

## NCERT Class 8 Maths Chapter 14 Factorisation

### Exercise 14.1

1. Find the common factors of the given terms.

- (i)  $12x$ ,  $36$
- (ii)  $2y$ ,  $22xy$
- (iii)  $14 pq$ ,  $28p^2q^2$
- (iv)  $2x$ ,  $3x^2$ ,  $4$
- (v)  $6 abc$ ,  $24ab^2$ ,  $12a^2b$
- (vi)  $16 x^3$ ,  $-4x^2$ ,  $32 x$
- (vii)  $10 pq$ ,  $20qr$ ,  $30 rp$
- (viii)  $3x^2y^3$ ,  $10x^3y^2$ ,  $6x^2y^2z$

**Solution:**

(i) Factors of  $12x$  and  $36$

$$12x = 2 \times 2 \times 3 \times x$$

$$36 = 2 \times 2 \times 3 \times 3$$

Common factors of  $12x$  and  $36$  are  $2$ ,  $2$ ,  $3$

and,  $2 \times 2 \times 3 = 12$

(ii) Factors of  $2y$  and  $22xy$

$$2y = 2 \times y$$

$$22xy = 2 \times 11 \times x \times y$$

Common factors of  $2y$  and  $22xy$  are  $2$ ,  $y$

and,  $2 \times y = 2y$

(iii) Factors of  $14pq$  and  $28p^2q$

$$14pq = 2 \times 7 \times p \times q$$

$$28p^2q = 2 \times 2 \times 7 \times p \times p \times q$$

Common factors of  $14 pq$  and  $28 p^2q$  are  $2$ ,  $7$ ,  $p$ ,  $q$

and,  $2 \times 7 \times p \times q = 14pq$

(iv) Factors of  $2x$ ,  $3x^2$  and  $4$

$$2x = 2 \times x$$

$$3x^2 = 3 \times x \times x$$

$$4 = 2 \times 2$$

Common factors of  $2x$ ,  $3x^2$  and  $4$  is  $1$ .

(v) Factors of  $6abc$ ,  $24ab^2$  and  $12a^2b$

$$6abc = 2 \times 3 \times a \times b \times c$$

$$24ab^2 = 2 \times 2 \times 2 \times 3 \times a \times b \times b$$

$$12a^2b = 2 \times 2 \times 3 \times a \times a \times b$$

Common factors of  $6abc$ ,  $24ab^2$  and  $12a^2b$  are  $2$ ,  $3$ ,  $a$ ,  $b$

and,  $2 \times 3 \times a \times b = 6ab$

(vi) Factors of  $16x^3$ ,  $-4x^2$  and  $32x$

$$16x^3 = 2 \times 2 \times 2 \times 2 \times x \times x \times x$$

$$-4x^2 = -1 \times 2 \times 2 \times x \times x$$

$$32x = 2 \times 2 \times 2 \times 2 \times 2 \times x$$

Common factors of  $16x^3$ ,  $-4x^2$  and  $32x$  are  $2, 2, x$

and,  $2 \times 2 \times x = 4x$

(vii) Factors of  $10pq$ ,  $20qr$  and  $30rp$

$$10pq = 2 \times 5 \times p \times q$$

$$20qr = 2 \times 2 \times 5 \times q \times r$$

$$30rp = 2 \times 3 \times 5 \times r \times p$$

Common factors of  $10pq$ ,  $20qr$  and  $30rp$  are  $2, 5$

and,  $2 \times 5 = 10$

(viii) Factors of  $3x^2y^3$ ,  $10x^3y^2$  and  $6x^2y^2z$

$$3x^2y^3 = 3 \times x \times x \times y \times y \times y$$

$$10x^3y^2 = 2 \times 5 \times x \times x \times x \times y \times y$$

$$6x^2y^2z = 3 \times 2 \times x \times x \times y \times y \times z$$

Common factors of  $3x^2y^3$ ,  $10x^3y^2$  and  $6x^2y^2z$  are  $x^2$ ,  $y^2$

and,  $x^2 \times y^2 = x^2y^2$

## 2. Factorise the following expressions

(i)  $7x - 42$

(ii)  $6p - 12q$

(iii)  $7a^2 + 14a$

(iv)  $-16z + 20z^3$

(v)  $20l^2m + 30alm$

(vi)  $5x^2y - 15xy^2$

(vii)  $10a^2 - 15b^2 + 20c^2$

(viii)  $-4a^2+4ab-4 ca$

(ix)  $x^2yz+xy^2z +xyz^2$

(x)  $ax^2y+bxy^2+cxyz$

**Solution:**

(i)  $7x = 7 \times x$

$42 = 2 \times 3 \times 7$

The common factor is 7

$$\therefore 7x - 42 = (7 \times x) - (2 \times 3 \times 7) = 7(x - 6)$$

(ii)  $6p = 2 \times 3 \times p$

$12q = 2 \times 2 \times 3 \times q$

The common factors are 2 and 3

$$\therefore 6p - 12q = (2 \times 3 \times p) - (2 \times 2 \times 3 \times q)$$

$$= 2 \times 3 [p - (2 \times q)]$$

$$= 6(p - 2q)$$

(iii)  $7a^2 = 7 \times a \times a$

$14a = 2 \times 7 \times a$

The common factors are 7 and a

$$\therefore 7a^2 + 14a = (7 \times a \times a) + (2 \times 7 \times a)$$

$$= 7 \times a [a + 2] = 7a(a + 2)$$

(iv)  $16z = 2 \times 2 \times 2 \times 2 \times z$

$20z^3 = 2 \times 2 \times 5 \times z \times z \times z$

The common factors are 2, 2, and z.

$$\therefore -16z + 20z^3 = -(2 \times 2 \times 2 \times 2 \times z) + (2 \times 2 \times 5 \times z \times z \times z)$$

$$= (2 \times 2 \times z) [-(2 \times 2) + (5 \times z \times z)]$$

$$= 4z(-4 + 5z^2)$$

$$(v) \quad 20l^2m = 2 \times 2 \times 5 \times l \times l \times m$$

$$30alm = 2 \times 3 \times 5 \times a \times l \times m$$

The common factors are 2, 5, l and m

$$\begin{aligned} \therefore 20l^2m + 30alm &= (2 \times 2 \times 5 \times l \times l \times m) + (2 \times 3 \times 5 \times a \times l \times m) \\ &= (2 \times 5 \times l \times m) [(2 \times l) + (3 \times a)] \\ &= 10lm(2l + 3a) \end{aligned}$$

$$(vi) \quad 5x^2y = 5 \times x \times x \times y$$

$$15xy^2 = 3 \times 5 \times x \times y \times y$$

The common factors are 5, x, and y

$$\begin{aligned} \therefore 5x^2y - 15xy^2 &= (5 \times x \times x \times y) - (3 \times 5 \times x \times y \times y) \\ &= 5 \times x \times y [x - (3 \times y)] \\ &= 5xy(x - 3y) \end{aligned}$$

$$(vii) \quad 10a^2 - 15b^2 + 20c^2$$

$$10a^2 = 2 \times 5 \times a \times a$$

$$-15b^2 = -1 \times 3 \times 5 \times b \times b$$

$$20c^2 = 2 \times 2 \times 5 \times c \times c$$

Common factor of  $10a^2$ ,  $15b^2$  and  $20c^2$  is 5

$$10a^2 - 15b^2 + 20c^2 = 5(2a^2 - 3b^2 + 4c^2)$$

$$(viii) \quad -4a^2 + 4ab - 4ca$$

$$-4a^2 = -1 \times 2 \times 2 \times a \times a$$

$$4ab = 2 \times 2 \times a \times b$$

$$-4ca = -1 \times 2 \times 2 \times c \times a$$

Common factor of  $-4a^2$ ,  $4ab$ ,  $-4ca$  are 2, 2, a i.e. 4a

So,

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

$$(ix) \quad x^2yz + xy^2z + xyz^2$$

$$x^2yz = x \times x \times y \times z$$

$$xy^2z = x \times y \times y \times z$$

$$xyz^2 = x \times y \times z \times z$$

Common factor of  $x^2yz$ ,  $xy^2z$  and  $xyz^2$  are x, y, z i.e. xyz

$$\text{Now, } x^2yz + xy^2z + xyz^2 = xyz(x + y + z)$$

$$(x) \quad ax^2y + bxy^2 + cxyz$$

$$ax^2y = a \times x \times x \times y$$

$$bxy^2 = b \times x \times y \times y$$

$$cxyz = c \times x \times y \times z$$

Common factors of  $a^2y$ ,  $bxy^2$  and  $cxyz$  are  $xy$

$$\text{Now, } ax^2y + bxy^2 + cxyz = xy(ax + by + cz)$$

### 3. Factorise.

(i)  $x^2+xy+8x+8y$

(ii)  $15xy - 6x + 5y - 2$

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

(iv)  $15pq + 15 + 9q + 25p$

(v)  $z - 7 + 7xy - xyz$

**Solution:**

$$\begin{aligned} (i) \quad & x^2 + xy + 8x + 8y = x \times x + x \times y + 8 \times x + 8 \times y \\ &= x(x + y) + 8(x + y) \\ &= (x + y)(x + 8) \end{aligned}$$

$$\begin{aligned} (ii) \quad & 15xy - 6x + 5y - 2 = 3 \times 5 \times x \times y - 3 \times 2 \times x + 5xy - 2 \\ &= 3x(5y - 2) + 1(5y - 2) \\ &= (5y - 2)(3x + 1) \end{aligned}$$

$$\begin{aligned} (iii) \quad & ax + bx - ay - by = a \times x + b \times x - a \times y - b \times y \\ &= x(a + b) - y(a + b) \\ &= (a + b)(x - y) \end{aligned}$$

$$\begin{aligned} (iv) \quad & 15pq + 15 + 9q + 25p = 15pq + 9q + 25p + 15 \\ &= 3 \times 5 \times p \times q + 3 \times 3 \times q + 5 \times 5 \times p + 3 \times 5 \\ &= 3q(5p + 3) + 5(5p + 3) \\ &= (5p + 3)(3q + 5) \end{aligned}$$

$$\begin{aligned} (v) \quad & z - 7 + 7xy - xyz = z - x \times y \times z - 7 + 7 \times x \times y \\ &= z(1 - xy) - 7(1 - xy) \\ &= (1 - xy)(z - 7) \end{aligned}$$

## Exercise 14.2

1. Factorise the following expressions.

(i)  $a^2+8a+16$

(ii)  $p^2-10p+25$

(iii)  $25m^2+30m+9$

(iv)  $49y^2+84yz+36z^2$

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

(vi)  $121b^2-88bc+16c^2$

(vii)  $(l+m)^2-4lm$  (Hint: Expand  $(l+m)^2$  first)

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

**Solution:**

(i)  $a^2+8a+16$

$$= a^2+2\times 4 \times a + 4^2$$

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

Using identity:  $(x+y)^2 = x^2+2xy+y^2$

(ii)  $p^2-10p+25$

$$= p^2-2\times 5 \times p + 5^2$$

$$= (p-5)^2$$

Using identity:  $(x-y)^2 = x^2-2xy+y^2$

(iii)  $25m^2+30m+9$

$$= (5m)^2-2\times 5m \times 3 + 3^2$$

$$= (5m+3)^2$$

Using identity:  $(x+y)^2 = x^2+2xy+y^2$

(iv)  $49y^2+84yz+36z^2$

$$= (7y)^2+2\times 7y \times 6z + (6z)^2$$

$$= (7y+6z)^2$$

Using identity:  $(x+y)^2 = x^2+2xy+y^2$

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

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

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

Using identity:  $(x-y)^2 = x^2-2xy+y^2$

(vi)  $121b^2-88bc+16c^2$

$$= (11b)^2-2\times 11b \times 4c + (4c)^2$$

$$= (11b-4c)^2$$

Using identity:  $(x-y)^2 = x^2-2xy+y^2$

(vii)  $(l+m)^2-4lm$  (Hint: Expand  $(l+m)^2$  first)

Expand  $(l+m)^2$  using identity:  $(x+y)^2 = x^2+2xy+y^2$

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

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

$$= (l-m)^2$$

Using identity:  $(x-y)^2 = x^2 - 2xy + y^2$

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

$$= (a^2)^2 + 2 \times a^2 \cdot b^2 + (b^2)^2$$

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

Using identity:  $(x+y)^2 = x^2 + 2xy + y^2$

## 2. Factorise.

(i)  $4p^2 - 9q^2$

(ii)  $63a^2 - 112b^2$

(iii)  $49x^2 - 36$

(iv)  $16x^5 - 144x^3$  differ

(v)  $(l+m)^2 - (l-m)^2$

(vi)  $9x^2y^2 - 16$

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

(viii)  $25a^2 - 4b^2 + 28bc - 49c^2$

### Solution:

(i)  $4p^2 - 9q^2$

$$= (2p)^2 - (3q)^2$$

$$= (2p-3q)(2p+3q)$$

Using identity:  $x^2 - y^2 = (x+y)(x-y)$

(ii)  $63a^2 - 112b^2$

$$= 7(9a^2 - 16b^2)$$

$$= 7((3a)^2 - (4b)^2)$$

$$= 7(3a+4b)(3a-4b)$$

Using identity:  $x^2 - y^2 = (x+y)(x-y)$

(iii)  $49x^2 - 36$

$$= (7a)^2 - 6^2$$

$$= (7a+6)(7a-6)$$

Using identity:  $x^2 - y^2 = (x+y)(x-y)$

(iv)  $16x^5 - 144x^3$

$$= 16x^3(x^2 - 9)$$

$$= 16x^3(x^2 - 9)$$

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

Using identity:  $x^2 - y^2 = (x+y)(x-y)$

$$(v) (l+m)^2 - (l-m)^2$$

$$= \{(l+m)-(l-m)\}\{(l+m)+(l-m)\}$$

Using Identity:  $x^2 - y^2 = (x+y)(x-y)$

$$= (l+m-l+m)(l+m+l-m)$$

$$= (2m)(2l)$$

$$= 4 ml$$

$$(vi) 9x^2y^2 - 16$$

$$= (3xy)^2 - 4^2$$

$$= (3xy-4)(3xy+4)$$

Using Identity:  $x^2 - y^2 = (x+y)(x-y)$

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

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

Using Identity:  $(x-y)^2 = x^2 - 2xy + y^2$

$$= \{(x-y)-z\}\{(x-y)+z\}$$

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

Using Identity:  $x^2 - y^2 = (x+y)(x-y)$

$$(viii) 25a^2 - 4b^2 + 28bc - 49c^2$$

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

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

$$= (5a)^2 - (2b-7c)^2$$

Using Identity:  $x^2 - y^2 = (x+y)(x-y)$ , we have

$$= (5a+2b-7c)(5a-2b-7c)$$

### 3. Factorise the expressions.

(i)  $ax^2 + bx$

(ii)  $7p^2 + 21q^2$

(iii)  $2x^3 + 2xy^2 + 2xz^2$

(iv)  $am^2 + bm^2 + bn^2 + an^2$

(v)  $(lm+l) + m + 1$

(vi)  $y(y+z) + 9(y+z)$

(vii)  $5y^2 - 20y - 8z + 2yz$

(viii)  $10ab+4a+5b+2$

(ix)  $6xy-4y+6-9x$

**Solution:**

(i)  $ax^2+bx = x(ax+b)$

(ii)  $7p^2+21q^2 = 7(p^2+3q^2)$

(iii)  $2x^3+2xy^2+2xz^2 = 2x(x^2+y^2+z^2)$

(iv)  $am^2+bm^2+bn^2+an^2 = m^2(a+b)+n^2(a+b) = (a+b)(m^2+n^2)$

(v)  $(lm+l)+m+1 = lm+m+l+1 = m(l+1)+(l+1) = (m+1)(l+1)$

(vi)  $y(y+z)+9(y+z) = (y+9)(y+z)$

(vii)  $5y-20y-8z+2yz = 5y(y-4)+2z(y-4) = (y-4)(5y+2z)$

(viii)  $10ab+4a+5b+2 = 5b(2a+1)+2(2a+1) = (2a+1)(5b+2)$

(ix)  $6xy-4y+6-9x = 6xy-9x-4y+6 = 3x(2y-3)-2(2y-3) = (2y-3)(3x-2)$

#### 4. Factorise.

(i)  $a^4-b^4$

(ii)  $p^4-81$

(iii)  $x^4-(y+z)^4$

(iv)  $x^4-(x-z)^4$

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

**Solution:**

(i)  $a^4-b^4$

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

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

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

(ii)  $p^4-81$

$$= (p^2)^2 - (9)^2$$

$$= (p^2-9)(p^2+9)$$

$$= (p^2-3^2)(p^2+9)$$

$$= (p-3)(p+3)(p^2+9)$$

(iii)  $x^4-(y+z)^4 = (x^2)^2 - [(y+z)^2]^2$

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

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

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

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

$$\begin{aligned}
&= \{x^2 - (x-z)^2\} \{x^2 + (x-z)^2\} \\
&= \{x - (x-z)\} \{x + (x-z)\} \{x^2 + (x-z)^2\} \\
&= z(2x-z)(x^2 + x^2 - 2xz + z^2) \\
&= z(2x-z)(2x^2 - 2xz + z^2) \\
(v) \quad &a^4 - 2a^2b^2 + b^4 = (a^2)^2 - 2a^2b^2 + (b^2)^2 \\
&= (a^2 - b^2)^2 \\
&= ((a-b)(a+b))^2
\end{aligned}$$

**5. Factorise the following expressions.**

- (i)  $p^2 + 6p + 8$
- (ii)  $q^2 - 10q + 21$
- (iii)  $p^2 + 6p - 16$

**Solution:**

(i)  $p^2 + 6p + 8$

We observed that,  $8 = 4 \times 2$  and  $4+2 = 6$

$p^2 + 6p + 8$  can be written as  $p^2 + 2p + 4p + 8$

Taking Common terms, we get

$$p^2 + 6p + 8 = p^2 + 2p + 4p + 8 = p(p+2) + 4(p+2)$$

Again  $p+2$  is common in both the terms.

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

This implies:  $p^2 + 6p + 8 = (p+2)(p+4)$

(ii)  $q^2 - 10q + 21$

Observed that,  $21 = -7 \times -3$  and  $-7 + (-3) = -10$

$$q^2 - 10q + 21 = q^2 - 3q - 7q + 21$$

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

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

This implies  $q^2 - 10q + 21 = (q-7)(q-3)$

(iii)  $p^2 + 6p - 16$

We observed that,  $-16 = -2 \times 8$  and  $8 + (-2) = 6$

$$p^2 + 6p - 16 = p^2 - 2p + 8p - 16$$

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

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

So,  $p^2 + 6p - 16 = (p+8)(p-2)$

### Exercise 14.3

1. Carry out the following divisions.

(i)  $28x^4 \div 56x$

(ii)  $-36y^3 \div 9y^2$

(iii)  $66pq^2r^3 \div 11qr^2$

(iv)  $34x^3y^3z^3 \div 51xy^2z^3$

(v)  $12a^8b^8 \div (-6a^6b^4)$

Solution:

(i)  $28x^4 = 2 \times 2 \times 7 \times x \times x \times x \times x$

$56x = 2 \times 2 \times 2 \times 7 \times x$

$$28x^4 \div 56x = \frac{2 \times 2 \times 7 \times x \times x \times x \times x}{2 \times 2 \times 2 \times 7 \times x} = \frac{x^3}{2} = \frac{1}{2}x^3$$

$$(ii) -36y^3 \div 9y^2 = \frac{-2 \times 2 \times 3 \times 3 \times y \times y \times y}{3 \times 3 \times y \times y} = -4y$$

$$(iii) 66pq^2r^3 \div 11qr^2 = \frac{2 \times 3 \times 11 \times p \times q \times q \times r \times r \times r}{11 \times q \times r \times r} = 6pqr$$

$$(iv) 34x^3y^3z^3 \div 51xy^2z^3 = \frac{2 \times 17 \times x \times x \times x \times y \times y \times y \times z \times z \times z}{3 \times 17 \times x \times y \times y \times z \times z \times z} = \frac{2}{3}x^2y$$

$$(v) 12a^8b^8 \div (-6a^6b^4) = \frac{2 \times 2 \times 3 \times a^8 \times b^8}{-2 \times 3 \times a^6 \times b^4} = -2 a^2 b^4$$

2. Divide the given polynomial by the given monomial.

(i)  $(5x^2 - 6x) \div 3x$

(ii)  $(3y^8 - 4y^6 + 5y^4) \div y^4$

(iii)  $8(x^3y^2z^2 + x^2y^3z^2 + x^2y^2z^3) \div 4x^2y^2z^2$

(iv)  $(x^3 + 2x^2 + 3x) \div 2x$

(v)  $(p^3q^6 - p^6q^3) \div p^3q^3$

Solution:

$$(i) 5x^2 - 6x = x(5x - 6)$$

$$(5x^2 - 6x) \div 3x = \frac{x(5x - 6)}{3x} = \frac{1}{3}(5x - 6)$$

$$(ii) 3y^8 - 4y^6 + 5y^4 = y^4(3y^4 - 4y^2 + 5)$$

$$(3y^8 - 4y^6 + 5y^4) \div y^4 = \frac{y^4(3y^4 - 4y^2 + 5)}{y^4} = 3y^4 - 4y^2 + 5$$

$$(iii) 8(x^3y^2z^2 + x^2y^3z^2 + x^2y^2z^3) = 8x^2y^2z^2(x + y + z)$$

$$8(x^3y^2z^2 + x^2y^3z^2 + x^2y^2z^3) \div 4x^2y^2z^2 = \frac{8x^2y^2z^2(x + y + z)}{4x^2y^2z^2} = 2(x + y + z)$$

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

$$(x^3 + 2x^2 + 3x) \div 2x = \frac{x(x^2 + 2x + 3)}{2x} = \frac{1}{2}(x^2 + 2x + 3)$$

$$(v) p^3q^6 - p^6q^3 = p^3q^3(q^3 - p^3)$$

$$(p^3q^6 - p^6q^3) \div p^3q^3 = \frac{p^3q^3(q^3 - p^3)}{p^3q^3} = q^3 - p^3$$

### 3. Work out the following divisions.

$$(i) (10x-25) \div 5$$

$$(ii) (10x-25) \div (2x-5)$$

$$(iii) 10y(6y+21) \div 5(2y+7)$$

$$(iv) 9x^2y^2(3z-24) \div 27xy(z-8)$$

$$(v) 96abc(3a-12)(5b-30) \div 144(a-4)(b-6)$$

**Solution:**

$$(i) (10x-25) \div 5 = 5(2x-5)/5 = 2x-5$$

$$(ii) (10x-25) \div (2x-5) = 5(2x-5)/(2x-5) = 5$$

$$(iii) 10y(6y+21) \div 5(2y+7) = 10y \times 3(2y+7)/5(2y+7) = 6y$$

$$(iv) 9x^2y^2(3z-24) \div 27xy(z-8) = 9x^2y^2 \times 3(z-8)/27xy(z-8) = xy$$

$$(v) 96abc(3a-12)(5b-30) \div 144(a-4)(b-6) = \frac{96abc \times 3(a-4) \times 5(b-6)}{144(a-4)(b-6)} = 10abc$$

### 4. Divide as directed.

$$(i) 5(2x+1)(3x+5) \div (2x+1)$$

$$(ii) 26xy(x+5)(y-4) \div 13x(y-4)$$

$$(iii) 52pqr(p+q)(q+r)(r+p) \div 104pq(q+r)(r+p)$$

$$(iv) 20(y+4)(y^2+5y+3) \div 5(y+4)$$

$$(v) x(x+1)(x+2)(x+3) \div x(x+1)$$

**Solution:**

$$(i) 5(2x+1)(3x+5) \div (2x+1) = \frac{5(2x+1)(3x+5)}{(2x+1)} \\ = 5(3x+5)$$

$$(ii) 26xy(x+5)(y-4) \div 13x(y-4) = \frac{2 \times 13 \times xy(x+5)(y-4)}{13x(y-4)} \\ = 2y(x+5)$$

$$(iii) 52pqr(p+q)(q+r)(r+p) \div 104pq(q+r)(r+p)$$

$$= \frac{2 \times 2 \times 13 \times p \times q \times r \times (p+q) \times (q+r) \times (r+p)}{2 \times 2 \times 2 \times 13 \times p \times q \times (q+r) \times (r+p)} \\ = \frac{1}{2}r(p+q)$$

$$(iv) 20(y+4)(y^2+5y+3) = 2 \times 2 \times 5 \times (y+4)(y^2+5y+3)$$

$$20(y+4)(y^2+5y+3) \div 5(y+4) = \frac{2 \times 2 \times 5 \times (y+4) \times (y^2+5y+3)}{5 \times (y+4)} \\ = 4(y^2+5y+3)$$

$$(v) x(x+1)(x+2)(x+3) \div x(x+1) = \frac{x(x+1)(x+2)(x+3)}{x(x+1)}$$

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

**5. Factorise the expressions and divide them as directed.**

$$(i) (y^2+7y+10) \div (y+5)$$

$$(ii) (m^2-14m-32) \div (m+2)$$

$$(iii) (5p^2-25p+20) \div (p-1)$$

$$(iv) 4yz(z^2+6z-16) \div 2y(z+8)$$

$$(v) 5pq(p^2-q^2) \div 2p(p+q)$$

$$(vi) 12xy(9x^2-16y^2) \div 4xy(3x+4y)$$

$$(vii) 39y^3(50y^2-98) \div 26y^2(5y+7)$$

**Solution:**

$$(i) (y^2+7y+10) \div (y+5)$$

First solve for equation,  $(y^2+7y+10)$

$$(y^2+7y+10) = y^2+2y+5y+10 = y(y+2)+5(y+2) = (y+2)(y+5)$$

$$\text{Now, } (y^2+7y+10) \div (y+5) = (y+2)(y+5) \div (y+5) = y+2$$

$$(ii) (m^2-14m-32) \div (m+2)$$

Solve for  $m^2-14m-32$ , we have

$$m^2-14m-32 = m^2+2m-16m-32 = m(m+2)-16(m+2) = (m-16)(m+2)$$

Now,  $(m^2 - 14m - 32) \div (m+2) = (m-16)(m+2)/(m+2) = m-16$

**(iii)  $(5p^2 - 25p + 20) \div (p-1)$**

Step 1: Take 5 common from the equation,  $5p^2 - 25p + 20$ , we get

$$5p^2 - 25p + 20 = 5(p^2 - 5p + 4)$$

Step 2: Factorize  $p^2 - 5p + 4$

$$p^2 - 5p + 4 = p^2 - p - 4p + 4 = (p-1)(p-4)$$

Step 3: Solve original equation

$$(5p^2 - 25p + 20) \div (p-1) = 5(p-1)(p-4) \div (p-1) = 5(p-4)$$

**(iv)  $4yz(z^2 + 6z - 16) \div 2y(z+8)$**

Factorize  $z^2 + 6z - 16$ ,

$$z^2 + 6z - 16 = z^2 - 2z + 8z - 16 = (z-2)(z+8)$$

$$\text{Now, } 4yz(z^2 + 6z - 16) \div 2y(z+8) = 4yz(z-2)(z+8) \div 2y(z+8) = 2z(z-2)$$

**(v)  $5pq(p^2 - q^2) \div 2p(p+q)$**

$p^2 - q^2$  can be written as  $(p-q)(p+q)$  using identity.

$$5pq(p^2 - q^2) \div 2p(p+q) = 5pq(p-q)(p+q) \div 2p(p+q) = 5/2q(p-q)$$

**(vi)  $12xy(9x^2 - 16y^2) \div 4xy(3x+4y)$**

Factorize  $9x^2 - 16y^2$ , we have

$$9x^2 - 16y^2 = (3x)^2 - (4y)^2 = (3x+4y)(3x-4y) \text{ using identity: } p^2 - q^2 = (p-q)(p+q)$$

$$\text{Now, } 12xy(9x^2 - 16y^2) \div 4xy(3x+4y) = 12xy(3x+4y)(3x-4y) \div 4xy(3x+4y) = 3(3x-4y)$$

**(vii)  $39y^3(50y^2 - 98) \div 26y^2(5y+7)$**

st solve for  $50y^2 - 98$ , we have

$$50y^2 - 98 = 2(25y^2 - 49) = 2((5y)^2 - 7^2) = 2(5y-7)(5y+7)$$

$$\text{Now, } 39y^3(50y^2 - 98) \div 26y^2(5y+7) =$$

$$\frac{3 \times 13 \times y^3 \times 2(5y-7)(5y+7)}{2 \times 13 \times y^2(5y+7)} = 3y(5y-7)$$

## Exercise 14.4

1.  $4(x-5) = 4x-5$

**Solution:**

$$4(x-5) = 4x - 20 \neq 4x - 5 = \text{RHS}$$

The correct statement is  $4(x-5) = 4x-20$

**2.  $x(3x+2) = 3x^2+2$**

**Solution:**

LHS =  $x(3x+2) = 3x^2+2x \neq 3x^2+2 = \text{RHS}$

The correct solution is  $x(3x+2) = 3x^2+2x$

**3.  $2x+3y = 5xy$**

**Solution:**

LHS =  $2x+3y \neq \text{R. H. S}$

The correct statement is  $2x+3y = 2x+3y$

**4.  $x+2x+3x = 5x$**

**Solution:**

LHS =  $x+2x+3x = 6x \neq \text{RHS}$

The correct statement is  $x+2x+3x = 6x$

**5.  $5y+2y+y-7y = 0$**

**Solution:**

LHS =  $5y+2y+y-7y = y \neq \text{RHS}$

The correct statement is  $5y+2y+y-7y = y$

**6.  $3x+2x = 5x^2$**

**Solution:**

LHS =  $3x+2x = 5x \neq \text{RHS}$

The correct statement is  $3x+2x = 5x$

**7.  $(2x)^2+4(2x)+7 = 2x^2+8x+7$**

**Solution:**

LHS =  $(2x)^2+4(2x)+7 = 4x^2+8x+7 \neq \text{RHS}$

The correct statement is  $(2x)^2+4(2x)+7 = 4x^2+8x+7$

**8.  $(2x)^2+5x = 4x+5x = 9x$**

**Solution:**

LHS =  $(2x)^2+5x = 4x^2+5x \neq 9x = \text{RHS}$

The correct statement is  $(2x)^2+5x = 4x^2+5x$

**9.  $(3x + 2)^2 = 3x^2+6x+4$**

**Solution:**

LHS =  $(3x+2)^2 = (3x)^2+2^2+2x \cdot 2 \cdot 3x = 9x^2+4+12x \neq \text{RHS}$

The correct statement is  $(3x + 2)^2 = 9x^2+4+12x$

**10. Substituting  $x = -3$  in**

- (a)  $x^2 + 5x + 4$  gives  $(-3)^2 + 5(-3) + 4 = 9 - 15 + 4 = -2$
- (b)  $x^2 - 5x + 4$  gives  $(-3)^2 - 5(-3) + 4 = 9 + 15 + 4 = 28$
- (c)  $x^2 + 5x$  gives  $(-3)^2 + 5(-3) = 9 - 15 = -6$

**Solution:**

(a) Substituting  $x = -3$  in  $x^2+5x+4$ , we have

$$x^2+5x+4 = (-3)^2 + 5(-3) + 4 = 9 - 15 + 4 = -2. \text{ This is the correct answer.}$$

(b) Substituting  $x = -3$  in  $x^2-5x+4$

$$x^2-5x+4 = (-3)^2 - 5(-3) + 4 = 9 + 15 + 4 = 28. \text{ This is the correct answer}$$

(c) Substituting  $x = -3$  in  $x^2+5x$

$$x^2+5x = (-3)^2 + 5(-3) = 9 - 15 = -6. \text{ This is the correct answer}$$

**11.  $(y-3)^2 = y^2-9$**

**Solution:**

LHS =  $(y-3)^2$ , which is similar to  $(a-b)^2$  identity, where  $(a-b)^2 = a^2+b^2-2ab$ .

$$(y-3)^2 = y^2 + (3)^2 - 2y \times 3 = y^2 + 9 - 6y \neq y^2 - 9 = \text{RHS}$$

The correct statement is  $(y-3)^2 = y^2 + 9 - 6y$

**12.  $(z+5)^2 = z^2+25$**

**Solution:**

LHS =  $(z+5)^2$ , which is similar to  $(a+b)^2$  identity, where  $(a+b)^2 = a^2+b^2+2ab$ .

$$(z+5)^2 = z^2 + 5^2 + 2 \times 5 \times z = z^2 + 25 + 10z \neq z^2 + 25 = \text{RHS}$$

The correct statement is  $(z+5)^2 = z^2 + 25 + 10z$

**13.  $(2a+3b)(a-b) = 2a^2-3b^2$**

**Solution:**

$$\begin{aligned} \text{LHS} &= (2a+3b)(a-b) = 2a(a-b) + 3b(a-b) \\ &= 2a^2 - 2ab + 3ab - 3b^2 \\ &= 2a^2 + ab - 3b^2 \\ &\neq 2a^2 - 3b^2 = \text{RHS} \end{aligned}$$

The correct statement is  $(2a+3b)(a-b) = 2a^2 + ab - 3b^2$

**14.  $(a+4)(a+2) = a^2+8$**

**Solution:**

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

$\neq a^2+8 = \text{RHS}$

The correct statement is  $(a+4)(a+2) = a^2+6a+8$

**15.  $(a-4)(a-2) = a^2-8$**

**Solution:**

$$\text{LHS} = (a-4)(a-2) = a(a-2)-4(a-2)$$

$$= a^2-2a-4a+8$$

$$= a^2-6a+8$$

$$\neq a^2-8 = \text{RHS}$$

The correct statement is  $(a-4)(a-2) = a^2-6a+8$

**16.  $3x^2/3x^2 = 0$**

**Solution:**

$$\text{LHS} = 3x^2/3x^2 = 1 \neq 0 = \text{RHS}$$

The correct statement is  $3x^2/3x^2 = 1$

**17.  $(3x^2+1)/3x^2 = 1 + 1 = 2$**

**Solution:**

$$\text{LHS} = (3x^2+1)/3x^2 = (3x^2/3x^2)+(1/3x^2) = 1+(1/3x^2) \neq 2 = \text{RHS}$$

The correct statement is  $(3x^2+1)/3x^2 = 1+(1/3x^2)$

**18.  $3x/(3x+2) = 1/2$**

**Solution:**

$$\text{LHS} = 3x/(3x+2) \neq 1/2 = \text{RHS}$$

The correct statement is  $3x/(3x+2) = 3x/(3x+2)$

**19.  $3/(4x+3) = 1/4x$**

**Solution:**

$$\text{LHS} = 3/(4x+3) \neq 1/4x$$

The correct statement is  $3/(4x+3) = 3/(4x+3)$

**20.  $(4x+5)/4x = 5$**

**Solution:**

$$\text{LHS} = (4x+5)/4x = 4x/4x + 5/4x = 1 + 5/4x \neq 5 = \text{RHS}$$

The correct statement is  $(4x+5)/4x = 1 + (5/4x)$

**21.  $\frac{7x+5}{5} = 7x$**

**Solution:**

$$\text{LHS} = (7x+5)/5 = (7x/5)+5/5 = (7x/5)+1 \neq 7x = \text{RHS}$$

The correct statement is  $(7x+5)/5 = (7x/5) + 1$

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