



Class 9 Maths – Ganita Manjari



Chapter 4: Exploring Algebraic Identities



Exercise Set 4.5 – Solutions

Exercise Set 4.5 contains **6 rational-expression simplification questions**. The textbook asks us to assume that the denominators are not equal to zero.



Q1. Simplify the following rational expressions

(i)

$$(3p^2 - 3pq - 18q^2) / (p^2 + 3pq - 10q^2)$$

Factor the numerator:

$$= 3(p^2 - pq - 6q^2)$$

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

Factor the denominator:

$$= (p + 5q)(p - 2q)$$

Therefore,

 **Answer:**

$$3(p - 3q)(p + 2q) / [(p + 5q)(p - 2q)]$$

(ii)

$$(n^3 - 3n^2m + 3nm^2 - m^3) / (5m^2 - 10mn + 5n^2)$$

Using:

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

Numerator:

$$= (n - m)^3$$

Denominator:

$$= 5(m^2 - 2mn + n^2)$$

$$= 5(m - n)^2$$

Since:

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

Therefore,

$$= (n - m)^3 / [5(n - m)^2]$$

$$= (n - m)/5$$

✓ Answer: $(n - m)/5$

(iii)

$$\frac{(w^3 - v^3 + x^3 + 3wvx)}{(w^2 + v^2 + x^2 - 2wv - 2vx + 2wx)}$$

Using:

$$a^3 + b^3 + c^3 - 3abc$$

Take:

$$a = w, b = x, c = -v$$

Therefore,

Numerator:

$$= (w + x - v)(w^2 + x^2 + v^2 - wx + xv + wv)$$

Denominator:

$$= (w + x - v)^2$$

Cancel the common factor:

✓ Answer:

$$(w^2 + x^2 + v^2 - wx + xv + wv) / (w + x - v)$$

(iv)

$$(4y^2 - 20yz + 25z^2) / (25z^2 - 4y^2)$$

Numerator:

$$= (2y - 5z)^2$$

Denominator:

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

Since:

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

Therefore,

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

✓ Answer:

$$(5z - 2y)/(5z + 2y)$$

(v)

$$[(x^2 + x - 6)(x^2 - 7x + 12)] / [(x^2 - 6x + 8)(x^2 - 9)]$$

Factor each expression:

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

$$x^2 - 7x + 12 = (x - 3)(x - 4)$$

$$x^2 - 6x + 8 = (x - 2)(x - 4)$$

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

Therefore,

$$= \frac{[(x+3)(x-2)(x-3)(x-4)]}{[(x-2)(x-4)(x-3)(x+3)]}$$

All common factors cancel.

✓ **Answer: 1**

(vi)

$$(p^4 - 16) / (p^2 - 4p + 4)$$

Using difference of squares:

$$p^4 - 16$$

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

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

Also,

$$p^2 - 4p + 4$$

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

Therefore,

$$= \frac{[(p - 2)(p + 2)(p^2 + 4)]}{(p - 2)^2}$$

Cancel $(p - 2)$:

✓ **Answer:**

$$(p + 2)(p^2 + 4)/(p - 2)$$



QUICK ANSWER KEY

Q1

① $3(p - 3q)(p + 2q) / [(p + 5q)(p - 2q)]$

$$\boxed{2} (n - m)/5$$

$$\boxed{3} (w^2 + x^2 + v^2 - wx + xv + wv)/(w + x - v)$$

$$\boxed{4} (5z - 2y)/(5z + 2y)$$

$$\boxed{5} 1$$

$$\boxed{6} (p + 2)(p^2 + 4)/(p - 2)$$

 Key concepts used:

- ◆ Difference of squares
- ◆ Perfect-square identities
- ◆ Cube identity
- ◆ Sum/difference of cubes
- ◆ Factorisation by splitting the middle term
- ◆ Cancellation of common factors in rational expressions

The textbook specifically states that the denominators are assumed to be non-zero while simplifying these expressions.