

# Exercise 7A

## SOLUTIONS 1

Answer :

- (i)  $12x + 15 = 3(4x + 5)$
- (ii)  $14m - 21 = 7(2m - 3)$
- (iii)  $9n - 12n^2 = 3n(3 - 4n)$

## SOLUTIONS 2

Answer :

(i) H.C.F. of  $16a^2$  and  $24ab$  is  $8a$ .

$$\therefore 16a^2 - 24ab = 8a(2a - 3b)$$

(ii) H.C.F. of  $15ab^2$  and  $20a^2b$  is  $5ab$ .

$$\therefore 15ab^2 - 20a^2b = 5ab(3b - 4a)$$

(iii) H.C.F. of  $12x^2y^3$  and  $21x^3y^2$  is  $3x^2y^2$ .

$$\therefore 12x^2y^3 - 21x^3y^2 = 3x^2y^2(4y - 7x)$$

## SOLUTIONS 3

Answer :

(i) H.C.F. of  $24x^3$  and  $36x^2y$  is  $6x^2$ .

$$\therefore 24x^3 - 36x^2y = 6x^2(4x - 6y)$$

(ii) H.C.F. of  $10x^3$  and  $15x^2$  is  $5x^3$ .

$$\therefore 10x^3 - 15x^2 = 5x^2(2x - 3)$$

(iii) H.C.F. of  $36x^3y$  and  $60x^2y^3z$  is  $12x^2y$

$$\therefore 36x^3y - 60x^2y^3z = 12x^2y(3x - 5y^2z)$$

## SOLUTIONS 4

**Answer :**

(i) H.C.F. of  $9x^3$ ,  $6x^2$  and  $12x$  is  $3x$ .

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

(ii) H.C.F. of  $8x^3$ ,  $72xy$  and  $12x$  is  $4x$ .

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

(iii) H.C.F. of  $18a^3b^3$ ,  $27a^2b^3$  and  $36a^3b^2$  is  $9a^2b^2$ .

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

## SOLUTIONS 5

**Answer :**

(i) H.C.F. of  $14x^3$ ,  $21x^4y$  and  $28x^2y^2$  is  $7x^2$ .

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

(ii) H.C.F. of  $-5$ ,  $-10t$  and  $20t^2$  is  $5$ .

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

## SOLUTIONS 6

**Answer :**

$$(i) x(x + 3) + 5(x + 3) = (x + 3)(x + 5)$$

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

$$(iii) 2m(1 - n) + 3(1 - n) = (1 - n)(2m + 3)$$

## SOLUTIONS 7

**Answer :**

We have:

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

## SOLUTIONS 8

**Answer:**

We have:

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

## SOLUTIONS 9

**Answer:**

We have:

$$9a(3a - 5b) - 12a^2(3a - 5b) = (3a - 5b)(9a - 12a^2) = 3a(3a - 5b)(3 - 4a)$$

## SOLUTIONS 10

**Answer:**

We have:

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

$$\therefore (x + 5)^2 - 4(x + 5) = (x + 5)(x + 1)$$

## SOLUTIONS 11

**Answer:**

$$\begin{aligned}3(a - 2b)^2 - 5(a - 2b) &= (a - 2b)\{3(a - 2b) - 5\} \\ &= (a - 2b)(3a - 6b - 5)\end{aligned}$$

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

## SOLUTIONS 12

**Answer:**

We have:

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

$$\therefore 2a + 6b - 3(a + 3b)^2 = (a + 3b)(2 - 3a - 9b)$$

## SOLUTIONS 13

**Answer :**

We have:

$$\begin{aligned}16(2p - 3q)^2 - 4(2p - 3q) &= (2p - 3q)\{16(2p - 3q) - 4\} \\&= (2p - 3q)(32p - 48q - 4)\end{aligned}$$

$$\therefore 16(2p - 3q)^2 - 4(2p - 3q) = (2p - 3q)(32p - 48q - 4)$$

## SOLUTIONS 14

**Answer :**

We have:

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

$$\therefore x(a - 3) + y(3 - a) = (a - 3)(x - y)$$

## SOLUTIONS 15

**Answer :**

We have:

$$\begin{aligned}12(2x - 3y)^2 - 16(3y - 2x) &= 12(2x - 3y)^2 + 16(2x - 3y) \\&= (2x - 3y)\{12(2x - 3y) + 16\} \\&= (2x - 3y)(24x - 36y + 16)\end{aligned}$$

$$\therefore 12(2x - 3y)^2 - 16(3y - 2x) = (2x - 3y)(24x - 36y + 16)$$

## SOLUTIONS 16

**Answer :**

We have:

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

## SOLUTIONS 17

**Answer :**

By grouping the terms:

$$\begin{aligned}ar + br + at + bt &= (ar + br) + (at + bt) \\&= r(a + b) + t(a + b) \\&= (a + b)(r + t)\end{aligned}$$

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

## SOLUTIONS 18

**Answer :**

By suitably arranging the terms:

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

$$\therefore x^2 - ax - bx + ab = (x - b)(x - a)$$

## SOLUTIONS 19

**Answer :**

By suitably arranging the terms:

$$\begin{aligned}ab^2 - bc^2 - ab + c^2 &= ab^2 - ab - bc^2 + c^2 \\&= (ab^2 - ab) - (bc^2 - c^2) \\&= ab(b - 1) - c^2(b - 1) \\&= (b - 1)(ab - c^2)\end{aligned}$$

$$\therefore ab^2 - bc^2 - ab + c^2 = (b - 1)(ab - c^2)$$

## SOLUTIONS 20

**Answer :**

By suitably arranging the terms:

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

$$\therefore x^2 - xz + xy - yz = (x + y)(x - z)$$

## SOLUTIONS 21

**Answer :**

By suitably arranging the terms:

$$\begin{aligned}6ab - b^2 + 12ac - 2bc &= 6ab + 12ac - b^2 - 2bc \\&= (6ab + 12ac) - (b^2 + 2bc) \\&= 6a(b + 2c) - b(b + 2c) \\&= (b + 2c)(6a - b)\end{aligned}$$

$$\therefore 6ab - b^2 + 12ac - 2bc = (b + 2c)(6a - b)$$

## SOLUTIONS 22

**Answer :**

We have:

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

$$\therefore (x - 2y)^2 + 4x - 8y = (x - 2y)(x - 2y + 4)$$

## SOLUTIONS 23

**Answer :**

We have:

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

$$\therefore y^2 - xy(1 - x) - x^3 = (y - x)(y + x^2)$$

## SOLUTIONS 24

**Answer :**

We have:

$$\begin{aligned}(ax + by)^2 + (bx - ay)^2 &= \left(a^2x^2 + b^2y^2 + 2axby\right) + \left(b^2x^2 + a^2y^2 - 2bxay\right) \\&= a^2x^2 + a^2y^2 + b^2y^2 + b^2x^2 + 2axby - 2bxay \\&= a^2(x^2 + y^2) + b^2x^2 + b^2y^2 + 2axby - 2axby \\&= a^2(x^2 + y^2) + b^2(x^2 + y^2) \\&= (x^2 + y^2)(a^2 + b^2)\end{aligned}$$
$$\therefore (ax + by)^2 + (bx - ay)^2 = (x^2 + y^2)(a^2 + b^2)$$

## SOLUTIONS 25

**Answer :**

We have:

$$\begin{aligned}ab^2 + (a - 1)b - 1 &= ab^2 + ba - b - 1 \\&= (ab^2 + ba) - (b + 1) \\&= ab(b + 1) - 1(b + 1) \\&= (b + 1)(ab - 1)\end{aligned}$$

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

## SOLUTIONS 26

**Answer :**

We have:

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

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

## SOLUTIONS 27

**Answer :**

We have:

$$\begin{aligned} ab(x^2 + y^2) - xy(a^2 + b^2) &= abx^2 + aby^2 - a^2xy - b^2xy \\ &= abx^2 - a^2xy + aby^2 - b^2xy \\ &= ax(bx - ay) + by(ay - bx) \\ &= ax(bx - ay) - by(bx - ay) \\ &= (bx - ay)(ax - by) \end{aligned}$$

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

## SOLUTIONS 28

**Answer :**

We have:

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

$$\therefore x^2 - x(a + 2b) + 2ab = (x - 2b)(x - a)$$

# Exercise 7B

## SOLUTIONS 1

Answer :

We have:

$$\begin{aligned}x^2 - 36 &= (x)^2 - (6)^2 \\&= (x + 6)(x - 6)\end{aligned}$$

$$\therefore x^2 - 36 = (x + 6)(x - 6)$$

## SOLUTIONS 2

Answer :

We have:

$$\begin{aligned}4a^2 - 9 &= (2a)^2 - (3)^2 \\&= (2a + 3)(2a - 3)\end{aligned}$$

$$\therefore 4a^2 - 9 = (2a + 3)(2a - 3)$$

## SOLUTIONS 3

Answer :

We have:

$$\begin{aligned}81 - 49x^2 &= (9)^2 - (7x)^2 \\&= (9 + 7x)(9 - 7x)\end{aligned}$$

$$\therefore 81 - 49x^2 = (9 + 7x)(9 - 7x)$$

## SOLUTIONS 4

Answer :

We have:

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

$$\therefore 4x^2 - 9y^2 = (2x + 3y)(2x - 3y)$$

## SOLUTIONS 5

Answer :

We have:

$$\begin{aligned}16a^2 - 225b^2 &= (4a)^2 - (15b)^2 \\&= (4a + 15b)(4a - 15b)\end{aligned}$$

$$\therefore 16a^2 - 225b^2 = (4a + 15b)(4a - 15b)$$

## SOLUTIONS 6

Answer :

We have:

$$\begin{aligned}9a^2b^2 - 25 &= (3ab)^2 - (5)^2 \\&= (3ab + 5)(3ab - 5)\end{aligned}$$

$$\therefore 9a^2b^2 - 25 = (3ab + 5)(3ab - 5)$$

## SOLUTIONS 7

Answer :

We have:

$$\begin{aligned}16a^2 - 144 &= (4a)^2 - (12)^2 \\&= (4a + 12)(4a - 12) \\&= 4(a + 3) 4(a - 3) = 16(a + 3)(a - 3)\end{aligned}$$

$$\therefore 16a^2 - 144 = 16(a + 3)(a - 3)$$

## SOLUTIONS 8

Answer :

We have:

$$\begin{aligned}63a^2 - 112b^2 &= 7(9a^2 - 16b^2) \\&= 7\{(3a)^2 - (4b)^2\} \\&= 7(3a + 4b)(3a - 4b)\end{aligned}$$

$$\therefore 63a^2 - 112b^2 = 7(3a + 4b)(3a - 4b)$$

## SOLUTIONS 9

**Answer :**

We have:

$$\begin{aligned}20a^2 - 45b^2 &= 5(4a^2 - 9b^2) \\&= 5\{(2a)^2 - (3b)^2\} \\&= 5(2a + 3b)(2a - 3b)\end{aligned}$$

$$\therefore 20a^2 - 45b^2 = 5(2a + 3b)(2a - 3b)$$

## SOLUTIONS 10

**Answer :**

We have:

$$\begin{aligned}12x^2 - 27 &= 3(4x^2 - 9) \\&= 3\{(2x)^2 - (3)^2\} \\&= 3(2x + 3)(2x - 3)\end{aligned}$$

$$\therefore 12x^2 - 27 = 3(2x + 3)(2x - 3)$$

## SOLUTIONS 11

**Answer :**

We have:

$$\begin{aligned}x^3 - 64x &= x(x^2 - 64) \\&= x\{(x)^2 - (8)^2\} \\&= x(x + 8)(x - 8)\end{aligned}$$

$$\therefore x^3 - 64x = x(x + 8)(x - 8)$$

## SOLUTIONS 12

**Answer :**

We have:

$$\begin{aligned}16x^5 - 144x^3 &= 16x^3(x^2 - 9) \\&= 16x^3\{(x)^2 - (3)^2\} \\&= 16x^3(x + 3)(x - 3)\end{aligned}$$

$$\therefore 16x^5 - 144x^3 = 16x^3(x + 3)(x - 3)$$

## SOLUTIONS 13

**Answer :**

We have:

$$\begin{aligned}3x^5 - 48x^3 &= 3x^3(x^2 - 16) \\&= 3x^3\{(x)^2 - (4)^2\} \\&= 3x^3(x + 4)(x - 4)\end{aligned}$$

$$\therefore 3x^5 - 48x^3 = 3x^3(x + 4)(x - 4)$$

## SOLUTIONS 14

**Answer :**

We have:

$$\begin{aligned}16p^3 - 4p &= 4p(4p^2 - 1) \\&= 4p\{(2p)^2 - (1)^2\} \\&= 4p(2p + 1)(2p - 1)\end{aligned}$$

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

## SOLUTIONS 15

**Answer :**

We have:

$$\begin{aligned}63a^2b^2 - 7 &= 7(9a^2b^2 - 1) \\&= 7\{(3ab)^2 - (1)^2\} \\&= 7(3ab + 1)(3ab - 1)\end{aligned}$$

$$\therefore 63a^2b^2 - 7 = 7(3ab + 1)(3ab - 1)$$

## SOLUTIONS 16

**Answer :**

We have:

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

$$\therefore 1 - (b - c)^2 = (1 + b - c)(1 - b + c)$$

## SOLUTIONS 17

**Answer :**

We have:

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

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

## SOLUTIONS 18

**Answer :**

We have:

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

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

## SOLUTIONS 19

**Answer :**

We have:

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

$$\therefore (2x + 5y)^2 - 1 = (2x + 5y + 1)(2x + 5y - 1)$$

## SOLUTIONS 20

**Answer :**

We have:

$$\begin{aligned}36c^2 - (5a + b)^2 &= (6c)^2 - (5a + b)^2 \\&= \{(6c) + (5a + b)\}\{(6c) - (5a + b)\} \\&= (6c + 5a + b)(6c - 5a - b)\end{aligned}$$

$$\therefore 36c^2 - (5a + b)^2 = (6c + 5a + b)(6c - 5a - b)$$

## SOLUTIONS 21

**Answer :**

We have:

$$\begin{aligned}(3x - 4y)^2 - 25z^2 &= (3x - 4y)^2 - (5z)^2 \\&= \{(3x - 4y) + 5z\}\{(3x - 4y) - 5z\} \\&= (3x - 4y + 5z)(3x - 4y - 5z)\end{aligned}$$

$$\therefore (3x - 4y)^2 - 25z^2 = (3x - 4y + 5z)(3x - 4y - 5z)$$

## SOLUTIONS 22

**Answer :**

We have:

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

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

## SOLUTIONS 23

**Answer :**

We have:

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

$$\therefore 25 - a^2 - b^2 - 2ab = (5 + a + b)(5 - a - b)$$

## SOLUTIONS 24

**Answer :**

We have:

$$\begin{aligned}25a^2 - 4b^2 + 28bc - 49c^2 &= 25a^2 - (4b^2 - 28bc + 49c^2) \\&= (5a)^2 - (2b - 7c)^2 \\&= \{5a + (2b - 7c)\}\{5a - (2b - 7c)\} \\&= (5a + 2b - 7c)(5a - 2b + 7c)\end{aligned}$$

$$\therefore 25a^2 - 4b^2 + 28bc - 49c^2 = (5a + 2b - 7c)(5a - 2b + 7c)$$

## SOLUTIONS 25

Answer :

We have:

$$\begin{aligned}9a^2 - b^2 + 4b - 4 &= 9a^2 - (b^2 - 4b + 4) \\&= (3a)^2 - (b - 2)^2 \\&= \{3a + (b - 2)\}\{3a - (b - 2)\} \\&= (3a + b - 2)(3a - b + 2)\end{aligned}$$

$$\therefore 9a^2 - b^2 + 4b - 4 = (3a + b - 2)(3a - b + 2)$$

## SOLUTIONS 26

Answer :

We have:

$$\begin{aligned}100 - (x - 5)^2 &= (10)^2 - (x - 5)^2 \\&= \{10 + (x - 5)\}\{10 - (x - 5)\} \\&= (10 + x - 5)(10 - x + 5) \\&= (5 + x)(15 - x)\end{aligned}$$

$$\therefore 100 - (x - 5)^2 = (5 + x)(15 - x)$$

## SOLUTIONS 27

Answer :

We have:

$$\begin{aligned}\{(405)^2 - (395)^2\} &= (405 + 395)(405 - 395) \\&= (800 \times 10) \\&= 8000\end{aligned}$$

$$\therefore \{(405)^2 - (395)^2\} = 8000$$

## SOLUTIONS 28

Answer :

We have:

$$\begin{aligned}\{(7.8)^2 - (2.2)^2\} &= (7.8 + 2.2)(7.8 - 2.2) \\&= (10 \times 5.6) \\&= 56\end{aligned}$$

$$\therefore \{(7.8)^2 - (2.2)^2\} = 56$$

## **Exercise 7C**

### **SOLUTIONS 1**

**Answer :**

We have:

$$\begin{aligned}x^2 + 8x + 16 &= x^2 + 2 \times x \times 4 + (4)^2 \\&= (x + 4)^2\end{aligned}$$

$$\therefore x^2 + 8x + 16 = (x + 4)^2$$

### **SOLUTIONS 2**

**Answer :**

We have:

$$\begin{aligned}x^2 + 14x + 49 &= x^2 + 2 \times x \times 7 + (7)^2 \\&= (x + 7)^2\end{aligned}$$

$$\therefore x^2 + 14x + 49 = (x + 7)^2$$

### **SOLUTIONS 3**

**Answer :**

We have:

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

$$\therefore 1 + 2x + x^2 = (x + 1)^2$$

### **SOLUTIONS 4**

**Answer :**

We have:

$$\begin{aligned}9 + 6z + z^2 &= z^2 + 6z + 9 \\&= z^2 + 2 \times z \times 3 + (3)^2 \\&= (z + 3)^2\end{aligned}$$

$$\therefore 9 + 6z + z^2 = (z + 3)^2$$

### **SOLUTIONS 5**

**Answer :**

We have:

$$\begin{aligned}x^2 + 6ax + 9a^2 &= x^2 + 2 \times x \times 3a + (3a)^2 \\&= (x + 3a)^2\end{aligned}$$

$$\therefore x^2 + 6ax + 9a^2 = (x + 3a)^2$$

## SOLUTIONS 6

**Answer :**

We have:

$$\begin{aligned}4y^2 + 20y + 25 &= (2y)^2 + 2 \times 2y \times 5 + (5)^2 \\&= (2y + 5)^2\end{aligned}$$

$$\therefore 4y^2 + 20y + 25 = (2y + 5)^2$$

## SOLUTIONS 7

**Answer :**

We have:

$$\begin{aligned}36a^2 + 36a + 9 &= (6a)^2 + 2 \times 6a \times 3 + (3)^2 \\&= (6a + 3)^2\end{aligned}$$

$$\therefore 36a^2 + 36a + 9 = (6a + 3)^2$$

## SOLUTIONS 8

**Answer :**

We have:

$$\begin{aligned}9m^2 + 24m + 16 &= (3m)^2 + 2 \times 3m \times 4 + (4)^2 \\&= (3m + 4)^2\end{aligned}$$

$$\therefore 9m^2 + 24m + 16 = (3m + 4)^2$$

## SOLUTIONS 9

**Answer :**

We have:

$$\begin{aligned}z^2 + z + \frac{1}{4} &= z^2 + 2 \times z \times \frac{1}{2} \times \left(\frac{1}{2}\right)^2 \\&= \left(z + \frac{1}{2}\right)^2\end{aligned}$$

$$\therefore z^2 + z + \frac{1}{4} = \left(z + \frac{1}{2}\right)^2$$

## SOLUTIONS 10

**Answer :**

We have:

$$\begin{aligned}49a^2 + 84ab + 36b^2 &= (7a)^2 + 2 \times 7a \times 6b + (6b)^2 \\&= (7a + 6b)^2\end{aligned}$$

$$\therefore 49a^2 + 84ab + 36b^2 = (7a + 6b)^2$$

## SOLUTIONS 11

**Answer :**

We have:

$$\begin{aligned}p^2 - 10p + 25 &= p^2 - 2 \times p \times 5 + (5)^2 \\&= (p - 5)^2\end{aligned}$$

$$\therefore p^2 - 10p + 25 = (p - 5)^2$$

## SOLUTIONS 12

**Answer :**

We have:

$$\begin{aligned}121a^2 - 88ab + 16b^2 &= (11a)^2 - 2 \times 11a \times 4b + (4b)^2 \\&= (11a - 4b)^2\end{aligned}$$

$$\therefore 121a^2 - 88ab + 16b^2 = (11a - 4b)^2$$

## SOLUTIONS 13

**Answer :**

We have:

$$\begin{aligned}1 - 6x + 9x^2 &= 9x^2 - 6x + 1 \\&= (3x)^2 - 2 \times 3x \times 1 + (1)^2 \\&= (3x - 1)^2\end{aligned}$$

$$\therefore 1 - 6x + 9x^2 = (3x - 1)^2$$

## SOLUTIONS 14

**Answer :**

We have:

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

$$\therefore 9y^2 - 12y + 4 = (3y - 2)^2$$

## SOLUTIONS 15

**Answer :**

We have:

$$\begin{aligned}16x^2 - 24x + 9 &= (4x)^2 - 2 \times 4x \times 3 + (3)^2 \\&= (4x - 3)^2\end{aligned}$$

$$\therefore 16x^2 - 24x + 9 = (4x - 3)^2$$

## SOLUTIONS 16

**Answer :**

We have:

$$\begin{aligned}m^2 - 4mn + 4n^2 &= m^2 - 2 \times m \times 2n + (2n)^2 \\&= (m - 2n)^2\end{aligned}$$

$$\therefore m^2 - 4mn + 4n^2 = (m - 2n)^2$$

## SOLUTIONS 17

**Answer :**

We have:

$$\begin{aligned}a^2b^2 - 6abc + 9c^2 &= (ab)^2 - 2 \times ab \times 3c + (3c)^2 \\&= (ab - 3c)^2\end{aligned}$$

## **SOLUTIONS 18**

**Answer :**

We have:

$$\begin{aligned}m^4 + 2m^2n^2 + n^4 &= (m^2)^2 + 2 \times m^2 \times n^2 + (n^2)^2 \\&= (m^2 + n^2)^2\end{aligned}$$

$$\therefore m^4 + 2m^2n^2 + n^4 = (m^2 + n^2)^2$$

## **SOLUTIONS 19**

**Answer :**

We have:

$$\begin{aligned}(l+m)^2 - 4lm &= (l^2 + m^2 + 2lm) - 4lm \\&= l^2 + m^2 + 2lm - 4lm \\&= l^2 + m^2 - 2lm \\&= (l)^2 + (m)^2 - 2 \times l \times m \\&= (l-m)^2\end{aligned}$$

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

## Exercise 7D

### SOLUTIONS 1

Answer :

The given expression is  $x^2 + 5x + 6$ .

Find two numbers that follow the conditions given below :

Sum = 5

Product = 6

Clearly, the numbers are 3 and 2.

$$\begin{aligned}x^2 + 5x + 6 &= x^2 + 3x + 2x + 6 \\&= x(x+3) + 2(x+3) \\&= (x+3)(x+2)\end{aligned}$$

### SOLUTIONS 2

Answer :

The given expression is  $y^2 + 10y + 24$ .

Find two numbers that follow the conditions given below :

Sum = 10

Product = 24

Clearly, the numbers are 6 and 4.

$$\begin{aligned}y^2 + 10y + 24 &= y^2 + 6y + 4y + 24 \\&= y(y+6) + 4(y+6) \\&= (y+6)(y+4)\end{aligned}$$

### SOLUTIONS 3

Answer :

The given expression is  $z^2 + 12z + 27$ .

Find two numbers that follow the conditions given below :

Sum = 12

Product = 27

Clearly, the numbers are 9 and 3.

$$\begin{aligned}z^2 + 12z + 27 &= z^2 + 9z + 3z + 27 \\&= z(z+9) + 3(z+9) \\&= (z+9)(z+3)\end{aligned}$$

### SOLUTIONS 4

**Answer :**

The given expression is  $p^2 + 6p + 8$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = 6$$

$$\text{Product} = 8$$

Clearly, the numbers are 4 and 2.

$$\begin{aligned} p^2 + 6p + 8 &= p^2 + 4p + 2p + 8 \\ &= p(p+4) + 2(p+4) \\ &= (p+4)(p+2) \end{aligned}$$

## SOLUTIONS 5

**Answer :**

The given expression is  $x^2 + 15x + 56$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = 15$$

$$\text{Product} = 56$$

Clearly, the numbers are 8 and 7.

$$\begin{aligned} x^2 + 15x + 56 &= x^2 + 8x + 7x + 56 \\ &= x(x+8) + 7(x+8) \\ &= (x+8)(x+7) \end{aligned}$$

## SOLUTIONS 6

**Answer :**

The given expression is  $y^2 + 19y + 60$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = 19$$

$$\text{Product} = 60$$

Clearly, the numbers are 15 and 4.

$$\begin{aligned} y^2 + 19y + 60 &= y^2 + 15y + 4y + 60 \\ &= y(y+15) + 4(y+15) \\ &= (y+15)(y+4) \end{aligned}$$

## SOLUTIONS 7

**Answer :**

The given expression is  $x^2 + 13x + 40$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = 13$$

$$\text{Product} = 40$$

Clearly, the numbers are 8 and 5.

$$\begin{aligned}x^2 + 13x + 40 &= x^2 + 8x + 5x + 40 \\&= x(x+8) + 5(x+8) \\&= (x+8)(x+5)\end{aligned}$$

## SOLUTIONS 8

**Answer :**

The given expression is  $q^2 - 10q + 21$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = -10$$

$$\text{Product} = 21$$

Clearly, the numbers are - 7 and - 3.

$$\begin{aligned}q^2 - 10q + 21 &= q^2 - 7q - 3q + 21 \\&= q(q-7) - 3(q-7) \\&= (q-7)(q-3)\end{aligned}$$

## SOLUTIONS 9

**Answer :**

The given expression is  $p^2 + 6p - 16$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = 6$$

$$\text{Product} = -16$$

Clearly, the numbers are 8 and - 2.

$$\begin{aligned}p^2 + 6p - 16 &= p^2 + 8p - 2p - 16 \\&= p(p+8) - 2(p+8) \\&= (p+8)(p-2)\end{aligned}$$

## SOLUTIONS 10

**Answer :**

*The given expression is  $x^2 - 10x + 24$ .*

*Find two numbers that follow the conditions given below :*

*Sum = -10*

*Product = 24*

*Clearly, the numbers are - 6 and - 4.*

$$x^2 - 10x + 24 = x^2 - 6x - 4x + 24$$

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

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

## **SOLUTIONS 11**

**Answer :**

*The given expression is  $x^2 - 23x + 42$ .*

*Find two numbers that follow the conditions given below :*

*Sum = -23*

*Product = 42*

*Clearly, the numbers are - 21 and - 2.*

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

$$= x(x - 21) - 2(x - 21)$$

$$= (x - 21)(x - 2)$$

## **SOLUTIONS 12**

**Answer :**

*The given expression is  $x^2 - 17x + 16$ .*

*Find two numbers that follow the conditions given below :*

*Sum = -17*

*Product = 16*

*Clearly, the numbers are - 16 and - 1.*

$$x^2 - 17x + 16 = x^2 - 16x - x + 16$$

$$= x(x - 16) - 1(x - 16)$$

$$= (x - 16)(x - 1)$$

## **SOLUTIONS 13**

**Answer :**

*The given expression is  $y^2 - 21y + 90$ .*

Find two numbers that follow the conditions given below :

$$\text{Sum} = -21$$

$$\text{Product} = 90$$

*Clearly, the numbers are  $-15$  and  $-6$ .*

$$\begin{aligned}y^2 - 21y + 90 &= y^2 - 15y - 6y + 90 \\&= y(y - 15) - 6(y - 15) \\&= (y - 15)(y - 6)\end{aligned}$$

## SOLUTIONS 14

**Answer :**

*The given expression is  $x^2 - 22x + 117$ .*

Find two numbers that follow the conditions given below :

$$\text{Sum} = -22$$

$$\text{Product} = 117$$

*Clearly, the numbers are  $-13$  and  $-9$ .*

$$\begin{aligned}x^2 - 22x + 117 &= x^2 - 13x - 9x + 117 \\&= x(x - 13) - 9(x - 13) \\&= (x - 13)(x - 9)\end{aligned}$$

## SOLUTIONS 15

**Answer :**

*The given expression is  $x^2 - 9x + 20$ .*

Find two numbers that follow the conditions given below :

$$\text{Sum} = -9$$

$$\text{Product} = 20$$

*Clearly, the numbers are  $-5$  and  $-4$ .*

$$\begin{aligned}x^2 - 9x + 20 &= x^2 - 5x - 4x + 20 \\&= x(x - 5) - 4(x - 5) \\&= (x - 5)(x - 4)\end{aligned}$$

## SOLUTIONS 16

**Answer :**

*The given expression is  $x^2 + x - 132$ .*

Find two numbers that follow the conditions given below :

*Sum = 1 and p*

*Product = -132*

*Clearly, the numbers are 12 and -11.*

$$\begin{aligned}x^2 + x - 132 &= x^2 + 12x - 11x - 132 \\&= x(x + 12) - 11(x + 12) \\&= (x + 12)(x - 11)\end{aligned}$$

## SOLUTIONS 17

**Answer :**

*The given expression is  $x^2 + 5x - 104$ .*

Find two numbers that follow the conditions given below :

*Sum = 5*

*Product = -104*

*Clearly, the numbers are 13 and -8.*

$$\begin{aligned}x^2 + 5x - 104 &= x^2 + 13x - 8x - 104 \\&= x(x + 13) - 8(x + 13) \\&= (x + 13)(x - 8)\end{aligned}$$

## SOLUTIONS 18

**Answer :**

*The given expression is  $y^2 + 7y - 144$ .*

Find two numbers that follow the conditions given below :

*Sum = 7*

*Product = -144*

*Clearly, the numbers are 16 and -9.*

$$\begin{aligned}y^2 + 7y - 144 &= y^2 + 16y - 9y - 144 \\&= y(y + 16) - 9(y + 16) \\&= (y + 16)(y - 9)\end{aligned}$$

## SOLUTIONS 19

**Answer :**

*The given expression is  $z^2 + 19z - 150$ .*

*Find two numbers that follow the conditions given below :*

*Sum = 19*

*Product = -150*

*Clearly, the numbers are 25 and -6.*

$$\begin{aligned} z^2 + 19z - 150 &= z^2 + 25z - 6z - 150 \\ &= z(z + 25) - 6(z + 25) \\ &= (z + 25)(z - 6) \end{aligned}$$

## **SOLUTIONS 20**

**Answer :**

*The given expression is  $y^2 + y - 72$ .*

*Find two numbers that follow the conditions given below :*

*Sum = 1*

*Product = -72*

*Clearly, the numbers are 9 and -8.*

$$\begin{aligned} y^2 + y - 72 &= y^2 + 9y - 8y - 72 \\ &= y(y + 9) - 8(y + 9) \\ &= (y + 9)(y - 8) \end{aligned}$$

## **SOLUTIONS 21**

**Answer :**

*The given expression is  $a^2 + 6a - 91$ .*

*Find two numbers that follow the conditions given below :*

*Sum = 6*

*Product = -91*

*Clearly, the numbers are 13 and -7.*

$$\begin{aligned} a^2 + 6a - 91 &= a^2 + 13a - 7a - 91 \\ &= a(a + 13) - 7(a + 13) \\ &= (a + 13)(a - 7) \end{aligned}$$

## **SOLUTIONS 22**

**Answer :**

The given expression is  $p^2 - 4p - 77$ .

Find two numbers that follow the conditions given below :

*Sum* = -4

*Product* = -77

*Clearly, the numbers are -11 and 7.*

$$\begin{aligned} p^2 - 4p - 77 &= p^2 - 11p + 7p - 77 \\ &= p(p - 11) + 7(p - 11) \\ &= (p - 11)(p + 7) \end{aligned}$$

## SOLUTIONS 23

**Answer :**

The given expression is  $x^2 - 7x - 30$ .

Find two numbers that follow the conditions given below :

*Sum* = -7

*Product* = -30

*Clearly, the numbers are -10 and 3.*

$$\begin{aligned} x^2 - 7x - 30 &= x^2 - 10x + 3x - 30 \\ &= x(x - 10) + 3(x - 10) \\ &= (x - 10)(x + 3) \end{aligned}$$

## SOLUTIONS 24

**Answer :**

The given expression is  $x^2 - 11x - 42$ .

Find two numbers that follow the conditions given below :

*Sum* = -11

*Product* = -42

*Clearly, the numbers are -14 and 3.*

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

## SOLUTIONS 25

**Answer :**

The given expression is  $x^2 - 5x - 24$ .

Find two numbers that follow the conditions given below :

*Sum = -5*

*Product = -24*

*Clearly, the numbers are - 8 and 3.*

$$\begin{aligned}x^2 - 5x - 24 &= x^2 - 8x + 3x - 24 \\&= x(x - 8) + 3(x - 8) \\&= (x - 8)(x + 3)\end{aligned}$$

## SOLUTIONS 26

**Answer :**

The given expression is  $y^2 - 6y - 135$ .

Find two numbers that follow the conditions given below :

*Sum = -6*

*Product = -135*

*Clearly, the numbers are - 15 and 9.*

$$\begin{aligned}y^2 - 6y - 135 &= y^2 - 15y + 9y - 135 \\&= y(y - 15) + 9(y - 15) \\&= (y - 15)(y + 9)\end{aligned}$$

## SOLUTIONS 27

**Answer :**

The given expression is  $z^2 - 12z - 45$ .

Find two numbers that follow the conditions given below :

*Sum = -12*

*Product = -45*

*Clearly, the numbers are - 15 and 3.*

$$\begin{aligned}z^2 - 12z - 45 &= z^2 - 15z + 3z - 45 \\&= z(z - 15) + 3(z - 15) \\&= (z - 15)(z + 3)\end{aligned}$$

## SOLUTIONS 28

**Answer :**

The given expression is  $x^2 - 4x - 12$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = -4$$

$$\text{Product} = -12$$

Clearly, the numbers are  $-6$  and  $2$ .

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

## SOLUTIONS 29

**Answer :**

The given expression is  $3x^2 + 10x + 8$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = 10$$

$$\text{Product} = 3 \times 8 = 24$$

Clearly, the numbers are  $6$  and  $4$ .

$$\begin{aligned}3x^2 + 10x + 8 &= 3x^2 + 10x + 8 \\&= 3x^2 + 6x + 4x + 8 \\&= 3x(x + 2) + 4(x + 2) \\&= (x + 2)(3x + 4)\end{aligned}$$

## SOLUTIONS 30

**Answer :**

The given expression is  $3y^2 + 14y + 8$

Find two numbers that follow the conditions given below :

$$\text{Sum} = 14$$

$$\text{Product} = 24$$

Clearly, the numbers are  $12$  and  $2$ .

$$\begin{aligned}3y^2 + 14y + 8 &= 3y^2 + 12y + 2y + 8 \\&= 3y(y + 4) + 2(y + 4) \\&= (3y + 2)(y + 4)\end{aligned}$$

## SOLUTIONS 31

**Answer :**

The given expression is  $3z^2 - 10z + 8$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = -10$$

$$\text{Product} = 3 \times 8 = 24$$

Clearly, the numbers are  $-6$  and  $-4$ .

$$\begin{aligned}3z^2 - 10z + 8 &= 3z^2 - 6z - 4z + 8 \\&= 3z(z - 2) - 4(z - 2) \\&= (3z - 4)(z - 2)\end{aligned}$$

## SOLUTIONS 32

**Answer :**

The given expression is  $2x^2 + x - 45$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = 1$$

$$\text{Product} = -45 \times 2 = -90$$

Clearly, the numbers are  $10$  and  $-9$ .

$$\begin{aligned}2x^2 + x - 45 &= 2x^2 + 10x - 9x - 45 \\&= 2x(x + 5) - 9(x + 5) \\&= (2x - 9)(x + 5)\end{aligned}$$

## SOLUTIONS 33

**Answer :**

The given expression is  $6p^2 + 11p - 10$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = 11$$

$$\text{Product} = 6 \times -10 = -60$$

Clearly, the numbers are  $15$  and  $-4$ .

$$\begin{aligned}6p^2 + 11p - 10 &= 6p^2 + 15p - 4p - 10 \\&= 3p(2p + 5) - 2(2p + 5) \\&= (2p + 5)(3p - 2)\end{aligned}$$

## SOLUTIONS 34

**Answer :**

The given expression is  $2x^2 - 17x - 30$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = -17$$

$$\text{Product} = -30 \times 2 = -60$$

Clearly, the numbers are  $-20$  and  $3$ .

$$\begin{aligned}2x^2 - 17x - 30 &= 2x^2 - 20x + 3x - 30 \\&= 2x(x - 10) + 3(x - 10) \\&= (2x + 3)(x - 10)\end{aligned}$$

## SOLUTIONS 35

**Answer :**

The given expression is  $7y^2 - 19y - 6$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = -19$$

$$\text{Product} = 7 \times -6 = -42$$

Clearly, the numbers are  $-21$  and  $2$ .

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

## SOLUTIONS 36

**Answer :**

The given expression is  $28 - 31x - 5x^2$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = -31$$

$$\text{Product} = 28 \times -5 = -140$$

Clearly, the numbers are  $-35$  and  $4$ .

$$\begin{aligned}28 - 31x - 5x^2 &= 28 + 4x - 35x - 5x^2 \\&= 4(x + 7) - 5x(7 + x) \\&= (x + 7)(4 - 5x)\end{aligned}$$

## SOLUTIONS 37

**Answer :**

The given expression is  $3 + 23z - 8z^2$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = 23$$

$$\text{Product} = 3 \times -8 = -24$$

Clearly, the numbers are 24 and -1.

$$\begin{aligned}3 + 23z - 8z^2 &= 3 + 24z - z - 8z^2 \\&= 3(1 + 8z) - z(1 + 8z) \\&= (1 + 8z)(3 - z)\end{aligned}$$

## SOLUTIONS 38

**Answer :**

The given expression is  $6x^2 - 5x - 6$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = -5$$

$$\text{Product} = -6 \times 6 = -36$$

Clearly, the numbers are -9 and 4.

$$\begin{aligned}6x^2 - 5x - 6 &= 6x^2 - 9x + 4x - 6 \\&= 3x(2x - 3) + 2(2x - 3) \\&= (2x - 3)(3x + 2)\end{aligned}$$

## SOLUTIONS 39

**Answer :**

The given expression is  $3m^2 + 24m + 36$ .

Find two numbers that follow the conditions given below :

$$\text{Sum} = 24$$

$$\text{Product} = 36 \times 3 = 108$$

Clearly, the numbers are 18 and 6.

$$\begin{aligned}3m^2 + 24m + 36 &= 3m^2 + 18m + 6m + 36 \\&= 3m(m + 6) + 6(m + 6) \\&= (3m + 6)(m + 6) = 3(m + 2)(m + 6)\end{aligned}$$

## SOLUTIONS 40

**Answer :**

*The given expression is  $4n^2 - 8n + 3$ .*

Find two numbers that follow the conditions given below :

*Sum = -8*

*Product =  $4 \times 3 = 12$*

*Clearly, the numbers are - 6 and - 2.*

$$\begin{aligned}4n^2 - 8n + 3 &= 4n^2 - 2n - 6n + 3 \\&= 2n(2n - 1) - 3(2n - 1) \\&= (2n - 1)(2n - 3)\end{aligned}$$

## SOLUTIONS 41

**Answer :**

*The given expression is  $6x^2 - 17x - 3$ .*

Find two numbers that follow the conditions given below :

*Sum = -17*

*Product =  $6 \times -3 = -18$*

*Clearly, the numbers are - 18 and 1.*

$$\begin{aligned}6x^2 - 17x - 3 &= 6x^2 - 18x + x - 3 \\&= 6x(x - 3) + 1(x - 3) \\&= (6x + 1)(x - 3)\end{aligned}$$

## SOLUTIONS 42

**Answer :**

*The given expression is  $7x^2 - 19x - 6$ .*

Find two numbers that follow the conditions given below :

*Sum = -19*

*Product =  $7 \times -6 = -42$*

*Clearly, the numbers are - 21 and 2.*

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