Chapter : 7. FACTORISATION

Exercise : 7A

Question: 1

(i) $12x + 15$

Taking 3 as common from the whole, we get,

$12x + 15 = 3(4x + 5)$.

(ii) $14m – 21$,

Taking 7 as common from the whole, we get,

$14m – 21 = 7(2m – 3)$

(iii) $9n – 12n^2$,

Taking 3n as common from the whole, we get,

$9n – 12n^2 = 3n (3 – 4n)$.

Question: 2

(i) Let’s take HCF of $16a^2 – 24ab$

Taking 8a as common from the whole, we get,

$16a^2 – 24ab = 8a(2a – 3b)$.

(ii) $15ab^2 – 20a^2b$,

Taking 5ab as common from the whole, we get,

$15ab^2 – 20a^2b = 5ab(3b – 4a)$

(iii) $12x^2y^3 – 21x^3y^2$,

Taking $3x^2y^2$ as common from the whole, we get,

$12x^2y^3 – 21x^3y^2 = 3x^2y^2(4y – 7x)$

Question: 3

(i) $24x^3 – 36x^2y$,

Taking $12x^2$ as common from the whole, we get,

$24x^3 – 36x^2y = 12x^2(2x – 3y)$

(ii) $10x^3 – 15x^2$

Taking $5x^2$ as common from the whole, we get,

$10x^3 – 15x^2 = 5x^2(2x – 3)$

(iii) $36x^3y – 60x^2y^3z$

Taking $12x^2y$ as common from the whole, we get,

$36x^3y – 60x^2y^3z = 12x^2y(3x – 5y^2z)$

Question: 4

(i) Let’s find out the HCF of $9x^3$, $6x^2$, $12x$

$3x$	$9x^3$, $6x^2$, $12x$
	$3x^2$, $2x$, 4

$3x$ is the highest common factor which divides $9x^3$, $6x^2$ and $12x$.

So,

$9x^3 – 6x^2 + 12x = 3x(3x^2 - 2x + 4)$

(ii) Let’s find out the HCF of $8x^3$, $72xy$ and $12x$

$4x$	$8x^3$, $72xy$, $12x$
	$2x$, $18y$, 3

$4x$ is the highest common factor which divides $8x^3$, $72xy$ and $12x$.

So,

$8x^3 – 72xy + 12x = 4x(2x^2 – 18y + 3)$

(iii) Let’s find out the HCF of $18a^3b^3$, $27a^2b^3$, $36a^3b^2$

$9a^2b^2$	$18a^3b^3$, $27a^2b^3$, $36a^3b^2$
	$2ab$, $3b$, $4a$

$9a^2b^2$ is the highest common factor which divides $18a^3b^3$, $27a^2b^3$, $36a^3b^2$.

So,

$18a^3b^3 – 27a^2b^3 + 36a^3b^2 = 9a^2b^2 (2ab - 3b + 4a)$

Question: 5

Factories:

Solution:

(i) Let’s find out the HCF of $14x^3$, $21x^4y$ and $28x^2y^2$

$7x^2$	$14x^3, 21x^4y, 28x^2y^2$
	$2x, 3x^2y, 4y^2$

$7x^2$ is the highest common factor of $14x^3, 21x^4y, 28x^2y^2$

So,

$14x^3 + 21x^4y - 28x^2y^2 = 7x^2(2x + 3x^2y - 4y^2)$

(ii) Let's find out the HCF of 5, 10t and $20t^2$,

5	$5, 10t, 20t^2$
	$1, 2t, 4t^2$

5 is the highest common factor of 5, 10t and $20t^2$.

So,

$- 5 - 10t + 20t^2 = - 5(1 + 2t - 4t^2)$

(Note: As we have learned in the previous chapter when we multiplied – sign with – sign it become +)

Question: 6

Factorise:<

Solution:

(i) x(x + 3) + 5(x + 3)

Taking x + 3 as common from the whole, we get,

(x + 3)(x + 5).

Hence, x(x + 3) + 5(x + 3) = (x + 3)(x + 5)

(ii) 5x(x – 4) -7(x – 4)

Taking x – 4 as common from the whole, we get,

5x(x – 4) -7(x – 4) = (x – 4)(5x – 7).

(iii) 2m(1 – n) +3(1 – n)

Taking 1 – n as common from the whole, we get,

2m(1 – n) +3(1 – n) = (1 – n)(2m + 3).

Question: 7

6a(a – 2b) + 5b(a – 2b)

Taking a – 2b as common from the whole, we get,

= (a – 2b)(6a + 5b).

Question: 8

$x^3(2a – b) + x^2(2a – b)$

Taking 2a – b as common from the whole, we get,

$= (2a – b)(x^3 + x^2)$.

Question: 9

$9a(3a – 5b) – 12a^2(3a – 5b)$

Taking 3a – 5b as common from the whole, we get,

$= (3a – 5b)(9a – 12a^2)$.

Question: 10

$(x + 5)^2 – 4(x + 5)$

Taking (x + 5) as common from the whole, we get,

$= (x + 5)\{(x + 5) – 4\}$

$= (x + 5)(x + 5 – 4)$

$= (x + 5)(x + 1)$

So,

The factors of $(x + 5)^2 – 4(x + 5)$ are: $(x + 5)$ and $(x + 1)$

Question: 11

$3(a – 2b)^2 -5(a – 2b)$

$= (a – 2b)\ \{3(a – 2b) – 5\}$

$= (a – 2b)\{(3a – 6b) – 5\}$

$= (a – 2b)(3a – 6b – 5)$

So,

We get,

$3(a – 2b)^2 -5(a – 2b) = (a – 2b)(3a – 6b – 5)$

Question: 12

Solution:

$16(2p – 3q)^2 – 4(2p – 3q)$

$= (2p – 3q)\{16(2p – 3q) – 4\}$

$= (2p – 3q)\{(32p – 48q) – 4\}$

$= (2p – 3q)(32p – 48q – 4)$

$= 4(2p – 3q)(8p – 12q -1)$

So,

We get,

$16(2p – 3q)^2 – 4(2p – 3q) = 4(2p – 3q)(8p – 12q -1)$

Question: 14

$x(a – 3) + y(3 – a)$

$= x(a – 3) – y(a – 3)$

$= (a – 3)(x – y)$

Question: 15

Solution:

$(x + y)(2x + 5) – (x + y)(x + 3)$

$= (x + y)\{(2x + 5) – (x + 3)\}$

$= (x + y)(2x + 5 – x – 3)$

$= (x + y)(2x – x + 5 – 3)$

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

So,

We get,

$(x + y)(2x + 5) – (x + y)(x + 3) = (x + y)(x + 2)$

Question: 17

$ar + br + at + bt$

First group the terms together;

$= (ar + br) + (at + bt)$

$= r(a + b) + t(a + b)$

$= (a + b)(r + t)$

So,

We get,

$ar + br + at + bt = (a + b)(r + t)$

Question: 18

$x^2 – ax – bx + ab$

Let’s arrange the terms in a suitable form;

$x^2 – ax – bx + ab$

$= x^2 – bx – ax + ab$

$= (x^2 – bx) – (ax – ab)$

$= x(x – b) – a(x – b)$

$= (x – b)(x –a)$

So we get,

$x^2 – ax – bx + ab = (x – b)(x –a)$

Question: 19

$ab^2 – bc^2 – ab + c^2$

Let’s first arrange the terms in a suitable form;

$ab^2 – bc^2 – ab + c^2$

$= ab^2 – ab – bc^2 + c^2$

$= (ab^2 – ab) – (bc^2 - c^2)$

$= ab(b – 1) – c^2(b - 1)$

$= (b – 1)(ab – c^2)$

So we get,

$ab^2 – bc^2 – ab + c^2 = (b – 1)(ab – c^2)$

Question: 20

Let’s first arrange the terms in a suitable form;

$x^2 – xz + xy – yz$

$= x^2 + xy – xz – yz$

$= (x^2 + xy) – (xz + yz)$

$= x(x + y) – z(x + y)$

$= (x + y)(x – z)$

So we get,

$x^2 – xz + xy – yz = (x + y)(x – z)$

Question: 21

$6ab – b^2 + 12ac – 2bc$

$= 6ab + 12ac – b^2 – 2bc$

$= (6ab + 12ac) – (b^2 + 2bc)$

$= 6a(b + 2c) – b(b + 2c)$

$= (b + 2c)(6a – b)$

So we get,

$6ab – b^2 + 12ac – 2bc = (b + 2c)(6a – b)$

Question: 22

$(x – 2y)^2 + 4x – 8y$

$= (x – 2y)^2 + 4(x – 2y)$

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

$= (x -2y)\{(x -2y) +4\}$

$= (x – 2y)(x – 2y + 4)$

So we get,

$(x – 2y)^2 + 4x – 8y = = (x – 2y)(x – 2y + 4)$

Question: 23

$y^2 – xy(1 – x) – x^3$

$= y^2 – xy + x^2y – x^3$

$= (y^2 – xy) + (x^2y – x^3)$

$= y(y – x) + x^2(y – x)$

$= (y –x)(y + x^2)$

So we get,

$y^2 – xy(1 – x) – x^3 = (y –x)(y + x^2)$

Question: 24

$(ax + by)^2 + (bx – ay)^2$

By using the formulas;

$(a + b)^2 = a^2 + b^2 + 2ab$ and

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

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

$= a^2x^2 + a^2y^2 + b^2y^2 + b^2x^2 + 2axby - 2bxay$

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

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

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

So we get,

$(ax + by)^2 + (bx - ay)^2 = (x^2 + y^2)(a^2 + b^2)$

Question: 25

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

$= ab^2 + ba - b - 1$

$= (ab^2 + ba) - (b + 1)$

$= ab (b + 1) - 1(b + 1)$

$= (b + 1)(ab - 1)$

So we get,

$ab^2 + (a - 1)b - 1 = (b + 1)(ab - 1)$

Question: 26

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

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

$= x^2(x - 3) + 1(x - 3)$

$= (x - 3)(x^2 + 1)$

So we get,

$x^3 - 3x^2 + x - 3 = (x - 3)(x^2 + 1)$

Question: 27

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

$= abx^2 + aby^2 - a^2xy - b^2xy$

$= abx^2 - a^2xy + aby^2 - b^2xy$

$= ax(bx - ay) + by(ay - bx)$

$= ax(bx - ay) - by(bx - ay)$

$= (bx - ay)(ax - by)$

So we get,

$ab(x^2 + y^2) - xy(a^2 + b^2) = (bx - ay)(ax - by)$

Question: 28

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

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

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

$= (x^2 - 2bx) - (ax - 2ab)$

= x(x – 2b) – a(x – 2b)

= (x – 2b)(x – a)

So we get,

x^2 – x(a + 2b) + 2ab = (x – 2b)(x – a)

Exercise : 7B

Question: 1

We have,

x^2 – 36

Which is,

= $(x)^2$ – $(6)^2$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

x^2 – 36 = $(x)^2$ – $(6)^2$

= (x + 6)(x – 6)

Question: 2

We have,

$4a^2$ – 9

= $(2a)^2$ – $(3)^2$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$4a^2$ – 9 = $(2a)^2$ – $(3)^2$

= (2a + 3)(2a – 3)

Question: 3

We have,

81 – $49x^2$

= $(9)^2$ – $(7x)^2$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

81 – $49x^2$ = $(9)^2$ – $(7x)^2$

= (9 + 7x)(9 – 7x)

Question: 4

We have,

$4x^2$ – $9y^2$

= $(2x)^2$ – $(3y)^2$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$4x^2$ – $9y^2$ = $(2x)^2$ – $(3y)^2$

= (2x + 3y)(2x – 3y)

Question: 5

We have,

$16a^2 – 225b^2$

$= (4a)^2 – (15b)^2$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$16a^2 – 225b^2 = (4a)^2 – (15b)^2$

= (4a + 15b)(4a – 15b)

Question: 6

We have,

$9a^2b^2 – 25$

$= (3ab)^2 – (5)^2$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$9a^2b^2 – 25 = (3ab)^2 – (5)^2$

= (3ab + 5)(3ab – 5)

Question: 7

We have,

$16a^2 – 144$

$= (4a)^2 – (12)^2$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$16a^2 – 144 = (4a)^2 – (12)^2$

= (4a + 12)(4a – 12)

= 4(a + 3) 4(a – 3)

= 16(a + 3)(a – 3)

Question: 8

We have,

$63a^2 – 112b^2$

$= 7(9a^2 – 16b^2)$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$63a^2 – 112b^2 = 7(9a^2 – 16b^2)$

$= 7\{(3a)^2 – (4b)^2\}$

= 7(3a + 4b)(3a – 4b)

Question: 9

We have,

$20a^2 – 45b^2$

$= 5(4a^2 – 9b^2)$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$20a^2 – 45b^2 = 5(4a^2 – 9b^2)$

$= 5\{(2a)^2 – (3b)^2\}$

$= 5(2a + 3b)(2a – 3b)$

Question: 10

We have,

$12x^2 – 27$

$= 3(4x^2 – 9)$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$12x^2 – 27 = 3(4x^2 – 9)$

$= 3\{(2x)^2 – (3)^2\}$

$= 3(2x + 3)(2x – 3)$

Question: 11

We have,

$x^3 – 64x$

$= x(x^2 – 64)$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$x^3 – 64x = x(x^2 – 64)$

$= x\{(x)^2 – (8)^2\}$

$= x(x + 8)(x – 8)$

Question: 12

We have,

$16x^5 – 144x^3$

$= 3x^3(x^2 – 9)$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$16x^5 – 144x^3 = 3x^3(x^2 – 9)$

$= 16x^3\{(x)^2 – (3)^2\}$

$= 16x^3(x + 3)(x – 3)$

Question: 13

We have,

$3x^5 – 48x^3$

$= 3x^3(x^2 - 16)$

By using the formula $a^2 - b^2 = (a + b)(a - b)$

We get,

$3x^5 - 48x^3 = 3x^3(x^2 - 16)$

$= 3x^3\{(x)^2 - (4)^2\}$

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

Question: 14

We have,

$16p^3 - 4p$

$= 4p(4p^2 - 1)$

By using the formula $a^2 - b^2 = (a + b)(a - b)$

We get,

$16p^3 - 4p = 4p(4p^2 - 1)$

$= 4p\{(2p)^2 - (1)^2\}$

$= 4p(2p + 1)(2p - 1)$

Question: 15

We have,

$63a^2b^2 - 7$

$= 7(9a^2b^2 - 1)$

By using the formula $a^2 - b^2 = (a + b)(a - b)$

We get,

$63a^2b^2 - 7 = 7(9a^2b^2 - 1)$

$= 7\{(3ab)^2 - (1)^2\}$

$= 7(3ab + 1)(3ab - 1)$

Question: 16

We have,

$1 - (b - c)^2$

$= (1)^2 - (b - c)^2$

By using the formula $a^2 - b^2 = (a + b)(a - b)$

We get,

$1 - (b - c)^2 = (1)^2 - (b - c)^2$

$= \{1 + (b - c)\}\{1 - (b - c)\}$

$= (1 + b - c)(1 - b + c)$

Question: 17

Given,

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

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

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

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

$= \{(2a + 3b) + 4c\}\{(2a + 3b) – 4c\}$

$= (2a + 3b + 4c)(2a + 3b – 4c)$

Question: 18

Factories:<

Solution:

We have,

$(l + m)^2 - (l –m)^2$

By using the formula $a^2 – b^2 = (a + b)(a – b)$Here,a = (l + m) and b = (l –m)

$\Rightarrow (l + m)^2 - (l –m)^2 = \{(l + m) + (l – m)\}\{(l + m) – (l – m)\}$

$= (l + m + l – m)(l + m – l + m)$ $= (2l)(2m)$

$= 4lm$

Question: 19

Given,

$(2x + 5y)^2 – (1)^2$

$= (2x + 5y)^2 – (1)^2$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$(2x + 5y)^2 – (1)^2 = (2x + 5y)^2 – (1)^2$

$= \{(2x + 5y) + 1\}\{(2x + 5y) – 1\}$

$= (2x + 5y + 1)(2x + 5y – 1)$

Question: 20

Given,

$36c^2 – (5a + b)^2$

$= (6c)^2 – (5a + b)^2$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$36c^2 – (5a + b)^2 = (6c)^2 – (5a + b)^2$

$= \{(6c) + (5a + b)\}\{(6c) – (5a + b)\}$

$= (6c + 5a + b)(6c – 5a – b)$

Question: 21

Given,

$(3x – 4y)^2 – 25z^2$

$= (3x – 4y)^2 – (5z)^2$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$(3x – 4y)^2 – 25z^2 = (3x – 4y)^2 – (5z)^2$

$=\{(3x – 4y) + 5z\}\{(3x – 4y) – 5z\}$

$= (3x – 4y + 5z)(3x – 4y – 5z)$

Question: 22

Given,

$x^2 – y^2 – 2y – 1$

$= x^2 – (y^2 + 2y + 1)$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$x^2 – y^2 – 2y – 1 = x^2 – (y^2 + 2y + 1)$

$= (x)^2 – (y + 1)^2$

$=\{x + (y +1)\}\{x – (y + 1)\}$

$= (x + y + 1)(x – y – 1)$

Question: 23

Given,

$25 – a^2 – b^2 – 2ab$

$= 25 – (a^2 + b^2 + 2ab)$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$25 – a^2 – b^2 – 2ab = 25 – (a^2 + b^2 + 2ab)$

$= 25 – (a + b)^2$

$=(5)^2 – (a + b)^2$

$= \{5 + (a + b)\}\{5 – (a + b)\}$

$= (5 + a + b)(5 – a – b)$

Question: 24

Given,

$25a^2 – 4b^2 + 28bc – 49c^2$

$= 25a^2 – (4b^2 – 28bc + 49c^2)$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$25a^2 – 4b^2 + 28bc – 49c^2 = 25a^2 – (4b^2 – 28bc + 49c^2)$

$= (5a)^2 – (2b – 7c)^2$

$= \{5a + (2b – 7c)\}\{5a – (2b – 7c)\}$

$= (5a + 2b – 7c)(5a – 2b + 7c)$

Question: 25

Given,

$9a^2 – b^2 + 4b – 4$

$= 9a^2 – (b^2 – 4b + 4)$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$9a^2 – b^2 + 4b – 4 = 9a^2 – (b^2 – 4b + 4)$

$= (3a)^2 – (b – 2)^2$

$= \{3a + (b – 2)\}\{3a – (b – 2)\}$

$= (3a + b - 2)(3a – b + 2)$

Question: 26

Given,

$100 – (x – 5)^2$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$100 – (x – 5)^2 = (10)^2 – (x – 5)^2$

$= \{10 + (x – 5)\}\{10 – (x – 5)\}$

$= (10 + x - 5)(10 – x + 5)$

$= (5 + x)(15 – x)$

Question: 27

Given,

$\{(405)^2 – (395)^2\}$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$\{(405)^2 – (395)^2\} = (405 + 395)(405 – 395)$

$= (800 \times 10)$

$= 8000$

Question: 28

We have,

$\{(7.8)^2 – (2.2)^2\}$

By using the formula $a^2 – b^2 = (a + b)(a – b)$

We get,

$\{(7.8)^2 – (2.2)^2\} = (7.8 + 2.2)(7.8 – 2.2)$

$= (10 \times 5.6)$

$= 56$

So,

$\{(7.8)^2 – (2.2)^2\} = 56$

Exercise : 7C

Question: 1

Factorize:

Solution:

Given,

$x^2 + 8x + 16$

By using the formula $(a + b)^2 = a^2 + 2ab + b^2$

We get,

$= x^2 + 2 \times (x) \times 4 + (4)^2$

$= (x + 4)^2$

Question: 2

Given;

$x^2 + 14x + 49$

By using the formula $(a + b)^2 = a^2 + 2ab + b^2$

We get,

$= x^2 + 2 \times (x) \times 7 + (7)^2$

$= (x + 7)^2$

Question: 3

Solution:

Given,

$9 + 6z + z^2 = z^2 + 6z + 9$

By using the formula $(a + b)^2 = a^2 + 2ab + b^2$

We get,

$= z^2 + 2 \times z \times 3 + (3)^2$

$= (3 + z)^2$

Question: 5

Factorize:

Solution:

Given;

$x^2 + 6ax + 9a^2$

By using the formula $(a + b)^2 = a^2 + 2ab + b^2$

We get,

$= x^2 + 2 \times (x) \times 3a + (3a)^2$

$= (x + 3a)^2$

Question: 6

Given;

$4y^2 + 20y + 25$

By using the formula $(a + b)^2 = a^2 + 2ab + b^2$

We get,

$= (2y)^2 + 2 \times 2y \times 5 + (5)^2$

$= (2y + 5)^2$

Question: 7

Given,

$36a^2 + 36a + 9$

By using the formula $(a + b)^2 = a^2 + 2ab + b^2$

We get,

$= (6a)^2 + 2\times6a\times3 + (3)^2$

$= (6a + 3)^2$

Question: 8

Given,

$9m^2 + 24m + 16$

By using the formula $(a + b)^2 = a^2 + 2ab + b^2$

We get,

$= (3m)^2 + 2\times3m\times4 + (4)^2$

$= (3m + 4)^2$

Question: 9

Given,

$$z^2 + z + \frac{1}{4}$$

By using the formula $(a + b)^2 = a^2 + 2ab + b^2$

We get,

$$= z^2 + 2 \times z \times \frac{1}{2} + \left(\frac{1}{2}\right)^2$$

$$= \left(z + \frac{1}{2}\right)$$

Question: 10

Given,

$49a^2 + 84ab + 36b^2$

By using the formula $(a + b)^2 = a^2 + 2ab + b^2$

We get,

$= (7a)^2 + 2 \times 7a \times 6b + (6b)^2$

$= (7a + 6b)^2$

Question: 11

Factorize:

Solution:

Given,

$P^2 – 10p + 25$

By using the formula $(a - b)^2 = a^2 – 2ab + b^2$

We get,

$= p^2 – 2 \times p \times 5 + (5)^2$

$= (p – 5)^2$

Question: 12

Factorize:

Solution:

Given,

$121a^2 – 88ab + 16b^2$

By using the formula $(a – b)^2 = a^2 – 2ab + b^2$

We get,

$= (11a)^2 – 2 \times 11a \times 4b + (4b)^2$

$= (11a – 4b)^2$

Question: 13

Given,

$1 – 6x + 9x^2 = 9x^2 – 6x + 1$

By using the formula $(a – b)^2 = a^2 – 2ab + b^2$

We get,

$= (3x)^2 – 2 \times (3x) \times 1 + (1)^2$

$= (3x – 1)^2$

Question: 14

Given,

$9y^2 – 12y + 4$

By using the formula $(a – b)^2 = a^2 – 2ab + b^2$

We get,

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

$= (3y – z)^2$

Question: 15

Given,

$16x^2 – 24x + 9$

By using the formula $(a - b)^2 = a^2 - 2ab + b^2$

$= (4x)^2 – 2 \times (4x) \times 3 + (3)^2$

$= (4x – 3)^2$

Question: 16

Given,

$m^2 – 4mn + 4n^2$

By using the formula $(a - b)^2 = a^2 - 2ab + b^2$

$= m^2 - 2 \times m \times 2n + (2n)^2$

$= (m - 2n)^2$

Question: 17

Given,

$a^2b^2 - 6ab + 9c^2$

By using the formula $(a - b)^2 = a^2 + b^2 - 2ab$

We get,

$= (ab)^2 - 2\times ab\times 3c + (3c)^2$

$= (ab - 3c)^2$

Question: 18

Given,

$m^4 + 2m^2n^2 + n^4$

By using the formula $(a + b)^2 = a^2 + b^2 + 2ab$

We get,

$= (m^2)^2 + 2\times m^2\times n^2 + (n^2)^2$

$= (m^2 + n^2)$

Question: 19

Factorize:

Solution:

Given,

$(l + m)^2 - 4lm$

By using the formula $(a + b)^2 = a^2 + b^2 + 2ab$

We get,

$(l + m)^2 - 4lm = (l^2 + m^2 + 2lm) - 4lm$

$= l^2 + m^2 + 2lm - 4lm$

$= l^2 + m^2 - 2lm$

$= (l)^2 + (m)^2 - 2\times l\times m$

$= (l - m)^2$

Exercise : 7D

Question: 1

Factorize:

Solution:

Given,

$x^2 + 5x + 6$

Now first find the numbers whose-

Sum = 5 and

Product = 6

Required numbers are 2 and 3,

So we get;

$x^2 + 5x + 6$

$= x^2 + 2x + 3x + 6$

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

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

Question: 2

Given,

$y^2 + 10y + 24$

Now first find the numbers whose-

Sum = 10 and

Product = 24

Required numbers are 6 and 4,

So we get;

$y^2 + 10y + 24 = y^2 + 6y + 4y + 24$

$= y(y + 6) + 4(y + 6)$

$= (y + 6)(y + 4)$

Question: 3

$z^2 + 12z + 27$

Now first find the numbers whose-

Sum = 12 and

Product = 27

Required numbers are 9 and 3,

So we get;

$z^2 + 12z + 27$

$= z^2 + 9z + 3z + 27$

$= z(z + 9) + 3(z + 9)$

$= (z + 9)(z + 3)$

Question: 4

Given,

$p^2 + 6p + 8$

Now first find the numbers whose-

Sum = 6 and

Product = 8

Required numbers are 4 and 2,

So we get;

$p^2 + 6p + 8$

$= p^2 + 4p + 2p + 8$

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

= (p + 4)(p + 2)

Question: 5

Given,

$x^2 + 15x + 56$

Now first find the numbers whose-

Sum = 15 and

Product = 56

Required numbers are 7 and 8,

So we get;

$x^2 + 15x + 56$

$= x^2 + 7x + 8x + 56$

= x(x + 7) + 8(x + 7)

= (x + 7)(x + 8)

Question: 6

$y^2 + 19y + 60$

Now first find the numbers whose-

Sum = 19 and

Product = 60

Required numbers are 15 and 4,

So we get;

$y^2 + 19y + 60$

$= y^2 + 15y + 4y + 60$

= y(y + 15) + 4(y + 15)

= (y + 15)(y + 4)

Question: 7

Given,

$x^2 + 13x + 40$

Now first find the numbers whose-

Sum = 13 and

Product = 40

Required numbers are 8 and 5,

So we get;

$x^2 + 13x + 40$

$= x^2 + 8x + 5x + 40$

= x(x + 8) + 5(x + 8)

= (x + 8)(x + 5)

Question: 8

Given,

$q^2 – 10q + 21$

Now first find the numbers whose-

Sum = - 10 and

Product = 21

Required numbers are 7 and 3,

So we get;

$q^2 – 10q + 21$

$= q^2 – 7q – 3q + 21$

$= q(q – 7) – 3(q – 7)$

$= (q – 7)(q – 3)$

Question: 9

Given,

$p^2 + 6p – 16$

Now first find the numbers whose-

Sum = 6 and

Product = - 16

Required numbers are 8 and 2,

So we get;

$p^2 + 6p – 16$

$= p^2 + 8p – 2p – 16$

$= p(p + 8) – 2(p + 8)$

$= (p + 8)(p – 2)$

Question: 10

Factorize:

Solution:

Given,

$x^2 – 10x + 24$

Now first find the numbers whose-

Sum = - 10 and

Product = 24

Required numbers are 6 and 4,

So we get;

$x^2 – 10x + 24$

$= x^2 – 6x – 4x + 24$

$= x(x – 6) – 4(x – 6)$

$= (x – 6)(x – 4)$

Question: 11

Factorize:

Solution:

Given,

$x^2 – 23x + 42$

Now, first we have to find out the numbers whose-

Sum = - 23 and

Product = 42

The numbers are 21 and 2,

So,

$x^2 – 23x + 42 = x^2 – 21x – 2x + 42$

$= x(x – 21) – 2(x – 21)$

$= (x – 21)(x – 2)$

Question: 12

Given,

$x^2 – 17x + 16$

Now, first we have to find out the numbers whose-

Sum = - 17 and

Product = 16

The numbers are 16 and 1,

So,

$x^2 – 17x + 16 = x^2 – 16x – 1x + 16$

$= x(x – 16) – 1(x – 16)$

$= (x – 16)(x – 1)$

Question: 13

Given,

$y^2 – 21y + 90$

Now, first we have to find out the numbers whose-

Sum = - 21 and

Product = 90

The numbers are 15 and 6,

So,

$y^2 – 21y + 90 = y^2 – 15y – 6y + 90$

$= y(y – 15) – 6(y – 15)$

$= (y – 15)(y – 6)$

Question: 14

Given,

$x^2 – 22x + 117$

Now, first we have to find out the numbers whose-

Sum = - 22 and

Product = 117

The numbers are 13 and 9,

So,

$x^2 - 22x + 117 = x^2 - 13x - 9x + 117$

$= x(x - 13) - 9(x - 13)$

$= (x - 13)(x - 9)$

Question: 15

$x^2 - 9x + 20$

Now, first we have to find out the numbers whose-

Sum = - 9 and

Product = 20

The numbers are 5 and 4,

So,

$x^2 - 9x + 20 = x^2 - 5x - 4x + 20$

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

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

Question: 16

$x^2 + x - 132$

Now, first we have to find out the numbers whose-

Sum = 1 and

Product = - 132

The numbers are 12 and 11,

So,

$x^2 + x - 132 = x^2 + 12x - 11x - 132$

$= x(x + 12) - 11(x + 12)$

$= (x + 12)(x - 11)$

Question: 17

Factorize:

Solution:

$x^2 + 5x - 104$

Now, first we have to find out the numbers whose-

Sum = 5 and

Product = - 104

The numbers are 13 and 8,

So,

$x^2 + 5x - 104 = x^2 + 13x - 8x - 104$

$= x(x + 13) - 8(x + 13)$

$= (x + 13)(x - 8)$

Question: 18

$y^2 + 7y – 144$

Now, first we have to find out the numbers whose-

Sum = 7 and

Product = - 144

The numbers are 16 and - 9,

So,

$y^2 + 7y – 144$

$= y^2 + 16y – 9y – 144$

$= y(y + 16) – 9(y + 16)$

$= (y + 16)(y – 9)$

Question: 19

Given,

$z^2 + 19z – 150$

Now, first we have to find out the numbers whose-

Sum = 19 and

Product = - 150

The numbers are 25 and 6,

So,

$z^2 + 19z – 150$

$= z^2 + 25z – 6z – 150$

$= z(z + 25) – 6(z + 25)$

$= (z + 25)(z – 6)$

Question: 20

Given,

$y^2 + y – 72$

Now, first we have to find out the numbers whose-

Sum = 1 and

Product = - 72

The numbers are 9 and 8,

So,

$y^2 + y – 72$

$= y^2 + 9y – 9y – 72$

$= y(y + 9) – 9(y + 9)$

$= (y + 9)(y – 9)$

Question: 21

$a^2 + 6a – 91$

Now, first we have to find out the numbers whose-

Sum = 6 and

Product = - 91

The numbers are 13 and 7,

So,

$a^2 + 6a – 91$

$= a^2 + 13a – 7a – 91$

$= a(a + 13) – 7(a + 13)$

$= (a + 13) (a – 7)$

Question: 22

$p^2 – 4p – 77$

Now, first we have to find out the numbers whose-

Sum = - 4 and

Product = - 77

The numbers are 11 and 7,

So,

$p^2 – 4p – 77$

$= p^2 – 11p + 7p – 77$

$= p(p – 11) + 7(p – 11)$

$= (p – 11)(p + 7)$

Question: 23

$x^2 – 7x – 30$

Now, first we have to find out the numbers whose-

Sum = - 7 and

Product = - 30

The numbers are 10 and 3,

So,

$x^2 – 7x – 30$

$= x^2 – 10x + 3x – 30$

$= x(x – 10) + 3(x – 10)$

$= (x – 10)(x + 3)$

Question: 24

$x^2 – 11x – 42$

Now, first we have to find out the numbers whose-

Sum = - 11 and

Product = - 42

The numbers are 14 and 3,

So,

$x^2 – 11x – 42$

$= x^2 – 14x + 3x – 42$

$= x(x – 14) + 3(x + 14)$

$= (x – 14)(x + 3)$

Question: 25

$x^2 – 5x – 24$

Now, first we have to find out the numbers whose-

Sum = - 5 and

Product = - 24

The numbers are - 8 and 3,

So,

$x^2 – 5x – 24$

$= x^2 – 8x + 3x – 24$

$= x(x – 8) + 3(x – 8)$

$= (x – 8)(x + 3)$

Question: 26

Given;

$y^2 – 6y – 135$

Now first find the numbers whose-

Sum = - 6 and

Product = - 135

Required numbers are 15 and 9,

So we get;

$y^2 – 6y – 135$

$= y^2 – 15y + 9y – 135$

$= y(y – 15) + 9(y – 15)$

$= (y – 15)(y + 9)$

Question: 27

Given

$z^2 – 12z – 45$

Now first find the numbers whose-

Sum = - 12 and

Product = - 45

Required numbers are 15 and 3,

So we get;

$z^2 – 12z – 45$

$= z^2 – 15z + 3z - 45$

$= z(z – 15) + 3(z – 15)$

$= (z – 15)(z + 3)$

Question: 28

Given,

$x^2 – 4x – 12$

Now first find the numbers whose-

Sum = - 4 and

Product = - 12

Required numbers are 6 and 2,

So we get;

$x^2 – 4x – 12$

$= x^2 – 6x + 2x – 12$

$= x(x – 6) + 2(x – 6)$

$= (x – 6)(x + 2)$

Question: 29

Given,

$3x^2 + 10x + 8$

Now first find the numbers whose-

Sum = 10 and

Product = $3 \times 8 = 24$

Required numbers are 6 and 4,

So we get;

$3x^2 + 10x + 8$

$= 3x^2 + 6x + 4x + 8$

$= 3x(x + 2) + 4(x + 2)$

$= (x + 2)(3x + 4)$

Question: 30

Factorize:

Solution:

Given,

$3y^2 + 14y + 8$

Now first find the numbers whose-

Sum = 14 and

Product = $3 \times 8 = 24$

Required numbers are 12 and 2,

So we get;

$3y^2 + 14y + 8 = 3y^2 + 12y + 2y + 8$

$= 3y(y + 4) + 2(y + 4)$

$= (y + 4)(3y + 2)$

Question: 31

Factorize:

Solution:

Given,

$3z^2 – 10z + 8$

Now, first we have to find out the numbers whose-

Sum = - 10 and

Product = 3 × 8 = 24

The numbers are 6 and 4,

So,

$3z^2 – 10z + 8$

$= 3z^2 – 6z – 4z + 8$

$= 3z(z – 2) – 4(z – 2)$

$= (z – 2)(3z – 4)$

Question: 32

Factorize:

Solution:

Given,

$2x^2 + x – 45$

Now first find the numbers whose-

Sum = 1 and

Product = - 45 × 2 = - 90

Required numbers are 10 and 9,

So we get;

$2x^2 + x – 45$

$= 2x^2 + 10x – 9x – 45$

$= 2x(x + 5) – 9(x + 5)$

$= (x + 5)(2x – 9)$

Question: 33

Factorize:

Solution:

Given,

$6p^2 + 11p – 10$

Now first find the numbers whose-

Sum = 11 and

Product = - 10 × 6 = - 60

Required numbers are 15 and 4,

So we get;

$= 6p^2 + 15p – 4p – 10$

= 3p(2p + 5) – 2(2p + 5)

= (2p + 5)(3p – 2)

Question: 34

Given,

$2x^2$ – 17x – 30

Now first find the numbers whose-

Sum = - 17 and

Product = - 30 × 2 = - 60

Required numbers are 20 and 3,

So we get;

$2x^2$ – 17x – 30

= $2x^2$ – 20x + 3x – 30

= 2x(x – 10) + 3(x – 10)

= (x – 10)(2x + 3)

Question: 35

Factorize:

Solution:

Given,

$7y^2$ – 19y – 6

Now first find the numbers whose-

Sum = - 19 and

Product = - 6 × 7 = - 42

Required numbers are 21 and 2,

So we get;

$7y^2$ – 19y – 6

= $7y^2$ – 21y + 2y – 6

= 7y(y – 3) + 2(y – 3)

= (y – 3)(7y + 2)

Question: 36

Factorize:

Solution:

Given,

28 – 31x – $5x^2$

Now first find the numbers whose-

Sum = - 31 and

Product = - 5 × 28 = 140

Required numbers are 35 and 4,

So we get;

$28 – 31x – 5x^2$

$= 28 + 4x – 35x – 5x^2$

$= 4(7 + x) – 5x(7 + x)$

$= (7 + x)(4 – 5x)$

Question: 37

Given,

$3 + 23z – 8z^2$

Now first find the numbers whose-

Sum = 23 and

Product = - 8 × 3 = 24

Required numbers are 24 and 1,

So we get;

$3 + 23z – 8z^2$

$= 3 + 24z – z – 8z^2$

$= 3(1 + 8z) – z(1 + 8z)$

$= (1 + 8z)(3 – z)$

Question: 38

Factorize:

Solution:

Given,

$6x^2 – 5x – 6$

Now first find the numbers whose-

Sum = - 5 and

Product = - 6 × 6 = - 36

Required numbers are 9 and 4,

So we get;

$= 6x^2 – 9x + 4x – 6$

$= 3x(2x – 3) + 2(2x – 3)$

$= (2x – 3)(3x + 2)$

Question: 39

Factorize:

Solution:

Given,

$3m^2 + 24m + 36$

Now first find the numbers whose-

Sum = 24 and

Product = 36 × 3 = 108

Required numbers are 18 and 6,

So we get;

$3m^2 + 24m + 36$

$= 3m^2 + 18m + 6m + 36$

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

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

Question: 40

Factorize:

Solution:

Given,

$4n^2 – 8n + 3$

Now first find the numbers whose-

Sum = - 8 and

Product = 4 × 3 = 12

Required numbers are 6 and 2,

So we get;

$4n^2 – 8n + 3$

$= 4n^2 – 2n – 6n + 3$

$= 2n(2n – 1) – 3(2n – 3)$

$= (2n – 1)(2n – 3)$

Question: 41

Factorize:

Solution:

Given,

$6x^2 – 17x – 3$

Now, first we have to find out the numbers whose-

Sum = - 17 and

Product = 6 × - 3 = - 18

The numbers are 18 and 1,

So,

$6x^2 – 17x – 3$

$= 6x^2 – 18x + 1x – 3$

$= 6x(x – 3) + 1(x – 3)$

$= (x – 3)(6x + 1)$

Question: 42

Given,

$7x^2 – 19x – 6$

Now, first we have to find out the numbers whose-

Sum = - 19 and

Product = 7 × - 6 = - 42

The numbers are 21 and 2,

So,

$7x^2 – 19x – 6$

$= 7x^2 – 21x + 2x – 6$

$= 7x(x – 3) + 2(x – 3)$

$= (x – 3)(7x + 2)$

Exercise : 7E

Question: 1

$(7a^2 – 63b^2) = 7(a^2 – 9b^2)$ (taking 7 as common from whole)

$= 7(a – 3b)(a + 3b)$ ∵ $a^2 – b^2 = (a – b)(a + b)$

Question: 2

$(2x – 32x^3) = 2x(1 – 16x^2)$ (taking 2x as common from whole)

$= 2x(1 – 4x)(1 + 4x)$ ∵ $a^2 – b^2 = (a – b)(a + b)$

Question: 3

$X^3 – 144x = x(x^2 – 144)$ (taking x as common from whole)

$= x(x – 12)(x + 12)$ ∵ $a^2 – b^2 = (a – b)(a + b)$

Question: 4

$2 – 50x^2 = 2(1 – 25x^2)$ (taking 2 as common from whole)

$= 2(1 – 5x)(1 + 5x)$ ∵ $a^2 – b^2 = (a – b)(a + b)$

Question: 5

$a^2+bc+ab+ac = a^2+ab + bc + ac$

Rearranging the terms and taking a and c as common respectively.

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

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

Question: 6

$pq^2 + q(p – 1) – 1 = pq^2 + qp – q – 1$

$= pq(q + 1) – 1(q + 1)$

$= (pq – 1)(q + 1)$

Question: 7

$= ab – mn + an – bm = ab + an – mn – bm$

$= a(b + n) – m(n + b)$

$= (a – m)(b + n)$.

Question: 8

$ab – a – b + 1$

$= a(b – 1) – 1(b – 1)$ (taking a and – 1 as common)

$= (a – 1)(b – 1)$.

Question: 9

$= x^2 – xz + xy – yz$

$= x(x – z) + y(x – z)$ (taking x and y as common resp.)

$= (x + y)(x – z)$.

Question: 10

$12m^2 – 27 = 3(4m^2 – 9)$ (taking 3 as common from whole)

$= 3(2m – 3)(2m + 3)$ $\because a^2 – b^2 = (a – b)(a + b)$

Question: 11

$x^3 – x = x(x^2 – 1)$ (taking x as common from whole)

$= x(x – 1)(x + 1)$ $\because a^2 – b^2 = (a – b)(a + b)$

Question: 12

$1 – 2ab – (a^2 + b^2) = 1 – 2ab – a^2 – b^2$

$= 1 – (2ab + a^2 + b^2)$

$= 1 – (a + b)^2$

$= (1 – a – b)(1 + a + b)$ $\because a^2 – b^2 = (a – b)(a + b)$

Question: 13

$x^2 + 6x + 8$

Factorizing the equation and taking x and 2 as common,

$= x^2 + 4x + 2x + 8$

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

$= (x + 2)(x + 4)$.

Question: 14

$x^2 + 4x – 21$

Factorizing the equation and taking x and – 3 as common,

$= x^2 + 7x – 3x – 21$

$= x(x + 7) – 3(x + 7)$

$= (x – 3)(x + 7)$.

Question: 15

$y^2 + 2y – 3$

Factorizing the equation and taking y and – 1 as common,

$= y^2 + 3y – y – 3$

$= y(y + 3) – 1(y + 3)$

$= (y + 3)(y – 1)$.

Question: 16

$40 + 3x – x^2$

Factorizing the equation and taking 8 and – x as common,

$= 40 + 8x – 3x – x^2$

= 8(5 + x) – x(5 + x)

= (8 – x)(5 + x).

Question: 17

$2x^2 + 5x + 3$

Factorizing the equation and taking 2x and 3 as common,

$= 2x^2 + 2x + 3x + 3$

= 2x(x +1) + 3(x + 1)

= (2x + 3)(x + 1).

Question: 18

$6a^2 – 13a + 6$

Factorizing the equation and taking 3a and – 2 as common,

$= 6a^2 – 9a – 4a + 6$

= 3a(2a – 3) – 2(2a – 3)

= (3a – 2)(2a – 3).

Question: 19

$4z^2 – 8z + 3$

Factorizing the equation and taking 2z and – 1 as common,

$= 4z^2 – 6z – 2z + 3$

= 2z(2z – 3) – 1(2z – 3)

= (2z – 1)(2z – 3).

Question: 20

$3 + 23y – 8y^2$

Factorizing the equation and taking 3 and – y as common,

$= 3 + 24y – y – 8y^2$

= 3(1 + 8y) – y(1 + 8y)

= (3 – y)(1 + 8y).