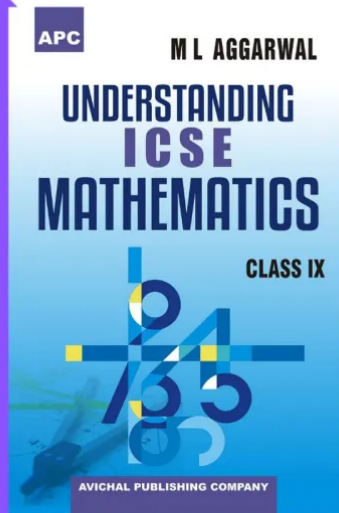


ML Aggarwal Solutions for Class 9 Maths

Chapter 3- Expansions



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ML Agrawal Solutions

CLASS 9 MATHS

Chapter 3: Expansions

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Chapter 3- Expansions

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ML Aggarwal Solutions for Class 9 Maths Chapter 3- Expansions

ML Aggarwal 9th Maths Chapter 3, Class 9 Maths Chapter 3 solutions

Exercise 3.1

By using standard formulae, expand the following (1 to 9):

1. (i) $(2x + 7y)^2$

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

Solution:

(i) $(2x + 7y)^2$

It can be written as

$$= (2x)^2 + 2 \times 2x \times 7y + (7y)^2$$

So we get

$$= 4x^2 + 28xy + 49y^2$$

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

It can be written as

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

So we get

$$= \frac{1}{4}x^2 + \frac{2}{3}xy + \frac{4}{9}y^2$$

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

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(ii) $(3x^2y + 5z)^2$

Solution:

(i) $(3x + 1/2x)^2$

It can be written as

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

So we get

$$= 9x^2 + 3 + 1/4x^2$$

$$= 9x^2 + 1/4x^2 + 3$$

(ii) $(3x^2y + 5z)^2$

It can be written as

$$= (3x^2y)^2 + 2 \times 3x^2y \times 5z + (5z)^2$$

So we get

$$= 9x^4y^2 + 30x^2yz + 25z^2$$

3. (i) $(3x - 1/2x)^2$

(ii) $(1/2x - 3/2y)^2$

Solution:

(i) $(3x - 1/2x)^2$

It can be written as

$$= (3x)^2 - 2 \times 3x \times 1/2x + (1/2x)^2$$

So we get

$$= 9x^2 - 3 + 1/4x^2$$

$$= 9x^2 + 1/4x^2 - 3$$

(ii) $(1/2x - 3/2y)^2$

It can be written as

$$= (1/2x)^2 + (3/2y)^2 - 2 \times 1/2x \times 3/2y$$

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So we get

$$= \frac{1}{4} x^2 + \frac{9}{4} y^2 - \frac{3}{2} xy$$

$$= \frac{1}{4} x^2 - \frac{3}{2} xy + \frac{9}{4} y^2$$

4. (i) $(x + 3)(x + 5)$

(ii) $(x + 3)(x - 5)$

(iii) $(x - 7)(x + 9)$

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

Solution:

(i) $(x + 3)(x + 5)$

By further calculation

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

So we get

$$= x^2 + 8x + 15$$

(ii) $(x + 3)(x - 5)$

By further calculation

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

So we get

$$= x^2 - 2x - 15$$

(iii) $(x - 7)(x + 9)$

By further calculation

$$= x^2 - (7 - 9)x - 7 \times 9$$

So we get

$$= x^2 + 2x - 63$$

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

By further calculation

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

So we get

$$= x^2 - 5xy + 6y^2$$

5. (i) $(x - 2y - z)^2$

(ii) $(2x - 3y + 4z)^2$

Solution:

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

It can be written as

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

By further calculation

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

So we get

$$= x^2 + 4y^2 + z^2 - 4xy + 4yz - 2zx$$

(ii) $(2x - 3y + 4z)^2$

It can be written as

$$= [2x + (-3y) + 4z]^2$$

By further calculation

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

So we get

$$= 4x^2 + 9y^2 + 16z^2 - 12xy - 24yz + 16zx$$

6. (i) $(2x + 3/x - 1)^2$

(ii) $(2/3 x - 3/2x - 1)^2$

Solution:

(i) $(2x + 3/x - 1)^2$

It can be written as

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$$= [2x + 3/x + (-1)]^2$$

By further calculation

$$= (2x)^2 + (3/x)^2 + (-1)^2 + 2 \times 2x \times 3/x + 2 \times 3/x \times (-1) + 2 \times (-1) \times 2x$$

So we get

$$= 4x^2 + 9/x^2 + 1 + 12 - 6/x - 4x$$

$$= 4x^2 + 9/x^2 + 13 - 6/x - 4x$$

$$(ii) (2/3 x - 3/2x - 1)^2$$

It can be written as

$$= [2/3 x - 3/2x - 1]^2$$

By further calculation

$$= (2/3 x)^2 + (-3/2x)^2 + (-1)^2 + 2 \times 2/3 x \times (-3/2x) + 2 \times (-3/2x) \times (-1) + 2 \times (-1) \times (2/3 x)$$

So we get

$$= 4/9 x^2 + 9/4x^2 + 1 - 2 + 3/x - 4/3 x$$

$$= 4/9 x^2 + 9/4x^2 - 1 - 4/3 x + 3/x$$

$$7. (i) (x + 2)^3$$

$$(ii) (2a + b)^3$$

Solution:

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

It can be written as

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

By further calculation

$$= x^3 + 8 + 6x (x + 2)$$

So we get

$$= x^3 + 8 + 6x^2 + 12x$$

$$= x^3 + 6x^2 + 12x + 8$$

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(ii) $(2a + b)^3$

It can be written as

$$= (2a)^3 + b^3 + 3 \times 2a \times b (2a + b)$$

By further calculation

$$= 8a^3 + b^3 + 6ab (2a + b)$$

So we get

$$= 8a^3 + b^3 + 12a^2b + 6ab^2$$

8. (i) $(3x + 1/x)^3$

(ii) $(2x - 1)^3$

Solution:

(i) $(3x + 1/x)^3$

It can be written as

$$= (3x)^3 + (1/x)^3 + 3 \times 3x \times 1/x (3x + 1/x)$$

By further calculation

$$= 27x^3 + 1/x^3 + 9 (3x + 1/x)$$

So we get

$$= 27x^3 + 1/x^3 + 27x + 9/x$$

(ii) $(2x - 1)^3$

It can be written as

$$= (2x)^3 - 1^3 - 3 \times 2x \times 1 (2x - 1)$$

By further calculation

$$= 8x^3 - 1 - 6x (2x - 1)$$

So we get

$$= 8x^3 - 1 - 12x^2 + 6x$$

$$= 8x^3 - 12x^2 + 6x - 1$$

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9. (i) $(5x - 3y)^3$

(ii) $(2x - 1/3y)^3$

Solution:

(i) $(5x - 3y)^3$

It can be written as

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

By further calculation

$$= 125x^3 - 27y^3 - 45xy (5x - 3y)$$

So we get

$$= 125x^3 - 27y^3 - 225x^2y + 135xy^2$$

(ii) $(2x - 1/3y)^3$

It can be written as

$$= (2x)^3 - (1/3y)^3 - 3 \times 2x \times 1/3y (2x - 1/3y)$$

By further calculation

$$= 8x^3 - 1/27y^3 - 2x/y (2x - 1/3y)$$

So we get

$$= 8x^3 - 1/27y^3 - 4x^2/y + 2x/3y^2$$

Simplify the following (10 to 19):

10. (i) $(a + b)^2 + (a - b)^2$

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

Solution:

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

It can be written as

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

By further calculation

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$$= a^2 + b^2 + 2ab + a^2 + b^2 - 2ab$$

So we get

$$= 2a^2 + 2b^2$$

Taking 2 as common

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

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

It can be written as

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

By further calculation

$$= a^2 + b^2 + 2ab - a^2 - b^2 + 2ab$$

So we get

$$= 4ab$$

$$11. (i) (a + 1/a)^2 + (a - 1/a)^2$$

$$(ii) (a + 1/a)^2 - (a - 1/a)^2$$

Solution:

$$(i) (a + 1/a)^2 + (a - 1/a)^2$$

It can be written as

$$= [a^2 + (1/a)^2 + 2 \times a \times 1/a] + [a^2 + (1/a)^2 - 2 \times a \times 1/a]$$

By further calculation

$$= [a^2 + 1/a^2 + 2] + [a^2 + 1/a^2 - 2]$$

So we get

$$= a^2 + 1/a^2 + 2 + a^2 + 1/a^2 - 2$$

$$= 2a^2 + 2/a^2$$

Taking 2 as common

$$= 2(a^2 + 1/a^2)$$

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$$(ii) (a + 1/a)^2 - (a - 1/a)^2$$

It can be written as

$$= [a^2 + (1/a)^2 + 2 \times a \times 1/a] - [a^2 + (1/a)^2 - 2 \times a \times 1/a]$$

By further calculation

$$= [a^2 + 1/a^2 + 2] - [a^2 + 1/a^2 - 2]$$

So we get

$$= a^2 + 1/a^2 + 2 - a^2 - 1/a^2 + 2$$

$$= 4$$

$$12. (i) (3x - 1)^2 - (3x - 2)(3x + 1)$$

$$(ii) (4x + 3y)^2 - (4x - 3y)^2 - 48xy$$

Solution:

$$(i) (3x - 1)^2 - (3x - 2)(3x + 1)$$

It can be written as

$$= [(3x)^2 + 1^2 - 2 \times 3x \times 1] - [(3x)^2 - (2 - 1)(3x) - 2 \times 1]$$

By further calculation

$$= [9x^2 + 1 - 6x] - [9x^2 - 3x - 2]$$

So we get

$$= 9x^2 + 1 - 6x - 9x^2 + 3x + 2$$

$$= -3x + 3$$

$$= 3 - 3x$$

$$(ii) (4x + 3y)^2 - (4x - 3y)^2 - 48xy$$

It can be written as

$$= [(4x)^2 + (3y)^2 + 2 \times 4x \times 3y] - [(4x)^2 + (3y)^2 - 2 \times 4x \times 3y] - 48xy$$

By further calculation

$$= [16x^2 + 9y^2 + 24xy] - [16x^2 + 9y^2 - 24xy] - 48xy$$

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So we get

$$= 16x^2 + 9y^2 + 24xy - 16x^2 - 9y^2 + 24xy - 48xy$$

$$= 0$$

13. (i) $(7p + 9q)(7p - 9q)$

(ii) $(2x - 3/x)(2x + 3/x)$

Solution:

(i) $(7p + 9q)(7p - 9q)$

It can be written as

$$= (7p)^2 - (9q)^2$$

$$= 49p^2 - 81q^2$$

(ii) $(2x - 3/x)(2x + 3/x)$

It can be written as

$$= (2x)^2 - (3/x)^2$$

$$= 4x^2 - 9/x^2$$

14. (i) $(2x - y + 3)(2x - y - 3)$

(ii) $(3x + y - 5)(3x - y - 5)$

Solution:

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

It can be written as

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

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

By further calculation

$$= (2x)^2 + y^2 - 2 \times 2x \times y - 9$$

So we get

$$= 4x^2 + y^2 - 4xy - 9$$

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(ii) $(3x + y - 5)(3x - y - 5)$

It can be written as

$$= [(3x - 5) + y][(3x - 5) - y]$$

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

By further calculation

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

So we get

$$= 9x^2 + 25 - 30x - y^2$$

$$= 9x^2 - y^2 - 30x + 25$$

15. (i) $(x + 2/x - 3)(x - 2/x - 3)$

(ii) $(5 - 2x)(5 + 2x)(25 + 4x^2)$

Solution:

(i) $(x + 2/x - 3)(x - 2/x - 3)$

It can be written as

$$= [(x - 3) + (2/x)][(x - 3) - (2/x)]$$

$$= (x - 3)^2 - (2/x)^2$$

Expanding using formula

$$= x^2 + 9 - 2 \times x \times 3 - 4/x^2$$

Expanding using formula

$$= 1000^2 + 3^2 + 2 \times 1000 \times 3$$

By further calculation

$$= 1000000 + 9 + 6000$$

$$= 1006009$$

(iii) $(10.2)^2$

It can be written as

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$$= (10 + 0.2)^2$$

Expanding using formula

$$= 10^2 + 0.2^2 + 2 \times 10 \times 0.2$$

By further calculation

$$= 100 + 0.04 + 4$$

$$= 104.04$$

24. Use $(a - b)^2 = a^2 - 2ab - b^2$ to evaluate the following:

(i) $(99)^2$

(ii) $(997)^2$

(iii) $(9.8)^2$

Solution:

(i) $(99)^2$

It can be written as

$$= (100 - 1)^2$$

Expanding using formula

$$= 100^2 - 2 \times 100 \times 1 + 1^2$$

By further calculation

$$= 10000 - 200 + 1$$

$$= 9801$$

(ii) $(997)^2$

It can be written as

$$= (1000 - 3)^2$$

Expanding using formula

$$= 1000^2 - 2 \times 1000 \times 3 + 3^2$$

By further calculation

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$$= 1000000 - 6000 + 9$$

$$= 994009$$

(iii) $(9.8)^2$

It can be written as

$$= (10 - 0.2)^2$$

Expanding using formula

$$= 10^2 - 2 \times 10 \times 0.2 + 0.2^2$$

By further calculation

$$= 100 - 4 + 0.04$$

$$= 96.04$$

25. By using suitable identities, evaluate the following:

(i) $(103)^3$

(ii) $(99)^3$

(iii) $(10.1)^3$

Solution:

(i) $(103)^3$

It can be written as

$$= (100 + 3)^3$$

Expanding using formula

$$= 100^3 + 3^3 + 3 \times 100 \times 3 (100 + 3)$$

By further calculation

$$= 1000000 + 27 + 900 \times 103$$

So we get

$$= 1000000 + 27 + 92700$$

$$= 1092727$$

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(ii) $(99)^3$

It can be written as

$$= (100 - 1)^3$$

Expanding using formula

$$= 100^3 - 1^3 - 3 \times 100 \times 1 (100 - 1)$$

By further calculation

$$= 1000000 - 1 - 300 \times 99$$

So we get

$$= 1000000 - 1 - 29700$$

$$= 1000000 - 29701$$

$$= 970299$$

(iii) $(10.1)^3$

It can be written as

$$= (10 + 0.1)^3$$

Expanding using formula

$$= 10^3 + 0.1^3 + 3 \times 10 \times 0.1 (10 + 0.1)$$

By further calculation

$$= 1000 + 0.001 + 3 \times 10.1$$

So we get

$$= 1000 + 0.001 + 30.3$$

$$= 1030.301$$

26. If $2a - b + c = 0$, prove that $4a^2 - b^2 + c^2 + 4ac = 0$.

Solution:

It is given that

$$2a - b + c = 0$$

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$$2a + c = b$$

By squaring on both sides

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

Expanding using formula

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

By further calculation

$$4a^2 + 4ac + c^2 = b^2$$

So we get

$$4a^2 - b^2 + c^2 + 4ac = 0$$

Hence, it is proved.

27. If $a + b + 2c = 0$, prove that $a^3 + b^3 + 8c^3 = 6abc$.

Solution:

It is given that

$$a + b + 2c = 0$$

We can write it as

$$a + b = -2c$$

By cubing on both sides

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

Expanding using formula

$$a^3 + b^3 + 3ab(a + b) = -8c^3$$

Substituting the value of $a + b$

$$a^3 + b^3 + 3ab(-2c) = -8c^3$$

So we get

$$a^3 + b^3 + 8c^3 = 6abc$$

Hence, it is proved.

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28. If $a + b + c = 0$, then find the value of $a^2/bc + b^2/ca + c^2/ab$.

Solution:

It is given that

$$a + b + c = 0$$

We can write it as

$$a^3 + b^3 + c^3 - 3abc = 0$$

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

Now dividing by abc on both sides

$$a^3/abc + b^3/abc + c^3/abc = 3$$

By further calculation

$$a^2/bc + b^2/ac + c^2/ab = 3$$

Therefore, the value of $a^2/bc + b^2/ca + c^2/ab$ is 3.

29. If $x + y = 4$, then find the value of $x^3 + y^3 + 12xy - 64$.

Solution:

It is given that

$$x + y = 4$$

By cubing on both sides

$$(x + y)^3 = 4^3$$

Expanding using formula

$$x^3 + y^3 + 3xy(x + y) = 64$$

Substituting the value of $x + y$

$$x^3 + y^3 + 3xy(4) = 64$$

So we get

$$x^3 + y^3 + 12xy - 64 = 0$$

Hence, the value of $x^3 + y^3 + 12xy - 64$ is 0.

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30. Without actually calculating the cubes, find the values of:

(i) $(27)^3 + (-17)^3 + (-10)^3$

(ii) $(-28)^3 + (15)^3 + (13)^3$

Solution:

(i) $(27)^3 + (-17)^3 + (-10)^3$

Consider $a = 27$, $b = -17$ and $c = -10$

We know that

$$a + b + c = 27 - 17 - 10 = 0$$

$$\text{So } a + b + c = 0$$

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

Substituting the values

$$27^3 + (-17)^3 + (-10)^3 = 3(27)(-17)(-10)$$

$$= 13770$$

(ii) $(-28)^3 + (15)^3 + (13)^3$

Consider $a = -28$, $b = 15$ and $c = 13$

We know that

$$a + b + c = -28 + 15 + 13 = 0$$

$$\text{So } a + b + c = 0$$

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

Substituting the values

$$(-28)^3 + (15)^3 + (13)^3 = 3(-28)(15)(13)$$

$$= -16380$$

31. Using suitable identity, find the value of:

$$\frac{86 \times 86 \times 86 + 14 \times 14 \times 14}{86 \times 86 - 86 \times 14 + 14 \times 14}$$

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Solution:

Consider $x = 86$ and $y = 14$

$$\frac{86 \times 86 \times 86 + 14 \times 14 \times 14}{86 \times 86 - 86 \times 14 + 14 \times 14}$$

It can be written as

$$= \frac{x^3 + y^3}{x^2 - xy + y^2}$$

So we get

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

$$= x + y$$

Substituting the values

$$= 86 + 14$$

$$= 100$$

Exercise 3.2

1. If $x - y = 8$ and $xy = 5$, find $x^2 + y^2$.

Solution:

We know that

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

It can be written as

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

It is given that

$$x - y = 8 \text{ and } xy = 5$$

Substituting the values

$$x^2 + y^2 = 8^2 + 2 \times 5$$

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So we get

$$= 64 + 10$$

$$= 74$$

2. If $x + y = 10$ and $xy = 21$, find $2(x^2 + y^2)$.

Solution:

We know that

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

It can be written as

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

It is given that

$$(x + y) = 10 \text{ and } xy = 21$$

Substituting the values

$$x^2 + y^2 = 10^2 - 2 \times 21$$

By further calculation

$$= 100 - 42$$

$$= 58$$

Here

$$2(x^2 + y^2) = 2 \times 58 = 116$$

3. If $2a + 3b = 7$ and $ab = 2$, find $4a^2 + 9b^2$.

Solution:

We know that

$$(2a + 3b)^2 = 4a^2 + 9b^2 + 12ab$$

It can be written as

$$4a^2 + 9b^2 = (2a + 3b)^2 - 12ab$$

It is given that

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$$2a + 3b = 7$$

$$ab = 2$$

Substituting the values

$$4a^2 + 9b^2 = 7^2 - 12 \times 2$$

By further calculation

$$= 49 - 24$$

$$= 25$$

4. If $3x - 4y = 16$ and $xy = 4$, find the value of $9x^2 + 16y^2$.

Solution:

We know that

$$(3x - 4y)^2 = 9x^2 + 16y^2 - 24xy$$

It can be written as

$$9x^2 + 16y^2 = (3x - 4y)^2 + 24xy$$

It is given that

$$3x - 4y = 16 \text{ and } xy = 4$$

Substituting the values

$$9x^2 + 16y^2 = 16^2 + 24 \times 4$$

By further calculation

$$= 256 + 96$$

$$= 352$$

5. If $x + y = 8$ and $x - y = 2$, find the value of $2x^2 + 2y^2$.

Solution:

We know that

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

It is given that

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$$x + y = 8 \text{ and } x - y = 2$$

Substituting the values

$$2x^2 + 2y^2 = 8^2 + 2^2$$

By further calculation

$$= 64 + 4$$

$$= 68$$

6. If $a^2 + b^2 = 13$ and $ab = 6$, find

(i) $a + b$

(ii) $a - b$

Solution:

(i) We know that

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

Substituting the values

$$= 13 + 2 \times 6$$

So we get

$$= 13 + 12$$

$$= 25$$

Here

$$a + b = \pm \sqrt{25} = \pm 5$$

(ii) We know that

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

Substituting the values

$$= 13 - 2 \times 6$$

So we get

$$= 13 - 12$$

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$$= 1$$

Here

$$a - b = \pm \sqrt{1} = \pm 1$$

7. If $a + b = 4$ and $ab = -12$, find

(i) $a - b$

(ii) $a^2 - b^2$.

Solution:

(i) We know that

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

It can be written as

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

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

It is given that

$$a + b = 4 \text{ and } ab = -12$$

Substituting the values

$$(a - b)^2 = 4^2 - 4(-12)$$

By further calculation

$$(a - b)^2 = 16 + 48 = 64$$

So we get

$$(a - b) = \pm \sqrt{64} = \pm 8$$

(ii) We know that

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

Substituting the values

$$a^2 - b^2 = 4 \times \pm 8$$

$$a^2 - b^2 = \pm 32$$

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8. If $p - q = 9$ and $pq = 36$, evaluate

(i) $p + q$

(ii) $p^2 - q^2$.

Solution:

(i) We know that

$$(p + q)^2 = p^2 + q^2 + 2pq$$

It can be written as

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

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

It is given that

$$p - q = 9 \text{ and } pq = 36$$

Substituting the values

$$(p + q)^2 = 9^2 + 4 \times 36$$

By further calculation

$$(p + q)^2 = 81 + 144 = 225$$

So we get

$$p + q = \pm \sqrt{225} = \pm 15$$

(ii) We know that

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

Substituting the values

$$p^2 - q^2 = 9 \times \pm 15$$

$$p^2 - q^2 = \pm 135$$

9. If $x + y = 6$ and $x - y = 4$, find

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

(ii) xy

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Solution:

We know that

$$(x + y)^2 - (x - y)^2 = 4xy$$

Substituting the values

$$6^2 - 4^2 = 4xy$$

By further calculation

$$36 - 16 = 4xy$$

$$20 = 4xy$$

$$4xy = 20$$

So we get

$$xy = 20/4 = 5$$

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

Substituting the values

$$= 6^2 - 2 \times 5$$

By further calculation

$$= 36 - 10$$

$$= 26$$

$$(ii) xy = 5$$

10. If $x - 3 = 1/x$, find the value of $x^2 + 1/x^2$.

Solution:

It is given that

$$x - 3 = 1/x$$

We can write it as

$$x - 1/x = 3$$

Here

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$$(x - 1/x)^2 = x^2 + 1/x^2 - 2$$

So we get

$$x^2 + 1/x^2 = (x - 1/x)^2 + 2$$

Substituting the values

$$x^2 + 1/x^2 = 3^2 + 2$$

By further calculation

$$= 9 + 2$$

$$= 11$$

11. If $x + y = 8$ and $xy = 3 \frac{3}{4}$, find the values of

(i) $x - y$

(ii) $3(x^2 + y^2)$

(iii) $5(x^2 + y^2) + 4(x - y)$.

Solution:

$$= 100 - 42$$

$$= 58$$

Here

$$2(x^2 + y^2) = 2 \times 58 = 116$$

3. If $2a + 3b = 7$ and $ab = 2$, find $4a^2 + 9b^2$.

Solution:

We know that

$$(2a + 3b)^2 = 4a^2 + 9b^2 + 12ab$$

It can be written as

$$4a^2 + 9b^2 = (2a + 3b)^2 - 12ab$$

It is given that

$$2a + 3b = 7$$

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$$ab = 2$$

Substituting the values

$$4a^2 + 9b^2 = 7^2 - 12 \times 2$$

By further calculation

$$= 49 - 24$$

$$= 25$$

4. If $3x - 4y = 16$ and $xy = 4$, find the value of $9x^2 + 16y^2$.

Solution:

We know that

$$(3x - 4y)^2 = 9x^2 + 16y^2 - 24xy$$

It can be written as

$$9x^2 + 16y^2 = (3x - 4y)^2 + 24xy$$

It is given that

$$3x - 4y = 16 \text{ and } xy = 4$$

Substituting the values

$$9x^2 + 16y^2 = 16^2 + 24 \times 4$$

By further calculation

$$= 256 + 96$$

$$= 352$$

5. If $x + y = 8$ and $x - y = 2$, find the value of $2x^2 + 2y^2$.

Solution:

We know that

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

It is given that

$$x + y = 8 \text{ and } x - y = 2$$

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Substituting the values

$$2x^2 + 2y^2 = 8^2 + 2^2$$

By further calculation

$$= 64 + 4$$

$$= 68$$

6. If $a^2 + b^2 = 13$ and $ab = 6$, find

(i) $a + b$

(ii) $a - b$

Solution:

(i) We know that

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

Substituting the values

$$= 13 + 2 \times 6$$

So we get

$$= 13 + 12$$

$$= 25$$

Here

$$a + b = \pm \sqrt{25} = \pm 5$$

(ii) We know that

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

Substituting the values

$$= 13 - 2 \times 6$$

So we get

$$= 13 - 12$$

$$= 1$$

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Here

$$a - b = \pm \sqrt{1} = \pm 1$$

7. If $a + b = 4$ and $ab = -12$, find

(i) $a - b$

(ii) $a^2 - b^2$.

Solution:

(i) We know that

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

It can be written as

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

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

It is given that

$$a + b = 4 \text{ and } ab = -12$$

Substituting the values

$$(a - b)^2 = 4^2 - 4(-12)$$

By further calculation

$$(a - b)^2 = 16 + 48 = 64$$

So we get

$$(a - b) = \pm \sqrt{64} = \pm 8$$

(ii) We know that

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

Substituting the values

$$a^2 - b^2 = 4 \times \pm 8$$

$$a^2 - b^2 = \pm 32$$

8. If $p - q = 9$ and $pq = 36$, evaluate

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(i) $p + q$

(ii) $p^2 - q^2$.

Solution:

(i) We know that

$$(p + q)^2 = p^2 + q^2 + 2pq$$

It can be written as

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

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

It is given that

$$p - q = 9 \text{ and } pq = 36$$

Substituting the values

$$(p + q)^2 = 9^2 + 4 \times 36$$

By further calculation

$$(p + q)^2 = 81 + 144 = 225$$

So we get

$$p + q = \pm \sqrt{225} = \pm 15$$

(ii) We know that

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

Substituting the values

$$p^2 - q^2 = 9 \times \pm 15$$

$$p^2 - q^2 = \pm 135$$

9. If $x + y = 6$ and $x - y = 4$, find

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

(ii) xy

Solution:

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We know that

$$(x + y)^2 - (x - y)^2 = 4xy$$

Substituting the values

$$6^2 - 4^2 = 4xy$$

By further calculation

$$36 - 16 = 4xy$$

$$20 = 4xy$$

$$4xy = 20$$

So we get

$$xy = 20/4 = 5$$

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

Substituting the values

$$= 6^2 - 2 \times 5$$

By further calculation

$$= 36 - 10$$

$$= 26$$

$$(ii) xy = 5$$

10. If $x - 3 = 1/x$, find the value of $x^2 + 1/x^2$.

Solution:

It is given that

$$x - 3 = 1/x$$

We can write it as

$$x - 1/x = 3$$

Here

$$(x - 1/x)^2 = x^2 + 1/x^2 - 2$$

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So we get

$$x^2 + 1/x^2 = (x - 1/x)^2 + 2$$

Substituting the values

$$x^2 + 1/x^2 = 3^2 + 2$$

By further calculation

$$= 9 + 2$$

$$= 11$$

11. If $x + y = 8$ and $xy = 3 \frac{3}{4}$, find the values of

(i) $x - y$

(ii) $3(x^2 + y^2)$

(iii) $5(x^2 + y^2) + 4(x - y)$.

Solution:

(i) We know that

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

It can be written as

$$(x - y)^2 = x^2 + y^2 + 2xy - 4xy$$

$$(x - y)^2 = (x + y)^2 - 4xy$$

It is given that

$$x + y = 8 \text{ and } xy = 3 \frac{3}{4} = 15/4$$

Substituting the values

$$(x - y)^2 = 8^2 - 4 \times 15/4$$

So we get

$$(x - y)^2 = 64 - 15 = 49$$

$$x - y = \pm \sqrt{49} = \pm 7$$

(ii) We know that

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

We can write it as

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

It is given that

$$x + y = 8 \text{ and } xy = 3 \frac{3}{4} = 15/4$$

Substituting the values

$$x^2 + y^2 = 8^2 - 2 \times 15/4$$

So we get

$$x^2 + y^2 = 64 - 15/2$$

Taking LCM

$$x^2 + y^2 = (128 - 15)/2 = 113/2$$

We get

$$3(x^2 + y^2) = 3 \times 113/2 = 339/2 = 169 \frac{1}{2}$$

(iii) We know that

$$5(x^2 + y^2) + 4(x - y) = 5 \times 113/2 + 4 \times \pm 7$$

By further calculation

$$= 565/2 \pm 28$$

We can write it as

$$= 565/2 + 28 \text{ or } 565/2 - 28$$

$$= 621/2 \text{ or } 509/2$$

It can be written as

$$= 310 \frac{1}{2} \text{ or } 254 \frac{1}{2}$$

12. If $x^2 + y^2 = 34$ and $xy = 10 \frac{1}{2}$, find the value of $2(x + y)^2 + (x - y)^2$.

Solution:

It is given that

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$$x^2 + y^2 = 34 \text{ and } xy = 10 \frac{1}{2} = 21/2$$

We know that

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

Substituting the values

$$(x + y)^2 = 34 + 2 (21/2)$$

So we get

$$(x + y)^2 = 55 \dots\dots (1)$$

We know that

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

Substituting the values

$$(x - y)^2 = 34 - 2 (21/2)$$

So we get

$$(x - y)^2 = 34 - 21 = 13 \dots\dots (2)$$

Using both the equations

$$2 (x + y)^2 + (x - y)^2 = 2 \times 55 + 13 = 123$$

13. If $a - b = 3$ and $ab = 4$, find $a^3 - b^3$.

Solution:

We know that

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

Substituting the values

$$a^3 - b^3 = 3^3 + 3 \times 4 \times 3$$

By further calculation

$$a^3 - b^3 = 27 + 36 = 63$$

14. If $2a - 3b = 3$ and $ab = 2$, find the value of $8a^3 - 27b^3$.

Solution:

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We know that

$$8a^3 - 27b^3 = (2a)^3 - (3b)^3$$

According to the formula

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

By further simplification

$$= (2a - 3b)^3 + 18ab (2a - 3b)$$

Substituting the values

$$= 3^3 + 18 \times 2 \times 3$$

By further calculation

$$= 27 + 108$$

$$= 135$$

15. If $x + 1/x = 4$, find the values of

(i) $x^2 + 1/x^2$

(ii) $x^4 + 1/x^4$

(iii) $x^3 + 1/x^3$

(iv) $x - 1/x$.

Solution:

(i) We know that

$$(x + 1/x)^2 = x^2 + 1/x^2 + 2$$

It can be written as

$$x^2 + 1/x^2 = (x + 1/x)^2 - 2$$

Substituting the values

$$= 4^2 - 2$$

$$= 16 - 2$$

$$= 14$$

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(ii) We know that

$$(x^2 + 1/x^2)^2 = x^4 + 1/x^4 + 2$$

It can be written as

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

Substituting the values

$$= 14^2 - 2$$

$$= 196 - 2$$

$$= 194$$

(iii) We know that

$$x^3 + 1/x^3 = (x + 1/x)^3 - 3x(1/x)(x + 1/x)$$

It can be written as

$$(x + 1/x)^3 - 3(x + 1/x) = 4^3 - 3 \times 4$$

By further calculation

$$= 64 - 12$$

$$= 52$$

(iv) We know that

$$(x - 1/x)^2 = x^2 + 1/x^2 - 2$$

Substituting the values

$$= 14 - 2$$

$$= 12$$

So we get

$$x - 1/x = \pm 2\sqrt{3}$$

16. If $x - 1/x = 5$, find the value of $x^4 + 1/x^4$.

Solution:

We know that

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$$(x - 1/x)^2 = x^2 + 1/x^2 - 2$$

It can be written as

$$x^2 + 1/x^2 = (x - 1/x)^2 + 2$$

Substituting the values

$$x^2 + 1/x^2 = 5^2 + 2 = 27$$

Here

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

Substituting the values

$$x^4 + 1/x^4 = 27^2 - 2$$

So we get

$$= 729 - 2$$

$$= 727$$

17. If $x - 1/x = \sqrt{5}$, find the values of

(i) $x^2 + 1/x^2$

(ii) $x + 1/x$

(iii) $x^3 + 1/x^3$

Solution:

(i) $x^2 + 1/x^2 = (x - 1/x)^2 + 2$

Substituting the values

$$= (\sqrt{5})^2 + 2$$

$$= 5 + 2$$

$$= 7$$

(ii) $(x + 1/x)^2 = x^2 + 1/x^2 + 2$

Substituting the values

$$= 7 + 2$$

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$$= 9$$

Here

$$(x + 1/x)^2 = 9$$

So we get

$$(x + 1/x) = \pm \sqrt{9} = \pm 3$$

$$(iii) x^3 + 1/x^3 = (x + 1/x)^3 - 3x (1/x) (x + 1/x)$$

Substituting the values

$$= (\pm 3)^3 - 3 (\pm 3)$$

By further calculation

$$= (\pm 27) - (\pm 9)$$

$$= \pm 18$$

18. If $x + 1/x = 6$, find

(i) $x - 1/x$

(ii) $x^2 - 1/x^2$.

Solution:

(i) We know that

$$(x - 1/x)^2 = x^2 + 1/x^2 - 2$$

It can be written as

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

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

Substituting the values

$$(x - 1/x)^2 = 6^2 - 4 = 32$$

So we get

$$x - 1/x = \pm \sqrt{32} = \pm 4\sqrt{2}$$

(ii) We know that

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$$x^2 - 1/x^2 = (x - 1/x) (x + 1/x)$$

Substituting the values

$$x^2 - 1/x^2 = (\pm 4\sqrt{2}) (6) = \pm 24\sqrt{2}$$

19. If $x + 1/x = 2$, prove that $x^2 + 1/x^2 = x^3 + 1/x^3 = x^4 + 1/x^4$.

Solution:

We know that

$$x^2 + 1/x^2 = (x + 1/x)^2 - 2$$

Substituting the values

$$x^2 + 1/x^2 = 2^2 - 2$$

So we get

$$x^2 + 1/x^2 = 4 - 2 = 2 \dots (1)$$

$$x^3 + 1/x^3 = (x + 1/x)^3 - 3(x + 1/x)$$

Substituting the values

$$x^3 + 1/x^3 = 2^3 - 3 \times 2$$

So we get

$$x^3 + 1/x^3 = 8 - 6 = 2 \dots\dots (2)$$

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

Substituting the values

$$x^4 + 1/x^4 = 2^2 - 2$$

So we get

$$x^4 + 1/x^4 = 4 - 2 = 2 \dots (3)$$

From equation (1), (2) and (3)

$$x^2 + 1/x^2 = x^3 + 1/x^3 = x^4 + 1/x^4$$

Hence, it is proved.

20. If $x - 2/x = 3$, find the value of $x^3 - 8/x^3$.

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Solution:

We know that

$$(x - 2/x)^3 = x^3 - 8/x^3 - 3(x)(2/x)(x - 2/x)$$

By further simplification

$$(x - 2/x)^3 = x^3 - 8/x^3 - 6(x - 2/x)$$

It can be written as

$$x^3 - 8/x^3 = (x - 2/x)^3 + 6(x - 2/x)$$

Substituting the values

$$x^3 - 8/x^3 = 3^3 + 6 \times 3$$

By further calculation

$$x^3 - 8/x^3 = 27 + 18 = 45$$

21. If $a + 2b = 5$, prove that $a^3 + 8b^3 + 30ab = 125$.

Solution:

We know that

$$(a + 2b)^3 = a^3 + 8b^3 + 3(a)(2b)(a + 2b)$$

Substituting the values

$$5^3 = a^3 + 8b^3 + 6ab(5)$$

By further calculation

$$125 = a^3 + 8b^3 + 30ab$$

Therefore, $a^3 + 8b^3 + 30ab = 125$.

22. If $a + 1/a = p$, prove that $a^3 + 1/a^3 = p(p^2 - 3)$.

Solution:

We know that

$$a^3 + 1/a^3 = (a + 1/a)^3 - 3a(1/a)(a + 1/a)$$

Substituting the values

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$$a^3 + 1/a^3 = p^3 - 3p$$

Taking p as common

$$a^3 + 1/a^3 = p (p^2 - 3)$$

Therefore, it is proved.

23. If $x^2 + 1/x^2 = 27$, find the value of $x - 1/x$.

Solution:

We know that

$$(x - 1/x)^2 = x^2 + 1/x^2 - 2$$

Substituting the values

$$(x - 1/x)^2 = 27 - 2 = 25$$

So we get

$$x - 1/x = \pm \sqrt{25} = \pm 5$$

24. If $x^2 + 1/x^2 = 27$, find the value of $3x^3 + 5x - 3/x^3 - 5/x$.

Solution:

We know that

$$(x - 1/x)^2 = x^2 + 1/x^2 - 2$$

Substituting the values

$$(x - 1/x)^2 = 27 - 2 = 25$$

So we get

$$x - 1/x = \pm \sqrt{25} = \pm 5$$

Here

$$3x^3 + 5x - 3/x^3 - 5/x = 3 (x^3 - 1/x^3) + 5 (x - 1/x)$$

It can be written as

$$= 3 [(x - 1/x)^3 + 3 (x - 1/x)] + 5 (x - 1/x)$$

Substituting the values

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$$= 3 [(\pm 5)^3 + 3 (\pm 5)] + 5 (\pm 5)$$

By further calculation

$$= 3 [(\pm 125) + (\pm 15)] + (\pm 25)$$

So we get

$$= (\pm 375) + (\pm 45) + (\pm 25)$$

$$= \pm 445$$

25. If $x^2 + 1/25x^2 = 8 \frac{3}{5}$, find $x + 1/5x$.

Solution:

We know that

$$(x + 1/5x)^2 = x^2 + 1/25x^2 + 2x (1/5x)$$

It can be written as

$$(x + 1/5x)^2 = x^2 + 1/25x^2 + 2/5$$

Substituting the values

$$(x + 1/5x)^2 = 8 \frac{3}{5} + 2/5$$

$$(x + 1/5x)^2 = 43/5 + 2/5$$

So we get

$$(x + 1/5x)^2 = 45/5 = 9$$

Here

$$x + 1/5x = \pm \sqrt{9} = \pm 3$$

26. If $x^2 + 1/4x^2 = 8$, find $x^3 + 1/8x^3$.

Solution:

We know that

$$(x + 1/2x)^2 = x^2 + (1/2x)^2 + 2x (1/2x)$$

It can be written as

$$(x + 1/2x)^2 = x^2 + 1/4x^2 + 1$$

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Substituting the values

$$(x + 1/2x)^2 = 8 + 1 = 9$$

So we get

$$x + 1/2x = \pm \sqrt{9} = \pm 3$$

Here

$$x^3 + 1/8x^3 = x^3 + (1/2x)^3$$

We know that

$$x^3 + 1/8x^3 = (x + 1/2x)^3 - 3x (1/2x) (x + 1/2x)$$

Substituting the values

$$x^3 + 1/8x^3 = (\pm 3)^3 - 3/2 (\pm 3)$$

By further calculation

$$x^3 + 1/8x^3 = \pm (27 - 9/2)$$

Taking LCM

$$x^3 + 1/8x^3 = \pm (54 - 9)/2$$

$$x^3 + 1/8x^3 = \pm 45/2 = \pm 22 \frac{1}{2}$$

Therefore, $x^3 + 1/8x^3 = \pm 22 \frac{1}{2}$.

27. If $a^2 - 3a + 1 = 0$, find

(i) $a^2 + 1/a^2$

(ii) $a^3 + 1/a^3$.

Solution:

It is given that

$$a^2 - 3a + 1 = 0$$

By dividing each term by a

$$a + 1/a = 3$$

(i) We know that

<https://www.indcareer.com/schools/ml-aggarwal-solutions-for-class-9-maths-chapter-3-expansions/>

$$(a + 1/a)^2 = a^2 + 1/a^2 + 2$$

It can be written as

$$a^2 + 1/a^2 = (a + 1/a)^2 - 2$$

Substituting the values

$$= 3^2 - 2$$

$$= 9 - 2$$

$$= 7$$

(ii) We know that

$$(a + 1/a)^3 = a^3 + 1/a^3 + 3(a + 1/a)$$

It can be written as

$$a^3 + 1/a^3 = (a + 1/a)^3 - 3(a + 1/a)$$

Substituting the values

$$= 3^3 - 3(3)$$

$$= 27 - 9$$

$$= 18$$

28. If $a = 1/(a - 5)$, find

(i) $a - 1/a$

(ii) $a + 1/a$

(iii) $a^2 - 1/a^2$.

Solution:

It is given that

$$a = 1/(a - 5)$$

We can write it as

$$a^2 - 5a - 1 = 0$$

Now divide each term by a

<https://www.indcareer.com/schools/ml-aggarwal-solutions-for-class-9-maths-chapter-3-expansions/>

$$a - 5 - 1/a = 0$$

So we get

$$a - 1/a = 5$$

$$(i) a - 1/a = 5$$

(ii) We know that

$$(a + 1/a)^2 = (a - 1/a)^2 + 4$$

Substituting the values

$$(a + 1/a)^2 = 5^2 + 4$$

So we get

$$(a + 1/a)^2 = 25 + 4 = 29$$

$$a + 1/a = \pm \sqrt{29}$$

(ii) We know that

$$a^2 - 1/a^2 = (a + 1/a)(a - 1/a)$$

Substituting the values

$$a^2 - 1/a^2 = \pm \sqrt{29} \times 5$$

$$a^2 - 1/a^2 = \pm 5\sqrt{29}$$

29. If $(x + 1/x)^2 = 3$, find $x^3 + 1/x^3$.

Solution:

It is given that

$$(x + 1/x)^2 = 3$$

$$(x + 1/x) = \pm \sqrt{3}$$

We know that

$$x^3 + 1/x^3 = (x + 1/x)^3 - 3(x + 1/x)$$

Substituting the values

$$x^3 + 1/x^3 = (\pm \sqrt{3})^3 - 3(\pm \sqrt{3})$$

<https://www.indcareer.com/schools/ml-aggarwal-solutions-for-class-9-maths-chapter-3-expansions/>

By further calculation

$$x^3 + 1/x^3 = (\pm 3\sqrt{3}) - (\pm 3\sqrt{3}) = 0$$

30. If $x = 5 - 2\sqrt{6}$, find the value of $\sqrt{x} + 1/\sqrt{x}$.

Solution:

It is given that

$$x = 5 - 2\sqrt{6}$$

We can write it as

$$\frac{1}{x} = \frac{1}{5 - 2\sqrt{6}} = \frac{5 + 2\sqrt{6}}{(5 - 2\sqrt{6})(5 + 2\sqrt{6})}$$

By further calculation

$$= \frac{5 + 2\sqrt{6}}{5^2 - 4 \times 6}$$

So we get

$$= \frac{5 + 2\sqrt{6}}{25 - 24}$$

$$= 5 + 2\sqrt{6}$$

Here

$$x + 1/x = 5 - 2\sqrt{6} + 5 + 2\sqrt{6} = 10$$

So we get

$$(\sqrt{x} + 1/\sqrt{x})^2 = x + 1/x + 2$$

Substituting the values

$$= 10 + 2$$

$$= 12$$

31. If $a + b + c = 12$ and $ab + bc + ca = 22$, find $a^2 + b^2 + c^2$.

Solution:

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We know that

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

We can write it as

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

Substituting the values

$$a^2 + b^2 + c^2 = 12^2 - 2(22)$$

By further calculation

$$a^2 + b^2 + c^2 = 144 - 44 = 100$$

32. If $a + b + c = 12$ and $a^2 + b^2 + c^2 = 100$, find $ab + bc + ca$.

Solution:

We know that

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

It can be written as

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

Taking out 2 as common

$$2(ab + bc + ca) = 12^2 - 100 = 144 - 100 = 44$$

By further calculation

$$ab + bc + ca = 44/2 = 22$$

33. If $a^2 + b^2 + c^2 = 125$ and $ab + bc + ca = 50$, find $a + b + c$.

Solution:

We know that

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

Substituting the values

$$(a + b + c)^2 = 125 + 2(50)$$

By further calculation

<https://www.indcareer.com/schools/ml-aggarwal-solutions-for-class-9-maths-chapter-3-expansions/>

$$(a + b + c)^2 = 125 + 100 = 225$$

So we get

$$a + b + c = \pm \sqrt{225} = \pm 15$$

34. If $a + b - c = 5$ and $a^2 + b^2 + c^2 = 29$, find the value of $ab - bc - ca$.

Solution:

It is given that

$$a + b - c = 5$$

By squaring on both sides

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

Expanding using formula

$$a^2 + b^2 + c^2 + 2ab - 2bc - 2ca = 25$$

Substituting the values and taking 2 as common

$$29 + 2(ab - bc - ca) = 25$$

By further calculation

$$2(ab - bc - ca) = 25 - 29 = -4$$

So we get

$$ab - bc - ca = -4/2 = -2$$

Therefore, $ab - bc - ca = -2$.

35. If $a - b = 7$ and $a^2 + b^2 = 85$, then find the value of $a^3 - b^3$.

Solution:

We know that

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

Substituting the values

$$7^2 = 85 - 2ab$$

By further calculation

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$$49 = 85 - 2ab$$

So we get

$$2ab = 85 - 49 = 36$$

Dividing by 2

$$ab = 36/2 = 18$$

Here

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

Substituting the values

$$a^3 - b^3 = 7(85 + 18)$$

By further calculation

$$a^3 - b^3 = 7 \times 103$$

So we get

$$a^3 - b^3 = 721$$

36. If the number x is 3 less than the number y and the sum of the squares of x and y is 29, find the product of x and y.

Solution:

It is given that

$$x = y - 3 \text{ and } x^2 + y^2 = 29$$

It can be written as

$$x - y = -3$$

By squaring on both sides

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

Expanding using formula

$$x^2 + y^2 - 2xy = 9$$

Substituting the values

<https://www.indcareer.com/schools/ml-aggarwal-solutions-for-class-9-maths-chapter-3-expansions/>

$$29 - 2xy = 9$$

By further calculation

$$-2xy = 9 - 29 = -20$$

Dividing by 2

$$xy = -20/-2 = 10$$

So we get

$$xy = 10$$

37. If the sum and the product of two numbers are 8 and 15 respectively, find the sum of their cubes.

Solution:

Consider x and y as the two numbers

$$x + y = 8 \text{ and } xy = 15$$

By cubing on both sides

$$(x + y)^3 = 8^3$$

Expanding using formula

$$x^3 + y^3 + 3xy(x + y) = 512$$

Substituting the values

$$x^3 + y^3 + 3 \times 15 \times 8 = 512$$

By further calculation

$$x^3 + y^3 + 360 = 512$$

So we get

$$x^3 + y^3 = 512 - 360 = 152$$

Chapter Test

1. Find the expansions of the following :

(i) $(2x + 3y + 5)(2x + 3y - 5)$

<https://www.indcareer.com/schools/ml-aggarwal-solutions-for-class-9-maths-chapter-3-expansions/>

(ii) $(6 - 4a - 7b)^2$

(iii) $(7 - 3xy)^3$

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

Solution:

(i) $(2x + 3y + 5)(2x + 3y - 5)$

Let us simplify the expression, we get

$$(2x + 3y + 5)(2x + 3y - 5) = [(2x + 3y) + 5][(2x + 3y) - 5]$$

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

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

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

$$= 4x^2 + 9y^2 + 12xy - 25$$

(ii) $(6 - 4a - 7b)^2$

Let us simplify the expression, we get

$$(6 - 4a - 7b)^2 = [6 + (-4a) + (-7b)]^2$$

$$= (6)^2 + (-4a)^2 + (-7b)^2 + 2(6)(-4a) + 2(-4a)(-7b) + 2(-7b)(6)$$

$$= 36 + 16a^2 + 49b^2 - 48a + 56ab - 84b$$

(iii) $(7 - 3xy)^3$

Let us simplify the expression

By using the formula, we get

$$(7 - 3xy)^3 = (7)^3 - (3xy)^3 - 3(7)(3xy)(7 - 3xy)$$

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$$= 343 - 27x^3y^3 - 63xy(7 - 3xy)$$

$$= 343 - 27x^3y^3 - 441xy + 189x^2y^2$$

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

Let us simplify the expression

By using the formula, we get

$$(x + y + 2)^3 = [(x + y) + 2]^3$$

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

$$= x^3 + y^3 + 3x^2y + 3xy^2 + 8 + 6(x + y)[(x + y) + 2]$$

$$= x^3 + y^3 + 3x^2y + 3xy^2 + 8 + 6(x + y)^2 + 12(x + y)$$

$$= x^3 + y^3 + 3x^2y + 3xy^2 + 8 + 6(x^2 + y^2 + 2xy) + 12x + 12y = x^3 + y^3 + 3x^2y + 3xy^2 + 8 + 6x^2 + 6y^2 + 12xy + 12x + 12y$$

$$= x^3 + y^3 + 3x^2y + 3xy^2 + 8 + 6x^2 + 6y^2 + 12x + 12y + 12xy$$

$$2. \text{ Simplify: } (x - 2)(x + 2)(x^2 + 4)(x^4 + 16)$$

Solution:

Let us simplify the expression, we get

$$(x - 2)(x + 2)(x^4 + 4)(x^4 + 16) = (x^2 - 4)(x^4 + 4)(x^4 + 16)$$

$$= [(x^2)^2 - (4)^2](x^4 + 16)$$

<https://www.indcareer.com/schools/ml-aggarwal-solutions-for-class-9-maths-chapter-3-expansions/>

$$= (x^4 - 16)(x^4 + 16)$$

$$= (x^4)^2 - (16)^2$$

$$= x^8 - 256$$

3. Evaluate 1002×998 by using a special product.

Solution:

Let us simplify the expression, we get

$$1002 \times 998 = (1000 + 2)(1000 - 2)$$

$$= (1000)^2 - (2)^2$$

$$= 1000000 - 4$$

$$= 999996$$

4. If $a + 2b + 3c = 0$, Prove that $a^3 + 8b^3 + 27c^3 = 18abc$

Solution:

Given:

$$a + 2b + 3c = 0, a + 2b = -3c$$

Let us cube on both the sides, we get

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

$$a^3 + (2b)^3 + 3(a)(2b)(a + 2b) = -27c^3$$

$$a^3 + 8b^3 + 6ab(-3c) = -27c^3$$

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$$a^3 + 8b^3 - 18abc = -27c^3$$

$$a^3 + 8b^3 + 27c^3 = 18abc$$

Hence proved.

5. If $2x = 3y - 5$, then find the value of $8x^3 - 27y^3 + 90xy + 125$.

Solution:

Given:

$$2x = 3y - 5$$

$$2x - 3y = -5$$

Now, let us cube on both sides, we get

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

$$(2x)^3 - (3y)^3 - 3 \times 2x \times 3y (2x - 3y) = -125$$

$$8x^3 - 27y^3 - 18xy (2x - 3y) = -125$$

Now, substitute the value of $2x - 3y = -5$

$$8x^3 - 27y^3 - 18xy (-5) = -125$$

$$8x^3 - 27y^3 + 90xy = -125$$

$$8x^3 - 27y^3 + 90xy + 125 = 0$$

6. If $a^2 - 1/a^2 = 5$, evaluate $a^4 + 1/a^4$

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Solution:

It is given that,

$$a^2 - 1/a^2 = 5$$

So,

$$\text{By using the formula, } (a + b)^2[a^2 - 1/a^2]^2 = a^4 + 1/a^4 - 2[a^2 - 1/a^2]^2 + 2 = a^4 + 1/a^4$$

Substitute the value of $a^2 - 1/a^2 = 5$, we get

$$5^2 + 2 = a^4 + 1/a^4$$

$$a^4 + 1/a^4 = 25 + 2$$

$$= 27$$

7. If $a + 1/a = p$ and $a - 1/a = q$, Find the relation between p and q .

Solution:

It is given that,

$$a + 1/a = p \text{ and } a - 1/a = q$$

so,

$$(a + 1/a)^2 - (a - 1/a)^2 = 4(a)(1/a)$$

$$= 4$$

By substituting the values, we get

$$p^2 - q^2 = 4$$

Hence the relation between p and q is that $p^2 - q^2 = 4$.

8. If $(a^2 + 1)/a = 4$, find the value of $2a^3 + 2/a^3$

Solution:

It is given that,

$$(a^2 + 1)/a = 4$$

$$a^2/a + 1/a = 4$$

$$a + 1/a = 4$$

<https://www.indcareer.com/schools/ml-aggarwal-solutions-for-class-9-maths-chapter-3-expansions/>

So by multiplying the expression by $2a$, we get

$$\begin{aligned}2a^3 + 2/a^3 &= 2[a^3 + 1/a^3] \\&= 2 [(a + 1/a)^3 - 3(a)(1/a)(a + 1/a)] \\&= 2 [(4)^3 - 3(4)] \\&= 2 [64 - 12] \\&= 2 (52) \\&= 104\end{aligned}$$

9. If $x = 1/(4 - x)$, find the value of

(i) $x + 1/x$

(ii) $x^3 + 1/x^3$

(iii) $x^6 + 1/x^6$

Solution:

It is given that,

$$x = 1/(4 - x)$$

So,

(i) $x(4 - x) = 1$

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

Now let us divide both sides by x , we get

$$4 - x = 1/x$$

$$4 = 1/x + x$$

$$1/x + x = 4$$

$$1/x + x = 4$$

(ii) $x^3 + 1/x^3 = (x + 1/x)^3 - 3(x + 1/x)$

By substituting the values, we get

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

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$$= 64 - 12$$

$$= 52$$

$$(iii) x^6 + 1/x^6 = (x^3 + 1/x^3)^2 - 2$$

$$= (52)^2 - 2$$

$$= 2704 - 2$$

$$= 2702$$

10. If $x - 1/x = 3 + 2\sqrt{2}$, find the value of $\frac{1}{4} (x^3 - 1/x^3)$

Solution:

It is given that,

$$x - 1/x = 3 + 2\sqrt{2}$$

So,

$$x^3 - 1/x^3 = (x - 1/x)^3 + 3(x - 1/x)$$

$$= (3 + 2\sqrt{2})^3 + 3(3 + 2\sqrt{2})$$

By using the formula, $(a+b)^3 = a^3 + b^3 + 3ab(a+b)$

$$= (3)^3 + (2\sqrt{2})^3 + 3(3)(2\sqrt{2})(3 + 2\sqrt{2}) + 3(3 + 2\sqrt{2})$$

$$= 27 + 16\sqrt{2} + 54\sqrt{2} + 72 + 9 + 6\sqrt{2}$$

$$= 108 + 76\sqrt{2}$$

Hence,

$$\frac{1}{4} (x^3 - 1/x^3) = \frac{1}{4} (108 + 76\sqrt{2})$$

$$= 27 + 19\sqrt{2}$$

11. If $x + 1/x = 3 \frac{1}{3}$, find the value of $x^3 - 1/x^3$

Solution:

It is given that,

$$x + 1/x = 3 \frac{1}{3}$$

we know that,

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$$(x - 1/x)^2 = x^2 + 1/x^2 - 2$$

$$= x^2 + 1/x^2 + 2 - 4$$

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

$$\text{But } x + 1/x = 3 \frac{1}{3} = 10/3$$

So,

$$(x - 1/x)^2 = (10/3)^2 - 4$$

$$= 100/9 - 4$$

$$= (100 - 36)/9$$

$$= 64/9$$

$$x - 1/x = \sqrt{(64/9)}$$

$$= 8/3$$

Now,

$$x^3 - 1/x^3 = (x - 1/x)^3 + 3(x)(1/x)(x - 1/x)$$

$$= (8/3)^3 + 3(8/3)$$

$$= ((512/27) + 8)$$

$$= 728/27$$

$$= 26 \frac{26}{27}$$

12. If $x = 2 - \sqrt{3}$, then find the value of $x^3 - 1/x^3$

Solution:

It is given that,

$$x = 2 - \sqrt{3}$$

so,

$$1/x = 1/(2 - \sqrt{3})$$

By rationalizing the denominator, we get

$$= [1(2 + \sqrt{3})] / [(2 - \sqrt{3})(2 + \sqrt{3})]$$

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$$= [(2 + \sqrt{3})] / [(2^2) - (\sqrt{3})^2]$$

$$= [(2 + \sqrt{3})] / [4 - 3]$$

$$= 2 + \sqrt{3}$$

Now,

$$x - 1/x = 2 - \sqrt{3} - 2 - \sqrt{3}$$

$$= -2\sqrt{3}$$

Let us cube on both sides, we get

$$(x - 1/x)^3 = (-2\sqrt{3})^3$$

$$x^3 - 1/x^3 - 3(x)(1/x)(x - 1/x) = 24\sqrt{3}$$

$$x^3 - 1/x^3 - 3(-2\sqrt{3}) = -24\sqrt{3}$$

$$x^3 - 1/x^3 + 6\sqrt{3} = -24\sqrt{3}$$

$$x^3 - 1/x^3 = -24\sqrt{3} - 6\sqrt{3}$$

$$= -30\sqrt{3}$$

Hence,

$$x^3 - 1/x^3 = -30\sqrt{3}$$

13. If the sum of two numbers is 11 and sum of their cubes is 737, find the sum of their squares.

Solution:

Let us consider x and y be two numbers

Then,

$$x + y = 11$$

$$x^3 + y^3 = 735 \text{ and } x^2 + y^2 = ?$$

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Now,

$$x + y = 11$$

Let us cube on both the sides,

$$(x + y)^3 = (11)^3$$

$$x^3 + y^3 + 3xy(x + y) = 1331$$

$$737 + 3x \times 11 = 1331$$

$$33xy = 1331 - 737$$

$$= 594$$

$$xy = 594/33$$

$$xy = 18$$

We know that, $x + y = 11$

By squaring on both sides, we get

$$(x + y)^2 = (11)^2$$

$$x^2 + y^2 + 2xy = 121 \quad x^2 + y^2 + 2 \times 18 = 121$$

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$$x^2 + y^2 + 36 = 121$$

$$x^2 + y^2 = 121 - 36$$

$$= 85$$

Hence sum of the squares = 85

14. If $a - b = 7$ and $a^3 - b^3 = 133$, find:

(i) ab

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

Solution:

It is given that,

$$a - b = 7$$

let us cube on both sides, we get

$$(i) (a - b)^3 = (7)^3$$

$$a^3 + b^3 - 3ab(a - b) = 343$$

$$133 - 3ab \times 7 = 343$$

$$133 - 21ab = 343$$

$$- 21ab = 343 - 133$$

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$$= 210$$

$$ab = -210/21$$

$$ab = -10$$

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

$$\text{Again } a - b = 7$$

Let us square on both sides, we get

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

$$a^2 + b^2 - 2ab = 49$$

$$a^2 + b^2 - 2 \times (-10) = 49$$

$$a^2 + b^2 + 20 = 49$$

$$a^2 + b^2 = 49 - 20$$

$$= 29$$

$$\text{Hence, } a^2 + b^2 = 29$$

15. Find the coefficient of x^2 expansion of $(x^2 + x + 1)^2 + (x^2 - x + 1)^2$

Solution:

Given:

The expression, $(x^2 + x + 1)^2 + (x^2 - x + 1)^2$

$$(x^2 + x + 1)^2 + (x^2 - x + 1)^2 = [((x^2 + 1) + x)^2 + ((x^2 + 1) - x)^2]$$

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

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

$$= x^4 + 1 + 2x^2 + x^2 + x^4 + 1 + 2x^2 + x^2$$

$$= 2x^4 + 6x^2 + 2$$

∴ Co-efficient of x^2 is 6.



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- Chapter 1- Rational and Irrational Numbers
- Chapter 2- Compound Interest
- Chapter 3- Expansions
- Chapter 4- Factorization
- Chapter 5- Simultaneous Linear Equations
- Chapter 6- Problems on Simultaneous Linear Equations
- Chapter 7- Quadratic Equations
- Chapter 8- Indices
- Chapter 9- Logarithms
- Chapter 10- Triangles
- Chapter 11- Mid Point Theorem
- Chapter 12- Pythagoras Theorem
- Chapter 13- Rectilinear Figures
- Chapter 14- Theorems on Area
- Chapter 15- Circle
- Chapter 16- Mensuration
- Chapter 17- Trigonometric Ratios
- Chapter 18- Trigonometric Ratios and Standard Angles
- Chapter 19- Coordinate Geometry
- Chapter 20- Statistics

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