PRACTICE PAPER 12 (2026-27)
CHAPTER 04 EXPLORING ALGEBRAIC IDENTITIES

SUBJECT: MATHEMATICS | **MAX. MARKS : 40**
CLASS : IX | **DURATION : 1½ hrs**

General Instructions:

(i). **All** questions are compulsory.
(ii). This question paper contains 2**0** questions divided into five Sections A, B, C, D and E.
(iii). **Section A** comprises of **10 MCQs** of **1 mark** each. **Section B** comprises of 4 questions of **2 marks** each. **Section C** comprises of 3 questions of **3 marks** each. **Section D** comprises of 1 question of **5 marks** each and **Section E** comprises of 2 Case Study Based Questions of **4 marks** each.
(iv). There is no overall choice.
(v). Use of Calculators is not permitted

SECTION – A

Questions 1 to 10 carry 1 mark each.

1. Using a suitable identity, the value of $1002^2 - 998^2$ is:
(a) 4000 (b) 8000 (c) 40000 (d) 80000

2. Which of the following is equal to $(2x + 3y)^3$?
(a) $8x^3 + 27y^3$
(b) $8x^3 + 18x^2y + 27xy^2 + 27y^3$
(c) $8x^3 + 36x^2y + 54xy^2 + 27y^3$
(d) $8x^3 + 12x^2y + 18xy^2 + 27y^3$

3. If x + y = 10 and $x^2 + y^2 = 58$ then xy is:
(a) 18 (b) 20 (c) 21 (d) 29

4. The factorisation of $81a^2 - 121b^2$ is:
(a) $(9a - 11b)^2$
(b) $(9a + 11b)^2$
(c) $(9a - 11b)(9a + 11b)$
(d) $(81a - 121b)(a + b)$

5. Which expression is the correct factorisation of $x^3 - 125$?
(a) $(x - 5)(x^2 + 5x + 25)$
(b) $(x + 5)(x^2 - 5x + 25)$
(c) $(x - 5)(x^2 - 5x + 25)$
(d) $(x + 5)(x^2 + 5x + 25)$

6. The value of $(51)^2 - (49)^2$ is:
(a) 100 (b) 200 (c) 2500 (d) 5000

7. If $a - b = 8$ and $ab = 8$ then the value of $a^2 + b^2$ is:
(a) 28 (b) 36 (c) 44 (d) 52

8. Which of the following is a factor of $27x^3 + 64y^3$?
(a) $3x$ – 4y (b) $3x$ + 4y (c) $9x$ + 16y (d) $27x$ + 64y

In the following questions 9 and 10, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

9. Assertion (A): $(x + 4)^3 + (x - 4)^3 = 2x^3 + 96x$
Reason (R): $(a + b)^3 + (a - b)^3 = 2a^3 + 6ab^2$

10. Assertion (A): $x^3 + 8$ is divisible by x + 2
Reason (R): $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. Without direct multiplication, find: 1004×996

12. Factorise: $64x^2 - 144y^2$

13. If p + q = 13 and pq = 36, find: $p^2 + q^2$

14. Simplify: $\frac{x^3+27}{x+3}$

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. Expand and simplify: $(3x - 2y)^3$

16. Factorise: $8a^3 + 27b^3$

17. If x + y = 8 and xy = 15 find: $x^3 + y^3$

SECTION – D

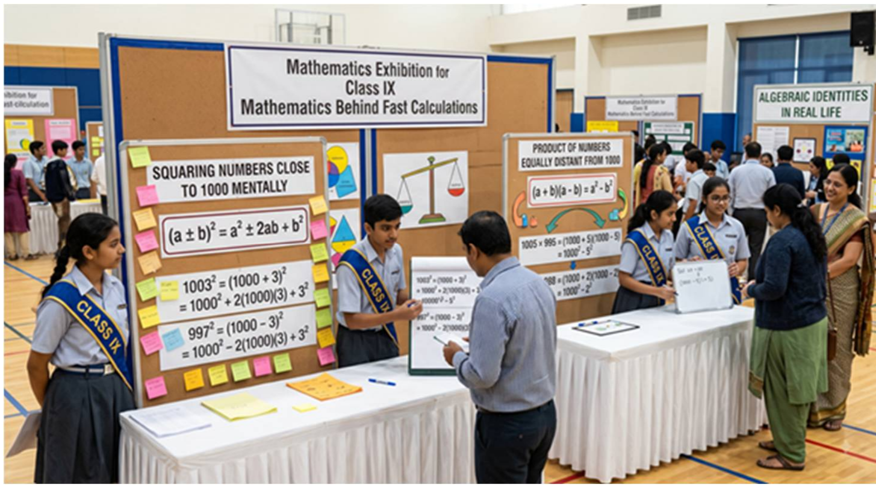
Questions 18 carry 5 marks each.

18. A square playground has side $(x + 6)$ m. A smaller square of side $(x - 6)$ m is marked inside it. Answer the following:
(a) Find the area of the larger square.
(b) Find the area of the smaller square.
(c) Find the difference between their areas.
(d) Simplify the difference using an appropriate identity.
(e) Find the difference when x = 14.

SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

19. Case Study – 1: Mathematics in a School Exhibition
As part of the Mathematics Exhibition, students of Class IX prepared a display titled **"Mathematics Behind Fast Calculations."** They demonstrated how algebraic identities can make lengthy calculations much easier. One group chose numbers close to 1000 and challenged visitors to calculate their squares mentally. Another group showed how the product of two numbers equally distant from 1000 can be found without ordinary multiplication. Their teacher explained that expressions of the form $(a + b)^2$ and $(a + b)(a - b)$ provide quick and reliable methods. The activity helped students understand that algebraic identities are not merely formulas to memorise but useful tools for solving real-life numerical problems.



Answer the following:

(a) Find 1006^2 using an identity. (2)

(b) Find 1006×994 using an appropriate identity. (2)

20. Case Study – 2: Designing a Decorative Floor

For the annual school function, a rectangular stage was decorated with a mathematical border. The designer represented the length and breadth of the central rectangular portion as $(x + 7)$ metres and $(x - 7)$ metres respectively. The students assisting with the decoration noticed that the expression for its area could be simplified without multiplying every term separately. Their Mathematics teacher used the identity to explain the calculation. The students then explored similar expressions involving squares and cubes and realised that algebraic identities can help simplify measurements, designs and calculations in architecture and decoration.

Answer the following:

(a) Write the expression for the area of the rectangular portion.

(b) Simplify the area using an appropriate identity.

(c) Find the area when x = 15.

PRACTICE PAPER 12 (2026-27)
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(ANSWERS)

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(iv). There is no overall choice.
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SECTION – A
Questions 1 to 10 carry 1 mark each.

1. Using a suitable identity, the value of $1002^2 - 998^2$ is:
(a) 4000 (b) 8000 (c) 40000 (d) 80000
Ans: (b) 8000
Using: $a^2 - b^2 = (a + b)(a - b)$, we get
$1002^2 - 998^2 = (1002 + 998)(1002 - 998) = 2000 \times 4 = 8000$

2. Which of the following is equal to $(2x + 3y)^3$?
(a) $8x^3 + 27y^3$ (b) $8x^3 + 18x^2y + 27xy^2 + 27y^3$
(c) $8x^3 + 36x^2y + 54xy^2 + 27y^3$ (d) $8x^3 + 12x^2y + 18xy^2 + 27y^3$
Ans: (c) $8x^3 + 36x^2y + 54xy^2 + 27y^3$
Using: $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
Put $a = 2x$, $b = 3y$
$(2x + 3y)^3 = (2x)^3 + 3(2x)^2(3y) + 3(2x)(3y)^2 + (3y)^3$
$= 8x^3 + 3(4x^2)(3y) + 3(2x)(9y^2) + 27y^3$
$= 8x^3 + 36x^2y + 54xy^2 + 27y^3$

3. If x + y = 10 and $x^2 + y^2 = 58$ then xy is:
(a) 18 (b) 20 (c) 21 (d) 29
Ans: (c) 21
Using: $(x + y)^2 = x^2 + 2xy + y^2$, we get
$\Rightarrow 10^2 = 58 + 2xy$
$\Rightarrow 100 = 58 + 2xy \Rightarrow 2xy = 42 \Rightarrow xy = 21$

4. The factorisation of $81a^2 - 121b^2$ is:
(a) $(9a - 11b)^2$ (b) $(9a + 11b)^2$
(c) $(9a - 11b)(9a + 11b)$ (d) $(81a - 121b)(a + b)$
Ans: (c) $(9a - 11b)(9a + 11b)$
We have: $81a^2 = (9a)^2$ and $121b^2 = (11b)^2$
Therefore: $81a^2 - 121b^2 = (9a)^2 - (11b)^2$
Using: $a^2 - b^2 = (a + b)(a - b)$, we get
$(9a)^2 - (11b)^2 = (9a + 11b)(9a - 11b)$

5. Which expression is the correct factorisation of $x^3 - 125$?

(a) $(x-5)(x^2+5x+25)$ (b) $(x+5)(x^2-5x+25)$
(c) $(x-5)(x^2-5x+25)$ (d) $(x+5)(x^2+5x+25)$
Ans: (a) $(x-5)(x^2+5x+25)$
$x^3-125=x^3-5^3$
Using: $a^3-b^3=(a-b)(a^2+ab+b^2)$, we get
$x^3-5^3=(x-5)(x^2+5x+25)$

6. The value of $(51)^2-(49)^2$ is:
(a) 100 (b) 200 (c) 2500 (d) 5000
Ans: (b) 200
$51^2-49^2=(51+49)(51-49)=100\times 2=200$

7. If $a-b=8$ and $ab=8$ then the value of a^2+b^2 is:
(a) 28 (b) 36 (c) 44 (d) 52
Ans: (d) 52
Using: $(a-b)^2=a^2-2ab+b^2$, we get
$6^2=a^2-2(8)+b^2$
$\Rightarrow 36=a^2+b^2-16$
$\Rightarrow a^2+b^2=36+16=52$

8. Which of the following is a factor of $27x^3+64y^3$?
(a) $3x$ – 4y (b) $3x$ + 4y (c) $9x$ + 16y (d) $27x$ + 64y
Ans: (b) $3x$ + 4y
$27x^3+64y^3=(3x)^3+(4y)^3$
Using: $a^3+b^3=(a+b)(a^2-ab+b^2)$, we get
the first factor is $3x+4y$

In the following questions 9 and 10, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

9. **Assertion (A):** $(x+4)^3+(x-4)^3=2x^3+96x$
Reason (R): $(a+b)^3+(a-b)^3=2a^3+6ab^2$
Ans: (a) Both A and R are true and R is the correct explanation of A.
Using: $(a+b)^3+(a-b)^3=2a^3+6ab^2$, we get
$(x+4)^3+(x-4)^3=2x^3+6(x)(4^2)$
$=2x^3+6x(16)=2x^3+96x$

10. **Assertion (A):** x^3+8 is divisible by x + 2
Reason (R): $a^3+b^3=(a+b)(a^2-ab+b^2)$
Ans: (a) Both A and R are true and R is the correct explanation of A.
We have: $x^3+8=x^3+2^3$
Using: $a^3+b^3=(a+b)(a^2-ab+b^2)$, we get
$x^3+8=(x+2)(x^2-2x+4)$
Hence $x+2$ is a factor.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. Without direct multiplication, find: 1004×996

Ans:
Write: $1004 = 1000 + 4$ and $996 = 1000 - 4$
Therefore: $1004 \times 996 = (1000 + 4)(1000 - 4)$
Using: $(a + b)(a - b) = a^2 - b^2$, we get
$(1000 + 4)(1000 - 4) = 1000^2 - 4^2 = 1000000 - 16 = 999984$

12. Factorise: $64x^2 - 144y^2$
Ans: $64x^2 - 144y^2 = (8x)^2 - (12y)^2$
Using: $(a + b)(a - b) = a^2 - b^2$, we get
$(8x)^2 - (12y)^2 = (8x + 12y)(8x - 12y)$
$= 4(2x + 3y) \times 4(2x - 3y) = 16(2x + 3y)(2x - 3y)$

13. If $p + q = 13$ and $pq = 36$, find: $p^2 + q^2$
Ans: Using: $(p + q)^2 = p^2 + 2pq + q^2$, we get
$13^2 = p^2 + 2(36) + q^2$
$\Rightarrow 169 = p^2 + q^2 + 72$
$\Rightarrow p^2 + q^2 = 169 - 72 = 97$

14. Simplify: $\frac{x^3+27}{x+3}$
Ans: $x^3 + 27 = x^3 + 3^3$
Using: $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$, we get
$x^3 + 3^3 = (x + 3)(x^2 - 3x + 9)$
$\therefore \frac{x^3+27}{x+3} = \frac{(x+3)(x^2-3x+9)}{x+3}$
$= x^2 - 3x + 9$

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. Expand and simplify: $(3x - 2y)^3$
Ans: Using: $(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$, we get
$(3x - 2y)^3 = (3x)^3 - 3(3x)^2(2y) + 3(3x)(2y)^2 - (2y)^3$
$= 27x^3 - 3(9x^2)(2y) + 3(3x)(4y^2) - 8y^3$
$= 27x^3 - 54x^2y + 36xy^2 - 8y^3$

16. Factorise: $8a^3 + 27b^3$
Ans: $8a^3 + 27b^3 = (2a)^3 + (3b)^3$
Using: $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$, we get
$(2a)^3 + (3b)^3 = (2a + 3b)((2a)^2 - (2a)(3b) + (3b)^2)$
$= (2a + 3b)(4a^2 - 6ab + 9b^2)$

17. If $x + y = 8$ and $xy = 15$ find: $x^3 + y^3$
Ans: Using: $x^3 + y^3 = (x + y)^3 - 3xy(x + y)$, we get
$x^3 + y^3 = 8^3 - 3(15)(8)$
$= 512 - 360 = 152$

SECTION – D

Questions 18 carry 5 marks each.

18. A square playground has side $(x + 6)$ m. A smaller square of side $(x - 6)$ m is marked inside it.
Answer the following:
(a) Find the area of the larger square.

(b) Find the area of the smaller square.
(c) Find the difference between their areas.
(d) Simplify the difference using an appropriate identity.
(e) Find the difference when x = 14.
Ans: The larger square has side: $x + 6$ m and the smaller square has side: $x - 6$ m
(a) Area of the larger square
$Area = side^2 = (x + 6)^2 = x^2 + 12x + 36$
(b) Area of the smaller square
$Area = (x - 6)^2 = x^2 - 12x + 36$
(c) Difference between the areas
Difference $= (x + 6)^2 - (x - 6)^2$
(d) Using: $(a + b)^2 - (a - b)^2 = 4ab$, we get
Difference $= 4(x)(6) = 24x$
(e) When x=14
Difference $= 24(14) = 336$

SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

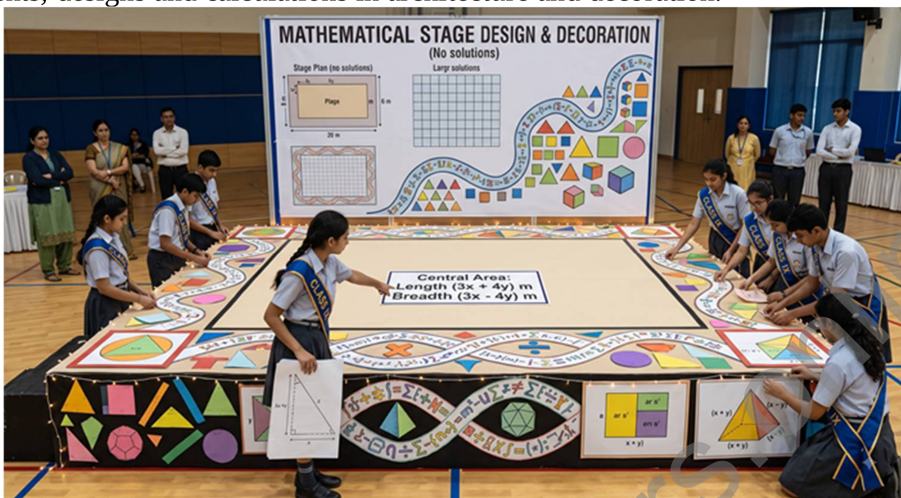
19. Case Study – 1: Mathematics in a School Exhibition

As part of the Mathematics Exhibition, students of Class IX prepared a display titled **"Mathematics Behind Fast Calculations."** They demonstrated how algebraic identities can make lengthy calculations much easier. One group chose numbers close to 1000 and challenged visitors to calculate their squares mentally. Another group showed how the product of two numbers equally distant from 1000 can be found without ordinary multiplication. Their teacher explained that expressions of the form $(a + b)^2$ and $(a + b)(a - b)$ provide quick and reliable methods. The activity helped students understand that algebraic identities are not merely formulas to memorise but useful tools for solving real-life numerical problems.

Answer the following:
(a) Find 1006^2 using an identity. (2)
(b) Find 1006×994 using an appropriate identity. (2)
Ans: (a) Using: $(a + b)^2 = a^2 + 2ab + b^2$, we get
$1006^2 = (1000 + 6)^2$
$= 1000^2 + 2(1000)(6) + 6^2 = 1000000 + 12000 + 36 = 1012036$
(b) Using: $(a + b)(a - b) = a^2 - b^2$, we get
$1006 \times 994 = (1000 + 6)(1000 - 6)$
$= 1000^2 - 6^2 = 1000000 - 36 = 999964$

20. Case Study – 2: Designing a Decorative Floor

For the annual school function, a rectangular stage was decorated with a mathematical border. The designer represented the length and breadth of the central rectangular portion as $(x + 7)$ metres and $(x - 7)$ metres respectively. The students assisting with the decoration noticed that the expression for its area could be simplified without multiplying every term separately. Their Mathematics teacher used the identity to explain the calculation. The students then explored similar expressions involving squares and cubes and realised that algebraic identities can help simplify measurements, designs and calculations in architecture and decoration.



Answer the following:

(a) Write the expression for the area of the rectangular portion. (1)

(b) Simplify the area using an appropriate identity. (2)

(c) Find the area when x = 15. (1)

Ans: (a) Length: x + 7

Breadth: x – 7

Therefore: Area = (x + 7)(x – 7)

(b) Using: $(a + b)(a - b) = a^2 - b^2$, we get

$Area = x^2 - 7^2 = x^2 - 49$

(c) $Area = 15^2 - 49 = 225 - 49 = 176$