

## CBSE NCERT Solutions for Class 8 Mathematics Chapter 14

### Back of Chapter Questions

#### Exercise 14.1

1. Find the common factors of the given terms.

(i)  $12x, 36$

(ii)  $2y, 22xy$

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

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

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

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

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

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

**Solution:**

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

$$\begin{array}{r|l} 2 & 12 \\ \hline 2 & 6 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

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

$$36 \Rightarrow$$

$$\begin{array}{r|l} 2 & 36 \\ \hline 2 & 18 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

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

Thus,

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

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

So, the common factors are 2, 2 and 3

And  $2 \times 2 \times 3 = 12$

(ii)  $2y, 22xy$

$2y = 2 \times y$

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

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

So, the common factors are 2 and y

And  $2 \times y = 2y$

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

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

2	14
7	7
	1

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

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

2	28
2	14
7	7
	1

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

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

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

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

$\therefore$  the common factor are 2, 7, p and q

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

$= 14pq$

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

$2x = 2 \times x$

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

$= 3 \times x \times x$

$4 = 2 \times 2$

There is no common factor visible.

∴ 1 is the only common factor of the given terms.

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

$$6abc = 6 \times abc$$

$$= 2 \times 3 \times abc$$

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

$$24ab^2 = 24 \times ab^2$$

2	24
2	12
2	6
3	3
	1

$$= 2 \times 2 \times 2 \times 3 \times ab^2$$

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

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

2	12
2	6
3	3
	1

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

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

$$\text{So, } 6abc = 2 \times 3 \times a \times b \times c$$

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

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

∴ the common factor are 2, 3, a and b

$$\text{And } 2 \times 3 \times a \times b = 6 \times ab$$

$$= 6ab$$

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

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

$$\begin{array}{r|l} 2 & 16 \\ \hline 2 & 8 \\ \hline 2 & 4 \\ \hline 2 & 2 \\ \hline & 1 \end{array}$$

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

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

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

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

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

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

$$32x = 32 \times x$$

$$\begin{array}{r|l} 2 & 32 \\ \hline 2 & 16 \\ \hline 2 & 8 \\ \hline 2 & 4 \\ \hline 2 & 2 \\ \hline & 1 \end{array}$$

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

$$\text{So, } 16x^3 = 2 \times 2 \times 2 \times 2 \times x \times x \times x$$

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

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

∴ the common factors are 2, 2 and x

$$\text{And } 2 \times 2 \times x = 4 \times x$$

$$= 4x$$

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

$$10pq = 10 \times pq$$

$$= 2 \times 5 \times pq$$

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

$$20qr = 20 \times qr$$

$$\begin{array}{r|l} 2 & 20 \\ \hline 2 & 10 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

$$\begin{aligned} &= 2 \times 2 \times 5 \times qr \\ &= 2 \times 2 \times 5 \times q \times r \\ 30rp &= 30 \times rp \end{aligned}$$

$$\begin{array}{r|l} 2 & 30 \\ \hline 3 & 15 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

$$\begin{aligned} &= 2 \times 3 \times 5 \times rp \\ &= 2 \times 2 \times 5 \times r \times p \\ \text{So, } 10pq &= 2 \times 5 \times p \times q \\ 20qr &= 2 \times 2 \times 5 \times q \times r \\ 30rp &= 2 \times 2 \times 5 \times r \times p \\ \therefore \text{ the common factors are } 2 \text{ and } 5 \end{aligned}$$

$$\text{And } 2 \times 5 = 10$$

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

$$\begin{aligned} 3x^2y^3 &= 3 \times x^2 \times y^3 \\ &= 3 \times x \times x \times y \times y \times y \\ 10x^3y^2 &= 10 \times x^3 \times y^2 \\ &= 2 \times 5 \times x^3 \times y^2 \\ &= 2 \times 5 \times x \times x \times x \times y \times y \end{aligned}$$

$$\begin{aligned} 6x^2y^2z &= 6 \times x^2 \times y^2 \times z \\ &= 2 \times 3 \times x^2 \times y^2 \times z \\ &= 2 \times 3 \times x \times x \times y \times y \times z \end{aligned}$$

$$\begin{aligned} \text{So, } 3x^2y^3 &= 2 \times x \times x \times y \times y \times y \\ 10x^3y^2 &= 2 \times 5 \times x \times x \times x \times y \times y \\ 6x^2y^2z &= 2 \times 3 \times x \times x \times y \times y \times z \end{aligned}$$

$$\begin{aligned} \therefore \text{the common factors are } x, x, y \text{ and } y \\ \text{And } x \times x \times y \times y &= (x \times x) \times (y \times y) \\ &= x^2 \times y^2 \\ &= x^2y^2 \end{aligned}$$

2. Factorise the following expressions.

- (i)  $7x - 42$
- (ii)  $6p - 12q$
- (iii)  $7a^2 + 14a$
- (iv)  $-16z + 20z^3$
- (v)  $20l^2m + 30 \ a/m$
- (vi)  $5x^2y - 15xy^2$
- (vii)  $10 \ a^2 - 15 \ b^2 + 20 \ c^2$
- (viii)  $-4a^2 + 4ab - 4 \ ca$
- (ix)  $x^2yz + xy^2z + xyz^2$
- (x)  $ax^2y + bxy^2 + cxyz$

**Solution:**

(i)  $7x - 42$

**Method 1:**

$$\begin{aligned} 7x &= 7 \times x \\ 42 &= 2 \times 3 \times 7 \end{aligned}$$

2	42
3	21
7	7
	1

7 is the only common factor.

$$\begin{aligned} 7x - 42 &= (7 \times x) - (2 \times 3 \times 7) \\ &= 7(x - (2 \times 3)) \\ &= 7(x - 6) \end{aligned}$$

**Method 2:**

$$7x - 42$$

$$\begin{aligned}
 &7x - 42 \\
 &= (7 \times x) - (7 \times 6) \\
 &= 7(x - 6) \text{ (taking 7 as common)}
 \end{aligned}$$

(ii)  $6p - 12q$

**Method 1:**

$$\begin{aligned}
 6p &= 6 \times p \\
 &= 2 \times 3 \times p
 \end{aligned}$$

$$12q = 12 \times q$$

2	12
2	6
3	3
	1

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

So, the common factors are 2 and 3.

$$\begin{aligned}
 6p - 12q &= (2 \times 3 \times p) - (2 \times 2 \times 3 \times q) \\
 &= 2 \times 3(p - (2 \times q)) \\
 &= 6(p - 2q)
 \end{aligned}$$

**Method 2:**

$$\begin{aligned}
 6p - 12q \\
 &= 6p - (6 \times 2)q \\
 &= 6(p - 2q) \text{ (taking 6 as common)}
 \end{aligned}$$

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

**Method 1:**

$$7a^2 = 7 \times a^2 = 7 \times a \times a$$

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

So, the common factors are 7 and a

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

**Method 2:**

$$\begin{aligned}
 &7a^2 + 14a \\
 &= 7a^2 + (7 \times 2)a \\
 &= (7a \times a) + (7a \times 2) \\
 &= 7a(a + 2) \text{ (taking } 7a \text{ common)}
 \end{aligned}$$

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

**Method 1:**

$$\begin{aligned}
 -16z &= -16 \times z \\
 &= -1 \times 2 \times 2 \times 2 \times 2 \times z \\
 20z^3 &= 20 \times z^3
 \end{aligned}$$

2	20
2	10
5	5
	1

$$= 2 \times 2 \times 5 \times z \times z \times z$$

So, the common factors are 2, 2 and z

$$\begin{aligned}
 &-16z + 20z^3 \\
 &= (-1 \times 2 \times 2 \times 2 \times 2 \times z) + (2 \times 2 \times 5 \times z \times z \times z)
 \end{aligned}$$

Taking  $2 \times 2 \times z$  common,

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

**Method 2:**

$$\begin{aligned}
 &-16z + 20z^3 \\
 &= (4 \times -4)z + (4 \times 5)z^3 \\
 &= 4z(-4 + 5z^2) \text{ (taking } 4z \text{ as common)}
 \end{aligned}$$

(v)  $20l^2m + 30 a/m$

**Method 1:**

$$20 l^2 m = 20 \times l^2 \times m$$



$$\begin{array}{r|l} 2 & 20 \\ \hline 2 & 10 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

$$= 2 \times 2 \times 5 \times 1 \times 1 \times m$$

$$30 \text{ alm} = 30 \times a \times 1 \times m$$

$$\begin{array}{r|l} 2 & 30 \\ \hline 3 & 15 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

$$= 2 \times 3 \times 5 \times a \times 1 \times m$$

$$\text{So, } 20l^2m = 2 \times 2 \times 5 \times 1 \times 1 \times m$$

$$30 \text{ alm} = 2 \times 3 \times 5 \times a \times 1 \times m$$

So, 2, 5, 1 and m are the common factors.

Now,

$$20l^2m + 30 \text{ alm} = (2 \times 2 \times 5 \times 1 \times 1 \times m) + (2 \times 3 \times 5 \times a \times 1 \times m)$$

Taking  $2 \times 5 \times 1 \times m$  common

$$= 2 \times 5 \times 1 \times m [(2 \times 1) + (3 \times a)]$$

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

**Method 2:**

$$20 l^2 m + 30 \text{ alm}$$

$$= (10 \times 2)l \times l \times m + (10 \times 3) a \times 1 \times m$$

Taking  $10 \times 1 \times m$  as common,

$$= 10 \times 1 \times m(2l + 3a)$$

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

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

**Method 1:**

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

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

$$= 3 \times 5 \times x \times y \times y$$

So, 5,  $x$  and  $y$  are the common factors.

Now,

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

Taking  $5 \times x \times y$  common

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

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

**Method 2:**

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

Taking 5 as common

$$= 5(x^2y - 3xy^2)$$

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

Taking  $xy$  as common

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

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

**Method 1:**

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

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

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

So, 5 is the common factor.

$$10a^2 - 15b^2 + 20c^2$$

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

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

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

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

**Method 2:**

$$10a^2 - 15b^2 + 20c^2$$

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

Taking 5 common,

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

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

**Method 1:**

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

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

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

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

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

So, 2, 2 and  $a$  are the common factors.

$$-4a^2 + 4ab - 4ca$$

$$= (-1 \times 2 \times 2 \times a \times a) + (2 \times 2 \times a \times b) - (2 \times 2 \times c \times a)$$

$$= 2 \times 2 \times a \times ((-1 \times a) + b - c)$$

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

**Method 2:**

$$-4a^2 + 4ab - 4ca$$

Taking 4 common,

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

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

Taking  $a$  common,

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

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

**Method 1:**

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

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

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

So,  $x$ ,  $y$  and  $z$  are the common factors.

$$x^2yz + xy^2z + xyz^2$$

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

Taking  $x \times y \times z$  common,

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

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

**Method 2:**

$$x^2yz + xy^2z + xyz^2$$

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

Taking  $xyz$  common,

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

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

**Method 1:**

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

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

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

So,  $x$  and  $y$  are the common factors.

$$ax^2y + bxy^2 + cxyz$$

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

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

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

**Method 2:**

$$ax^2y + bxy^2 + cxyz$$

$$= (x \times axy) + (x \times by^2) + (x \times cyz)$$

Taking  $x$  common,

$$= x(axy + by^2 + cyz)$$

$$= x((ax \times y) + (by \times y) + (cz \times y))$$

Taking  $y$  common,

$$= x \times y(ax + by + cz)$$

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

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:**

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

$$= \underbrace{(x^2 + xy)}_{\substack{\text{Both have } x \\ \text{as common} \\ \text{factor}}} + \underbrace{(8x + 8y)}_{\substack{\text{Both have } 8 \\ \text{as common} \\ \text{factor}}}$$

$$= x(x + y) + 8(x + y)$$

Taking  $(x + y)$  common

$$= (x + y)(x + 8)$$

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

$$15xy - 6x + 5y - 2$$

$$= \underbrace{(15xy - 6x)}_{\substack{\text{Both have } 3 \\ \text{and } x \text{ as} \\ \text{common} \\ \text{factor}}} + \underbrace{(5y - 2)}_{\substack{\text{Since nothing is} \\ \text{common, we} \\ \text{take } 1 \text{ common}}}$$

$$= 3x(5y - 2) + 1(5y - 2)$$

Taking  $(5y - 2)$  common

$$= (5y - 2)(3x + 1)$$

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

$$ax + bx - ay - by$$

$$= \underbrace{(ax + bx)}_{\substack{\text{Both have } x \\ \text{as common} \\ \text{factor}}} - \underbrace{(ay - by)}_{\substack{\text{Both have } y \\ \text{as common} \\ \text{factor}}}$$

$$= x(a + b) - y(a + b)$$

Taking  $(a + b)$  common

$$= (a + b)(x - y)$$

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

$$15pq + 15 + 9q + 25p$$

$$= \underbrace{(15pq + 25p)}_{\substack{\text{Both have } 5 \\ \text{and } p \text{ as common} \\ \text{factor}}} + \underbrace{(15 + 9q)}_{\substack{\text{Both have } 3 \\ \text{as common} \\ \text{factor}}}$$

$$= 5p(3q + 5) + 3(5 + 3q)$$

$$= 5p(3q + 5) + 3(3q + 5)$$

Taking  $(3q + 5)$  Common,

$$= (3q + 5)(5p + 3)$$

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

$$z - 7 + 7xy - xyz$$

$$(z - 7) + \underbrace{(7xy - xyz)}$$

Both have  $x$   
and  $y$  as  
common factor

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

$$= (z - 7) + xy \times -(z - 7) \text{ (As } (7 - z) = -(z - 7))$$

$$= (z - 7) - xy(z - 7)$$

Taking  $(z - 7)$  common

$$= (z - 7)(1 - xy)$$

### 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)  $a^2 + 8a + 16$

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

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

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

$$\text{Using } (x + y)^2 = x^2 + y^2 + 2xy$$

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

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

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

$$p^2 - 10p + 25$$

$$= p^2 - 10p + 5^2$$

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

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

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

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

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

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

$$25m^2 + 30m + 9$$

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

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

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

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

Here,  $a = 5m$  and  $b = 3$

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

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

$$49y^2 + 84yz + 36z^2$$

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

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

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

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

Here,  $a = 7y$  and  $b = 6z$

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

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

$$4x^2 - 8x + 4$$

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

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

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

Here,  $a = 2x$  and  $b = 2$

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

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

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

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

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

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

Here,  $x = 11b$  and  $y = 4c$

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

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

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

Here,  $a = l$  and  $b = m$

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

$$= l^2 + m^2 + 2lm(1 - 2)$$

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

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

Here,  $a = l$  and  $b = m$

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

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

$$a^4 + 2a^2b^2 + b^4$$

Using  $(a^m)^n = a^{m \times n}$

$$\therefore (a^2)^2 = a^{2 \times 2} = a^4$$

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

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

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

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

Here,  $x = a^2$  and  $y = b^2$



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

2. Factorise

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

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

(iii)  $49x^2 - 36$

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

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

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

$$\text{Using } a^2 - b^2 = (a + b)(a - b)$$

$$\text{Here } a = 2p \text{ and } b = 3q$$

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

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

$$63a^2 - 112b^2$$

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

Taking 7 common,

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

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

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

$$\text{Here } x = 3a \text{ and } y = 4b$$

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

(iii)  $49x^2 - 36$

$$49x^2 - 36$$

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

$$\text{Using } a^2 - b^2 = (a + b)(a - b)$$

$$\text{Here } a = 7x \text{ and } b = 6$$

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

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

$$16x^5 - 144x^3$$

$$= 16x^2x^3 - 144x^3$$

Taking  $x^3$  common,

$$= x^3(16x^2 - 144)$$

$$= x^3((4x)^2 - (12)^2)$$

$$\text{Using } a^2 - b^2 = (a + b)(a - b)$$

$$\text{Here } a = 4x \text{ and } b = 12$$

$$= x^3(4x + 12)(4x - 12)$$

$$= x^3 \frac{(4x + 12)}{\text{Both have 4 as common factor}} \frac{(4x - 12)}{\text{Both have 4 as common factor}}$$

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

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

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

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

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

$$\text{Using } a^2 - b^2 = (a + b)(a - b)$$

$$\text{Here } a = (l + m) \text{ and } b = (l - m)$$

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

$$= [l + m + l - m][l + m - l + m]$$

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

$$= 2 \times 2 \times l \times m$$

$$= 4lm$$

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

$$9x^2y^2 - 16$$

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

$$\text{Using } a^2 - b^2 = (a + b)(a - b)$$

$$\text{Here } a = 3xy \text{ and } b = 4$$

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

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

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

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

$$\text{Using } (a - b)^2 = a^2 + b^2 - 2ab$$

$$\text{Here } a = x \text{ and } b = y$$

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

$$\text{Using } a^2 - b^2 = (a + b)(a - b)$$

$$\text{Here } a = x - y \text{ and } b = z$$

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

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

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

Taking-common

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

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

$$= 25a^2 - ((2b)^2 + (7c)^2 - 2 \times 2b \times 7c)$$

$$\text{Using } (x - y)^2 = x^2 + y^2 - 2xy$$

$$\text{Here } x = 2b \text{ and } y = 7c$$

$$= 25a^2 - (2b - 7c)^2$$

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

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

$$\text{Here } x = 5a \text{ and } y = 2b - 7c$$

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

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

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)  $ax^2 + bx$

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

$$bx = b \times x$$

So,  $x$  is a common factor.

Taking  $x$  common,

$$= x((a \times x) + b)$$

$$= x(ax + b)$$

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

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

$$21q^2 = 21 \times q^2 = 3 \times 7 \times q \times q$$

So, 7 is the only common factor.

Taking 7 common,

$$= 7 \times ((p \times p) + (3 \times q \times q))$$

$$= 7 \times (p^2 + 3q^2)$$

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

**Method 1:**

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

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

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

$$2xz^2 = 2 \times x \times z^2 = 2 \times x \times z \times z$$

So, 2 and  $x$  are the common factors.

$$2x^3 + 2xy^2 + 2xz^2$$

$$= (2 \times x \times x \times x) + (2 \times x \times y \times y) + (2 \times x \times z \times z)$$

Taking  $2 \times x$  common,

$$= 2 \times x((x \times x) + (y \times y) + (z \times z))$$

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

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

$$\frac{(am^2 + bm^2)}{\text{Both have } m^2 \text{ as}} + \frac{(bn^2 + an^2)}{\text{Both have } n^2 \text{ as}}$$

*common factor*      *common factor*

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

Taking  $(a + b)$  common,

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

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

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

Taking  $l$  common,

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

Taking  $(m + 1)$  common,

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

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

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

Taking  $(y + z)$  common,

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

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

$$5y^2 - 20y - 8z + 2yz$$

$$= \frac{(5y^2 - 20y)}{\text{Both have 5 only y}} + \frac{(-8z + 2yz)}{\text{Both have 2 only z}}$$

*as common factors*      *as common factors*

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

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

Taking  $(y - 4)$  as common,

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

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

$$10ab + 4a + 5b + 2$$

$$\frac{(10ab + 4a)}{\substack{\text{Both have 2 and} \\ \text{as common factors}}} + \frac{(5b + 2)}{\substack{\text{Since nothing is} \\ \text{common, we} \\ \text{take 1 common}}}$$

$$= 2a(5b + 2) + 1(5b + 2)$$

Taking  $(5b + 2)$  as common,

$$= (5b + 2)(2a + 1)$$

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

$$\frac{(6xy - 4y)}{\substack{\text{Both have 2 and } y \\ \text{as common factors}}} + \frac{(6 - 9x)}{\substack{\text{Both have 3} \\ \text{as common factors}}}$$

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

$$= 2y(3x - 2) + 3 \times -1(3x - 2) \text{ (As } (2 - 3x) = -1 \times (3x - 2))$$

$$= 2y(3x - 2) - 3(3x - 2)$$

Taking  $(3x - 2)$  as common,

$$= (3x - 2)(2y - 3)$$

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)  $a^4 - b^4$

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

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

$$\text{Here } x = a^2 \text{ and } y = b^2$$

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

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

$$\text{Here } x = a \text{ and } y = b$$

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

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

(ii)  $p^4 - 81$

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

$$\text{Using } a^2 - b^2 = (a + b)(a - b)$$

$$\text{Here } a = p^2 \text{ and } b = 9$$

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

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

$$\text{Again Using } a^2 - b^2 = (a + b)(a - b)$$

$$\text{Here } a = p \text{ and } b = 3$$

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

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

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

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

$$\text{Using } a^2 - b^2 = (a + b)(a - b)$$

$$\text{Here } a = x^2 \text{ and } b = (y + z)^2$$

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

$$\text{Again Using } a^2 - b^2 =$$

$$(a + b)(a - b)$$

$$\text{Here } a = x \text{ and } b = (y + z)$$

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

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

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

$$= (x^2)^2 - [(x - z)^2]^2$$

$$\text{Using } a^2 - b^2 = (a + b)(a - b)$$

$$\text{Here } a = x^2 \text{ and } b = (x - z)^2$$

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

$$\text{Again Using } a^2 - b^2 =$$

$$(a + b)(a - b)$$

Here  $a = x$  and  $b = (x - z)$

$$\begin{aligned} &= [x^2 + (x - z)^2][x + (x - z)][x - (x - z)] \\ &= [x^2 + (x - z)^2][x + x - z][x - x + z] \\ &= [x^2 + (x - z)^2][2x - z][z] \end{aligned}$$

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

Here  $a = x$  and  $b = z$

$$\begin{aligned} &= [x^2 + (x^2 + z^2 - 2xz)][2x - z][z] \\ &= [x^2 + x^2 + z^2 - 2xz][2x - z][z] \\ &= [2x^2 + z^2 - 2xz][2x - z][z] \\ &= z(2x - z)(2x^2 + z^2 - 2xz) \end{aligned}$$

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

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

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

Here  $x = a^2$  and  $y = b^2$

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

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

Here  $x = a$  and  $y = b$

$$\begin{aligned} &= [(a + b)(a - b)]^2 \\ &= (a + b)^2(a - b)^2 \text{ (Since } (ab)^m = a^m \times b^m \text{)} \end{aligned}$$

5. Factorise the following expressions:

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

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

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

**Solution:**

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

$$= p^2 + 2p + 4p + 8 \text{ (here } 6p \text{ can be written as } 2p + 4p \text{)}$$

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

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



Taking  $(p + 2)$  common,

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

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

$$= q^2 - 3q - 7q + 21 \text{ (here } -10q \text{ can be written as } -3q - 7q\text{)}$$

$$= (q^2 - 3q) - (7q - 21)$$

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

Taking  $(q - 3)$  common,

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

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

$$= p^2 - 2p + 8p - 16 \text{ (here, } 6p \text{ can be written as } -2p + 8p\text{)}$$

$$= (p^2 - 2p) + (8p - 16)$$

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

Taking  $(p - 2)$  common

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

### Exercise: 14.3

1. Carryout 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)  $28x^4 \div 56x$

$$= \frac{28x^4}{56x}$$

$$= \frac{28}{56} \times \frac{x^4}{x}$$

$$= \frac{1}{2} \times x^{4-1} \left( \frac{a^m}{a^n} = a^{m-n} \right)$$

$$= \frac{1}{2} \times x^3$$

$$= \frac{1}{2}x^3$$

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

$$= \frac{-36y^3}{9y^2}$$

$$= \frac{-36}{9} \times \frac{y^3}{y^2}$$

$$= -4 \times y^{3-2} \left( \frac{a^m}{a^n} = a^{m-n} \right)$$

$$= -4y$$

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

$$= \frac{66pq^2r^3}{11qr^2}$$

$$= \frac{66}{11} \times p \times \frac{q^2}{q} \times \frac{r^3}{r^2}$$

$$= 6 \times p \times q^{2-1} \times r^{3-2} \left( \frac{a^m}{a^n} = a^{m-n} \right)$$

$$= 6 \times p \times q \times r$$

$$= 6pqr$$

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

$$= \frac{34x^3y^3z^3}{51xy^2z^3}$$

$$= \frac{34}{51} \times \frac{x^3}{x} \times \frac{y^3}{y^2} \times \frac{z^3}{z^3}$$

$$= \frac{2}{3} \times x^{3-1} \times y^{3-2} \times z^{3-3} \left( \frac{a^m}{a^n} = a^{m-n} \right)$$

$$= \frac{2}{3} \times x^2 \times y \times z^0$$

$$= \frac{2}{3} \times x^2 \times y \times 1$$

$$= \frac{2}{3}x^2y$$

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

$$\begin{aligned}
 &= \frac{12a^8b^8}{-6a^6b^4} \\
 &= \frac{12}{-6} \times \frac{a^8}{a^6} \times \frac{b^8}{b^4} \\
 &= -2 \times a^{8-6} \times b^{8-4} \left( \frac{a^m}{a^n} = a^{m-n} \right) \\
 &= -2 \times a^2 \times b^4 \\
 &= -2a^2b^4
 \end{aligned}$$

2. **(Method 1:)** Separating each term

Divide the given polynomial by the given monomial.

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

**Solution:**

$$5x^2 - 6x$$

Taking  $x$  common,

$$= x(5x - 6)$$

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

$$= \frac{x}{x} \times \frac{5x - 6}{3}$$

$$= \frac{5x - 6}{3}$$

**(Method 2:)** Cancelling the terms

Divide the given polynomial by the given monomial.

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

**Solution:**

$$\frac{5x^2 - 6x}{3x}$$

$$= \frac{5x^2}{3x} - \frac{6x}{3x}$$

$$= \left( \frac{5}{3} \times \frac{x^2}{x} \right) - \left( \frac{6}{3} \times \frac{x}{x} \right)$$

$$= \left( \frac{5}{3} \times x \right) - 2$$

$$= \frac{5}{3}x - 2$$

$$= \frac{5x - (2 \times 3)}{3} = \frac{5x - 6}{3}$$

(ii) **(Method 1:)**

Divide the given polynomial by the given monomial.

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

**Solution:**

$$3y^8 - 4y^6 + 5y^4$$

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

Taking  $y^4$  common

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

$$\Rightarrow \frac{3y^8 - 4y^6 + 5y^4}{y^4}$$

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

$$= 3y^4 - 4y^2 + 5$$

**(Method 2:)**

Divide the given polynomial by the given monomial.

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

**Solution:**

$$\frac{3y^8 - 4y^6 + 5y^4}{y^4}$$

$$= \frac{3y^8}{y^4} - \frac{4y^6}{y^4} + \frac{5y^4}{y^4}$$

$$= 3 \times y^{8-4} - 4 \times y^{6-4} + 5 \times y^{4-4} \left( \frac{a^m}{a^n} = a^{m-n} \right)$$

$$= 3 \times y^4 - 4 \times y^2 + 5y^0$$

$$= 3y^4 - 4y^2 + 5(a^0 = 1)$$

(iii) **(Method 1:)**

Divide the given polynomial by the given monomial.

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

**Solution:**

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

$$= 8(x \times x^2y^2z^2) + (y \times x^2y^2z^2) + (z \times x^2y^2z^2)$$

Taking  $x^2y^2z^2$  common

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

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

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

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

$$= 2 \times (x + y + z)$$

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

**(Method 2:)**

Divide the given polynomial by the given monomial.

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

**Solution:**

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

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

$$= 2x + 2y + 2z$$

Taking 2 common

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

**(iv) (Method 1:)**

Divide the given polynomial by the given monomial.

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

**Solution:**

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

Taking  $x$  common,

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

$$\Rightarrow \frac{x^3 + 2x^2 + 3x}{2x}$$

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

$$= \frac{x}{x} \times \frac{x^2 + 2x + 3}{2}$$

$$= \frac{x^2 + 2x + 3}{2}$$

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

**(Method 2:)**

Divide the given polynomial by the given monomial.

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

**Solution:**

$$\frac{x^3 + 2x^2 + 3x}{2x}$$

$$= \frac{x^3}{2x} + \frac{2x^2}{2x} + \frac{3x}{2x}$$

$$= \left(\frac{1}{2} \times \frac{x^3}{x}\right) + \left(\frac{2}{2} \times \frac{x^2}{x}\right) + \left(\frac{3}{2} \times \frac{x}{x}\right)$$

$$= \left(\frac{1}{2} \times x^2\right) + (1 \times x) + \left(\frac{3}{2} \times 1\right)$$

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

$$= \frac{x^2 + 2x + 3}{2}$$

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

(v) **(Method 1:)**

Divide the given polynomial by the given monomial.

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

**Solution:**

$$p^3q^6 - p^6q^3$$

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

Taking  $p^3q^3$  common,

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

$$\Rightarrow \frac{p^3q^6 - p^6q^3}{p^3q^3}$$

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

$$= q^3 - p^3$$

**(Method 2:)**

Divide the given polynomial by the given monomial.

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

**Solution:**

$$\frac{p^3q^6 - p^6q^3}{p^3q^3}$$

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

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

$$= q^{6-3} - p^{6-3} \left( \frac{a^m}{a^n} = a^{m-n} \right)$$

$$= q^3 - p^3$$

3. Work out the following divisions.

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

**Solution:**

$$10x - 25$$

$$= (5 \times 2)x - (5 \times 5)$$

Taking 5 common,

$$= 5(2x - 5)$$

Dividing,  $\frac{10x-25}{5}$

$$= \frac{5(2x-5)}{5}$$

$$= (2x-5)$$

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

**Solution:**

$$10x-25$$

$$= (5 \times 2)x - (5 \times 5)$$

Taking 5 common,

$$= 5(2x-5)$$

Dividing,  $\frac{(10x-25)}{(2x-5)}$

$$= \frac{5(2x-5)}{(2x-5)}$$

$$= 5$$

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

**Solution:**

$$10y(6y+21)$$

$$= 10y[(3 \times 2)y + (3 \times 7)]$$

Taking 3 common,

$$= 10y \times 3(2y+7)$$

Dividing,  $\frac{10y(6y+21)}{5(2y+7)}$

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

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

$$= 3 \times 2 \times y \times 1$$

$$= 6y$$

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

**Solution:**



$$9x^2y^2(3z - 24)$$

$$= 9x^2y^2 \times [3z - (3 \times 8)]$$

Taking 3 common,

$$= 9x^2y^2 \times 3(z - 8)$$

$$= 27x^2y^2(z - 8)$$

Dividing,  $\frac{9x^2y^2(3z-24)}{27xy(z-8)}$

$$= \frac{27x^2y^2(z - 8)}{27xy(z - 8)}$$

$$= \frac{27}{27} \times \frac{x^2}{x} \times \frac{y^2}{y} \times \frac{(z - 8)}{(z - 8)}$$

$$= 1 \times x \times y \times 1 \left( \frac{a^m}{a^n} = a^{m-n} \right)$$

$$= xy$$

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

**Solution:**

$$96 abc (3a - 12)(5b - 30)$$

$$= 96 abc (3a - (3 \times 4))(5b - 30)$$

Taking 3 common,

$$= 96 abc \times 3(a - 4)(5b - 30)$$

$$= 288 abc (a - 4)(5b - 30)$$

$$= 288 abc (a - 4)(5b - 5 \times 6)$$

Taking 5 common,

$$= 288 abc(a - 4) \times 5(b - 6)$$

$$= 288 \times 5 abc(a - 4)(b - 6)$$

$$= 1440 abc (a - 4)(b - 6)$$

Dividing,

$$\frac{96 abc (3a - 12)(5b - 30)}{144(a - 4)(b - 6)}$$

$$= \frac{1440 abc (a - 4)(b - 6)}{144 (a - 4)(b - 6)}$$

$$= \frac{1440}{144} \times abc \times \frac{(a-4)}{(a-4)} \times \frac{(b-6)}{(b-6)}$$

$$= 10 \times abc \times 1 \times 1$$

$$= 10 abc$$

4. Divide as directed

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

**Solution:**

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

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

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

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

**Solution:**

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

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

$$= \frac{26y(x + 5)}{13}$$

$$= \frac{26}{13} \times y(x + 5)$$

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

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

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

**Solution:**

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

$$= \frac{52pqr(p + q)(q + r)(r + p)}{104pq(q + r)(r + p)}$$

$$= \frac{52}{104} \times \frac{pqr}{pq} \times (p + q) \times \frac{(q + r)}{(q + r)} \times \frac{(r + p)}{(r + p)}$$

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

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

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

**Solution:**

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

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

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

$$= 4 \times 1 \times (y^2 + 5y + 3)$$

$$= 4(y^2 + 5y + 3)$$

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

**Solution:**

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

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

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

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

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

5. Factorise the expressions and divide them as directed.

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

**Solution:**

$$y^2 + 7y + 10$$

$$= y^2 + 2y + 5y + 10 \text{ (here, the middle term can be split as } 7y = 2y + 5y \text{)}$$

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

$$= y(y + 2) + 5(y + 2)$$

Taking  $(y + 2)$  common,

$$= (y + 2)(y + 5)$$

Now, dividing

$$\begin{aligned}
 & (y^2 + 7y + 10) \div (y + 5) \\
 &= \frac{y^2 + 7y + 10}{(y + 5)} \\
 &= \frac{(y + 2)(y + 5)}{(y + 5)} \\
 &= (y + 2) \times \frac{(y + 5)}{(y + 5)} \\
 &= (y + 2)
 \end{aligned}$$

Hint: To split the middle term

We need to find two numbers whose

$$\text{Sum} = 7$$

$$\text{Product} = 10$$

	Sum	Product
1 and 10	11	10
2 and 5	7	10

So, we write  $7y = 2y + 5y$

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

**Solution:**

$$m^2 - 14m - 32$$

$$= m^2 + 2m - 16m - 32 \text{ (here, the middle term can be split as } -14m = 2m - 16m \text{)}$$

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

$$= m(m + 2) - 16(m + 2)$$

Taking  $(m + 2)$  common,

$$= (m + 2)(m - 16)$$

Now, dividing

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

$$= \frac{m^2 - 14m - 32}{(m + 2)}$$

$$= \frac{(m + 2)(m - 16)}{(m + 2)}$$

$$= \frac{(m+2)}{(m+2)} \times (m-16)$$

$$= (m-16)$$

Hint: To split the middle term

We need to find two numbers whose

$$\text{Sum} = -14$$

$$\text{Product} = -32$$

	Sum	Product
1 and -32	-31	-32
2 and -16	-14	-32

So, we write  $-14m = 2m - 16m$

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

**Solution:**

$$5p^2 - 25p + 20$$

Taking 5 common,

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

$$= 5(p^2 - p - 4p + 4) \text{ (here, the middle term can be split as- } 5p = -p - 4p \text{)}$$

$$= 5[(p^2 - p) - (4p - 4)]$$

$$5[p(p - 1) - 4(p - 1)]$$

Taking  $(p - 1)$  common,

$$= 5(p - 1)(p - 4)$$

Now, dividing

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

$$= \frac{5p^2 - 25p + 20}{(p - 1)}$$

$$= \frac{5(p - 1)(p - 4)}{(p - 1)}$$

$$= 5 \times \frac{(p - 1)}{(p - 1)} \times (p - 4)$$

$$= 5(p - 4)$$

Hint: To split the middle term

We need to find two numbers whose

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

$$\text{Product} = 4$$

	Sum	Product
-1 and -4	-5	4

So, we write  $-5p = -p - 4p$

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

**Solution:**

$$4yz(z^2 + 6z - 16)$$

$$= 4yz(z^2 - 2z + 8z - 16) \text{ (here, the middle term can be split as } 6z = -2z + 8z)$$

$$= 4yz[(z^2 - 2z) + (8z - 16)]$$

$$= 4yz[z(z - 2) + 8(z - 2)]$$

Taking  $(z - 2)$  common,

$$= 4yz(z - 2)(z + 8)$$

Now, dividing

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

$$= \frac{4yz(z - 2)(z + 8)}{2y(z + 8)}$$

$$= \frac{4}{2} \times \frac{y}{y} \times z \times (z - 2) \times \frac{(z + 8)}{(z + 8)}$$

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

$$= 2z(z - 2)$$

Hint: To split the middle term

We need to find two numbers whose

$$\text{Sum} = 6$$

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

	Sum	Product
-1 and 16	15	-16
-2 and 8	-15	-16

-2 and 8	6	-16
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So, we write  $6z = -2z + 8z$

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

**Solution:**

$$5pq(p^2 - q^2)$$

$$\text{Using } a^2 - b^2 = (a + b)(a - b)$$

$$\text{Here } a = p \text{ and } b = q$$

$$= 5pq(p + q)(p - q)$$

Now, dividing

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

$$= \frac{5pq(p^2 - q^2)}{2p(p + q)}$$

$$= \frac{5pq(p + q)(p - q)}{2p(p + q)}$$

$$= \frac{5}{2} \times \frac{p}{p} \times q \times \frac{(p + q)}{(p + q)} \times (p - q)$$

$$= \frac{5}{2} \times q \times (p - q)$$

$$= \frac{5}{2}q(p - q)$$

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

**Solution:**

$$12xy(9x^2 - 16y^2)$$

$$= 12xy[(3x)^2 - (4y)^2]$$

$$\text{Using } a^2 - b^2 = (a + b)(a - b)$$

$$\text{Here } a = 3x \text{ and } b = 4y$$

$$= 12xy(3x + 4y)(3x - 4y)$$

Now, dividing

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

$$= \frac{12xy(9x^2 - 16y^2)}{4xy(3x + 4y)}$$

$$\begin{aligned}
 &= \frac{12xy(3x+4y)(3x-4y)}{4xy(3x+4y)} \\
 &= \frac{12}{4} \times \frac{xy}{xy} \times \frac{(3x+4y)}{(3x+4y)} \times (3x-4y) \\
 &= 3(3x-4y)
 \end{aligned}$$

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

**Solution:**

$$\begin{aligned}
 &39y^3(50y^2 - 98) \\
 &= 39y^3(2 \times 25y^2 - 2 \times 49)
 \end{aligned}$$

Taking 2 common,

$$\begin{aligned}
 &= 39y^3 \times 2(25y^2 - 49) \\
 &= 78y^3(25y^2 - 49)
 \end{aligned}$$

$$= 78y^3[(5y)^2 - (7)^2]$$

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

Here $a = 5y$ and $b = 7$
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$$= 78y^3(5y - 7)(5y + 7)$$

Now, dividing

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

$$= \frac{39y^3(50y^2 - 98)}{26y^2(5y + 7)}$$

$$= \frac{78y^3(5y + 7)(5y - 7)}{26y^2(5y + 7)}$$

$$= \frac{78}{26} \times \frac{y^3}{y^2} \times \frac{(5y + 7)}{(5y + 7)} \times (5y - 7)$$

$$= 3 \times y \times (5y - 7)$$

$$= 3y(5y - 7)$$