

## Exercise 14.1

### Question 1:

Find the common factors of the given terms.

(i)  $12x, 36$

(iii)  $14pq, 28p^2q^2$

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

(vii)  $10pq, 20qr, 30rp$

(ii)  $2y, 22xy$

(iv)  $2x, 3x^2, 4$

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

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

### Answer 1:

(i)  $12x = 2 \times 2 \times 3 \times x$

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

Hence, the common factors are 2, 2 and 3 =  $2 \times 2 \times 3 = 12$

(ii)  $2y = 2 \times y$

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

Hence, the common factors are 2 and  $y = 2 \times y = 2y$

(iii)  $14pq = 2 \times 7 \times p \times q$

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

Hence, the common factors are  $2 \times 7 \times p \times q = 14pq$

(iv)  $2x = 2 \times x \times 1$

$$3x^2 = 3 \times x \times x \times 1$$

$$4 = 2 \times 2 \times 1$$

Hence, the common factor is 1.

(v)  $6abc = 2 \times 3 \times a \times b \times c$

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

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

Hence, the common factors are  $2 \times 3 \times a \times b = 6ab$

(vi)  $16x^3 = 2 \times 2 \times 2 \times 2 \times x \times x \times x$

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

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

Hence, the common factors are  $2 \times 2 \times x = 4x$

$$\begin{aligned} \text{(vii)} \quad 10pq &= 2 \times 5 \times p \times q \\ 20qr &= 2 \times 2 \times 5 \times q \times r \\ 30rp &= 2 \times 3 \times 5 \times r \times p \end{aligned}$$

Hence, the common factors are  $2 \times 5 = 10$

$$\begin{aligned} \text{(viii)} \quad 3x^2y^3 &= 3 \times x \times x \times y \times y \times y \\ 10x^3y^2 &= 2 \times 5 \times x \times x \times x \times y \times y \\ 6x^2y^2z &= 2 \times 3 \times x \times x \times y \times y \times z \end{aligned}$$

Hence, the common factors are  $x \times x \times y \times y = x^2y^2$

### Question 2:

Factorize the following expressions.

$$\text{(i)} \quad 7x - 42$$

$$\text{(ii)} \quad 6p - 12q$$

$$\text{(iii)} \quad 7a^2 + 14a$$

$$\text{(iv)} \quad -16z + 20z^3$$

$$\text{(v)} \quad 20l^2m + 30alm$$

$$\text{(vi)} \quad 5x^2y - 15xy^2$$

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

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

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

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

### Answer 2:

$$\text{(i)} \quad 7x - 42 = 7 \times x - 2 \times 3 \times 7$$

Taking common factors from each term,

$$= 7(x - 2 \times 3)$$

$$= 7(x - 6)$$

$$\text{(ii)} \quad 6p - 12q = 2 \times 3 \times p - 2 \times 2 \times 3 \times q$$

Taking common factors from each term,

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

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

$$\text{(iii)} \quad 7a^2 + 14a = 7 \times a \times a + 2 \times 7 \times a$$

Taking common factors from each term,

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

$$= 7a(a + 2)$$

(iv)  $-16z + 20z^3 = (-1) \times 2 \times 2 \times 2 \times 2 \times z + 2 \times 2 \times 5 \times z \times z \times z$

Taking common factors from each term,

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

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

(v)  $20l^2m + 30alm = 2 \times 2 \times 5 \times l \times l \times m + 2 \times 3 \times 5 \times a \times l \times m$

Taking common factors from each term,

$$= 2 \times 5 \times l \times m(2 \times l + 3 \times a)$$

$$= 10lm(2l + 3a)$$

(vi)  $5x^2y - 15xy^2 = 5 \times x \times x \times y + 3 \times 5 \times x \times y \times y$

Taking common factors from each term,

$$= 5 \times x \times y(x - 3y)$$

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

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

Taking common factors from each term,

$$= 5(2 \times a \times a - 3 \times b \times b + 2 \times 2 \times c \times c)$$

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

(viii)  $-4a^2 + 4ab - 4ca = (-1) \times 2 \times 2 \times a \times a + 2 \times 2 \times a \times b - 2 \times 2 \times c \times a$

Taking common factors from each term,

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

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

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

Taking common factors from each term,

$$= x \times y \times z(x + y + z)$$

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

$$(x) \quad ax^2y + bxy^2 + cxyz = a \times x \times x \times y + b \times x \times y \times y + c \times x \times y \times z$$

Taking common factors from each term,

$$= x \times y (a \times x + b \times y + c \times z)$$

$$= xy(ax + by + cz)$$

### Question 3:

Factorize:

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

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

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

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

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

### Answer 3:

$$(i) \quad x^2 + xy + 8x + 8y = x(x + y) + 8(x + y) \\ = (x + y)(x + 8)$$

$$(ii) \quad 15xy - 6x + 5y - 2 = 3x(5y - 2) + 1(5y - 2) \\ = (5y - 2)(3x + 1)$$

$$(iii) \quad ax + bx - ay - by = (ax + bx) - (ay + by) \\ = x(a + b) - y(a + b) \\ = (a + b)(x - y)$$

$$(iv) \quad 15pq + 15 + 9q + 25p = 15pq + 25p + 9q + 15 \\ = 5p(3q + 5) + 3(3q + 5) \\ = (3q + 5)(5p + 3)$$

$$(v) \quad z - 7 + 7xy - xyz = 7xy - 7 - xyz + z \\ = 7(xy - 1) - z(xy - 1) \\ = (xy - 1)(7 - z) = (-1)(1 - xy)(-1)(z - 7) \\ = (1 - xy)(z - 7)$$

## Exercise 14.2

### Question 1:

Factorize 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)  $a^4 + 2a^2b^2 + b^4$

### Answer 1:

(i)  $a^2 + 8a + 16 = a^2 + (4+4)a + 4 \times 4$

Using identity  $x^2 + (a+b)x + ab = (x+a)(x+b)$ ,

Here  $x = a, a = 4$  and  $b = 4$

$$a^2 + 8a + 16 = (a+4)(a+4) = (a+4)^2$$

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

Using identity  $x^2 + (a+b)x + ab = (x+a)(x+b)$ ,

Here  $x = p, a = -5$  and  $b = -5$

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

(iii)  $25m^2 + 30m + 9 = (5m)^2 + 2 \times 5m \times 3 + (3)^2$

Using identity  $a^2 + 2ab + b^2 = (a+b)^2$ , here  $a = 5m, b = 3$

$$25m^2 + 30m + 9 = (5m+3)^2$$

(iv)  $49y^2 + 84yz + 36z^2 = (7y)^2 + 2 \times 7y \times 6z + (6z)^2$

Using identity  $a^2 + 2ab + b^2 = (a+b)^2$ , here  $a = 7y, b = 6z$

$$49y^2 + 84yz + 36z^2 = (7y+6z)^2$$

$$(v) \quad 4x^2 - 8x + 4 = (2x)^2 - 2 \times 2x \times 2 + (2)^2$$

Using identity  $a^2 - 2ab + b^2 = (a - b)^2$ , here  $a = 2x, b = 2$

$$4x^2 - 8x + 4 = (2x - 2)^2 = (2)^2 (x - 1)^2 = 4(x - 1)^2$$

$$(vi) \quad 121b^2 - 88bc + 16c^2 = (11b)^2 - 2 \times 11b \times 4c + (4c)^2$$

Using identity  $a^2 - 2ab + b^2 = (a - b)^2$ , here  $a = 11b, b = 4c$

$$121b^2 - 88bc + 16c^2 = (11b - 4c)^2$$

$$(vii) \quad \begin{aligned} (l + m)^2 - 4lm &= l^2 + 2 \times l \times m + m^2 - 4lm & [\because (a + b)^2 = a^2 + 2ab + b^2] \\ &= l^2 + 2lm + m^2 - 4lm \\ &= l^2 - 2lm + m^2 \\ &= (l - m)^2 & [\because (a - b)^2 = a^2 - 2ab + b^2] \end{aligned}$$

$$(viii) \quad \begin{aligned} a^4 + 2a^2b^2 + b^4 &= (a^2)^2 + 2 \times a^2 \times b^2 + (b^2)^2 \\ &= (a^2 + b^2)^2 & [\because (a + b)^2 = a^2 + 2ab + b^2] \end{aligned}$$

### Question 2:

Factorize:

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

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

$$(iii) \quad 49x^2 - 36$$

$$(iv) \quad 16x^5 - 144x^2$$

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

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

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

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

### Answer 2:

$$(i) \quad \begin{aligned} 4p^2 - 9q^2 &= (2p)^2 - (3q)^2 \\ &= (2p - 3q)(2p + 3q) & [\because a^2 - b^2 = (a - b)(a + b)] \end{aligned}$$

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

$$\begin{aligned} \text{(iii)} \quad 49x^2 - 36 &= (7x)^2 - (6)^2 \\ &= (7x-6)(7x+6) \quad [\because a^2 - b^2 = (a-b)(a+b)] \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad 16x^5 - 144x^3 &= 16x^3(x^2 - 9) \\ &= 16x^3[(x)^2 - (3)^2] \\ &= 16x^3(x-3)(x+3) \quad [\because a^2 - b^2 = (a-b)(a+b)] \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad (l+m)^2 - (l-m)^2 &= [(l+m)+(l-m)][(l+m)-(l-m)] \\ & \quad [\because a^2 - b^2 = (a-b)(a+b)] \\ &= (l+m+l-m)(l+m-l+m) \\ &= (2m)(2l) = 4lm \end{aligned}$$

$$\begin{aligned} \text{(vi)} \quad 9x^2y^2 - 16 &= (3xy)^2 - (4)^2 \\ &= (3xy-4)(3xy+4) \quad [\because a^2 - b^2 = (a-b)(a+b)] \end{aligned}$$

$$\begin{aligned} \text{(vii)} \quad (x^2 - 2xy + y^2) - z^2 &= (x-y)^2 - z^2 \\ & \quad [\because (a-b)^2 = a^2 - 2ab + b^2] \\ &= (x-y-z)(x-y+z) \quad [\because a^2 - b^2 = (a-b)(a+b)] \end{aligned}$$

$$\begin{aligned} \text{(viii)} \quad 25a^2 - 4b^2 + 28bc - 49c^2 &= 25a^2 - (4b^2 - 28bc + 49c^2) \\ &= 25a^2 - [(2b)^2 - 2 \times 2b \times 7c + (7c)^2] \\ &= 25a^2 - (2b-7c)^2 \quad [\because (a-b)^2 = a^2 - 2ab + b^2] \\ &= (5a)^2 - (2b-7c)^2 \\ &= [5a - (2b-7c)][5a + (2b-7c)] \quad [\because a^2 - b^2 = (a-b)(a+b)] \\ &= (5a - 2b + 7c)(5a + 2b - 7c) \end{aligned}$$

### Question 3:

Factorize the expressions:

(i)  $ax^2 + bx$

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

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

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

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

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

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

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

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

### Answer 3:

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

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

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

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

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



### Question 4:

Factorize:

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

$$(ii) \quad p^4 - 81$$

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

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

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

### Answer 4:

$$\begin{aligned} (i) \quad a^4 - b^4 &= (a^2)^2 - (b^2)^2 \\ &= (a^2 - b^2)(a^2 + b^2) && [\because a^2 - b^2 = (a-b)(a+b)] \\ &= (a-b)(a+b)(a^2 + b^2) && [\because a^2 - b^2 = (a-b)(a+b)] \end{aligned}$$

$$\begin{aligned} (ii) \quad p^4 - 81 &= (p^2)^2 - (9)^2 \\ &= (p^2 - 9)(p^2 + 9) && [\because a^2 - b^2 = (a-b)(a+b)] \\ &= (p^2 - 3^2)(p^2 + 9) \\ &= (p-3)(p+3)(p^2 + 9) && [\because a^2 - b^2 = (a-b)(a+b)] \end{aligned}$$

$$\begin{aligned} (iii) \quad x^4 - (y+z)^4 &= (x^2)^2 - [(y+z)^2]^2 \\ &= [x^2 - (y+z)^2][x^2 + (y+z)^2] && [\because a^2 - b^2 = (a-b)(a+b)] \\ &= [x - (y+z)][x + (y+z)][x^2 + (y+z)^2] && [\because a^2 - b^2 = (a-b)(a+b)] \\ &= (x - y + z)(x + y + z)[x^2 + (y+z)^2] \end{aligned}$$

$$\begin{aligned} (iv) \quad x^4 - (x-z)^4 &= (x^2)^2 - [(x-z)^2]^2 \\ &= [x^2 - (x-z)^2][x^2 + (x-z)^2] && [\because a^2 - b^2 = (a-b)(a+b)] \\ &= [x - (x-z)][x + (x+z)][x^2 + (x-z)^2] && [\because a^2 - b^2 = (a-b)(a+b)] \\ &= (x - x + z)(x + x + z)(x^2 + x^2 - 2xz + z^2) && [\because (a-b)^2 = a^2 - 2ab + b^2] \\ &= x(2x+z)(2x^2 - 2xz + z^2) \end{aligned}$$

$$\begin{aligned}
 \text{(v)} \quad a^4 - 2a^2b^2 + b^4 &= (a^2)^2 - 2a^2b^2 + (b^2)^2 \\
 &= (a^2 - b^2)^2 && [\because (a-b)^2 = a^2 - 2ab + b^2] \\
 &= [(a-b)(a+b)]^2 && [\because a^2 - b^2 = (a-b)(a+b)] \\
 &= (a-b)^2 (a+b)^2 && [\because (xy)^m = x^m \cdot y^m]
 \end{aligned}$$

### Question 5:

Factorize the following expressions:

$$\text{(i)} \quad p^2 + 6p + 8$$

$$\text{(ii)} \quad q^2 - 10q + 21$$

$$\text{(iii)} \quad p^2 + 6p - 16$$

### Answer 5:

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

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

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

## Exercise 14.3

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

### Answer 1:

$$\begin{aligned} \text{(i)} \quad 28x^4 \div 56x &= \frac{28x^4}{56x} = \frac{28}{56} \times \frac{x^4}{x} \\ &= \frac{1}{2}x^3 \end{aligned}$$

$$[\because x^m \div x^n = x^{m-n}]$$

$$\begin{aligned} \text{(ii)} \quad -36y^3 \div 9y^2 &= \frac{-36y^3}{9y^2} = \frac{-36}{9} \times \frac{y^3}{y^2} \\ &= -4y \end{aligned}$$

$$[\because x^m \div x^n = x^{m-n}]$$

$$\begin{aligned} \text{(iii)} \quad 66pq^2r^3 \div 11qr^2 &= \frac{66pq^2r^3}{11qr^2} = \frac{66}{11} \times \frac{pq^2r^3}{qr^2} \\ &= 6pqr \end{aligned}$$

$$[\because x^m \div x^n = x^{m-n}]$$

$$\begin{aligned} \text{(iv)} \quad 34x^3y^3z^3 \div 51xy^2z^3 &= \frac{34x^3y^3z^3}{51xy^2z^3} = \frac{34}{51} \times \frac{x^3y^3z^3}{xy^2z^3} \\ &= \frac{2}{3}x^2y \end{aligned}$$

$$[\because x^m \div x^n = x^{m-n}]$$

$$\begin{aligned} \text{(v)} \quad 12a^8b^8 \div (-6a^6b^4) &= \frac{12a^8b^8}{-6a^6b^4} = \frac{12}{-6} \times \frac{a^8b^8}{a^6b^4} \\ &= -2a^2b^4 \end{aligned}$$

$$[\because x^m \div x^n = x^{m-n}]$$



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

### Answer 3:

(i)  $(10x - 25) \div 5 = \frac{10x - 25}{5}$   
 $= \frac{5(2x - 5)}{5} = 2x - 5$

(ii)  $(10x - 25) \div (2x - 5) = \frac{10x - 25}{(2x - 5)}$   
 $= \frac{5(2x - 5)}{(2x - 5)} = 5$

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

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

(v)  $96abc(3a - 12)(5b - 30) \div 144(a - 4)(b - 6) = \frac{96abc(3a - 12)(5b - 30)}{144(a - 4)(b - 6)}$   
 $= \frac{12 \times 4 \times 2 \times abc \times 3(a - 4) \times 5(b - 6)}{12 \times 4 \times 3(a - 4)(b - 6)} = 10abc$

### Question 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)  $x(x+1)(x+2)(x+3) \div x(x+1)$

### Answer 4:

$$\begin{aligned} \text{(i)} \quad 5(2x+1)(3x+5) \div (2x+1) &= \frac{5(2x+1)(3x+5)}{(2x+1)} \\ &= 5(3x+5) \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad 26xy(x+5)(y-4) \div 13x(y-4) &= \frac{26xy(x+5)(y-4)}{13x(y-4)} \\ &= \frac{13 \times 2 \times xy(x+5)(y-4)}{13x(y-4)} = 2y(x+5) \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad 52pqr(p+q)(q+r)(r+p) \div 104pq(q+r)(r+p) &= \frac{52pqr(p+q)(q+r)(r+p)}{104pq(q+r)(r+p)} \\ &= \frac{52pqr(p+q)(q+r)(r+p)}{52 \times 2 \times pq(q+r)(r+p)} = \frac{1}{2}r(p+q) \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad 20(y+4)(y^2+5y+3) \div 5(y+4) &= \frac{20(y+4)(y^2+5y+3)}{5(y+4)} \\ &= 4(y^2+5y+3) \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad x(x+1)(x+2)(x+3) \div x(x+1) &= \frac{x(x+1)(x+2)(x+3)}{x(x+1)} \\ &= (x+2)(x+3) \end{aligned}$$

### Question 5:

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

### Answer 5:

$$\begin{aligned} \text{(i)} \quad (y^2 + 7y + 10) \div (y + 5) &= \frac{y^2 + 7y + 10}{(y + 5)} \\ &= \frac{y^2 + (2 + 5)y + 2 \times 5}{(y + 5)} = \frac{y^2 + 2y + 5y + 2 \times 5}{(y + 5)} \\ &= \frac{(y + 2)(y + 5)}{(y + 5)} \quad [\because x^2 + (a + b)x + ab = (x + a)(x + b)] \\ &= y + 2 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad (m^2 - 14m + 32) \div (m + 2) &= \frac{m^2 - 14m + 32}{(m + 2)} \\ &= \frac{m^2 + (-16 + 2)m + (-16) \times 2}{(m + 2)} \\ &= \frac{(m - 16)(m + 2)}{(m + 2)} \quad [\because x^2 + (a + b)x + ab = (x + a)(x + b)] \\ &= (m - 16) \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad (5p^2 - 25p + 20) \div (p - 1) &= \frac{5p^2 - 25p + 20}{(p - 1)} \\ &= \frac{5p^2 - 20p - 5p + 20}{(p - 1)} \end{aligned}$$

$$\begin{aligned}
&= \frac{5p(p-4) - 5(p-4)}{(p-1)} \\
&= \frac{(5p-5)(p-4)}{(p-1)} = \frac{5(p-1)(p-4)}{(p-1)} \\
&= 5(p-4)
\end{aligned}$$

$$\begin{aligned}
\text{(iv)} \quad 4yz(z^2 + 6z - 16) \div 2y(z+8) &= \frac{4yz(z^2 + 6z - 16)}{2y(z+8)} \\
&= \frac{4yz[z^2 + (8-2)z + 8 \times (-2)]}{2y(z+8)} \\
&= \frac{4yz(z-2)(z+8)}{2y(z+8)} \quad [\because x^2 + (a+b)x + ab = (x+a)(x+b)] \\
&= 2z(z-2)
\end{aligned}$$

$$\begin{aligned}
\text{(v)} \quad 5pq(p^2 - q^2) \div 2p(p+q) &= \frac{5pq(p^2 - q^2)}{2p(p+q)} \\
&= \frac{5pq(p-q)(p+q)}{2p(p+q)} \quad [\because a^2 - b^2 = (a-b)(a+b)] \\
&= \frac{5}{2}q(p-q)
\end{aligned}$$

$$\begin{aligned}
\text{(vi)} \quad 12xy(9x^2 - 16y^2) \div 4xy(3x+4y) &= \frac{12xy(9x^2 - 16y^2)}{4xy(3x+4y)} \\
&= \frac{12xy[(3x)^2 - (4y)^2]}{4xy(3x+4y)} \\
&= \frac{12xy(3x-4y)(3x+4y)}{4xy(3x+4y)} \quad [\because a^2 - b^2 = (a-b)(a+b)] \\
&= 3(3x-4y)
\end{aligned}$$



$$\begin{aligned}
 \text{(vii)} \quad 39y^3(50y^2 - 98) \div 26y^2(5y + 7) &= \frac{39y^3(50y^2 - 98)}{26y^2(5y + 7)} \\
 &= \frac{39y^3 \times 2(25y^2 - 49)}{26y^2(5y + 7)} \\
 &= \frac{39y^2 \times 2[(5y)^2 - (7)^2]}{26y^2(5y + 7)} \\
 &= \frac{39y^2 \times 2(5y - 7)(5y + 7)}{26y^2(5y + 7)} \quad [\because a^2 - b^2 = (a - b)(a + b)] \\
 &= 3y(5y - 7)
 \end{aligned}$$

## Exercise 14.4

### Question 1:

Find and correct the errors in the following mathematical statement:  $4(x-5) = 4x-5$

### Answer 1:

$$\text{L.H.S.} = 4(x-5) = 4x-20 \neq \text{R.H.S.}$$

Hence, the correct mathematical statements is  $4(x-5) = 4x-20$ .

### Question 2:

Find and correct the errors in the following mathematical statement:  $x(3x+2) = 3x^2 + 2$

### Answer 2:

$$\text{L.H.S.} = x(3x+2) = 3x^2 + 2x \neq \text{R.H.S.}$$

Hence, the correct mathematical statements is  $x(3x+2) = 3x^2 + 2x$ .

### Question 3:

Find and correct the errors in the following mathematical statement:  $2x+3y = 5xy$

### Answer 3:

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

Hence, the correct mathematical statements is  $2x+3y = 2x+3y$ .

### Question 4:

Find and correct the errors in the following mathematical statement:  $x+2x+3x = 5x$

### Answer 4:

$$\text{L.H.S.} = x+2x+3x = 6x \neq \text{R.H.S.}$$

Hence, the correct mathematical statements is  $x+2x+3x = 6x$ .

**Question 5:**

Find and correct the errors in the following mathematical statement:  $5y + 2y + y - 7y = 0$

**Answer 5:**

$$\text{L.H.S.} = 5y + 2y + y - 7y = 8y - 7y = y \neq \text{R.H.S.}$$

Hence, the correct mathematical statements is  $5y + 2y + y - 7y = y$ .

**Question 6:**

Find and correct the errors in the following mathematical statement:  $3x + 2x = 5x^2$

**Answer 6:**

$$\text{L.H.S.} = 3x + 2x = 5x \neq \text{R.H.S.}$$

Hence, the correct mathematical statements is  $3x + 2x = 5x$ .

**Question 7:**

Find and correct the errors in the following mathematical statement:

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

**Answer 7:**

$$\text{L.H.S.} = (2x)^2 + 4(2x) + 7 = 4x^2 + 8x + 7 \neq \text{R.H.S.}$$

Hence, the correct mathematical statements is  $(2x)^2 + 4(2x) + 7 = 4x^2 + 8x + 7$ .

**Question 8:**

Find and correct the errors in the following mathematical statement:

$$(2x)^2 + 5x = 4x + 5x = 9x$$

**Answer 8:**

$$\text{L.H.S.} = (2x)^2 + 5x = 4x^2 + 5x \neq \text{R.H.S.}$$

Hence, the correct mathematical statements is  $(2x)^2 + 5x = 4x^2 + 5x$ .

**Question 9:**

Find and correct the errors in the following mathematical statement:

$$(3x+2)^2 = 3x^2 + 6x + 4$$

**Answer 9:**

$$\text{L.H.S.} = (3x+2)^2 = (3x)^2 + 2 \times 3x \times 2 + (2)^2 = 9x^2 + 12x + 4 \neq \text{R.H.S.}$$

Hence, the correct mathematical statements is  $(3x+2)^2 = 9x^2 + 12x + 4$ .

**Question 10:**

Find and correct the errors in the following mathematical statements:

Substituting  $x = -3$  in:

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

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

(c)  $x^2 + 5x$  gives  $(-3)^2 + 5(-3) = -9 - 15 = -24$

**Answer 10:**

(a) L.H.S. =  $x^2 + 5x + 4$

Putting  $x = -3$  in given expression,

$$= (-3)^2 + 5(-3) + 4 = 9 - 15 + 4 = -2 \neq \text{R.H.S.}$$

Hence,  $x^2 + 5x + 4$  gives  $(-3)^2 + 5(-3) + 4 = 9 - 15 + 4 = -2$ .

(b) L.H.S. =  $x^2 - 5x + 4$

Putting  $x = -3$  in given expression,

$$= (-3)^2 - 5(-3) + 4 = 9 + 15 + 4 = 28 \neq \text{R.H.S.}$$

Hence,  $x^2 - 5x + 4$  gives  $(-3)^2 - 5(-3) + 4 = 9 + 15 + 4 = 28$ .

(c) L.H.S. =  $x^2 + 5x$

Putting  $x = -3$  in given expression,

$$= (-3)^2 + 5(-3) = 9 - 15 = -6 \neq \text{R.H.S.}$$

Hence,  $x^2 + 5x$  gives  $(-3)^2 + 5(-3) = 9 - 15 = -6$ .

**Question 11:**

Find and correct the errors in the following mathematical statement:  $(y-3)^2 = y^2 - 9$

**Answer 11:**

$$\begin{aligned} \text{L.H.S.} &= (y-3)^2 = y^2 - 2 \times y \times 3 + (3)^2 && \left[ \because (a-b)^2 = a^2 - 2ab + b^2 \right] \\ &= y^2 - 6y + 9 \neq \text{R.H.S.} \end{aligned}$$

Hence, the correct statements is  $(y-3)^2 = y^2 - 6y + 9$ .

**Question 12:**

Find and correct the errors in the following mathematical statement:  $(z+5)^2 = z^2 + 25$

**Answer 12:**

$$\begin{aligned} \text{L.H.S.} &= (z+5)^2 = z^2 + 2 \times z \times 5 + (5)^2 && \left[ \because (a+b)^2 = a^2 + 2ab + b^2 \right] \\ &= z^2 + 10z + 25 \end{aligned}$$

Hence, the correct statement is  $(z+5)^2 = z^2 + 10z + 25$ .

**Question 13:**

Find and correct the errors in the following mathematical statement:

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

**Answer 13:**

$$\begin{aligned} \text{L.H.S.} &= (2a+3b)(a-b) = 2a(a-b) + 3b(a-b) \\ &= 2a^2 - 2ab + 3ab - 3b^2 = 2a^2 + ab - 3b^2 \neq \text{R.H.S.} \end{aligned}$$

Hence, the correct statement is  $(2a+3b)(a-b) = 2a^2 + ab - 3b^2$ .

**Question 14:**

Find and correct the errors in the following mathematical statement:

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

 **Answer14:**

$$\begin{aligned}\text{L.H.S.} &= (a+4)(a+2) = a(a+2) + 4(a+2) \\ &= a^2 + 2a + 4a + 8 = a^2 + 6a + 8 \neq \text{R.H.S.}\end{aligned}$$

Hence, the correct statement is  $(a+4)(a+2) = a^2 + 6a + 8$ .

**Question 15:**

Find and correct the errors in the following mathematical statement:

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

 **Answer 15:**

$$\begin{aligned}\text{L.H.S.} &= (a-4)(a-2) = a(a-2) - 4(a-2) \\ &= a^2 - 2a - 4a + 8 = a^2 - 6a + 8 \neq \text{R.H.S.}\end{aligned}$$

Hence, the correct statement is  $(a-4)(a-2) = a^2 - 6a + 8$ .

**Question 16:**

Find and correct the errors in the following mathematical statement:  $\frac{3x^2}{3x^2} = 0$

 **Answer 16:**

$$\text{L.H.S.} = \frac{3x^2}{3x^2} = \frac{1}{1} = 1 \neq \text{R.H.S.}$$

Hence, the correct statement is  $\frac{3x^2}{3x^2} = 1$ .

**Question 17:**

Find and correct the errors in the following mathematical statement:  $\frac{3x^2+1}{3x^2} = 1+1 = 2$

 **Answer 17:**

$$\begin{aligned}\text{L.H.S.} &= \frac{3x^2+1}{3x^2} = \frac{3x^2}{3x^2} + \frac{1}{3x^2} \\ &= 1 + \frac{1}{3x^2} \neq \text{R.H.S.}\end{aligned}$$

Hence, the correct statement is  $\frac{3x^2+1}{3x^2} = 1 + \frac{1}{3x^2}$ .

**Question 18:**

Find and correct the errors in the following mathematical statement:  $\frac{3x}{3x+2} = \frac{1}{2}$

 **Answer 18:**

$$\text{L.H.S.} = \frac{3x}{3x+2} \neq \text{R.H.S.}$$

Hence, the correct statement is  $\frac{3x}{3x+2} = \frac{3x}{3x+2}$ .

**Question 19:**

Find and correct the errors in the following mathematical statement:  $\frac{3}{4x+3} = \frac{1}{4x}$

 **Answer 19:**

$$\text{L.H.S.} = \frac{3}{4x+3} \neq \text{R.H.S.}$$

Hence, the correct statement is  $\frac{3}{4x+3} = \frac{3}{4x+3}$ .

**Question 20:**

Find and correct the errors in the following mathematical statement:  $\frac{4x+5}{4x} = 5$

 **Answer 20:**

$$\text{L.H.S.} = \frac{4x+5}{4x} = \frac{4x}{4x} + \frac{5}{4x} = 1 + \frac{5}{4x} \neq \text{R.H.S.}$$

Hence, the correct statement is  $\frac{4x+5}{4x} = 1 + \frac{5}{4x}$ .

**Question 21:**

Find and correct the errors in the following mathematical statement:  $\frac{7x+5}{5} = 7x$

 **Answer 21:**

$$\text{L.H.S.} = \frac{7x+5}{5} = \frac{7x}{5} + \frac{5}{5} = \frac{7x}{5} + 1 \neq \text{R.H.S.}$$

Hence, the correct statement is  $\frac{7x+5}{5} = \frac{7x}{5} + 1$ .