

EXERCISE 7.7

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Factorize each of the following algebraic expressions:

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

Solution:

We have,

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

To factorize the given expression we have to find two numbers p and q such that $p+q = 12$ and $pq = -45$

So we can replace $12x$ by $15x - 3x$

-45 by 15×3

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

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

Solution:

We have,

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

By considering, $p+q = -3$ and $pq = -40$

So we can replace $-3x$ by $5x - 8x$

-40 by 5×-8

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

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

Solution:

We have,

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

By considering, $p+q = 3$ and $pq = -88$

So we can replace $3a$ by $11a - 8a$

-88 by -11×8

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

4. $a^2 - 14a - 51$

Solution:

We have,

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

By considering, $p+q = -14$ and $pq = -51$ So we can replace $-14a$ by $3a - 17a$ -51 by -17×3

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

5. $x^2 + 14x + 45$

Solution:

We have,

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

By considering, $p+q = 14$ and $pq = 45$ So we can replace $14x$ by $5x + 9x$ 45 by 5×9

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

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

Solution:

We have,

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

By considering, $p+q = -22$ and $pq = 120$ So we can replace $-22x$ by $-12x - 10x$ 120 by -12×-10

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

7. $x^2 - 11x - 42$

Solution:

We have,

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

By considering, $p+q = -11$ and $pq = -42$ So we can replace $-11x$ by $3x - 14x$

-42 by 3×-14

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

8. $a^2 + 2a - 3$

Solution:

We have,

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

By considering, $p+q = 2$ and $pq = -3$

So we can replace $2a$ by $3a - a$

-3 by 3×-1

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

9. $a^2 + 14a + 48$

Solution:

We have,

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

By considering, $p+q = 14$ and $pq = 48$

So we can replace $14a$ by $8a + 6a$

48 by 8×6

$$\begin{aligned}a^2 + 14a + 48 &= a^2 + 8a + 6a + 48 \\ &= a(a + 8) + 6(a + 8) \\ &= (a + 6)(a + 8)\end{aligned}$$

10. $x^2 - 4x - 21$

Solution:

We have,

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

By considering, $p+q = -4$ and $pq = -21$

So we can replace $-4x$ by $3x - 7x$

-21 by 3×-7

$$\begin{aligned}x^2 + 4x - 21 &= x^2 + 3x - 7x - 21 \\ &= x(x + 3) - 7(x + 3) \\ &= (x - 7)(x + 3)\end{aligned}$$

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

Solution:

We have,

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

By considering, $p+q = 5$ and $pq = -36$ So we can replace $5y$ by $9y - 4y$ -36 by 9×-4

$$\begin{aligned}y^2 + 5y - 36 &= y^2 + 9y - 4y - 36 \\ &= y(y + 9) - 4(y + 9) \\ &= (y - 4)(y + 9)\end{aligned}$$

12. $(a^2 - 5a)^2 - 36$ **Solution:**

We have,

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

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

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

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

So now we shall factorize the expression $(a^2 - 5a + 6)$ By considering, $p+q = -5$ and $pq = 6$ So we can replace $-5a$ by $a - 6a$ 6 by 1×-6

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

So now we shall factorize the expression $(a^2 - 5a + 6)$ By considering, $p+q = -5$ and $pq = -6$ So we can replace $-5a$ by $-2a - 3a$ 6 by -2×-3

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

$$\begin{aligned}\therefore (a^2 - 5a)^2 - 36 &= (a^2 - 5a + 6)(a^2 - 5a - 6) \\ &= (a + 1)(a - 6)(a - 2)(a - 3)\end{aligned}$$

13. $(a + 7)(a - 10) + 16$ **Solution:**

We have,

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

$$a^2 - 10a + 7a - 70 + 16$$

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

By considering, $p+q = -3$ and $pq = -54$

So we can replace $-3a$ by $6a - 9a$

-54 by 6×-9

$$a^2 - 3a - 54 = a^2 + 6a - 9a - 54$$

$$= a(a + 6) - 9(a + 6)$$

$$= (a - 9)(a + 6)$$

