

Factorization Worksheet-1 — Quadratic Expressions (single variable)

Sutras: Anurupyena ("proportionately") + Adyamadyena Antyamantyena ("first by first, last by last") · or split the middle term.

Factorise each quadratic expression. Tip: check with Gunita Samuccaya — (sum of coeffs of expression) = product of the factor coeff-sums.

Name: _____

Date: _____

Score: _____ / 20

1) $x^2 - 15x + 56$

Answer: _____

2) $x^2 + 2x + 1$

Answer: _____

3) $x^2 + 23x + 132$

Answer: _____

4) $x^2 + 12x + 32$

Answer: _____

5) $x^2 + 10x + 21$

Answer: _____

6) $x^2 + 3x - 4$

Answer: _____

7) $x^2 + 16x + 63$

Answer: _____

8) $3x^2 + 2x - 8$

Answer: _____

9) $2x^2 - 8$

Answer: _____

10) $2x^2 - 10x - 12$

Answer: _____

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Factorise each quadratic expression. Tip: check with Gunita Samuccaya — (sum of coeffs of expression) = product of the factor coeff-sums.

Name: _____

Date: _____

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11) $x^2 - 25$

Answer: _____

12) $x^2 + 16x + 60$

Answer: _____

13) $x^2 - 22x + 120$

Answer: _____

14) $x^2 - 9x - 10$

Answer: _____

15) $x^2 + 12x + 11$

Answer: _____

16) $x^2 - 15x + 54$

Answer: _____

17) $2x^2 + 14x + 20$

Answer: _____

18) $x^2 + 15x + 44$

Answer: _____

19) $x^2 - 5x + 4$

Answer: _____

20) $4x^2 - 12x + 9$

Answer: _____

Factorization Worksheet-2 — Verifying Factors (Gunita Samuccaya)

Sub-sutra: Gunita-Samuccaya Samuccaya-Gunita — coefficient-sum of the expression = product of the factor coefficient-sums.

Use the rule to check whether each factorisation is correct: is $(1+b+c)$ equal to $(\text{factor-1 sum}) \times (\text{factor-2 sum})$?

Name: _____

Date: _____

Score: _____ / 20

1) $x^2 - 3x - 40 = (x + 5)(x - 8)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

2) $x^2 - 19x + 88 = (x - 11)(x - 6)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

3) $x^2 + 2x - 24 = (x + 6)(x - 6)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

4) $x^2 - 3x - 10 = (x - 5)(x + 2)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

5) $x^2 - 6x + 5 = (x - 1)(x - 5)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

6) $x^2 + 16x + 55 = (x + 5)(x + 13)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

7) $x^2 - x - 20 = (x + 4)(x - 4)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

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

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

9) $x^2 + 13x + 30 = (x + 10)(x + 3)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

10) $x^2 - 15x + 44 = (x - 4)(x - 13)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

Factorization Worksheet-2 — Verifying Factors (Gunita Samuccaya)

Sub-sutra: Gunita-Samuccaya Samuccaya-Gunita — coefficient-sum of the expression = product of the factor coefficient-sums.

Use the rule to check whether each factorisation is correct: is $(1+b+c)$ equal to $(\text{factor-1 sum}) \times (\text{factor-2 sum})$?

Name: _____

Date: _____

Score: _____ / 20

11) $x^2 + 4x - 60 = (x - 6)(x + 10)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

12) $x^2 - 49 = (x + 7)(x - 7)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

13) $x^2 + 6x - 27 = (x - 3)(x + 8)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

14) $x^2 - 10x + 16 = (x - 2)(x - 8)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

15) $x^2 + 13x + 40 = (x + 8)(x + 5)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

16) $x^2 - 18x + 80 = (x - 10)(x - 8)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

17) $x^2 + 14x + 48 = (x + 8)(x + 5)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

18) $x^2 - x - 90 = (x - 10)(x + 9)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

19) $x^2 - 11x + 28 = (x - 7)(x - 4)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

20) $x^2 - 2x - 99 = (x + 9)(x - 11)$

Sum of coeffs (expr) = _____ Product of factor-sums = _____
Factors correct? Yes / No

Factorization Worksheet-3 — Multi-variable (Homogeneous) Quadratics

Sutras: Adyamadyena Antyamantyena ("first by first") + Lopana-Sthapana ("by alternate elimination and retention").

Factorise each homogeneous expression in x, y, z. (Set one variable to 0, factorise, then combine the common terms.)

Name: _____

Date: _____

Score: _____ / 20

1) $x^2 - 4xy + 5xz + 3y^2 - 9yz + 6z^2$

Answer: _____

2) $x^2 - 3xy + xz + 2y^2 - 2yz$

Answer: _____

3) $3x^2 - 6xy - 2xz + 3y^2 + 2yz$

Answer: _____

4) $2x^2 + 7xy - 3xz + 3y^2 + 6yz - 9z^2$

Answer: _____

5) $x^2 + 4xy + 3y^2 + 6yz - 9z^2$

Answer: _____

6) $3x^2 + 3xy - xz - 6y^2 - 2yz$

Answer: _____

7) $2x^2 + 9xy + 5xz + 9y^2 + 12yz + 3z^2$

Answer: _____

Factorization Worksheet-3 — Multi-variable (Homogeneous) Quadratics

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Factorise each homogeneous expression in x, y, z. (Set one variable to 0, factorise, then combine the common terms.)

Name: _____

Date: _____

Score: _____ / 20

8) $x^2 + 4xy - xz + 3y^2 - 3yz$

Answer: _____

9) $2x^2 - 7xy - 3xz + 6y^2 + 4yz - 2z^2$

Answer: _____

10) $2x^2 - xy + 3xz - yz + z^2$

Answer: _____

11) $2x^2 - xy - 3xz - 6y^2 - 8yz - 2z^2$

Answer: _____

12) $x^2 - 2xz - 4y^2 + 8yz - 3z^2$

Answer: _____

13) $2x^2 - 3xy + 8xz - 2y^2 - yz + 6z^2$

Answer: _____

14) $6x^2 - 2xy + 5xz - 4y^2 + z^2$

Answer: _____

Factorization Worksheet-3 — Multi-variable (Homogeneous) Quadratics

Sutras: Adyamadyena Antyamantyena ("first by first") + Lopana-Sthapana ("by alternate elimination and retention").

Factorise each homogeneous expression in x, y, z. (Set one variable to 0, factorise, then combine the common terms.)

Name: _____

Date: _____

Score: _____ / 20

15) $x^2 - 3xy + 2y^2 - yz - z^2$

Answer: _____

16) $2x^2 + 9xy - 4xz + 9y^2 - 9yz + 2z^2$

Answer: _____

17) $x^2 + xy + 2xz - 6y^2 + yz + z^2$

Answer: _____

18) $x^2 + 2xy + xz - 3y^2 + 3yz$

Answer: _____

19) $x^2 + 5xy + 6y^2 - yz - z^2$

Answer: _____

20) $3x^2 - 6xy + 2xz + 2yz - z^2$

Answer: _____

Worksheet-1 — Quadratic Expressions

- | | |
|------------------------|------------------------|
| 1) $(x - 7)(x - 8)$ | 2) $(x + 1)(x + 1)$ |
| 3) $(x + 12)(x + 11)$ | 4) $(x + 8)(x + 4)$ |
| 5) $(x + 3)(x + 7)$ | 6) $(x - 1)(x + 4)$ |
| 7) $(x + 9)(x + 7)$ | 8) $(3x - 4)(x + 2)$ |
| 9) $(2x + 4)(x - 2)$ | 10) $(2x + 2)(x - 6)$ |
| 11) $(x - 5)(x + 5)$ | 12) $(x + 6)(x + 10)$ |
| 13) $(x - 10)(x - 12)$ | 14) $(x - 10)(x + 1)$ |
| 15) $(x + 1)(x + 11)$ | 16) $(x - 6)(x - 9)$ |
| 17) $(2x + 4)(x + 5)$ | 18) $(x + 11)(x + 4)$ |
| 19) $(x - 1)(x - 4)$ | 20) $(2x - 3)(2x - 3)$ |

Worksheet-2 — Verifying Factors (Gunita Samuccaya)

- | | |
|---------------------------|----------------------------|
| 1) Correct: $-42 = -42$ | 2) Wrong: $70 \neq 50$ |
| 3) Wrong: $-21 \neq -35$ | 4) Correct: $-12 = -12$ |
| 5) Correct: $0 = 0$ | 6) Wrong: $72 \neq 84$ |
| 7) Wrong: $-20 \neq -15$ | 8) Correct: $20 = 20$ |
| 9) Correct: $44 = 44$ | 10) Wrong: $30 \neq 36$ |
| 11) Correct: $-55 = -55$ | 12) Correct: $-48 = -48$ |
| 13) Wrong: $-20 \neq -18$ | 14) Correct: $7 = 7$ |
| 15) Correct: $54 = 54$ | 16) Correct: $63 = 63$ |
| 17) Wrong: $63 \neq 54$ | 18) Correct: $-90 = -90$ |
| 19) Correct: $18 = 18$ | 20) Correct: $-100 = -100$ |

Worksheet-3 — Multi-variable Quadratics

- | | |
|----------------------------------|----------------------------------|
| 1) $(x - 3y + 3z)(x - y + 2z)$ | 2) $(x - 2y)(x - y + z)$ |
| 3) $(x - y)(3x - 3y - 2z)$ | 4) $(x + 3y - 3z)(2x + y + 3z)$ |
| 5) $(x + y + 3z)(x + 3y - 3z)$ | 6) $(x + 2y)(3x - 3y - z)$ |
| 7) $(2x + 3y + 3z)(x + 3y + z)$ | 8) $(x + 3y)(x + y - z)$ |
| 9) $(x - 2y - 2z)(2x - 3y + z)$ | 10) $(x + z)(2x - y + z)$ |
| 11) $(2x + 3y + z)(x - 2y - 2z)$ | 12) $(x + 2y - 3z)(x - 2y + z)$ |
| 13) $(2x + y + 2z)(x - 2y + 3z)$ | 14) $(2x - 2y + z)(3x + 2y + z)$ |
| 15) $(x - y + z)(x - 2y - z)$ | 16) $(2x + 3y - 2z)(x + 3y - z)$ |
| 17) $(x + 3y + z)(x - 2y + z)$ | 18) $(x + 3y)(x - y + z)$ |
| 19) $(x + 2y - z)(x + 3y + z)$ | 20) $(x - 2y + z)(3x - z)$ |