we get
= 9x + 7x
= -2x

(ii) $23y^2$, $8y^2$ and $– 12y^2$
It can be written as
= $23y^2 + 8y^2 – 12y^2$
So we get
= $31y^2 – 12y^2$
= $19y^2$

(iii) 18pq, -15pq and 3pq
It can be written as
= 18pq – 15pq + 3pq
So we get
= 3pq + 3pq
= 6pq

3. Simplify:
(i) 3m + 12m – 5m
(ii) $7n^2 – 9n^2 + 3n^2$
(iii) 25zy – 8zy – 6zy
(iv) $-5ax^2 + 7ax^2 – 12ax^2$
(v) – 16am + 4mx + 4am – 15mx + 5am
Solution:

(i) 3m + 12m – 5m
It can be written as
= 15m – 5m
So we get
= 10m

(ii) $7n^2 – 9n^2 + 3n^2$
It can be written as
= $(7 + 3) n^2 – 9n^2$
So we get
= $10n^2 – 9n^2$
= n^2

(iii) 25zy – 8zy – 6zy
It can be written as
= 25zy – 14zy
So we get
= 11zy

(iv) $-5ax^2 + 7ax^2 – 12ax^2$
It can be written as
$= (-5 – 12) ax^2 + 7ax^2$
So we get
$= -17ax^2 + 7ax^2$
$= -10ax^2$

(v) – 16am + 4mx + 4am – 15mx + 5am
It can be written as
= (-16 + 4 + 5) am + (4 – 15) mx
So we get
= - 7am – 11mx

4. Add:
(i) a + b and 2a + 3b
(ii) 2x + y and 3x – 4y
(iii) -3a + 2b and 3a + b
(iv) 4 + x, 5 – 2x and 6x
Solution:

(i) a + b and 2a + 3b
It can be written as
= a + b + 2a + 3b
So we get
= a + 2a + b + 3b
= 3a + 4b

(ii) 2x + y and 3x – 4y
It can be written as
= 2x + y + 3x – 4y
So we get
= 2x + 3x + y – 4y
= 5x – 3y

(iii) -3a + 2b and 3a + b
It can be written as
= -3a + 2b + 3a + b
So we get
= -3a + 3a + 2b + b
= 3b

(iv) 4 + x, 5 – 2x and 6x
It can be written as
= 4 + x + 5 – 2x + 6x
So we get
= x – 2x + 6x + 4 + 5
= 5x + 9

5. Find the sum of:
(i) 3x + 8y + 7z, 6y + 4z – 2x and 3y – 4x + 6z

(ii) 3a + 5b + 2c, 2a + 3b – c and a + b + c
(iii) $4x^2 + 8xy – 2y^2$ and $8xy – 5y^2 + x^2$
(iv) $9x^2 – 6x + 7$, 5 – 4x and $6 – 3x^2$
(v) $5x^2 – 2xy + 3y^2$, $-2x^2 + 5xy + 9y^2$ and $3x^2 – xy – 4y^2$
Solution:

(i) 3x + 8y + 7z, 6y + 4z – 2x and 3y – 4x + 6z
It can be written as
= 3x + 8y + 7z + 6y + 4z – 2x + 3y – 4x + 6z
By further calculation
= 3x – 2x – 4x + 8y + 6y + 3y + 7z + 4z + 6z
So we get
= 3x – 6x + 17y + 17z
= -3x + 17y + 17z

(ii) 3a + 5b + 2c, 2a + 3b – c and a + b + c
It can be written as
= 3a + 5b + 2c + 2a + 3b – c + a + b + c
By further calculation
= 3a + 2a + a + 5b + 3b + b + 2c – c + c
So we get
= 6a + 9b + 3c – c
= 6a + 9b + 2c

(iii) $4x^2 + 8xy – 2y^2$ and $8xy – 5y^2 + x^2$
It can be written as
= $4x^2 + 8xy – 2y^2 + 8xy – 5y^2 + x^2$
By further calculation
= $4x^2 + x^2 + 8xy + 8xy – 2y^2 – 5y^2$
So we get
= $5x^2 + 16xy – 7y^2$

(iv) $9x^2 – 6x + 7$, 5 – 4x and $6 – 3x^2$
It can be written as
= $9x^2 – 6x + 7 + 5 – 4x + 6 – 3x^2$
By further calculation
= $9x^2 – 3x^2 – 6x – 4x + 7 + 5 + 6$
So we get
= $6x^2 – 10x + 18$

(v) $5x^2 – 2xy + 3y^2$, $-2x^2 + 5xy + 9y^2$ and $3x^2 – xy – 4y^2$
It can be written as
= $5x^2 – 2xy + 3y^2 - 2x^2 + 5xy + 9y^2 + 3x^2 – xy – 4y^2$
By further calculation
= $5x^2 – 2x^2 + 3x^2 – 2xy + 5xy – xy + 3y^2 + 9y^2 – 4y^2$
So we get
= $6x^2 + 2xy + 8y^2$

6. Find the sum of:
(i) x and 3y

(ii) -2a and +5
(iii) $-4x^2$ and + 7x
(iv) +4a and -7b
(v) x^3, $3x^2y$ and $2y^2$
(vi) 11 and –by
Solution:

(i) x and 3y
The sum of x and 3y is x + 3y.

(ii) -2a and +5
The sum of -2a and + 5 is -2a + 5.

(iii) $-4x^2$ and + 7x
The sum of $-4x^2$ and + 7x is $-4x^2$ + 7x.

(iv) +4a and -7b
The sum of +4a and -7b is + 4a – 7b.

(v) x^3, $3x^2y$ and $2y^2$
The sum of x^3, $3x^2y$ and $2y^2$ is $x^3 + 3x^2y + 2y^2$.

(vi) 11 and –by
The sum of 11 and -by is 11 – by.

7. The sides of a triangle are 2x + 3y, x + 5y and 7x -2y. Find its perimeter.
Solution:

It is given that
Sides of a triangle are 2x + 3y, x + 5y and 7x -2y
We know that
Perimeter = Sum of all three sides of a triangle
Substituting the values
= 2x + 3y + x + 5y + 7x – 2y
By further calculation
= 2x + x + 7x + 3y + 5y – 2y
So we get
= 10x + 8y – 2x
= 10x + 6y

8. The two adjacent sides of a rectangle are 6a + 9b and 8a – 4b. Find its perimeter.
Solution:

It is given that
Sides of a rectangle are 6a + 9b and 8a – 4b
So length = 6a + 9b and breadth = 8a – 4b
We know that
Perimeter = 2 (length + breadth)
Substituting the values
= 2 (6a + 9b + 8a – 4b)

By further calculation
= 2 (14a + 5b)
So we get
= 28a + 10b

9. Subtract the second expression from the first:
(i) 2a + b, a + b
(ii) -2b + 2c, b + 3c
(iii) 5a + b, -6b + 2a
(iv) $a^3 – 1 + a, 3a – 2a^2$
(v) p + 2, 1
Solution:

(i) 2a + b, a + b
It can be written as
= (2a + b) – (a + b)
So we get
= 2a + b – a – b
= 2a – a + b – b
= a

(ii) -2b + 2c, b + 3c
It can be written as
= (-2b + 2c) – (b + 3c)
So we get
= -2b + 2c – b – 3c
= -2b – b + 2c - 3c
= -3b – c

(iii) 5a + b, -6b + 2a
It can be written as
= (5a + b) – (-6b + 2a)
So we get
= 5a + b + 6b – 2a
= 5a – 2a + b + 6b
= 3a + 7b

(iv) $a^3 – 1 + a, 3a – 2a^2$
It can be written as
= $(a^3 – 1 + a) – (3a – 2a^2)$
So we get
= $a^3 – 1 + a – 3a + 2a^2$
= $a^3 + 2a^2 + a – 3a – 1$
= $a^3 + 2a^2 – 2a – 1$

(v) p + 2, 1
It can be written as
= p + 2 – 1
So we get
= p + 1

10. Subtract:
(i) 4x from 8 – x
(ii) -8c from c + 3d
(iii) – 5a – 2b from b + 6c
(iv) $4p + p^2$ from $3p^2 – 8p$
(v) 5a – 3b + 2c from 4a – b – 2c
Solution:

(i) 4x from 8 – x
It can be written as
= (8 – x) – 4x
By further calculation
= 8 – x – 4x
= 8 – 5x

(ii) -8c from c + 3d
It can be written as
= (c + 3d) – (-8c)
By further calculation
= c + 3d + 8c
= 9c + 3d

(iii) – 5a – 2b from b + 6c
It can be written as
= (b + 6c) – (-5a – 2b)
By further calculation
= b + 6c + 5a + 2b
= 5a + 3b + 6c

(iv) $4p + p^2$ from $3p^2 – 8p$
It can be written as
= $(3p^2 – 8p) – (4p + p^2)$
By further calculation
= $3p^2 – 8p – 4p – p^2$
= $2p^2 – 12p$

(v) 5a – 3b + 2c from 4a – b – 2c
It can be written as
= (4a – b – 2c) – (5a – 3b + 2c)
By further calculation
= 4a – b – 2c – 5a + 3b – 2c
= -a + 2b – 4c

11. Subtract $-5a^2 – 3a + 1$ from the sum of $4a^2 + 3 – 8a$ and 9a – 7.
Solution:

We know that
Sum of $4a^2 + 3 – 8a$ and 9a – 7 can be written as
= $4a^2 + 3 – 8a + 9a – 7$
By further calculation

$= 4a^2 + a – 4$

Here
$(4a^2 + a – 4) – (-5a^2 – 3a + 1) = 4a^2 + a – 4 + 5a^2 + 3a – 1$
By further calculation
$= 4a^2 + 5a^2 + a + 3a – 4 - 1$
So we get
$= 9a^2 + 4a - 5$

12. By how much does $8x^3 – 6x^2 + 9x – 10$ exceed $4x^3 + 2x^2 + 7x – 3$?
Solution:

We know that
$8x^3 – 6x^2 + 9x – 10$ exceed $4x^3 + 2x^2 + 7x – 3$
It can be written as
$= (8x^3 – 6x^2 + 9x – 10) – (4x^3 + 2x^2 + 7x – 3)$
By further calculation
$= 8x^3 – 6x^2 + 9x – 10 – 4x^3 – 2x^2 -7x + 3$
So we get
$= 8x^3 – 4x^3 – 6x^2 - 2x^2 + 9x – 7x – 10 + 3$
$= 4x^3 – 8x^2 + 2x - 7$

13. What must be added to $2a^3 + 5a – a^2 – 6$ to get $a^2 – a – a^3 + 1$?
Solution:

The answer can be obtained by subtracting $2a^3 + 5a – a^2 – 6$ from $a^2 – a – a^3 + 1$
$= (-a^3 + a^2 – a + 1) – (2a^3 + 5a – a^2 – 6)$
It can be written as
$= -a^3 + a^2 – a + 1 - 2a^3 - 5a + a^2 + 6$
By further calculation
$= - a^3 - 2a^3 + a^2 + a^2 – a – 5a + 1 + 6$
$= -3a^3 + 2a^2 – 6a + 7$

14. What must be subtracted from $a^2 + b^2 + 2ab$ to get $– 4ab + 2b^2$?
Solution:

The answer can be obtained by subtracting $– 4ab + 2b^2$ from $a^2 + b^2 + 2ab$
$= a^2 + b^2 + 2ab – (– 4ab + 2b^2)$
It can be written as
$= a^2 + b^2 + 2ab + 4ab - 2b^2$
By further calculation
$= a^2 + b^2 - 2b^2 + 2ab + 4ab$
$= a^2 - b^2 + 6ab$

15. Find the excess of $4m^2 + 4n^2 + 4p^2$ over $m^2 + 3n^2 – 5p^2$.
Solution:

The answer can be obtained by subtracting $m^2 + 3n^2 – 5p^2$ from $4m^2 + 4n^2 + 4p^2$
$= (4m^2 + 4n^2 + 4p^2) – (m^2 + 3n^2 – 5p^2)$
It can be written as

$= 4m^2 + 4n^2 + 4p^2 - m^2 - 3n^2 + 5p^2$

By further calculation

$= 4m^2 - m^2 + 4n^2 - 3n^2 + 4p^2 + 5p^2$

$= 3m^2 + n^2 + 9p^2$

EXERCISE 11C

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1. Multiply:
(i) 3x, $5x^2y$ and 2y
(ii) 5, 3a and $2ab^2$
(iii) 5x + 2y and 3xy
(iv) 6a – 5b and – 2a
(v) 4a + 5b and 4a – 5b
Solution:

(i) 3x, $5x^2y$ and 2y
Product = $3x \times 5x^2y \times 2y$
We can write it as
$= 3 \times 5 \times 2 \times x \times x^2 \times y \times y$
So we get
$= 30x^3y^2$

(ii) 5, 3a and $2ab^2$
Product = $5 \times 3a \times 2ab^2$
We can write it as
$= 5 \times 3 \times 2 \times a \times ab^2$
So we get
$= 30a^2b^2$

(iii) 5x + 2y and 3xy
Product = 3xy (5x + 2y)
We can write it as
$= 3xy \times 5x + 3xy \times 2y$
So we get
$= 15x^2y + 6xy^2$

(iv) 6a – 5b and – 2a
Product = - 2a (6a – 5b)
We can write it as
$= -2a \times 6a + 2a \times 5b$
So we get
$= -12a^2 + 10ab$

(v) 4a + 5b and 4a – 5b
Product = (4a + 5b) (4a – 5b)
So we get
$= 16a^2 – 25b^2$

$$\begin{array}{r} 4a + 5b \\ \times\ 4a - 5b \\ \hline 16a^2 + 20ab \\ \quad - 20ab - 25b^2 \\ \hline 16a^2 \quad - 25b^2 \end{array}$$

2. Copy and complete the following multiplications:

(i) $3a + 2b$ × $x - 3xy$

(ii) $9x - 5y$ × $x - 3xy$

(iii) $3xy - 2x^2 - 6x$ × $x - 5x^2 y$

(iv) $a + b$ × $x\ a + b$

(v) $ax - b$ × $x\ 2ax + 2b^2$

Solution:

(i) $3a + 2b$ × $x - 3xy$

$-9axy - 6bxy$

(ii) $9x - 5y$ × $x - 3xy$

$-27x^2y + 15xy^2$

(iii) $3xy - 2x^2 - 6x$ × $x - 5x^2 y$

$-15x^3y^2 + 10x^4y + 30x^3y$

(iv) $a + b$ × $x\ a + b$

$a^2 + ab$

$ab + b^2$

$a^2 + 2ab + b^2$

(v) $ax - b$ × $x\ 2ax + 2b^2$

$2a^2x^2 - 2abx + 2b^2x - 2b^3$

3. Evaluate:
(i) (c + 5) (c – 3)
(ii) (3c – 5d) (4c – 6d)
(iii) (1/2a + 1/2b) (1/2a – 1/2b)
(iv) (a^2 + 2ab + b^2) (a + b)
(v) (3x – 1) ($4x^3$ – $2x^2$ + 6x – 3)
Solution:

(i) (c + 5) (c – 3)
It can be written as
= c (c – 3) + 5 (c – 3)
By further calculation
= c^2 – 3c + 5c – 15
= c^2 + 2c – 15

(ii) (3c – 5d) (4c – 6d)
It can be written as
= 3c (4c – 6d) – 5d (4c – 6d)
By further calculation
= $12c^2 – 18cd – 20cd + 30d^2$
= $12c^2 – 38d + 30d^2$

(iii) (1/2a + 1/2b) (1/2a – 1/2b)
It can be written as
= 1/2a (1/2a – 1/2b) + 1/2b (1/2a – 1/2b)
By further calculation
= $1/4a^2 – 1/4ab + 1/4ab – 1/4b^2$
= $1/4a^2 – 1/4b^2$

(iv) $(a^2 + 2ab + b^2) (a + b)$
It can be written as
= a $(a^2 + 2ab + b^2)$ + b $(a^2 + 2ab + b^2)$
By further calculation
= $a^3 + 2a^2b + ab^2 + a^2b + 2ab^2 + b^3$
= $a^3 + b^3 + 3a^2b + 3ab^2$

(v) $(3x – 1) (4x^3 – 2x^2 + 6x – 3)$
It can be written as
= 3x $(4x^3 – 2x^2 + 6x – 3)$ – 1 $(4x^3 – 2x^2 + 6x – 3)$
By further calculation
= $12x^4 – 6x^3 + 18x^2 – 9x – 4x^3 + 2x^2 – 6x + 3$
= $12x^4 – 6x^3 – 4x^3 + 18x^2 + 2x^2 – 9x – 6x + 3$
So we get
= $12x^4 – 10x^3 + 20x^2 – 15x + 3$

4. Evaluate:
(i) (a + b) (a – b).
(ii) $(a^2 + b^2) (a + b) (a – b)$, using the result of (i).
(iii) $(a^4 + b^4) (a^2 + b^2) (a + b) (a – b)$, using the result of (ii).
Solution:

(i) (a + b) (a – b).
It can be written as
= a (a – b) + b (a – b)
By further calculation
= $a^2 – ab + ab – b^2$
= $a^2 – b^2$

(ii) $(a^2 + b^2) (a + b) (a – b)$
Substituting the result of (i)
= $(a^2 + b^2) (a^2 – b^2)$
It can be written as
= $a^2 (a^2 – b^2) + b^2 (a^2 – b^2)$
So we get
= $a^4 – a^2b^2 + a^2b^2 – b^4$

$= a^4 – b^4$

(iii) $(a^4 + b^4) (a^2 + b^2) (a + b) (a – b)$
Substituting the result of (ii)
$= (a^4 + b^4) (a^4 – b^4)$
It can be written as
$= a^4 (a^4 – b^4) + b^4 (a^4 – b^4)$
By further calculation
$= a^8 – a^4b^4 + a^4b^4 – b^8$
$= a^8 – b^8$

5. Evaluate:
(i) (3x – 2y) (4x + 3y)
(ii) (3x – 2y) (4x + 3y) (8x – 5y)
(iii) (a + 5) (3a – 2) (5a + 1)
(iv) (a + 1) (a^2 – a + 1) and (a – 1) (a^2 + a + 1); and then: (a + 1) (a^2 – a + 1) + (a – 1) (a^2 + a + 1)
(v) (5m – 2n) (5m + 2n) ($25m^2 + 4n^2$)
Solution:

(i) (3x – 2y) (4x + 3y)
It can be written as
$= 3x (4x + 3y) – 2y (4x + 3y)$
By further calculation
$= 12x^2 + 9xy – 8xy – 6y^2$
So we get
$= 12x^2 + xy – 6y^2$

(ii) (3x – 2y) (4x + 3y) (8x – 5y)
Substituting result of (i)
$= (12x^2 + xy – 6y^2) (8x – 5y)$
It can be written as
$= 8x (12x^2 + xy – 6y^2) – 5y (12x^2 + xy – 6y^2)$
By further calculation
$= 96x^3 + 8x^2y – 48xy^2 – 60x^2y – 5xy^2 + 30y^3$
So we get
$= 96x^3 + 8x^2y – 60x^2y – 48xy^2 – 5xy^2 + 30y^3$
$= 96x^3 - 52\ x^2y – 53xy^2 + 30y^3$

(iii) (a + 5) (3a – 2) (5a + 1)
It can be written as
$= a (3a – 2) + 5 (3a – 2) (5a + 1)$
By further calculation
$= (3a^2 – 2a + 15a – 10) (5a + 1)$
So we get
$= (3a^2 + 13a – 10) (5a + 1)$
We can write it as
$= 5a (3a^2 + 13a – 10) + 1 (3a^2 + 13a – 10)$
By further calculation
$= 15a^3 + 65a^2 – 50a + 3a^2 + 13a – 10$
$= 15a^3 + 68a^2 – 37a - 10$

(iv) $(a + 1) (a^2 – a + 1)$ and $(a – 1) (a^2 + a + 1)$; and then: $(a + 1) (a^2 – a + 1) + (a – 1) (a^2 + a + 1)$
Consider
$(a + 1) (a^2 – a + 1)$
It can be written as
$= a (a^2 – a + 1) + 1 (a^2 – a + 1)$
By further calculation
$= a^3 – a^2 + a + a^2 – a + 1$
So we get
$= a^3 + 1$

$(a – 1) (a^2 + a + 1)$
It can be written as
$= a (a^2 + a + 1) – 1 (a^2 + a + 1)$
By further calculation
$= a^3 + a^2 + a – a^2 – a – 1$
So we get
$= a^3 – 1$

Here
$(a + 1) (a^2 – a + 1) + (a – 1) (a^2 + a + 1)$
$= a^3 + 1 + a^3 – 1$
$= 2a^3$

(v) $(5m – 2n) (5m + 2n) (25m^2 + 4n^2)$
It can be written as
$= [5m (5m + 2n) – 2n (5m + 2n)] (25m^2 + 4n^2)$
By further calculation
$= (25m^2 + 10mn – 10mn – 4n^2) (25m^2 + 4n^2)$
So we get
$= (25m^2 - 4n^2) (25m^2 + 4n^2)$
We can write it as
$= 25m^2 (25m^2 + 4n^2) – 4n^2 (25m^2 + 4n^2)$
By multiplying the terms
$= 625m^4 + 100m^2n^2 – 100m^2n^2 – 16n^4$
$= 625m^4 - 16n^4$

6. Multiply:
(i) mn^4, m^3n and $5m^2n^3$
(ii) 2mnpq, 4mnpq and 5mnpq
(iii) pq – pm and p^2m
(iv) $x^3 – 3y^3$ and $4x^2y^2$
(v) $a^3 – 4ab$ and $2a^2b$
Solution:

(i) mn^4, m^3n and $5m^2n^3$
It can be written as
$= 5m^2n^3 \times mn^4 \times m^3n$
By further calculation
$= 5m^{(2 + 1 + 3)} n^{(3 + 4 + 1)}$
$= 5m^6n^8$

(ii) 2mnpq, 4mnpq and 5mnpq
It can be written as
= 5mnpq × 2mnpq × 4mnpq
By further calculation
= $5 \times 2 \times 4\ m^{(1+1+1)}\ n^{(1+1+1)}\ p^{(1+1+1)}\ q^{(1+1+1)}$
= $40m^3n^3p^3q^3$

(iii) pq – pm and p^2m
It can be written as
= $p^2m \times (pq - pm)$
So we get
= $p^3qm - p^3m^2$

(iv) $x^3 - 3y^3$ and $4x^2y^2$
It can be written as
= $4x^2y^2 \times (x^3 - 3y^3)$
By further calculation
= $4x^5y^2 - 12x^2y^5$

(v) $a^3 - 4ab$ and $2a^2b$
It can be written as
= $2a^2b \times (a^3 - 4ab)$
By further calculation
= $2a^5b - 8a^3b^2$

7. Multiply:
(i) (2x + 3y) (2x + 3y)
(ii) (2x – 3y) (2x + 3y)
(iii) (2x + 3y) (2x – 3y)
(iv) (2x – 3y) (2x – 3y)
(v) (-2x + 3y) (2x – 3y)
Solution:

(i) (2x + 3y) (2x + 3y)
It can be written as
= 2x (2x + 3y) + 3y (2x + 3y)
By further calculation
= $4x^2 + 6xy + 6xy + 9y^2$
= $4x^2 + 12xy + 9y^2$

(ii) (2x – 3y) (2x + 3y)
It can be written as
= 2x (2x + 3y) – 3y (2x + 3y)
By further calculation
= $4x^2 + 6xy – 6xy – 9y^2$
= $4x^2 – 9y^2$

(iii) (2x + 3y) (2x – 3y)
It can be written as
= 2x (2x – 3y) + 3y (2x – 3y)

By further calculation
$= 4x^2 – 6xy + 6xy – 9y^2$
$= 4x^2 – 9y^2$

(iv) (2x – 3y) (2x – 3y)
It can be written as
= 2x (2x – 3y) – 3y (2x – 3y)
By further calculation
$= 4x^2 – 6xy – 6xy + 9y^2$
$= 4x^2 – 12xy + 9y^2$

(v) (-2x + 3y) (2x – 3y)
It can be written as
= -2x (2x – 3y) + 3y (2x – 3y)
By further calculation
$= - 4x^2 + 6xy + 6xy – 9y^2$
$= - 4x^2 + 12xy – 9y^2$

EXERCISE 11D

1. Divide:
(i) – 16ab^{2}c by 6abc
(ii) 25x^{2}y by – 5y^2
(iii) 8x + 24 by 4
(iv) 4a^2 – a by – a
(v) 8m – 16 by – 8
Solution:

(i) – 16ab^{2}c by 6abc
We can write it as
= – 16ab^{2}c/ 6abc
= -8/3 b

(ii) 25x^{2}y by – 5y^2
We can write it as
= 25x^{2}y/ -5y^2
= -5 x^2/y

(iii) 8x + 24 by 4
We can write it as
= (8x + 24)/4
Separating the terms
= 8x/4 + 24/4
= 2x + 6

(iv) 4a^2 – a by – a
We can write it as
= (4a^2 – a)/ -a
Separating the terms
= 4a^2/-a – a/-a
= - 4a + 1

(v) 8m – 16 by – 8
We can write it as
= (8m – 16)/ -8
Separating the terms
= 8m/-8 – 16/-8
= - m + 2

2. Divide:
(i) n^2 – 2n + 1 by n – 1
(ii) m^2 – 2mn + n^2 by m – n
(iii) 4a^2 + 4a + 1 by 2a + 1
(iv) p^2 + 4p + 4 by p + 2
(v) x^2 + 4xy + 4y^2 by x + 2y
Solution:

(i) n^2 – 2n + 1 by n – 1

$$
\begin{array}{r|l}
 & n - 1 \\
\hline
n - 1 & n^2 - 2n + 1 \\
 & n^2 - n \\
\hline
 & -n + 1 \\
 & -n + 1 \\
\hline
 & 0
\end{array}
$$

$n^2 – 2n + 1$ by $n – 1 = n – 1$

(ii) $m^2 – 2mn + n^2$ by $m – n$

$$
\begin{array}{r|l}
 & m - n \\
\hline
m - n & m^2 - 2mn + n^2 \\
 & m^2 - mn \\
\hline
 & -mn + n^2 \\
 & -mn + n^2 \\
\hline
 & 0
\end{array}
$$

$m^2 – 2mn + n^2$ by $m – n = m - n$

(iii) $4a^2 + 4a + 1$ by $2a + 1$

$$
\begin{array}{r|l}
 & 2a + 1 \\
\hline
2a + 1 & 4a^2 + 4a + 1 \\
 & 4a^2 + 2a \\
\hline
 & 2a + 1 \\
 & 2a + 1 \\
\hline
 & 0
\end{array}
$$

$4a^2 + 4a + 1$ by $2a + 1 = 2a + 1$

(iv) $p^2 + 4p + 4$ by $p + 2$

$$
\begin{array}{r|l}
 & p + 2 \\
\hline
p + 2 & p^2 + 4p + 4 \\
 & p^2 + 2p \\
\hline
 & 2p + 4 \\
 & 2p + 4 \\
\hline
 & 0
\end{array}
$$

$p^2 + 4p + 4$ by $p + 2 = p + 2$

(v) $x^2 + 4xy + 4y^2$ by $x + 2y$

$$
\begin{array}{r|l}
 & x + 2y \\
\hline
x + 2y & x^2 + 4xy + 4y^2 \\
 & x^2 + 2xy \\
\hline
 & 2xy + 4y^2 \\
 & 2xy + 4y^2 \\
\hline
 & 0
\end{array}
$$

$x^2 + 4xy + 4y^2$ by $x + 2y = x + 2y$

3. The area of a rectangle is $6x^2 – 4xy – 10y^2$ square unit and its length is $2x + 2y$ unit. Find its breadth.
Solution:

It is given that
Area of a rectangle = $6x^2 – 4xy – 10y^2$ square unit
Length = $2x + 2y$ unit
We know that
Breadth = Area/ Length
So we get
= $(6x^2 – 4xy – 10y^2)/ (2x + 2y)$
= $3x – 5y$ units

$$
\begin{array}{r|l}
 & 3x - 5y \\
\hline
2x + 2y & 6x^2 - 4xy - 10y^2 \\
 & 6x^2 + 6xy \\
\hline
 & - 10xy - 10y^2 \\
 & - 10xy - 10y^2 \\
\hline
 & 0
\end{array}
$$

4. The area of a rectangular field is $25x^2 + 20xy + 3y^2$ square unit. If its length is $5x + 3y$ unit, find its breadth. Hence, find its perimeter.
Solution:

It is given that
Area of a rectangular field = $25x^2 + 20xy + 3y^2$ square unit
Length = $5x +3y$ unit
We know that
Breadth = Area/ Length
So we get
= $(25x^2 + 20xy + 3y^2)/ (5x + 3y)$
= $5x + y$ units

$$
\begin{array}{r|l}
 & 5x + y \\
\hline
5x + 3y & 25x^2 + 20xy + 3y^2 \\
 & 25x^2 + 15xy \\
\hline
 & 5xy + 3y^2 \\
 & 5xy + 3y^2 \\
\hline
 & 0
\end{array}
$$

Now the perimeter of the rectangular field = 2 (length + breadth)
Substituting the values
= 2 (5x + 3y + 5x + y)
So we get
= 2 (10x + 4y)
= 20x + 8y

5. Divide:
(i) $2m^3n^5$ by – mn
(ii) $5x^2$ – 3x by x
(iii) $10x^3y – 9xy^2 – 4x^2y^2$ by xy
(iv) $3y^3 – 9ay^2 – 6ab^2y$ by – 3y
(v) $x^5 – 15x^4 – 10x^2$ by $– 5x^2$
Solution:

(i) $2m^3n^5$ by – mn
It can be written as
= $2m^3n^5$/ -mn
= $-2m^2n^4$

(ii) $5x^2$ – 3x by x
It can be written as
= $(5x^2 – 3x)$/ x
Separating the terms
= $5x^2/x – 3x/x$
= 5x – 3

(iii) $10x^3y – 9xy^2 – 4x^2y^2$ by xy
It can be written as
= $(10x^3y – 9xy^2 – 4x^2y^2)$/ xy
Separating the terms
= $10x^3y/xy – 9xy^2/xy – 4x^2y^2/xy$
= $10x^2 – 9y – 4xy$

(iv) $3y^3 – 9ay^2 – 6ab^2y$ by – 3y
It can be written as
= $(3y^3 – 9ay^2 – 6ab^2y)$/ -3y
Separating the terms
= $3y^3/-3y – 9ay^2/-3y – 6ab^2y$/ -3y
= $-y^2 + 3ay^2 + 2ab^2$

(v) $x^5 – 15x^4 – 10x^2$ by $– 5x^2$
It can be written as
= $(x^5 – 15x^4 – 10x^2)$/ $-5x^2$
Separating the terms
= $x^5/-5x^2 – 15x^4/-5x^2 – 10x^2/-5x^2$
= $-1/5x^3 + 3x^2 + 2$

EXERCISE 11E

Simplify:

1. x/2 + x/4

Solution:

x/2 + x/4
Taking LCM
= (2x + x)/4
= 3x/4

2. a/10 + 2a/5

Solution:

a/10 + 2a/5
Taking LCM
= (a + 4a)/ 10
= 5a/10
= a/2

3. y/4 + 3y/5

Solution:

y/4 + 3y/5
Taking LCM
= (5y + 12y)/ 20
= 17y/20

4. x/2 – x/8

Solution:

x/2 – x/8
Taking LCM
= (4x – x)/ 8
= 3x/8

5. 3y/4 – y/5

Solution:

3y/4 – y/5
Taking LCM
= (15y – 4y)/ 20
= 11y/20

6. 2p/3 – 3p/5

Solution:

2p/3 – 3p/5
Taking LCM
= (10p – 9p)/ 15

= p/15

7. k/2 + k/3 + 2k/5
Solution:

k/2 + k/3 + 2k/5
Here the LCM of 2, 3 and 5 is 30
= (15k + 10k + 12k)/ 30
= 37k/30

8. 2x/5 + 3x/4 – 3x/5
Solution:

2x/5 + 3x/4 – 3x/5
Here the LCM of 5 and 4 is 20
= (8x + 15x – 12x)/ 20
= 11x/20

9. 4a/7 – 2a/3 + a/7
Solution:

4a/7 – 2a/3 + a/7
Here the LCM of 3 and 7 is 21
= (12a – 14a + 3a)/ 21
= a/21

10. 2b/5 – 7b/15 + 13b/3
Solution:

2b/5 – 7b/15 + 13b/3
Here the LCM of 3, 5 and 15 is 15
= (6b – 7b + 65b)/ 15
= 64b/15

11. 6k/7 – (8k/9 – k/3)
Solution:

6k/7 – (8k/9 – k/3)
Here the LCM of 7, 9 and 3 is 63
= [54k – (56k – 21k)]/ 63
By further calculation
= (54k – 35k)/ 63
= 19k/63

12. 3a/8 + 4a/5 – (a/2 + 2a/5)
Solution:

3a/8 + 4a/5 – (a/2 + 2a/5)
Here the LCM of 8, 5 and 2 is 40
= [15a + 32a – (20a + 16a)]/ 40

By further calculation
= (47a – 36a)/ 40
= 11a/40

13. x + x/2 + x/3
Solution:

x + x/2 + x/3
Taking LCM
= (6x + 3x + 2x)/ 6
= 11x/6

14. y/5 + y – 19y/15
Solution:

y/5 + y – 19y/15
Here the LCM of 5 and 15 is 15
= (3y + 15y – 19y)/ 15
So we get
= - y/15

15. x/5 + (x + 1)/2
Solution:

x/5 + (x + 1)/2
Here the LCM of 5 and 2 is 10
= (2x + 5x + 5)/ 10
= (7x + 5)/ 10

EXERCISE 11F

Enclose the given terms in brackets as required:

1. $x – y – z = z – (……)$

2. $x^2 – xy^2 – 2xy – y^2 = x^2 – (……)$

3. $4a – 9 + 2b – 6 = 4a – (……..)$

4. $x^2 – y^2 + z^2 + 3x – 2y = x^2 – (……)$

5. $-2a^2 + 4ab – 6a^2b^2 + 8ab^2 = -2a (……)$

Solution:

1. $x – y – z = z – (y + z)$

2. $x^2 – xy^2 – 2xy – y^2 = x^2 – (xy^2 + 2xy + y^2)$

3. $4a – 9 + 2b – 6 = 4a – (9 – 2b + 6)$

4. $x^2 – y^2 + z^2 + 3x – 2y = x^2 – (y^2 – z^2 – 3x + 2y)$

5. $-2a^2 + 4ab – 6a^2b^2 + 8ab^2 = -2a (a – 2b + 3ab^2 – 4b^2)$

Simplify:

6. 2x – (x + 2y – z)

Solution:

2x – (x + 2y – z)
We can write it as
= 2x – x – 2y + z
So we get
= x – 2y + z

7. p + q – (p – q) + (2p – 3q)

Solution:

p + q – (p – q) + (2p – 3q)
We can write it as
= p + q – p + q + 2p – 3q
So we get
= 2p - q

8. 9x – (-4x + 5)

Solution:

9x – (- 4x + 5)
We can write it as
= 9x + 4x – 5
So we get
= 13x - 5

9. 6a – (- 5a – 8b) + (3a + b)

Solution:

6a – (- 5a – 8b) + (3a + b)
We can write it as
= 6a + 5a + 8b + 3a + b
So we get
= 6a + 5a + 3a + 8b + b
= 14a + 9b

10. (p – 2q) – (3q – r)
Solution:

(p – 2q) – (3q – r)
We can write it as
= p – 2q – 3q + r
So we get
= p – 5q + r

11. 9a (2b – 3a + 7c)
Solution:

9a (2b – 3a + 7c)
We can write it as
= $18ab – 27a^2 + 63ca$

12. – 5m (- 2m + 3n – 7p)
Solution:

– 5m (- 2m + 3n – 7p)
We can write it as
= $10m^2 – 15mn + 35mp$

13. – 2x (x + y) + x^2
Solution:

– 2x (x + y) + x^2
We can write it as
= $-2x^2 – 2xy + x^2$
So we get
= $- x^2 – 2xy$

14. b (2b – 1/b) – 2b (b – 1/b)
Solution:

b (2b – 1/b) – 2b (b – 1/b)
We can write it as
= $2b^2 – 1 – 2b^2 + 2$
So we get
= 1

15. 8 (2a + 3b – c) – 10 (a + 2b + 3c)
Solution:

8 (2a + 3b – c) – 10 (a + 2b + 3c)
We can write it as
= 16a + 24b – 8c – 10a – 20b – 30c
So we get
= 6a + 4b – 38c