PRACTICE PAPER 10 (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. A company manufactures square digital display panels. The side of each panel is $(9x+2)$cm. Which algebraic expression correctly represents the area of one panel?

(a) $81x^2 + 36x + 4$ (b) $81x^2 + 18x + 4$

(c) $81x^2 + 4$ (d) $18x^2 + 36x + 4$

2. Which expression is a perfect square?

(a) $16x^2 + 56x + 49$ (b) $16x^2 + 64x + 49$

(c) $16x^2 + 48x + 49$ (d) $16x^2 + 32x + 49$

3. A student claims $64y^2 - 1 = (8y - 1)^2$. Identify the correct statement.

(a) The student is correct. (b) The correct factorisation is $(8y - 1)(8y + 1)$.

(c) It cannot be factorised. (d) It equals $(8y + 1)^2$.

4. A square park has side $x$metres. After renovation, each side is increased by 6 metres. The increase in the area of the park is

(a) $x^2 + 12x + 36$ (b) $6x + 36$ (c) $12x + 36$ (d) 36

5. If $a + b = 20, ab = 84$, find $a^2 + b^2$.

(a) 248 (b) 256 (c) 400 (d) 232

6. Without multiplying directly, $1003 \times 997 =$

(a) 999991 (b) 999999 (c) 1000009 (d) 1000991

7. Factorise: $x^2 + 19x + 84$.

(a) $(x + 12)(x + 7)$ (b) $(x + 14)(x + 5)$

(c) $(x + 21)(x - 2)$ (d) $(x + 10)(x + 9)$

8. Which expression simplifies to $x + 11$?

(a) $\frac{x^2+121}{x+11}$ (b) $\frac{x^2-121}{x+11}$ (c) $\frac{x^2-121}{x-11}$ (d) $\frac{x^2-22x+121}{x+11}$

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):** $25x^2 + 30x + 9 = (5x + 3)^2$
Reason (R): $(a + b)^2 = a^2 + 2ab + b^2$

10. **Assertion (A):** $81m^2 - 16 = (9m + 4)(9m - 4)$
Reason (R): $a^2 - b^2 = (a + b)(a - b)$

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. A student expands $(11x - 6)^2$ as $121x^2 - 36$.
Identify the mistake and write the correct expansion using a suitable algebraic identity.

12. A teacher asks students to evaluate 303×297 without ordinary multiplication. Find the value using a suitable algebraic identity.

13. Factorise: $225a^2 - 150ab + 25b^2$.

14. A rectangular classroom has length $(x + 14)$ m and breadth $(x - 9)$ m.
Find the algebraic expression for its area.

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. Without performing ordinary multiplication, evaluate $1002^2 - 998^2$.

16. Prove that $(x + 8)^2 - (x - 8)^2 = 32x$.

17. A square playground has side $(2x + 9)$ m. A square stage of side $(2x)$ m is constructed inside it. Find the remaining area of the playground.

SECTION – D

Questions 18 carry 5 marks each.

18. An educational institution is constructing a Mathematics Discovery Centre. The centre consists of a large square activity court and a rectangular exhibition hall.
The side of the square court is $(6x-5)$metres.
The exhibition hall has length $(4x+3)$metres and breadth $(2x+7)$metres. The architect wants students to verify the algebraic expressions before approving the final blueprint.
Answer the following.
(i) Find the algebraic expression for the area of the square activity court using a suitable identity.
(ii) Find the algebraic expression for the area of the exhibition hall.
(iii) If $x = 8$, calculate the total area occupied by both structures.

SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

19. Case Study – 1: High-Speed Railway Station Design
Engineers are designing a high-speed railway station. The waiting hall is rectangular with length $(x+24)$metres and breadth $(x+5)$metres. Before preparing the construction estimate, engineers

calculate the algebraic expression representing the floor area. To ensure accuracy, they factorise the obtained expression and verify whether it returns the original dimensions. Finally, they calculate the actual floor area when $x = 11$. This exercise demonstrates how algebraic identities and factorisation help engineers verify building plans, estimate materials, and avoid costly construction errors.

Answer the following.

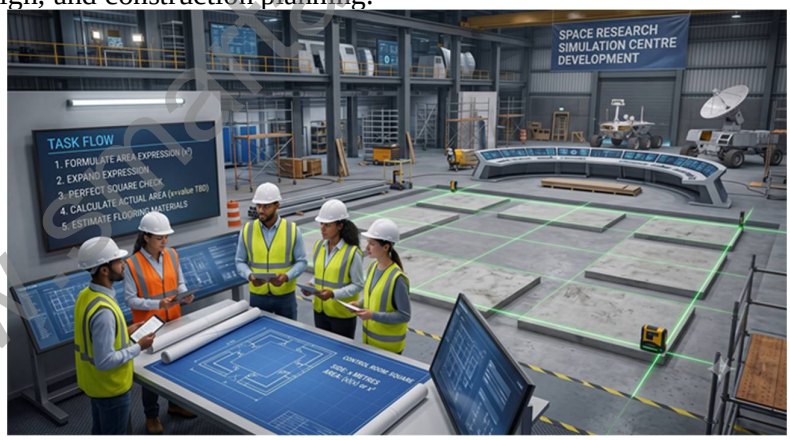
(i) Find the algebraic expression for the floor area. (1)

(ii) Factorise: $\mathbf{144a^2 - 24ab + b^2}$ (2)

(iii) Find the floor area when $x = 11$. (1)

20. Case Study – 2: Space Research Simulation Centre

A Space Research Simulation Centre is being developed for school students. The control room is designed as a square whose side is $(8x+5)$metres. Before purchasing flooring tiles, the project team expands the expression for the area using an algebraic identity. They then verify that the obtained expression is a perfect square and finally calculate the actual area when $x = 4$. This activity helps students understand how algebraic identities are applied in space research facilities, engineering design, and construction planning.



Answer the following.

(i) Expand: $(8x+5)^2$. (1)

(ii) Factorise: $6x^2 + 13x + 6$ (2)

(iii) Find the area when $x = 4$. (1)

PRACTICE PAPER 10 (2026-27)
CHAPTER 04 EXPLORING ALGEBRAIC IDENTITIES
(ANSWERS)

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SECTION – A
Questions 1 to 10 carry 1 mark each.

1. A company manufactures square digital display panels. The side of each panel is $(9x+2)$cm. Which algebraic expression correctly represents the area of one panel?
(a) $81x^2 + 36x + 4$ (b) $81x^2 + 18x + 4$
(c) $81x^2 + 4$ (d) $18x^2 + 36x + 4$
Ans: (a) $81x^2 + 36x + 4$
Using, $(a + b)^2 = a^2 + 2ab + b^2$
where $a = 9x, b = 2$
$(9x + 2)^2 = 81x^2 + 36x + 4$
The middle term is $2(9x)(2) = 36x$.

2. Which expression is a perfect square?
(a) $16x^2 + 56x + 49$ (b) $16x^2 + 64x + 49$
(c) $16x^2 + 48x + 49$ (d) $16x^2 + 32x + 49$
Ans**:** (a) $16x^2 + 56x + 49$
Since $16x^2 = (4x)^2, 49 = 7^2$
Middle term = $2(4x)(7) = 56x$
Therefore, $16x^2 + 56x + 49 = (4x + 7)^2$

3. A student claims $64y^2 - 1 = (8y - 1)^2$.
Identify the correct statement.
(a) The student is correct. (b) The correct factorisation is $(8y - 1)(8y + 1)$.
(c) It cannot be factorised. (d) It equals $(8y + 1)^2$.
Ans: (b) The correct factorisation is $(8y - 1)(8y + 1)$.
Using, $a^2 - b^2 = (a + b)(a - b)$
$64y^2 - 1 = (8y + 1)(8y - 1)$

4. A square park has side $x$metres. After renovation, each side is increased by 6 metres. The increase in the area of the park is
(a) $x^2 + 12x + 36$ (b) $6x + 36$ (c) $12x + 36$ (d) 36
Ans: (c) $12x + 36$
New area = $(x + 6)^2 = x^2 + 12x + 36$
Increase = $x^2 + 12x + 36 - x^2 = 12x + 36$

5. If $a + b = 20, ab = 84$, find $a^2 + b^2$.
(a) 248 (b) 256 (c) 400 (d) 232
Ans**:** (d) 232
Using, $(a + b)^2 = a^2 + b^2 + 2ab$
$400 = a^2 + b^2 + 168$
$\Rightarrow a^2 + b^2 = 232$

6. Without multiplying directly, $1003 \times 997 =$
(a) 999991 (b) 999999 (c) 1000009 (d) 1000991
Ans: (a) 999991
$1003 = 1000 + 3, 997 = 1000 - 3$
Using, $(a + b)(a - b) = a^2 - b^2 = 1000^2 - 3^2 = 1000000 - 9 = 999991$

7. Factorise: $x^2 + 19x + 84$.
(a) $(x + 12)(x + 7)$ (b) $(x + 14)(x + 5)$
(c) $(x + 21)(x - 2)$ (d) $(x + 10)(x + 9)$
Ans:
We need two numbers whose sum is 19 and product is 84.
These are 12 and 7.
Hence, $x^2 + 19x + 84 = (x + 12)(x + 7)$

8. Which expression simplifies to $x + 11$?
(a) $\frac{x^2+121}{x+11}$ (b) $\frac{x^2-121}{x+11}$ (c) $\frac{x^2-121}{x-11}$ (d) $\frac{x^2-22x+121}{x+11}$
Ans: (c) $\frac{x^2-121}{x-11}$
$x^2 - 121 = (x - 11)(x + 11)$
Therefore, $\frac{(x-11)(x+11)}{x-11} = x + 11$

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):** $25x^2 + 30x + 9 = (5x + 3)^2$
Reason (R): $(a + b)^2 = a^2 + 2ab + b^2$
Ans: (a) Both A and R are true and R is the correct explanation of A.
$(5x + 3)^2 = 25x^2 + 30x + 9$

10. **Assertion (A):** $81m^2 - 16 = (9m + 4)(9m - 4)$
Reason (R): $a^2 - b^2 = (a + b)(a - b)$
Ans: (a) Both A and R are true and R is the correct explanation of A.
Since, $81m^2 = (9m)^2, 16 = 4^2$,
using the difference of squares identity, $81m^2 - 16 = (9m + 4)(9m - 4)$
The identity $a^2 - b^2 = (a + b)(a - b)$correctly explains the factorisation.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. A student expands $(11x - 6)^2$ as $121x^2 - 36$.
Identify the mistake and write the correct expansion using a suitable algebraic identity.

Ans: Using the identity, $(a-b)^2 = a^2 - 2ab + b^2$
where $a = 11x, b = 6$
$(11x-6)^2 = (11x)^2 - 2(11x)(6) + 6^2$
$= 121x^2 - 132x + 36$
The student has omitted the middle term $(-132x)$.
Therefore, $(11x-6)^2 = 121x^2 - 132x + 36$

12. A teacher asks students to evaluate 303×297 without ordinary multiplication. Find the value using a suitable algebraic identity.
Ans: Here, $303 = 300 + 3$ and $297 = 300 - 3$
Using, $(a+b)(a-b) = a^2 - b^2$
$= (300)^2 - 3^2 = 90000 - 9 = 89991$
Hence, $303 \times 297 = 89991$

13. Factorise: $225a^2 - 150ab + 25b^2$.
Ans: $225a^2 = (15a)^2$
$25b^2 = (5b)^2$
Middle term $= -2(15a)(5b)$
Therefore, $225a^2 - 150ab + 25b^2 = (15a - 5b)^2$
Taking common factor, $= (5(3a-b))^2$
Hence, $225a^2 - 150ab + 25b^2 = 25(3a-b)(3a-b)$

14. A rectangular classroom has length $(x+14)$ m and breadth $(x-9)$ m. Find the algebraic expression for its area.
Ans: Area = length × breadth
$= (x+14)(x-9)$
Using distributive property, $= x^2 - 9x + 14x - 126$
$= x^2 + 5x - 126$

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. Without performing ordinary multiplication, evaluate $1002^2 - 998^2$.
Ans: Using the identity, $a^2 - b^2 = (a+b)(a-b)$
Let $a = 1002, b = 998$
Then, $1002^2 - 998^2$
$= (1002 + 998)(1002 - 998)$
$= 2000 \times 4 = 8000$

16. Prove that $(x+8)^2 - (x-8)^2 = 32x$.
Ans: Using identities, $(x+8)^2 = x^2 + 16x + 64$
and $(x-8)^2 = x^2 - 16x + 64$
Subtracting, $(x+8)^2 - (x-8)^2$
$= x^2 + 16x + 64 - (x^2 - 16x + 64)$
$= x^2 + 16x + 64 - x^2 + 16x - 64 = 32x$

17. A square playground has side $(2x+9)$ m. A square stage of side $(2x)$ m is constructed inside it. Find the remaining area of the playground.
Ans: Area of playground $= (2x+9)^2 = 4x^2 + 36x + 81$
Area of stage $= (2x)^2 = 4x^2$
Remaining area $= 4x^2 + 36x + 81 - 4x^2 = 36x + 81$

SECTION – D

Questions 18 carry 5 marks each.

18. An educational institution is constructing a Mathematics Discovery Centre. The centre consists of a large square activity court and a rectangular exhibition hall.
The side of the square court is $(6x-5)$metres.
The exhibition hall has length $(4x+3)$metres and breadth $(2x+7)$metres. The architect wants students to verify the algebraic expressions before approving the final blueprint.
Answer the following.
(i) Find the algebraic expression for the area of the square activity court using a suitable identity.
(ii) Find the algebraic expression for the area of the exhibition hall.
(iii) If $x = 8$, calculate the total area occupied by both structures.

Ans: (i) Area of the Square Court
Side = $(6x - 5)$ m
Using, $(a - b)^2 = a^2 - 2ab + b^2$
where, $a = 6x, b = 5$
$(6x - 5)^2 = (6x)^2 - 2(6x)(5) + 5^2 = 36x^2 - 60x + 25$
Hence, Area = $36x^2 - 60x + 25$ m^2
(ii) Area of Exhibition Hall
Length = $(4x + 3)$
Breadth = $(2x + 7)$
Area = $(4x + 3)(2x + 7) = 8x^2 + 28x + 6x + 21 = 8x^2 + 34x + 21$
Hence, Area = $8x^2 + 34x + 21$ m^2
(iii) Total Area when $\boldsymbol{x = 8}$
Area of Square Court = $36(8)^2 - 60(8) + 25$
$= 36(64) - 480 + 25 = 2304 - 480 + 25 = 1849\ m^2$
Area of Exhibition Hall = $8(64) + 34(8) + 21 = 512 + 272 + 21 = 805\ m^2$
Total Area = $1849 + 805 = 2654\ m^2$

SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

19. Case Study – 1: High-Speed Railway Station Design

Engineers are designing a high-speed railway station. The waiting hall is rectangular with length $(x+24)$metres and breadth $(x+5)$metres. Before preparing the construction estimate, engineers calculate the algebraic expression representing the floor area. To ensure accuracy, they factorise the obtained expression and verify whether it returns the original dimensions. Finally, they calculate the actual floor area when $x = 11$. This exercise demonstrates how algebraic identities and factorisation help engineers verify building plans, estimate materials, and avoid costly construction errors.

Answer the following.
(i) Find the algebraic expression for the floor area. (1)
(ii) Factorise: $\mathbf{144a^2 - 24ab + b^2}$ (2)
(iii) Find the floor area when $x = 11$. (1)
Ans: (i) Area $= (x + 24)(x + 5) = x^2 + 5x + 24x + 120 = x^2 + 29x + 120$
(ii) We need two numbers whose Sum $= 29$ and Product $= 120$
The numbers are $\mathbf{24}$ and $\mathbf{5}$
Therefore, $\mathbf{x^2 + 29x + 120 = (x + 24)(x + 5)}$
(iii) Here, $\mathbf{144a^2 = (12a)^2}$ and $\mathbf{b^2 = (b)^2}$
Also, $\mathbf{2(12a)(b) = 24ab}$
The middle term is negative.
Hence, $\mathbf{144a^2 - 24ab + b^2 = (12a - b)^2 = (12a - b)\ \ (12a - b)}$

20. Case Study – 2: Space Research Simulation Centre

A Space Research Simulation Centre is being developed for school students. The control room is designed as a square whose side is $(8x+5)$metres. Before purchasing flooring tiles, the project team expands the expression for the area using an algebraic identity. They then verify that the obtained expression is a perfect square and finally calculate the actual area when $x = 4$. This activity helps students understand how algebraic identities are applied in space research facilities, engineering design, and construction planning.

Answer the following.
(i) Expand: $(8x+5)^2$. (1)
(ii) Factorise: $6x^2 + 13x + 6$ (2)
(iii) Find the area when $x = 4$. (1)
Ans: (i) Using, $(a + b)^2 = a^2 + 2ab + b^2$
$= (8x)^2 + 2(8x)(5) + 5^2$
$= 64x^2 + 80x + 25$
(ii) We require two numbers whose Product $= 6 \times 6 = 36$ and Sum $= 13$
The numbers are 9 and 4
Therefore, $6x^2 + 13x + 6 = 6x^2 + 9x + 4x + 6$
$= 3x(2x + 3) + 2(2x + 3) = (2x + 3)(3x + 2)$
(iii) Side $= 8(4) + 5 = 37$ m
Area $= 37^2 = 1369$ m^2