

7. Factorization

Exercise 7.1

1. Question

Find the greatest common factor (GCF/HCF) of the following polynomials

$$2x^2 \text{ and } 12x^2$$

Answer

The numerical coefficients of given numerical are 2, 12

Greatest common factor of 2, 12 is 2

Common literals appearing in given numerical is x

Smallest power of x in two monomials = 2

Monomials of common literals with smallest power = x^2

Hence, the greatest common factor = $2x^2$

2. Question

Find the greatest common factor (GCF/HCF) of the following polynomials:

$$6x^3y \text{ and } 18x^2y^3$$

Answer

The numerical coefficients of given numerical are 6, 18

Greatest common factor of 6, 18 is 6

Common literals appearing in given numerical are x and y

Smallest power of x in both monomials = 2

Smallest power of y in both monomials = 1

Binomials of common literals with smallest power = x^2y

Hence, the greatest common factor = $6x^2y$

3. Question

Find the greatest common factor (GCF/HCF) of the following polynomials:

$$7x, 21x^2 \text{ and } 14xy^2$$

Answer

The numerical coefficients of given numerical are 7, 21, 14

Greatest common factor of 7, 21, 14 is 7

Common literals appearing in given numerical are x and y

Smallest power of x in three monomials = 1

Smallest power of y in three monomials = 0

Monomials of common literals with smallest power = x

Hence, the greatest common factor = $7x$

4. Question

Find the greatest common factor (GCF/HCF) of the following polynomials:

$42x^2yz$ and $63x^3y^2z^3$

Answer

The numerical coefficients of given numerical are 42 and 63.

Greatest common factor of 42, 63 is 21.

Common literals appearing in given numerical are x, y and z

Smallest power of x in two monomials = 2

Smallest power of y in two monomials = 1

Smallest power of z in two monomials = 1

Monomials of common literals with smallest power = x^2yz

Hence, the greatest common factor = $21x^2yz$

5. Question

Find the greatest common factor (GCF/HCF) of the following polynomials:

$12ax^2$, $6a^2x^3$ and $2a^3x^5$

Answer

The numerical coefficients of given numerical are 12, 6, 2

Greatest common factor of 12, 6, 2 is 2.

Common literals appearing in given numerical are a and x

Smallest power of x in three monomials = 2

Smallest power of a in three monomials = 1

Monomials of common literals with smallest power = ax^2

Hence, the greatest common factor = $2ax^2$

6. Question

Find the greatest common factor (GCF/HCF) of the following polynomials:

$9x^2$, $15x^2y^3$, $6xy^2$ and $21x^2y^5$

Answer

The numerical coefficients of given numerical are 9, 15, 16, 21

Greatest common factor of 9, 15, 16, 21 is 3.

Common literals appearing in given numerical are x and y

Smallest power of x in four monomials = 1

Smallest power of y in four monomials = 0

Monomials of common literals with smallest power = x

Hence, the greatest common factor = 3x

7. Question

Find the greatest common factor (GCF/HCF) of the following polynomials:

$4a^2b^3$, $-21a^3b$, $18a^4b^3$

Answer

The numerical coefficients of given numerical are 4, -12, 18.

Greatest common factor of 4, -12, 18 is 2.

Common literals appearing in given numerical are a and b

Smallest power of a in three monomials = 2

Smallest power of b in three monomials = 1

Monomials of common literals with smallest power = a^2b

Hence, the greatest common factor = $2a^2b$

8. Question

Find the greatest common factor (GCF/HCF) of the following polynomials:

$$6x^2y^2, -9xy^3, 3x^3y^2$$

Answer

The numerical coefficients of given numerical are 6, 9, 3

Greatest common factor of 6, 9, 3 is 3.

Common literals appearing in given numerical are x and y

Smallest power of x in three monomials = 1

Smallest power of y in three monomials = 2

Monomials of common literals with smallest power = xy^2

Hence, the greatest common factor = $3xy^2$

9. Question

Find the greatest common factor (GCF/HCF) of the following polynomials:

$$a^2b^3, a^3b^2$$

Answer

The numerical coefficients of given numerical are 0

Common literals appearing in given numerical are a and b

Smallest power of a in two monomials = 2

Smallest power of b in two monomials = 2

Monomials of common literals with smallest power = the greatest common factor = a^2b^2

10. Question

Find the greatest common factor (GCF/HCF) of the following polynomials:

$$36a^2b^2c^4, 54a^4c^2, 90a^4b^2c^2$$

Answer

The numerical coefficients of given numerical are 36, 54, 90

Greatest common factor of 36, 54, 90 is 18.

Common literals appearing in given numerical are a, b and c

Smallest power of a in three monomials = 2

Smallest power of b in three monomials = 0

Smallest power of c in three monomials = 2

Monomials of common literals with smallest power = a^2c^2

Hence, the greatest common factor = $18a^2c^2$

11. Question

Find the greatest common factor (GCF/HCF) of the following polynomials:

$$x^3, yx^2$$

Answer

The numerical coefficients of given numerical are 0

Common literals appearing in given numerical are x and y

Smallest power of x in two monomials = 2

Smallest power of y in two monomials = 0

Monomials of common literals with smallest power = x^2

Hence, the greatest common factor = x^2

12. Question

Find the greatest common factor (GCF/HCF) of the following polynomials:

$$15a^3, -54a^2, -150a$$

Answer

The numerical coefficients of given numerical are 15, -45, -150

Greatest common factor of 15, -45, -150 is 15.

Common literals appearing in given numerical is smallest power of a in three monomials = 1

Monomials of common literals with smallest power = a

Hence, the greatest common factor = 15a

13. Question

Find the greatest common factor (GCF/HCF) of the following polynomials:

$$2x^3y^2, -10x^2y^3, 14xy$$

Answer

The numerical coefficients of given numerical are 2, 10, 14.

Greatest common factor of 2, 10, 14 is 2.

Common literals appearing in given numerical are x and y

Smallest power of x in three monomials = 1

Smallest power of y in three monomials = 1

Monomials of common literals with smallest power = xy

Hence, the greatest common factor = 2xy

14. Question

Find the greatest common factor (GCF/HCF) of the following polynomials:

$$14x^3y^5, -10x^5y^3, 12x^2y^2$$

Answer

The numerical coefficients of given numerical are 14, 10, 2.

Greatest common factor of 14, 10, 2 is 2.

Common literals appearing in given numerical are x and y

Smallest power of x in three monomials = 2

Smallest power of y in three monomials = 2

Monomials of common literals with smallest power = x^2y^2

Hence, the greatest common factor = $2x^2y^2$

15. Question

Find the greatest common factor of the terms in each of the following expressions:

$$5a^5 + 10a^5 - 15a^2$$

Answer

The highest common factor of three terms = $5a^2$

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

16. Question

Find the greatest common factor of the terms in each of the following expressions:

$$2xyz + 3x^2y + 4y^2$$

Answer

The highest common factor of three terms = y

Therefore,

$$= y(2xz + 3x^2 + 4y)$$

17. Question

Find the greatest common factor of the terms in each of the following expressions:

$$3a^2b^2 + 4b^2c^2 + 12a^2b^2c^2$$

Answer

The highest common factor of three terms = b^2

Therefore,

$$3a^2b^2 + 4b^2c^2 + 12a^2b^2c^2 = b^2(3a^2 + 4c^2 + 12a^2c^2)$$

Exercise 7.2

1. Question

Factorize the following:

$$3x - 9$$

Answer

Greatest common factor of the two terms namely 3x and -9 of expression 3x - 9 is 3

$$3x = 3 \times x \text{ and } -9 = 3 \times (-3)$$

$$3x - 9 = 3(x - 3)$$

2. Question

Factorize the following:

$$5x - 15x^2$$

Answer

Greatest common factor of the two terms namely $5x$ and $-15x^2$ of expression $5x - 15x^2$ is $5x - 15x^2$

$$5x = 5x(1) \text{ and } -15x^2 = 5x(-3x)$$

$$5x - 15x^2 = 5x(1 - 3x)$$

3. Question

Factorize the following:

$$20a^{12}b^2 - 15a^8b^4$$

Answer

Greatest common factor of the two terms namely $20a^{12}b^2$ and $-15a^8b^4$ of expression $20a^{12}b^2 - 15a^8b^4$ is $5a^8b^2$

$$20a^{12}b^2 = 5a^8b^2 (4a^4) \text{ and } -15a^8b^4 = 5a^8b^2 (-3b^2)$$

$$20a^{12}b^2 - 15a^8b^4 = 5a^8b^2 (4a^4 - 3b^2) = 5a^8b^2((2a)^2 - (b\sqrt{3})^2) = 5a^8b^2(2a + b\sqrt{3})(2a - b\sqrt{3})$$

4. Question

Factorize the following:

$$72x^6y^7 - 96x^7y^6$$

Answer

Greatest common factor of the two terms namely $72x^6y^7$ and $-96x^7y^6$ of expression $72x^6y^7 - 96x^7y^6$ is $24x^6y^6$

$$72x^6y^7 = 24x^6y^6 (3y) \text{ and } -96x^7y^6 = 24x^6y^6(-4x)$$

$$72x^6y^7 - 96x^7y^6 = 24x^6y^6 (3y - 4x)$$

5. Question

Factorize the following:

$$20x^3 - 40x^2 + 80x$$

Answer

Greatest common factor of the two terms namely $20x^3$, $-40x^2$ and $80x$ of expression $20x^3 - 40x^2 + 80x$ is $20x$

$$20x^3 - 40x^2 + 80x = 20x(x^2 - 2x + 4)$$

6. Question

Factorize the following:

$$2x^3y^2 - 4x^2y^3 + 8xy^4$$

Answer

Greatest common factor of the two terms namely $2x^3y^2$, $-4x^2y^3$, $-8xy^4$ of expression $2x^3y^2 - 4x^2y^3 - 8xy^4$ is $2xy^2$

$$2x^3y^2 - 4x^2y^3 - 8xy^4 = 2xy^2 (x^2 - 2xy + 4y)$$

7. Question

Factorize the following:

$$10m^3n^2 + 15m^4n - 20m^2n^3$$

Answer

Greatest common factor of the two terms namely $10m^3n^2$, $15m^4n$, $-20m^2n^3$ of expression $10m^3n^2 + 15m^4n - 20m^2n^3$ is $5mn^2$

$$10m^3n^2 + 15m^4n - 20m^2n^3 = 5mn^2(2mn + 3m^2 - 4n)$$

8. Question

Factorize the following:

$$2a^4b^4 - 3a^3b^5 + 4a^2b^5$$

Answer

Greatest common factor of the two terms namely $2a^4b^4$, $-3a^3b^5$, $4a^2b^5$ of expression $2a^4b^4 - 3a^3b^5 + 4a^2b^5$ is a^2b^4

$$2a^4b^4 - 3a^3b^5 + 4a^2b^5 = a^2b^4(2a^2 - 3ab + 4b)$$

9. Question

Factorize the following:

$$28a^2 + 14a^2b^2 - 21a^4$$

Answer

Greatest common factor of the two terms namely $28a^2$, $14a^2b^2$, $-21a^4$ of expression $28a^2 + 14a^2b^2 - 21a^4$ is $7a^2$

$$28a^2 + 14a^2b^2 - 21a^4 = 7a^2(4 + 2b^2 - 3a^2)$$

10. Question

Factorize the following:

$$a^4b - 3a^2b^2 - 6ab^3$$

Answer

Greatest common factor of the two terms namely a^4b , $-3a^2b^2$, $-6ab^3$ of expression $a^4b - 3a^2b^2 - 6ab^3$ is ab

$$a^4b - 3a^2b^2 - 6ab^3 = ab(a^3 - 3ab - 6ab^2)$$

11. Question

Factorize the following:

$$2l^2mn - 3lm^2n + 4lmn^2$$

Answer

Greatest common factor of the two terms namely $2l^2mn$, $-3lm^2n$, $4lmn^2$ of expression $2l^2mn - 3lm^2n + 4lmn^2$ is lm

$$2l^2mn - 3lm^2n + 4lmn^2 = lm(2l - 3m + 4n)$$

12. Question

Factorize the following:

$$x^4y^2 - x^2y^4 - x^4y^4$$

Answer

Greatest common factor of the two terms namely x^4y^2 , $-x^2y^4$, $-x^4y^4$ of expression $x^4y^2 - x^2y^4 - x^4y^4$ is x^2y^2

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

13. Question

Factorize the following:

$$9x^2y + 3axy$$

Answer

Greatest common factor of the two terms namely $9x^2y$ and $3axy$ of expression $9x^2y + 3axy$ is $3xy$

$$9x^2y + 3axy = 3xy(3x^2 + a)$$

14. Question

Factorize the following:

$$16m - 4m^2$$

Answer

Greatest common factor of the two terms namely $16m - 4m^2$ of expression $16m - 4m^2$ is $4m$

$$16m - 4m^2 = 4m(4 - m)$$

15. Question

Factorize the following:

$$-4a^2 + 4ab - 4ca$$

Answer

Greatest common factor of the two terms namely $-4a$, $4ab$, $-4ca$ of expression $-4a + 4ab - 4ca$ is $-4a$

$$-4a + 4ab - 4ca = -4a(a - b + c)$$

16. Question

Factorize the following:

$$16m - 4m^2$$

Answer

Greatest common factor of the two terms namely x^2yz , xy^2z , xyz^2 of expression $x^2yz + xy^2z + xyz^2$ is xyz

$$x^2yz + xy^2z + xyz^2 = xyz(x + y + z)$$

17. Question

Factorize the following:

$$ax^2y + bxy^2 + cxyz$$

Answer

Greatest common factor of the two terms namely $-4a$, $4ab$, $-4ca$ of expression $-4a + 4ab - 4ca$ is $-4a$

$$ax^2y + bxy^2 + cxyz = xy(ax + by + cz)$$

Exercise 7.3

1. Question

Factorize each of the following algebraic expressions:

$$6x(2x - y) + 7y(2x - y)$$

Answer

$$(6x + 7y)(2x - y) \text{ [Therefore, taking } (2x - y) \text{ common]}$$

2. Question

Factorize each of the following algebraic expressions:

$$2r(y - z) + s(x - y)$$

Answer

$$-2r(x - y) + s(x - y) \text{ [Therefore, taking } -1 \text{ common]}$$

$$= (x - y)(-2r + s) \text{ [Therefore, taking } (x - y) \text{ common]}$$

$$= (x - y)(s - 2r)$$

3. Question

Factorize each of the following algebraic expressions:

$$7a(2x - 3) + 3b(2x - 3)$$

Answer

$$(7a + 3b)(2x - 3) \text{ [Therefore, taking } (2x - 3) \text{ common]}$$

4. Question

Factorize each of the following algebraic expressions:

$$9a(6a - 5b) - 12a^2(6a - 5b)$$

Answer

$$(9a - 12a^2)(6a - 5b) \text{ [Therefore, taking } (6a - 5b) \text{ common]}$$

5. Question

Factorize each of the following algebraic expressions:

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

Answer

$$(x - 2y)[5(x - 2y) + 3] \text{ [Therefore, taking } (x - 2y) \text{ common]}$$

$$= (x - 2y)(5x - 10y + 3)$$

6. Question

Factorize each of the following algebraic expressions:

$$16(2l - 3m)^2 - 12(3m - 2l)$$

Answer

$$16(2l - 3m)^2 + 12(2l - 3m) \text{ [Therefore, } 3m - 2l = -(2l - 3m)]$$

$$= 4(2l - 3m)[4(2l - 3m) + 3] \text{ [Therefore, taking } 4(2l - 3m) \text{ common]}$$

$$= 4(2l - 3m)(8l - 12m + 3)$$

7. Question

Factorize each of the following algebraic expressions:

$$3a(x - 2y) - b(x - 2y)$$

Answer

$$(3a - b)(x - 2y) \text{ [Therefore, taking } (x - 2y) \text{ as common]}$$

8. Question

Factorize each of the following algebraic expressions:

$$a^2(x+y) + b^2(x+y) + c^2(x+y)$$

Answer

$$(a^2 + b^2 + c^2)(x+y) \text{ [Therefore, taking } (x+y) \text{ common in each term]}$$

9. Question

Factorize each of the following algebraic expressions:

$$(x-y)^2 + (x-y)$$

Answer

$$(x-y)(x-y+1) \text{ [Therefore, taking } (x-y) \text{ common]}$$

10. Question

Factorize each of the following algebraic expressions:

$$6(a+2b) - 4(a+2b)^2$$

Answer

$$[6 - 4(a+2b)](a+2b) \text{ [Therefore, taking } (a+2b) \text{ common]}$$

$$= (6 - 4a - 8b)(a+2b)$$

11. Question

Factorize each of the following algebraic expressions:

$$a(x-y) + 2b(y-x) + c(x-y)^2$$

Answer

$$a(x-y) - 2b(x-y) + c(x-y)^2 \text{ [Therefore, } (y-x) = -(x-y)\text{]}$$

$$= (x-y)[a - 2b + c(x-y)]$$

$$= (x-y)(a - 2b + cx - cy)$$

12. Question

Factorize each of the following algebraic expressions:

$$-4(x-2y)^2 + 8(x-2y)$$

Answer

$$-(x-2y)[4(x-2y) - 8] \text{ [Therefore, taking } -(x-2y) \text{ as common]}$$

$$= -(x-2y)(4x - 8y - 8)$$

13. Question

Factorize each of the following algebraic expressions:

$$x^3(a-2b) + x^2(a-2b)$$

Answer

$$x^2(a-2b)(x+1) \text{ [Therefore, taking } x^2(a-2b) \text{ as common]}$$

14. Question

Factorize each of the following algebraic expressions:

$$(2x-3y)(a+b) + (3x-2y)(a+b)$$

Answer

$$(a + b)(2x - 3y + 3x - 2y) \text{ [Therefore, taking } (a + b) \text{ common]} \\ = (a + b)(5x - 5y)$$

15. Question

Factorize each of the following algebraic expressions:

$$4(x + y)(3a - b) + 6(x + y)(2b - 3a)$$

Answer

$$2(x + y)[2(3a - b) + 3(2b - 3a)] \text{ [Therefore, by taking } 2(x + y) \text{ common]} \\ = 2(x + y)(4b - 3a)$$

Exercise 7.4

1. Question

Factorize each of the following expressions:

$$qr - pr + qs - ps$$

Answer

$$q(r + s) - p(r + s) \\ = (q - p)(r + s)$$

2. Question

Factorize each of the following expressions:

$$p^2q - pr^2 - pq + r^2$$

Answer

$$p(pq - r^2) - 1(pq - r^2) \\ = (p - 1)(pq - r^2)$$

3. Question

Factorize each of the following expressions:

$$1 + x + xy + x^2y$$

Answer

$$1(1 + xy) + x(1 + xy) \\ = (1 + x)(1 + xy)$$

4. Question

Factorize each of the following expressions:

$$ax + ay - bx - by$$

Answer

$$a(x + y) - b(x + y) \\ = (a - b)(x + y)$$

5. Question

Factorize each of the following expressions:

$$xa^2 + xb^2 - ya^2 - yb^2$$

Answer

$$\begin{aligned} & x(a^2 + b^2) - y(a^2 + b^2) \\ &= (x - y)(a^2 + b^2) \end{aligned}$$

6. Question

Factorize each of the following expressions:

$$x^2 + xy + xzyz$$

Answer

$$\begin{aligned} & x(x + 3) + y(x + 3) \\ &= (x + y)(x + 3) \end{aligned}$$

7. Question

Factorize each of the following expressions:

$$2ax + bx + 2ay + by$$

Answer

$$\begin{aligned} & 2a(x + y) + b(x + y) \\ &= (2a + b)(x + y) \end{aligned}$$

8. Question

Factorize each of the following expressions:

$$ax - by - ay + y^2$$

Answer

$$\begin{aligned} & a(b - y) - y(b - y) \\ &= (a - y)(b - y) \end{aligned}$$

9. Question

Factorize each of the following expressions:

$$axy + bcxy - az - bcz$$

Answer

$$\begin{aligned} & a(xy - z) + bc(xy - z) \\ &= (a + bc)(xy - z) \end{aligned}$$

10. Question

Factorize each of the following expressions:

$$lm^2 - mn^2 - lm + n^2$$

Answer

$$\begin{aligned} & 2m(m - 1) - n^2(m - 1) \\ &= (2m - n^2)(m - 1) \end{aligned}$$

11. Question

Factorize each of the following expressions:

$$x^3 - y^2 + x - x^2y^2$$

Answer

$$y^2 (1 + x^2) + x (1 + x^2) \\ = (x - y^2) (1 + x^2)$$

12. Question

Factorize each of the following expressions:

$$6xy + 6 - 9y - 4x$$

Answer

$$2x (3y - 2) - 3 (3y - 2) \\ = (2x - 3) (3y - 2)$$

13. Question

Factorize each of the following expressions:

$$x^2 - 2ax - 2ab + bx$$

Answer

$$x (x + b) - 2a (x + b) \\ = (x - 2a) (x + b)$$

14. Question

Factorize each of the following expressions:

$$x^3 - 2x^2y + 3xy^2 - 6y^3$$

Answer

$$x (x^2 + 3y^2) - 2y (x^2 + 3y^2) \\ = (x - 2y) (x^2 + 3y^2)$$

15. Question

Factorize each of the following expressions:

$$abx^2 + (ay - b)x - y$$

Answer

$$abx^2 - ayx - bx - y \\ = bx (ax - 1) + y (ax - 1) \\ = (bx + y) (ax - 1)$$

16. Question

Factorize each of the following expressions:

$$(ax + by)^2 + (bx - ay)^2$$

Answer

$$a^2x^2 + b^2y^2 + 2axby + b^2x^2 + a^2y^2 - 2axby \\ = a^2 (x^2 + y^2) + b^2 (x^2 + y^2) \\ = (a^2 + b^2) (x^2 + y^2)$$

17. Question

Factorize each of the following expressions:

$$16(a-b)^3 - 24(a-b)^2$$

Answer

$$\begin{aligned} & 8(a-b)^2 [2(a-b) - 3] \\ & = 8(a-b)^2 [2a - 2b - 3] \end{aligned}$$

18. Question

Factorize each of the following expressions:

$$ab(x^2 + 1) + x(a^2 + b^2)$$

Answer

$$\begin{aligned} & abx^2 + ab + xa^2 + xb^2 \\ & = ax(bx + a) + b(bx + a) \\ & = (ax + b)(bx + a) \end{aligned}$$

19. Question

Factorize each of the following expressions:

$$a^2x^2 + (ax^2 + 1)x + a$$

Answer

$$\begin{aligned} & a^2x^2 + ax^3 + x + a \\ & = x(ax^2 + 1) + a(ax^2 + 1) \\ & = (x + a)(ax^2 + 1) \end{aligned}$$

20. Question

Factorize each of the following expressions:

$$a(a - 2b - c) + 2bc$$

Answer

$$\begin{aligned} & a^2 - 2ab - ac + 2bc \\ & = a(a - c) - 2b(a - c) \\ & = (a - 2b)(a - c) \end{aligned}$$

21. Question

Factorize each of the following expressions:

$$a(a + b - c) - bc$$

Answer

$$\begin{aligned} & a^2 + ab + ac - bc \\ & = a(a - c) + b(a - c) \\ & = (a + b)(a - c) \end{aligned}$$

22. Question

Factorize each of the following expressions:

$$x^2 - 11xy - x + 11y$$

Answer

$$\begin{aligned} & x(x - 1) - 11y(x - 1) \\ &= (x - 11y)(x - 1) \end{aligned}$$

23. Question

Factorize each of the following expressions:

$$ab - a - b + 1$$

Answer

$$\begin{aligned} & a(b - 1) - 1(b - 1) \\ &= (a - 1)(b - 1) \end{aligned}$$

24. Question

Factorize each of the following expressions:

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

Answer

$$\begin{aligned} & x(x - 1) - y(x - 1) \\ &= (x - y)(x - 1) \end{aligned}$$

Exercise 7.5**1. Question**

Factorize each of the following expressions:

$$16x^2 - 25y^2$$

Answer

$$\begin{aligned} & (4x)^2 - (5y)^2 \\ &= (4x + 5y)(4x - 5y) \end{aligned}$$

2. Question

Factorize each of the following expressions:

$$27x^2 - 12y^2$$

Answer

Consider $27x^2 - 12y^2$, Taking 3 common we get, $3[(3x)^2 - (2y)^2]$ As we know $a^2 - b^2 = (a-b)(a+b)$

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

3. Question

Factorize each of the following expressions:

$$144a^2 - 289b^2$$

Answer

$$\begin{aligned} & (12a)^2 - (17b)^2 \\ &= (12a + 17b)(12a - 17b) \end{aligned}$$

4. Question

Factorize each of the following expressions:

$$12m^2 - 27$$

Answer

$$3(4m^2 - 9)$$

$$= 3[(2m)^2 - 3^2]$$

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

5. Question

Factorize each of the following expressions:

$$125x^2 - 45y^2$$

Answer

$$5(25x^2 - 9y^2)$$

$$= 5[(5x)^2 - (3y)^2]$$

$$= 5(5x + 3y)(5x - 3y)$$

6. Question

Factorize each of the following expressions:

$$144a^2 - 169b^2$$

Answer

$$(12a)^2 - (13b)^2$$

$$= (12a + 13b)(12a - 13b)$$

7. Question

Factorize each of the following expressions:

$$(2a - b)^2 - 16c^2$$

Answer

$$(2a - b)^2 - (4c)^2$$

$$= (2a - b + 4c)(2a - b - 4c)$$

8. Question

Factorize each of the following expressions:

$$(x + 2y)^2 - 4(2x - y)^2$$

Answer

$$(x + 2y)^2 - [2(2x - y)]^2$$

$$= [(x + 2y) + 2(2x - y)][(x + 2y) - 2(2x - y)]$$

$$= (x + 4x + 2y - 2y)(x - 4x + 2y + 2y)$$

$$= (5x)(4y - 3x)$$

9. Question

Factorize each of the following expressions:

$$3a^5 - 48a^3$$

Answer

$$\begin{aligned} & 3a^3 (a^2 - 16) \\ & = 3a^3 (a^2 - 4^2) \\ & = 3a^3 (a + 4) (a - 4) \end{aligned}$$

10. Question

Factorize each of the following expressions:

$$a^4 - 16b^4$$

Answer

$$\begin{aligned} & (a^2)^2 - (4b^2)^2 \\ & = (a^2 + 4b^2) (a^2 - 4b^2) \end{aligned}$$

11. Question

Factorize each of the following expressions:

$$x^8 - 1$$

Answer

$$\begin{aligned} & (x^4)^2 - (1)^2 \\ & = (x^4 + 1) (x^4 - 1) \end{aligned}$$

12. Question

Factorize each of the following expressions:

$$64 - (a + 1)^2$$

Answer

$$\begin{aligned} & 8^2 - (a + 1)^2 \\ & = [8 + (a + 1)] [8 - (a + 1)] \\ & = (a + 9) (7 - a) \end{aligned}$$

13. Question

Factorize each of the following expressions:

$$36l^2 - (m + n)^2$$

Answer

$$\begin{aligned} & (6l)^2 - (m + n)^2 \\ & = (6l + m + n) (6l - m - n) \end{aligned}$$

14. Question

Factorize each of the following expressions:

$$25x^4y^4 - 1$$

Answer

$$\begin{aligned} & (5x^2y^2)^2 - (1)^2 \\ & = (5x^2y^2 - 1) (5x^2y^2 + 1) \end{aligned}$$

15. Question

Factorize each of the following expressions:

$$a^4 - \frac{1}{b^4}$$

Answer

$$\begin{aligned} & (a^2)^2 - \left(\frac{1}{b \cdot b}\right)^2 \\ & = \left(a^2 + \frac{1}{b \cdot b}\right) \left(a^2 - \frac{1}{b \cdot b}\right) \end{aligned}$$

16. Question

Factorize each of the following expressions:

$$x^3 - 144x$$

Answer

$$\begin{aligned} & x [x^2 - (12)^2] \\ & = x (x + 12) (x - 12) \end{aligned}$$

17. Question

Factorize each of the following expressions:

$$(x - 4y)^2 - 625$$

Answer

$$\begin{aligned} & (x - 4y)^2 - (25)^2 \\ & = (x - 4y + 25) (x - 4y - 25) \end{aligned}$$

18. Question

Factorize each of the following expressions:

$$9(a - b)^2 - 100(x - y)^2$$

Answer

$$\begin{aligned} & [3(a - b)]^2 - [10(x - y)]^2 \\ & = [3(a - b) + 10(x + y)] [3(a - b) - 10(x - y)] \\ & = [3a - 3b + 10x - 10y] [3a - 3b - 10x + 10y] \end{aligned}$$

19. Question

Factorize each of the following expressions:

$$(3 + 2a)^2 - 25a^2$$

Answer

$$\begin{aligned} & (3 + 2a)^2 - (5a)^2 \\ & = (3 + 2a + 5a) (3 + 2a - 5a) \\ & = (7a + 3) (3 - 3a) \end{aligned}$$

20. Question

Factorize each of the following expressions:

$$(x + y)^2 - (a - b)^2$$

Answer

$$[(x + y) + (a - b)] [(x + y) - (a - b)]$$

$$= (x + y + a - b)(x + y - a + b)$$

21. Question

Factorize each of the following expressions:

$$\frac{1}{16}x^2y^2 - \frac{4}{49}y^2z^2$$

Answer

$$\begin{aligned} & \left(\frac{1}{4}xy\right)^2 - \left(\frac{2}{7}yz\right)^2 \\ &= \left(\frac{xy}{4} + \frac{2yz}{7}\right)\left(\frac{xy}{4} - \frac{2yz}{7}\right) \\ &= y^2\left(\frac{x}{4} + \frac{2z}{7}\right)\left(\frac{x}{4} - \frac{2z}{7}\right) \end{aligned}$$

22. Question

Factorize each of the following expressions:

$$75a^3b^2 - 108ab^4$$

Answer

$$\begin{aligned} & 3ab^2(25a^2 - 36b^2) \\ &= 3ab^2[(5a)^2 - (6b)^2] \\ &= 3ab^2(5a + 6b)(5a - 6b) \end{aligned}$$

23. Question

Factorize each of the following expressions:

$$x^5 - 16x^3$$

Answer

$$\begin{aligned} & x^3(x^2 - 16) \\ &= x^3(x^2 - 4^2) \\ &= x^3(x + 4)(x - 4) \end{aligned}$$

24. Question

Factorize each of the following expressions:

$$\frac{50}{x^2} - \frac{2x^2}{81}$$

Answer

$$\begin{aligned} & 2\left(\frac{25}{x^2} - \frac{x^2}{81}\right) \\ &= 2\left[\left(\frac{5}{x}\right)^2 - \left(\frac{x}{9}\right)^2\right] \\ &= 2\left(\frac{5}{x} + \frac{x}{9}\right)\left(\frac{5}{x} - \frac{x}{9}\right) \end{aligned}$$

25. Question

Factorize each of the following expressions:

$$256x^5 - 81x$$

Answer

$$\begin{aligned}
 & x(256x^4 - 81) \\
 & = x[(16x^2)^2 - 9^2] \\
 & = x(16x + 9)(16x - 9)
 \end{aligned}$$

26. Question

Factorize each of the following expressions:

$$a^4 - (2b + c)^4$$

Answer

$$\begin{aligned}
 & (a^2)^2 - [(2b + c)^2]^2 \\
 & = [a^2 + (2b + c)^2][a^2 - (2b + c)^2] \\
 & = [a^2 + (2b + c)^2][a + 2b + c][a - 2b - c]
 \end{aligned}$$

27. Question

Factorize each of the following expressions:

$$(3x + 4y)^4 - x^4$$

Answer

$$\begin{aligned}
 & [(3x + 4y)^2]^2 - (x^2)^2 \\
 & = [(3x + 4y)^2 + x^2][(3x + 4y)^2 - x^2] \\
 & = [(3x + 4y)^2 + x^2][3x + 4y + x][3x + 4y - x]
 \end{aligned}$$

28. Question

Factorize each of the following expressions:

$$p^2q^2 - p^4q^4$$

Answer

$$\begin{aligned}
 & (pq)^2 - (p^2q^2)^2 \\
 & = (pq + p^2q^2)(pq - p^2q^2) \\
 & = (pq)^2(1 + pq)(1 - pq)
 \end{aligned}$$

29. Question

Factorize each of the following expressions:

$$3x^3y - 24xy^3$$

Answer

$$\begin{aligned}
 & 3xy(x^2 - 81y^2) \\
 & = 3xy[x^2 - (9y)^2] \\
 & = (3xy)(x + 9y)(x - 9y)
 \end{aligned}$$

30. Question

Factorize each of the following expressions:

$$a^4b^4 - 16c^4$$

Answer

$$\begin{aligned}
 & (a^2b^2)^2 - (4c^2)^2 \\
 &= (a^2b^2 + 4c^2)(a^2b^2 - 4c^2) \\
 &= (a^2b^2 + 4c^2)(ab + 2c)(ab - 2c)
 \end{aligned}$$

31. Question

Factorize each of the following expressions:

$$x^4 - 625$$

Answer

$$\begin{aligned}
 & (x^2)^2 - (25)^2 \\
 &= (x^2 + 25)(x^2 - 25) \\
 &= (x^2 + 25)(x + 5)(x - 5)
 \end{aligned}$$

32. Question

Factorize each of the following expressions:

$$x^4 - 1$$

Answer

$$\begin{aligned}
 & (x^2)^2 - (1)^2 \\
 &= (x^2 + 1)(x^2 - 1) \\
 &= (x^2 + 1)(x + 1)(x - 1)
 \end{aligned}$$

33. Question

Factorize each of the following expressions:

$$49(a - b)^2 - 25(a + b)^2$$

Answer

$$\begin{aligned}
 & [7(a - b)]^2 - [5(a + b)]^2 \\
 &= [7(a - b) + 5(a + b)][7(a - b) - 5(a + b)] \\
 &= (7a - 7b + 5a + 5b)(7a - 7b - 5a - 5b) \\
 &= (12a - 2b)(2a - 12b) \\
 &= 2(6a - b)2(a - 6b) \\
 &= 4(6a - b)(a - 6b)
 \end{aligned}$$

34. Question

Factorize each of the following expressions:

$$x - y - x^2 + y^2$$

Answer

$$\begin{aligned}
 & x - y - (x^2 - y^2) \\
 &= x - y - (x + y)(x - y) \\
 &= (x - y)(1 - x - y)
 \end{aligned}$$

35. Question

Factorize each of the following expressions:

$$16(2x - 1)^2 - 25y^2$$

Answer

$$\begin{aligned} & [4(2x - 1)]^2 - (5y)^2 \\ & = (8x - 4 + 5y)(8x - 4 - 5y) \end{aligned}$$

36. Question

Factorize each of the following expressions:

$$4(xy + 1)^2 - 9(x - 1)^2$$

Answer

$$\begin{aligned} & [2x(xy + 1)]^2 - [3(x - 1)]^2 \\ & = (2xy + 2 + 3x - 3)(2xy + 2 - 3x + 3) \\ & = (2xy + 3x - 1)(2xy - 3x + 5) \end{aligned}$$

37. Question

Factorize each of the following expressions:

$$(2x + 1)^2 - 9x^4$$

Answer

$$\begin{aligned} & (2x + 1)^2 - (3x^2)^2 \\ & = (2x + 1 + 3x^2)(2x + 1 - 3x^2) \\ & = (3x^2 + 2x + 1)(-3x^2 + 2x + 1) \end{aligned}$$

38. Question

Factorize each of the following expressions:

$$x^4 - (2y - 3z)^2$$

Answer

$$\begin{aligned} & (x^2)^2 - (2y - 3z)^2 \\ & = (x^2 + 2y - 3z)(x^2 - 2y + 3z) \end{aligned}$$

39. Question

Factorize each of the following expressions:

$$a^2 - b^2 + a - b$$

Answer

$$\begin{aligned} & (a + b)(a - b) + (a - b) \\ & = (a - b)(a + b + 1) \end{aligned}$$

40. Question

Factorize each of the following expressions:

$$16a^4 - b^4$$

Answer

$$\begin{aligned} & (4a^2)^2 - (b^2)^2 \\ & = (4a^2 + b^2)(4a^2 - b^2) \end{aligned}$$

$$= (4a^2 + b^2) (2a + b) (2a - b)$$

41. Question

Factorize each of the following expressions:

$$a^4 - 16(b - c)^4$$

Answer

$$(a^2)^2 - [4(b - c)^2]$$

$$= [a^2 + 4(b - c)^2] [a^2 - 4(b - c)^2]$$

$$= [a^2 + 4(b - c)^2] [(a + 2b - 2c)(a - 2b + 2c)]$$

42. Question

Factorize each of the following expressions:

$$2a^4 - 32a$$

Answer

$$2a(a^4 - 16)$$

$$= 2a[(a^2)^2 - (4)^2]$$

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

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

43. Question

Factorize each of the following expressions:

$$a^4b^4 - 81c^4$$

Answer

$$(a^2b^2)^2 - (9c^2)^2$$

$$= (a^2b^2 + 9c^2)(a^2b^2 - 9c^2)$$

$$= (a^2b^2 + 9c^2)(ab + 3c)(ab - 3c)$$

44. Question

Factorize each of the following expressions:

$$xy^9 - yx^9$$

Answer

$$xy(y^8 - x^8)$$

$$= xy[(y^4)^2 - (x^4)^2]$$

$$= xy(y^4 + x^4)(y^4 - x^4)$$

$$= xy(y^4 + x^4)(y^2 + x^2)(y^2 - x^2)$$

$$= xy(y^4 + x^4)(y^2 + x^2)(y + x)(y - x)$$

45. Question

Factorize each of the following expressions:

$$x^3 - x$$

Answer

$$\begin{aligned} & x(x^2 - 1) \\ & = x(x + 1)(x - 1) \end{aligned}$$

46. Question

Factorize each of the following expressions:

$$18^2x^2 - 32$$

Answer

$$\begin{aligned} & 2[(3ax)^2 - (4)^2] \\ & = 2(3ax + 4)(3ax - 4) \end{aligned}$$

Exercise 7.6**1. Question**

Factorize each of the following algebraic expressions:

$$4x^2 + 12xy + 9y^2$$

Answer

$$\begin{aligned} & 4x^2 + 12xy + 9y^2 \\ & = (2x)^2 + (3y)^2 + 2(2x)(3y) \\ & = (2x + 3y)^2 \end{aligned}$$

2. Question

Factorize each of the following algebraic expressions:

$$9a^2 - 24ab + 16b^2$$

Answer

Consider $9a^2 - 24ab + 16b^2$, As we know $(x - y)^2 = x^2 + y^2 - 2xy$ Here $x = 3a$, $y = 4b$ So,

$$\begin{aligned} & (3a)^2 + (4b)^2 - 2(3a)(4a) \\ & = (3a - 4b)^2 \end{aligned}$$

3. Question

Factorize each of the following algebraic expressions:

$$p^2q^2 - 6pqr + 9r^2$$

Answer

$$\begin{aligned} & (pq)^2 + (3r)^2 - 2(pq)(3r) \\ & = (pq - 3r)^2 \end{aligned}$$

4. Question

Factorize each of the following algebraic expressions:

$$36a^2 + 36a + 9$$

Answer

$$\begin{aligned} & 9(4a^2 + 4a + 1) \\ & = 9[(2a)^2 + 2(2a) + 1^1] \end{aligned}$$

$$= 9(2a + 1)^2$$

5. Question

Factorize each of the following algebraic expressions:

$$a^2 + 2ab + b^2 - 16$$

Answer

$$(a + b)^2 - 4^2$$

$$= (a + b + 4)(a + b - 4)$$

6. Question

Factorize each of the following algebraic expressions:

$$9z^2 - x^2 + 4xy - 4y^2$$

Answer

$$(3z)^2 - [x^2 - 2(x)(2y) + (2y)^2]$$

$$= (3z)^2 - (x - 2y)^2$$

$$= [3z + (x - 2y)][3z - (x - 2y)]$$

7. Question

Factorize each of the following algebraic expressions:

$$9a^4 - 24a^2b^2 + 16b^4 - 256$$

Answer

$$(3a^2)^2 - 2(4a^2)(3b^2) + (4b^2)^2 - (16)^2$$

$$= (3a^2 - 4b^2)^2 - (16)^2$$

$$= (3a^2 - 4b^2 + 16)(3a^2 - 4b^2 - 16)$$

8. Question

Factorize each of the following algebraic expressions:

$$16 - a^6 + 4a^3b^3 - 4b^6$$

Answer

$$4^2 - [(a^3)^2 - 2(a^3)(2b^3) + (2b^3)^2]$$

$$= 4^2 - (a^3 - 2b^3)^2$$

$$= [4 + (a^3 - 2b^3)][4 - (a^3 - 2b^3)]$$

9. Question

Factorize each of the following algebraic expressions:

$$a^2 - 2ab + b^2 - c^2$$

Answer

$$(a + b)^2 - c^2$$

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

10. Question

Factorize each of the following algebraic expressions:

$$x^2 + 2x + 1 - 9y^2$$

Answer

$$\begin{aligned}(x + 1)^2 - (3y)^2 \\ = (x + 3y + 1)(x - 3y + 1)\end{aligned}$$

11. Question

Factorize each of the following algebraic expressions:

$$a^2 + 4ab + 3b^2$$

Answer

$$\begin{aligned}a^2 + ab + 3ab + 3b^2 \\ = a(a + b) + 3b(a + b) \\ = (a + 3b)(a + b)\end{aligned}$$

12. Question

Factorize each of the following algebraic expressions:

$$96 - 4x - x^2$$

Answer

$$\begin{aligned}-x^2 - 4x + 96 \\ = -x^2 - 12x + 8x + 96 \\ = -x(x + 12) + 8(x + 12) \\ = (x + 12)(-x + 8)\end{aligned}$$

13. Question

Factorize each of the following algebraic expressions:

$$a^4 + 3a^2 + 4$$

Answer

$$\begin{aligned}(a^2)^2 + (a^2)^2 + 2(2a^2) + 4 - a^2 \\ = (a^2 + 2)^2 + (-a^2) \\ = (a^2 + 2 + a)(a^2 + 2 - a)\end{aligned}$$

14. Question

Factorize each of the following algebraic expressions:

$$4x^4 + 1$$

Answer

$$\begin{aligned}(2x^2)^2 + 1 + 4x^2 - 4x^2 \\ = (2x^2 + 1)^2 - 4x^2 \\ = (2x^2 + 2x + 1)(2x^2 - 2x + 1)\end{aligned}$$

15. Question

Factorize each of the following algebraic expressions:

$$4x^4 + y^4$$

Answer

$$\begin{aligned}(2x^2)^2 + (y^2)^2 + 4x^2y^2 - 4x^2y^2 \\ &= (2x^2 + y^2)^2 - 4x^2y^2 \\ &= (2x^2 + y^2 + 2xy)(2x^2 + y^2 - 2xy)\end{aligned}$$

16. Question

Factorize each of the following algebraic expressions:

$$(x+2)^2 - 6(x+2) + 9$$

Answer

$$\begin{aligned}x^2 + 4 + 4x - 6x - 12 + 9 \\ &= x^2 + 1 - 2x \\ &= (x - 1)^2\end{aligned}$$

17. Question

Factorize each of the following algebraic expressions:

$$25 - p^2 - q^2 - 2pq$$

Answer

$$\begin{aligned}25 - (p^2 + q^2 + 2pq) \\ &= (5)^2 - (p + q)^2 \\ &= (5 + p + q)(5 - p - q) \\ &= -(p + q - 5)(p + q + 5)\end{aligned}$$

18. Question

Factorize each of the following algebraic expressions:

$$x^2 + 9y^2 - 6xy - 25a^2$$

Answer

$$\begin{aligned}(x - 3y)^2 - (5a)^2 \\ &= (x - 3y + 5a)(x - 3y - 5a)\end{aligned}$$

19. Question

Factorize each of the following algebraic expressions:

$$49 - a^2 + 8ab - 16b^2$$

Answer

$$\begin{aligned}49 - (a^2 - 8ab + 16b^2) \\ &= 49 - (a - 4b)^2\end{aligned}$$

$$\text{We know: } a^2 - b^2 = (a + b)(a - b)$$

$$\begin{aligned}&= (7 + a - 4b)(7 - a + 4b) \\ &= -(a - 4b + 7)(a - 4b - 7)\end{aligned}$$

20. Question

Factorize each of the following algebraic expressions:

$$a^2 - 8ab + 16b^2 - 25c^2$$

Answer

$$\begin{aligned} & (a - 4b)^2 - (5c)^2 \\ & = (a - 4b + 5c)(a - 4b - 5c) \end{aligned}$$

21. Question

Factorize each of the following algebraic expressions:

$$x^2 - y^2 + 6y - 9$$

Answer

$$\begin{aligned} & x^2 + 6y - (y^2 - 6y + 9) \\ & = x^2 - (y - 3)^2 \\ & = (x + y - 3)(x - y + 3) \end{aligned}$$

22. Question

Factorize each of the following algebraic expressions:

$$25x^2 - 10x + 1 - 36y^2$$

Answer

$$\begin{aligned} & (5x)^2 - 2(5x) + 1 - (6y)^2 \\ & = (5x - 1)^2 - (6y)^2 \\ & = (5x - 1 + 6y)(5x - 1 - 6y) \end{aligned}$$

23. Question

Factorize each of the following algebraic expressions:

$$a^2 - b^2 + 2bc - c^2$$

Answer

$$\begin{aligned} & a^2 - (b^2 - 2bc + c^2) \\ & = a^2 - (b - c)^2 \\ & = (a + b - c)(a - b + c) \end{aligned}$$

24. Question

Factorize each of the following algebraic expressions:

$$a^4 + 2b + b^2 - c^2$$

Answer

$$\begin{aligned} & (a + b)^2 - c^2 \\ & = (a + b + c)(a + b - c) \end{aligned}$$

25. Question

Factorize each of the following algebraic expressions:

$$49 - x^2 - y^2 + 2xy$$

Answer

$$49 - (x^2 + y^2 - 2xy)$$

$$= 7^2 - (x - y)^2$$

$$= [7 + (x - y)] [7 - x + y]$$

26. Question

Factorize each of the following algebraic expressions:

$$a^2 + 4b^2 - 4ab - 4c^2$$

Answer

$$a^2 - 2(a)(2b) + (2b)^2 - (2c)^2$$

$$= (a - 2b)^2 - (2c)^2$$

$$= (a - 2b + 2c)(a - 2b - 2c)$$

27. Question

Factorize each of the following algebraic expressions:

$$x^2 - y^2 - 4xz + 4z^2$$

Answer

$$x^2 - 2(x)(2z) + (2z)^2 - y^2$$

$$= (x - 2z)^2 - y^2$$

As $a^2 - b^2 = (a+b)(a-b)$

$$= (x - 2z + y)(x - 2z - y)$$

Exercise 7.7

1. Question

Factorize each of the following algebraic expressions:

$$x^2 + 12x - 45$$

Answer

In order to factorize the given expression, we find to find two numbers p and q such that:

$$p + q = 12, pq = -45$$

Clearly,

$$15 - 3 = 12, 15(-3) = -45$$

Therefore, split 12x as 15x - 3x

Therefore,

$$x^2 + 12x - 45 = x^2 + 15x - 3x - 45$$

$$= x(x + 15) - 3(x + 15)$$

$$= (x - 3)(x + 15)$$

2. Question

Factorize each of the following algebraic expressions:

$$40 + 3x - x^2$$

Answer

$$-(x^2 - 3x - 40)$$

In order to factorize the given expression, we find to find two numbers p and q such that:

$$p + q = -3, pq = -40$$

Clearly,

$$5 - 8 = -3, 5(-8) = -40$$

Therefore, split $-3x$ as $5x - 8x$

Therefore,

$$\begin{aligned}x^2 - 3x - 40 &= x^2 + 5x - 8x - 40 \\&= x(x + 5) - 8(x + 5) \\&= (x - 8)(x + 5)\end{aligned}$$

3. Question

Factorize each of the following algebraic expressions:

$$a^2 + 3a - 88$$

Answer

In order to factorize the given expression, we find to find two numbers p and q such that:

$$p + q = 3, pq = -88$$

Therefore, split $3a$ as $11a - 8a$

Therefore,

$$\begin{aligned}a^2 + 3a - 88 &= a^2 + 11a - 8a - 88 \\&= a(a + 11) - 8(a + 11) \\&= (a - 8)(a + 11)\end{aligned}$$

4. Question

Factorize each of the following algebraic expressions:

$$a^2 - 14a - 51$$

Answer

In order to factorize the given expression, we find to find two numbers p and q such that:

$$p + q = -14, pq = -51$$

Clearly,

$$3 - 17 = -14, 3(-17) = -51$$

Therefore, split $-14a$ as $3a - 17a$

Therefore,

$$\begin{aligned}a^2 - 14a - 51 &= a^2 + 3a - 17a - 51 \\&= a(a + 3) - 17(a + 3) \\&= (a - 17)(a + 3)\end{aligned}$$

5. Question

Factorize each of the following algebraic expressions:

$$x^2 + 14x + 45$$

Answer

In order to factorize the given expression, we find to find two numbers p and q such that:

$$p + q = 14, pq = 45$$

Clearly,

$$5 + 9 = 14, 5(9) = 45$$

Therefore, split $14x$ as $5x + 9x$

Therefore,

$$\begin{aligned}x^2 + 14x + 45 &= x^2 + 5x + 9x + 45 \\ &= x(x + 5) + 9(x + 5) \\ &= (x + 9)(x + 5)\end{aligned}$$

6. Question

Factorize each of the following algebraic expressions:

$$x^2 - 22x + 120$$

Answer

In order to factorize the given expression, we find to find two numbers p and q such that:

$$p + q = -22, pq = 120$$

Clearly,

$$-12 - 10 = -22, (-12)(-10) = -120$$

Therefore, split $-22x$ as $-12x - 10x$

Therefore,

$$\begin{aligned}x^2 - 22x + 120 &= x^2 - 12x - 10x + 120 \\ &= x(x - 12) - 10(x - 12) \\ &= (x - 10)(x - 12)\end{aligned}$$

7. Question

Factorize each of the following algebraic expressions:

$$x^2 - 11x - 42$$

Answer

In order to factorize the given expression, we find to find two numbers p and q such that:

$$p + q = -11, pq = -42$$

Clearly,

$$3 - 14 = -11, 3(-14) = -42$$

Therefore, split $(-11x)$ as $3x - 14x$

Therefore,

$$\begin{aligned}x^2 - 11x - 42 &= x^2 + 3x - 14x - 42 \\ &= x(x + 3) - 14(x + 3) \\ &= (x - 14)(x + 3)\end{aligned}$$

8. Question

Factorize each of the following algebraic expressions:

$$a^2 + 2a - 3$$

Answer

In order to factorize the given expression, we find to find two numbers p and q such that:

$$p + q = 2, pq = -3$$

Clearly,

$$p = 3, q = -1$$

Therefore, split (2a) as (3a - a)

Therefore,

$$a^2 + 2a - 3 = a^2 + 3a - a - 3$$

$$= a(a + 3) - 1(a + 3)$$

$$= (a - 1)(a + 3)$$

9. Question

Factorize each of the following algebraic expressions:

$$a^2 + 14a + 48$$

Answer

In order to factorize the given expression, we find to find two numbers p and q such that:

$$p + q = 14, pq = 48$$

Clearly,

$$8 + 6 = 14, 8(6) = 48$$

Therefore, split (14a) as 8a + 6a

Therefore,

$$a^2 + 14a + 48 = a^2 + 8a + 6a + 48$$

$$= a(a + 8) + 6(a + 8)$$

$$= (a + 6)(a + 8)$$

10. Question

Factorize each of the following algebraic expressions:

$$x^2 - 4x - 21$$

Answer

In order to factorize the given expression, we find to find two numbers p and q such that:

$$p + q = -4, pq = -21$$

Clearly,

$$3 - 7 = -4, 3(-7) = -21$$

Therefore, split (-4x) as 3x - 7x

Therefore,

$$x^2 + 4x - 21 = x^2 + 3x - 7x - 21$$

$$= x(x + 3) - 7(x + 3)$$

$$= (x - 7)(x + 3)$$

11. Question

Factorize each of the following algebraic expressions:

$$y^2 + 5y - 36$$

Answer

In order to factorize the given expression, we find to find two numbers p and q such that:

$$p + q = 5, pq = -36$$

Clearly,

$$9 - 4 = 5, 9(-4) = -36$$

Therefore, split 5y as 9y - 4y

Therefore,

$$y^2 + 5y - 36 = y^2 + 9y - 4y - 36$$

$$= y(y + 9) - 4(y + 9)$$

$$= (y - 4)(y + 9)$$

12. Question

Factorize each of the following algebraic expressions:

$$(a^2 - 5a)^2 - 36$$

Answer

It can be written as $(a^2 - 5a)^2 - 6^2$

Using $a^2 - b^2 = (a + b)(a - b)$

$$(a^2 - 5a)^2 - 6^2 = (a^2 - 5a + 6)(a^2 - 5a - 6)$$

To factorize $(a^2 - 5a + 6)$, we need to find p and q where,

$$p + q = -5, pq = 6$$

Clearly,

$$-2 - 3 = -5, (-2)(-3) = 6$$

Therefore, split -5a as a - 6a

Therefore,

$$a^2 - 5a - 6 = a^2 - a - 6a + 6$$

$$= (a - 6)(a - 1)$$

Therefore,

$$(a^2 - 5a)^2 - 36 = (a^2 - 5a + 6)(a^2 - 5a - 6)$$

$$= (a - 1)(a - 2)(a - 3)(a - 6)$$

13. Question

Factorize each of the following algebraic expressions:

$$(a + 7)(a - 10) + 16$$

Answer

$$a^2 - 3a - 54$$

In order to factorize the given expression, we find to find two numbers p and q such that:

$$p + q = -3, pq = -54$$

Clearly,

$$6 - 9 = -3, 6(-9) = -54$$

Therefore, split $-3a$ as $6a - 9a$

Therefore,

$$\begin{aligned} a^2 - 3a - 54 &= a^2 + 6a - 9a - 54 \\ &= (a - 9)(a + 6) \end{aligned}$$

Therefore,

$$(a + 7)(a - 10) + 16 = (a - 9)(a + 6)$$

Exercise 7.8

1. Question

Resolve each of the following quadratic trinomials into factors:

$$2x^2 + 5x + 3$$

Answer

Here, coefficient of $x^2 = 2$, coefficient of $x = 5$ and constant term $= 3$

We shall now split up the coefficient of x i.e., 5 into two parts whose sum is 5 and product is $2 * 3 = 6$

So, we write middle term $5x$ as $2x + 3x$

Thus, we have

$$\begin{aligned} 2x^2 + 5x + 3 &= 2x^2 + 2x + 3x + 3 \\ &= 2x(x + 1) + 3(x + 1) \\ &= (2x + 3)(x + 1) \end{aligned}$$

2. Question

Resolve each of the following quadratic trinomials into factors:

$$2x^2 - 3x - 2$$

Answer

Here, coefficient of $x^2 = 2$, coefficient of $x = -3$ and constant term $= -2$

We shall now split up the coefficient of x i.e., -3 into two parts whose sum is -3 and product is $2 * -2 = -4$

So, we write middle term $-3x$ as $-4x + x$

Thus, we have

$$\begin{aligned} 2x^2 - 3x - 2 &= 2x^2 - 4x + x - 2 \\ &= 2x(x - 2) + 1(x - 2) \\ &= (x - 2)(2x + 1) \end{aligned}$$

3. Question

Resolve each of the following quadratic trinomials into factors:

$$3x^2 + 10x + 3$$

Answer

Here, coefficient of $x^2 = 3$, coefficient of $x = 10$ and constant term = 3

We shall now split up the coefficient of x i.e., 10 into two parts whose sum is 10 and product is $3 * 3 = 9$

So, we write middle term $10x$ as $9x + x$

Thus, we have

$$\begin{aligned}3x^2 + 10x + 3 &= 3x^2 + 9x + x + 3 \\ &= 3x(x + 3) + 1(x + 3) \\ &= (3x + 1)(x + 3)\end{aligned}$$

4. Question

Resolve each of the following quadratic trinomials into factors:

$$7x - 6 - 2x^2$$

Answer

$$7x - 6 - 2x^2 = -2x^2 + 7x - 6$$

Here, coefficient of $x^2 = -2$, coefficient of $x = 7$ and constant term = -6

We shall now split up the coefficient of x i.e., 7 into two parts whose sum is 7 and product is $-2 * -6 = 12$

Clearly,

$$4 + 3 = 7 \text{ and,}$$

$$4 * 3 = 12$$

So, we write middle term $7x$ as $4x + 3x$

Thus, we have

$$\begin{aligned}-2x^2 + 7x - 6 &= -2x^2 + 4x + 3x - 6 \\ &= -2x(x - 2) + 3(x - 2) \\ &= (x - 2)(3 - 2x)\end{aligned}$$

5. Question

Resolve each of the following quadratic trinomials into factors:

$$7x^2 - 19x - 6$$

Answer

Here, coefficient of $x^2 = 7$, coefficient of $x = -19$ and constant term = -6

We shall now split up the coefficient of x i.e., -19 into two parts whose sum is -19 and product is $7 * -6 = -42$

Clearly,

$$2 - 21 = -19 \text{ and,}$$

$$2 * (-21) = -42$$

So, we write middle term - 19x as $2x - 21x$

Thus, we have

$$\begin{aligned}7x^2 - 19x - 6 &= 7x^2 + 2x - 21x - 6 \\ &= x(7x + 2) - 3(7x + 2) \\ &= (7x + 2)(x - 3)\end{aligned}$$

6. Question

Resolve each of the following quadratic trinomials into factors:

$$28 - 31x - 5x^2$$

Answer

$$28 - 31x - 5x^2 = -5x^2 - 31x + 28$$

Here, coefficient of $x^2 = -5$, coefficient of $x = -31$ and constant term = 28

We shall now split up the coefficient of x i.e., -31 into two parts whose sum is -31 and product is $-5(28) = -140$

Clearly,

$$4 - 35 = -31 \text{ and,}$$

$$4(-35) = -140$$

So, we write middle term $-31x$ as $4x - 35x$

Thus, we have

$$-5x^2 - 31x + 28 = -5x^2 + 4x - 35x + 28$$

$$= -x(5x - 4) - 7(5x - 4)$$

$$= -(x + 7)(5x - 4)$$

7. Question

Resolve each of the following quadratic trinomials into factors:

$$3 + 23y - 8y^2$$

Answer

$$3 + 23y - 8y^2 = -8y^2 + 23y + 3$$

Here, coefficient of $y^2 = -8$, coefficient of $y = 23$ and constant term = 3

We shall now split up the coefficient of x i.e., 23 into two parts whose sum is 23 and product is $-8(3) = -24$

Clearly,

$$24 - 1 = 23 \text{ and,}$$

$$24(-1) = -24$$

So, we write middle term $23y$ as $24y - y$

Thus, we have

$$-8y^2 + 23y + 3 = -8y^2 + 24y - y + 3$$

$$= -8y(y - 3) - 1(y - 3)$$

$$= -(8y + 1)(y - 3)$$

8. Question

Resolve each of the following quadratic trinomials into factors:

$$11x^2 - 54x + 63$$

Answer

$$11x^2 - 54x + 63$$

Here, coefficient of $x^2 = 11$, coefficient of $x = -54$ and constant term = 63

We shall now split up the coefficient of x i.e., -54 into two parts whose sum is -54 and product is $11 * 63 =$

693

Clearly,

$$-33x - 21x = -54x \text{ and,}$$

$$(-33) * (-21) = 693$$

So, we write middle term $-54x$ as $-33x - 21x$

Thus, we have

$$\begin{aligned} 11x^2 - 54x + 63 &= 11x^2 - 33x - 21x - 6 \\ &= 11x(x - 3) - 21(x - 3) \\ &= (11x - 21)(x - 3) \end{aligned}$$

9. Question

Resolve each of the following quadratic trinomials into factors:

$$7x - 6x^2 + 20$$

Answer

$$7x - 6x^2 + 20 = -6x^2 + 7x + 20$$

Here, coefficient of $x^2 = -6$, coefficient of $x = 7$ and constant term $= 20$

We shall now split up the coefficient of x i.e., 7 into two parts whose sum is 7 and product is $-6 * 20 = -120$

Clearly,

$$15 - 8 = 7 \text{ and,}$$

$$15(-8) = -120$$

So, we write middle term $7x$ as $15x - 8x$

Thus, we have

$$\begin{aligned} -6x^2 + 7x + 20 &= -6x^2 + 15x - 8x + 20 \\ &= -3x(2x - 5) - 4(2x - 5) \\ &= -(3x + 4)(2x - 5) \end{aligned}$$

10. Question

Resolve each of the following quadratic trinomials into factors:

$$3x^2 + 22x + 35$$

Answer

$$3x^2 + 22x + 35$$

Here, coefficient of $x^2 = 3$, coefficient of $x = 22$ and constant term $= 35$

We shall now split up the coefficient of x i.e., 22 into two parts whose sum is 22 and product is $3 * 35 = 105$

So, we write middle term $22x$ as $15x + 7x$

Thus, we have

$$\begin{aligned} 3x^2 + 22x + 35 &= 3x^2 + 15x + 7x + 35 \\ &= 3x(x + 5) + 7(x + 5) \\ &= (3x + 7)(x + 5) \end{aligned}$$

11. Question

Resolve each of the following quadratic trinomials into factors:

$$12x^2 - 17xy + 6y^2$$

Answer

$$12x^2 - 17xy + 6y^2$$

Here, coefficient of $x^2 = 12$, coefficient of $x = -17$ and constant term = $6y^2$

We shall now split up the coefficient of middle term i.e., $-17y$ into two parts whose sum is $-17y$ and product is $12 * 6y^2 = 72y^2$

Clearly,

$$-9y - 8y = -17y \text{ and,}$$

$$(-9y)(-8y) = 72y^2$$

So, we replace middle term $-17xy = -9xy - 8xy$

Thus, we have

$$12x^2 - 17xy + 6y^2 = 12x^2 - 9xy - 8xy + 6y^2$$

$$= 3x(4x - 3y) - 2y(4x - 3y)$$

$$= (3x - 2y)(4x - 3y)$$

12. Question

Resolve each of the following quadratic trinomials into factors:

$$6x^2 - 5xy - 6y^2$$

Answer

Here, coefficient of $x^2 = 6$, coefficient of $x = -5y$ and constant term = $-6y^2$

We shall now split up the coefficient of middle term i.e., $-5y$ into two parts whose sum is $-5y$ and product is $6(-6y^2) = -36y^2$

Clearly,

$$4y - 9y = -5y \text{ and,}$$

$$(4y)(-9y) = -36y^2$$

So, we replace middle term $-5xy = 4xy - 9xy$

Thus, we have

$$6x^2 - 5xy - 6y^2 = 6x^2 + 4xy - 9xy - 6y^2$$

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

13. Question

Resolve each of the following quadratic trinomials into factors:

$$6x^2 - 13xy + 2y^2$$

Answer

Here, coefficient of $x^2 = 6$, coefficient of $x = -13y$ and constant term = $2y^2$

We shall now split up the coefficient of middle term i.e., $-13y$ into two parts whose sum is $-13y$ and product is $6(2y^2) = 12y^2$

Clearly,

$$-12y - y = -13y \text{ and,}$$

$$(-12y)(-y) = 12y^2$$

So, we replace middle term $-13xy = -12xy - xy$

Thus, we have

$$6x^2 - 13xy + 2y^2 = 6x^2 - 12xy - xy - 2y^2$$

$$= (6x - y)(x - 2y)$$

14. Question

Resolve each of the following quadratic trinomials into factors:

$$14x^2 + 11xy - 15y^2$$

Answer

Here, coefficient of $x^2 = 14$, coefficient of $x = 11y$ and constant term = $-15y^2$

We shall now split up the coefficient of middle term i.e., $11y$ into two parts whose sum is $11y$ and product is $14(-15y^2) = -210y^2$

Clearly,

$$21y - 10y = 11y \text{ and,}$$

$$(21y)(-10y) = -210y^2$$

So, we replace middle term $11xy = 21xy - 10xy$

Thus, we have

$$14x^2 + 11xy - 15y^2 = 14x^2 + 21xy - 10xy - 15y^2$$

$$= 2x(7x - 5y) + 3y(7x - 5y)$$

$$= (2x + 3y)(7x - 5y)$$

15. Question

Resolve each of the following quadratic trinomials into factors:

$$6a^2 + 17ab - 3b^2$$

Answer

Here, coefficient of $a^2 = 6$, coefficient of $a = 17b$ and constant term = $-3b^2$

We shall now split up the coefficient of middle term i.e., $17b$ into two parts whose sum is $17b$ and product is $6(-3b^2) = -18b^2$

Clearly,

$$18b - b = 17b \text{ and,}$$

$$6(-3b^2) = -18b^2$$

So, we replace middle term $17ab = 18ab - ab$

Thus, we have

$$6a^2 + 17ab - 3b^2 = 6a^2 + 18ab - ab - 3b^2$$

$$= 6a(a + 3b) - b(a + 3b)$$

$$= (6a - b)(a + 3b)$$

16. Question

Resolve each of the following quadratic trinomials into factors:

$$36a^2 + 12abc - 15b^2c^2$$

Answer

Here, coefficient of $a^2 = 36$, coefficient of $a = 12bc$ and constant term = $-15b^2c^2$

We shall now split up the coefficient of middle term i.e., $12bc$ into two parts whose sum is $12bc$ and product is $36(-15b^2c^2) = -500b^2c^2$

So, we replace middle term $12abc = 30abc - 18abc$

Thus, we have

$$36a^2 - 12abc - 15b^2c^2 = 36a^2 + 30abc - 18abc - 15b^2c^2$$

$$= (6a + 5bc)(6a - 3bc)$$

17. Question

Resolve each of the following quadratic trinomials into factors:

$$15x^2 - 16xyz - 15y^2z^2$$

Answer

Here, coefficient of $x^2 = 15$, coefficient of $x = -16yz$ and constant term = $-15y^2z^2$

We shall now split up the coefficient of middle term i.e., $-16yz$ into two parts whose sum is $-16yz$ and product is $15(-15y^2z^2) = -225y^2z^2$

Clearly,

$$-25yz + 9yz = -16yz \text{ and,}$$

$$(-25yz)(9yz) = -225y^2z^2$$

So, we replace middle term $-16xyz = -25yz - 9yz$

Thus, we have

$$15x^2 - 16xyz - 15y^2z^2 = 15x^2 - 25yz + 9yz - 15y^2z^2$$

$$= 5x(3x - 5yz) + 3yz(3x - 5yz)$$

$$= (5x + 3yz)(3x - 5yz)$$

18. Question

Resolve each of the following quadratic trinomials into factors:

$$(x - 2y)^2 - 5(x - 2y) + 6$$

Answer

$$x^2 + 4y^2 - 4xy - 5x + 10y + 6$$

Here, coefficient of $(x - 2y)^2 = 1$, coefficient of $(x - 2y) = -5$ and constant = 6

We shall now split up the coefficient of middle term i.e., -5 into two parts whose sum is -5 and product is $6(1) = 6$

Clearly,

$$-2 - 3 = -5 \text{ and,}$$

$$-2(-3) = 6$$

So, we replace $-5(x - 2y) = -2(x - 2y) - 3(x - 2y)$

Thus, we have

$$(x - 2y)^2 - 5(x - 2y) + 6 = (x - 2y)^2 - 2(x - 2y) - 3(x - 2y) + 6$$

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

19. Question

Resolve each of the following quadratic trinomials into factors:

$$(2a - b)^2 + 2(2a - b) - 8$$

Answer

Here, coefficient of $(2a - b)^2 = 1$, coefficient of $(2a - b) = 2$ and constant term = - 8

We shall now split up the coefficient of middle term i.e., 2 into two parts whose sum is 2 and product is -8 (1) = - 8

Clearly,

$$4 - 2 = 2 \text{ and,}$$

$$4(-2) = - 8$$

So, we replace $2(2a - b) = 4(2a - b) - 2(2a - b)$

Thus, we have

$$(2a - b)^2 + 2(2a - b) - 8 = (2a - b)^2 + 4(2a - b) - 2(2a - b) - 8$$

$$= (2a - b)(2a - b + 4) - 2(2a - b + 4)$$

$$= (2a - b - 2)(2a - b + 4)$$

Exercise 7.9

1. Question

Factorize each of the following quadratic polynomials by using the method of completing;

$$p^2 + 6p + 8$$

Answer

$$p^2 + 6p + 8$$

Here, coefficient of p^2 is unity so we add and subtract square of half of coefficient of p

Therefore,

$$p^2 + 6p + 8 = p^2 + 6p + 3^2 - 3^2 + 8 \text{ (Adding and subtracting } 3^2)$$

$$= (p + 3)^2 - 1^2 \text{ (By completing the square)}$$

$$= (p + 3 - 1)(p + 3 + 1)$$

$$= (p + 2)(p + 4)$$

2. Question

Factorize each of the following quadratic polynomials by using the method of completing;

$$q^2 - 10q + 21$$

Answer

$q^2 - 10q + 21$ Coefficient of q^2 is 1 so we add and subtract square of half of coefficient of q

Therefore,

$$q^2 - 10q + 21 = q^2 - 10q + 5^2 - 5^2 + 21 \text{ (Adding and subtracting } 5^2)$$

$$= (q - 5)^2 - 2^2 \text{ (By completing the square)}$$

$$= (q - 5 - 2) (q - 5 + 2)$$

$$= (q - 7) (q - 3)$$

3. Question

Factorize each of the following quadratic polynomials by using the method of completing;

$$4y^2 + 12y + 5$$

Answer

$$4y^2 + 12y + 5$$

$$\text{We have } 4y^2 + 12y + 5 = 4 \left(y^2 + 3y + \frac{5}{4} \right) \text{ [Therefore, coefficient of } y^2 = 1]$$

$$= 4 \left[y^2 + 3y + \left(\frac{3}{2} \right)^2 - \left(\frac{3}{2} \right)^2 + \frac{5}{4} \right]$$

$$= 4 \left[\left(y + \frac{3}{2} \right)^2 - 1^2 \right] \text{ (Completing the square)}$$

$$= 4 \left(y + \frac{3}{2} + 1 \right) \left(y + \frac{3}{2} - 1 \right)$$

$$= (2y + 5) (2y + 1)$$

4. Question

Factorize each of the following quadratic polynomials by using the method of completing;

$$p^2 + 6p - 16$$

Answer

$$p^2 + 6p - 16$$

$$\text{Coefficient of } p^2 = 1$$

Therefore, we have

$$p^2 + 6p + 3^2 - 3^2 - 16 \text{ (Adding and subtracting } 3^2)$$

$$= (p + 3)^2 - 5^2 \text{ (Completing the square)}$$

$$= (p + 3 + 5) (p + 3 - 5)$$

$$= (p + 8) (p - 2)$$

5. Question

Factorize each of the following quadratic polynomials by using the method of completing;

$$x^2 + 12x + 20$$

Answer

$$x^2 + 12x + 20$$

$$\text{Coefficient of } x^2 = 1$$

Therefore, we have

$$x^2 + 12x + 6^2 - 6^2 + 20 \text{ (Adding and subtracting } 6^2)$$

$$= (x + 6)^2 - 4^2 \text{ (Completing the square)}$$

$$= (x + 6 + 4) (x + 6 - 4)$$

$$= (x + 10) (x + 2)$$

$$= 4 \left[x - \frac{3}{2} + 1 \right] \left[x - \frac{3}{2} - 1 \right]$$

$$= (2x - 1)(2x - 5)$$

6. Question

Factorize each of the following quadratic polynomials by using the method of completing;

$$a^2 - 14a - 51$$

Answer

$$a^2 - 14a - 51$$

Coefficient of $a^2 = 1$

Therefore, we have

$$a^2 - 14a - 51 = a^2 - 14a + 7^2 - 7^2 - 51 \text{ (Therefore, adding and subtracting } 7^2)$$

$$= (a - 7)^2 - 10^2 \text{ (Completing the square)}$$

$$= (a - 7 + 10)(9 - 7 - 10)$$

$$= (a + 3)(a - 17)$$

7. Question

Factorize each of the following quadratic polynomials by using the method of completing;

$$a^2 + 2a - 3$$

Answer

$$a^2 + 2a - 3$$

Coefficient of $a^2 = 1$

Therefore, we have

$$a^2 + 2a - 3 = a^2 + 2a + 1^2 - 1^2 - 3 \text{ (Adding and subtracting } 1^2)$$

$$= (a + 1)^2 - 2^2 \text{ (Completing the square)}$$

$$= (a + 1 + 2)(a + 1 - 2)$$

$$= (a + 3)(a - 1)$$

8. Question

Factorize each of the following quadratic polynomials by using the method of completing;

$$4x^2 - 12x + 5$$

Answer

$$4x^2 - 12x + 5$$

We have,

$$4x^2 - 12x + 5 = 4 \left(x^2 - 3x + \frac{5}{4} \right)$$

$$= 4 \left[x^2 - 3x + \left(\frac{3}{2} \right)^2 - \left(\frac{3}{2} \right)^2 + \frac{5}{4} \right] \text{ [Therefore, adding and subtracting } \left(\frac{3}{2} \right)^2]$$

$$= 4 \left[\left(x - \frac{3}{2} \right)^2 - 1^2 \right] \text{ (Therefore, completing the square)}$$

9. Question

Factorize each of the following quadratic polynomials by using the method of completing;

$$y^2 - 7y + 12$$

Answer

$$y^2 - 7y + 12$$

$$\text{Coefficient of } y^2 = 1$$

Therefore, we have

$$y^2 - 7y + 12 = y^2 - 7y + \left(\frac{7}{2}\right)^2 - \left(\frac{7}{2}\right)^2 + 12 \text{ [By adding and subtracting } \left(\frac{7}{2}\right)^2]$$

$$= \left(y - \frac{7}{2}\right)^2 - \left(\frac{1}{2}\right)^2 \text{ (Completing the square)}$$

$$= \left(y - \frac{7}{2} - \frac{1}{2}\right) \left(y - \frac{7}{2} + \frac{1}{2}\right)$$

$$= (y - 4) (y - 3)$$

10. Question

Factorize each of the following quadratic polynomials by using the method of completing;

$$z^2 - 4z - 12$$

Answer

$$z^2 - 4z - 12$$

$$\text{Coefficient of } z^2 = 1$$

Therefore, we have

$$z^2 - 4z - 12 = z^2 - 4z + 2^2 - 2^2 - 12 \text{ [By adding and subtracting } 2^2]$$

$$= (z - 2)^2 - 4^2 \text{ (Completing the square)}$$

$$= (z - 2 + 4) (z - 2 - 4)$$

$$= (z + 2) (z - 6)$$