EXPRESSWALA ACADEMY

Factorization

Question Paper, Set 10

Time: 1 hour 30 minutes | Maximum marks: 50

Name: _____ Class: _____ Date: _____

1. Answer all 20 questions. The marks for each question are shown in brackets.
2. Show your working for the 2, 3 and 5 mark questions.
3. The key sheet and worked solutions are at the end of this paper.

1. Factorize $64 - 121p^2$. [1 mark]

2. Factorize $25t^2 + 60t + 36$. [1 mark]

3. Factorize $9y^2 - 12y + 4$. [1 mark]

4. Factorize $4x^2 + 12xy + 9y^2 - 4$. [3 marks]

5. To factorize $9t^2 + 15t + 4$ by splitting the middle term, we need two numbers whose product is 9×4 and whose sum is 15. Find them. [1 mark]

6. Factorize $5y^2 - 31y + 6$. [2 marks]

7. Factorize $5m^2 + 39m - 8$. [2 marks]

8. Factorize $19t^2 - 47t - 30$. [3 marks]

9. Factorize $9x - x^2 - 20$. [2 marks]

10. To factorize $4p^2 - 8pq - 5q^2$ by splitting the middle term, we need two numbers whose product is $4 \times (-5)$ and whose sum is -8. Find them. [1 mark]

11. Factorize $9\sqrt{5}y^2 - 15y - 10\sqrt{5}$. [5 marks]

12. Factorize $2x^2 + \frac{31}{21}x + \frac{2}{21}$. [5 marks]

13. Factorize $9x^2 + 16y^2 + 9z^2 - 24xy - 24yz + 18zx$. [2 marks]

14. Factorize $x^3 + 9x(x + 3) + 27$. [3 marks]

15. Factorize $64m^6 - 125n^3$. [2 marks]

16. Factorize $125 + 8a^3$. [2 marks]

17. Factorize $x^3 - 73x - 72$. [5 marks]

18. Factorize $81x^4 + 9x^2 + 1$. [3 marks]

19. Factorize $(4m - 3n)^3 + (3n - 1)^3 + (1 - 4m)^3$. [1 mark]

20. Factorize $256p^9 - pq^8$. [5 marks]

Key sheet

Q	Answer
1	$(8+11p)(8-11p)$
2	$(5t+6)^2$
3	$(3y-2)^2$
4	$(2x+3y+2)(2x+3y-2)$
5	3 and 12
6	$(5y-1)(y-6)$
7	$(5m-1)(m+8)$
8	$(19t+10)(t-3)$
9	$(x-4)(5-x)$
10	2 and -10
11	$(3\sqrt{5}y+5)(3y-2\sqrt{5})$
12	$\frac{1}{21}(14x+1)(3x+2)$, i.e. $\left(x+\frac{2}{3}\right)\left(2x+\frac{1}{7}\right)$
13	$(3x-4y+3z)^2$
14	$(x+3)^3$
15	$(4m^2-5n)(16m^4+20m^2n+25n^2)$
16	$(2a+5)(4a^2-10a+25)$
17	$(x+1)(x+8)(x-9)$
18	$(9x^2+3x+1)(9x^2-3x+1)$
19	$3(4m-3n)(3n-1)(1-4m)$
20	$p(16p^4+q^4)(4p^2+q^2)(2p+q)(2p-q)$

Solutions

1. Factorize $64 - 121p^2$. [1]

$64 - 121p^2 = 8^2 - (11p)^2$

$= (8 + 11p)(8 - 11p)$

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

Ans: $(8 + 11p)(8 - 11p)$

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2. Factorize $25t^2 + 60t + 36$. [1]

$25t^2 + 60t + 36 = (5t)^2 + 6^2 + 2(5t)(6)$

$= (5t + 6)^2$

$= (5t + 6)(5t + 6)$

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

Ans: $(5t + 6)^2$

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3. Factorize $9y^2 - 12y + 4$. [1]

$9y^2 - 12y + 4 = (3y)^2 + 2^2 - 2(3y)(2)$

$= (3y - 2)^2$

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

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

Ans: $(3y - 2)^2$

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4. Factorize $4x^2 + 12xy + 9y^2 - 4$. [3]

$4x^2 + 12xy + 9y^2 - 4 = (2x + 3y)^2 - 2^2$

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

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

Ans: $(2x + 3y + 2)(2x + 3y - 2)$

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5. To factorize $9t^2 + 15t + 4$ by splitting the middle term, we need two numbers whose product is 9×4 and whose sum is 15. Find them. [1]

$9 \times 4 = 36$

$3 \times 12 = 36$ and $3 + 12 = 15$

So the numbers are 3 and 12.

Ans: 3 and 12

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6. Factorize $5y^2 - 31y + 6$. [2]

$5 \times 6 = 30$: $(-1) \times (-30) = 30$ and $-1 - 30 = -31$

$= 5y^2 - y - 30y + 6$

$= y(5y - 1) - 6(5y - 1)$

$= (5y - 1)(y - 6)$

Ans: $(5y - 1)(y - 6)$

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7. Factorize $5m^2 + 39m - 8$. [2]

$5 \times (-8) = -40$: $(-1) \times 40 = -40$ and $-1 + 40 = 39$

$= 5m^2 - m + 40m - 8$

$= m(5m - 1) + 8(5m - 1)$

$= (5m - 1)(m + 8)$

Ans: $(5m - 1)(m + 8)$

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8. Factorize $19t^2 - 47t - 30$. [3]

$19 \times (-30) = -570$

$570 = 2 \times 3 \times 5 \times 19 = 10 \times 57$, and $10 - 57 = -47$

$= 19t^2 + 10t - 57t - 30$

$= t(19t + 10) - 3(19t + 10)$

$= (19t + 10)(t - 3)$

Ans: $(19t + 10)(t - 3)$

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9. Factorize $9x - x^2 - 20$. [2]

Writing the terms in order: $-x^2 + 9x - 20$

$(-1) \times (-20) = 20$: $4 \times 5 = 20$ and $4 + 5 = 9$

$= -x^2 + 4x + 5x - 20$

$= -x(x - 4) + 5(x - 4)$

$= (x - 4)(5 - x)$

Ans: $(x - 4)(5 - x)$

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10. To factorize $4p^2 - 8pq - 5q^2$ by splitting the middle term, we need two numbers whose product is $4 \times (-5)$ and whose sum is -8. Find them. [1]

$4 \times (-5) = -20$

$2 \times (-10) = -20$ and $2 - 10 = -8$

So the numbers are 2 and -10.

Ans: 2 **and** -10

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11. Factorize $9\sqrt{5}y^2 - 15y - 10\sqrt{5}$. [5]

$9\sqrt{5} \times (-10\sqrt{5}) = 9 \times (-10) \times 5 = -450$: $15 \times (-30) = -450$ and $15 - 30 = -15$

$= 9\sqrt{5}y^2 + 15y - 30y - 10\sqrt{5}$

$= 3y(3\sqrt{5}y + 5) - 2\sqrt{5}(3\sqrt{5}y + 5)$

$= (3\sqrt{5}y + 5)(3y - 2\sqrt{5})$

Ans: $(3\sqrt{5}y + 5)(3y - 2\sqrt{5})$

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12. Factorize $2x^2 + \frac{31}{21}x + \frac{2}{21}$. [5]

$2x^2 + \frac{31}{21}x + \frac{2}{21} = \frac{42x^2+31x+2}{21}$

$= \frac{1}{21}(42x^2 + 31x + 2)$

$42 \times 2 = 84$: $3 \times 28 = 84$ and $3 + 28 = 31$

$= \frac{1}{21}[42x^2 + 3x + 28x + 2]$

$= \frac{1}{21}[3x(14x + 1) + 2(14x + 1)]$

$= \frac{1}{21}(14x + 1)(3x + 2)$

$= \left(x + \frac{2}{3}\right)\left(2x + \frac{1}{7}\right)$

Ans: $\frac{1}{21}(14x + 1)(3x + 2)$, **i.e.** $\left(x + \frac{2}{3}\right)\left(2x + \frac{1}{7}\right)$

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13. Factorize $9x^2 + 16y^2 + 9z^2 - 24xy - 24yz + 18zx$. [2]

$9x^2 + 16y^2 + 9z^2 - 24xy - 24yz + 18zx = (3x)^2 + (4y)^2 + (3z)^2 - 2(3x)(4y) - 2(4y)(3z) + 2(3z)(3x)$

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

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

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

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14. Factorize $x^3 + 9x(x + 3) + 27$. [3]

$x^3 + 9x(x + 3) + 27 = x^3 + 9x^2 + 27x + 27$

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

$= (x + 3)^3$

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

Ans: $(x + 3)^3$

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15. Factorize $64m^6 - 125n^3$. [2]

$64m^6 - 125n^3 = (4m^2)^3 - (5n)^3$

$= (4m^2 - 5n)[(4m^2)^2 + (4m^2)(5n) + (5n)^2]$

$= (4m^2 - 5n)(16m^4 + 20m^2n + 25n^2)$

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

Ans: $(4m^2 - 5n)(16m^4 + 20m^2n + 25n^2)$

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16. Factorize $125 + 8a^3$. [2]

$125 + 8a^3 = 5^3 + (2a)^3$

$= (5 + 2a)[5^2 - (5)(2a) + (2a)^2]$

$= (2a + 5)(4a^2 - 10a + 25)$

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

Ans: $(2a + 5)(4a^2 - 10a + 25)$

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17. Factorize $x^3 - 73x - 72$. [5]

$x^3 - 73x - 72 = x^3 - x - 72x - 72$

$= x(x^2 - 1) - 72(x + 1)$

$= x(x + 1)(x - 1) - 72(x + 1)$

$= (x + 1)[x(x - 1) - 72]$

$= (x + 1)(x^2 - x - 72)$

Now $x^2 - x - 72$: $8 \times (-9) = -72$ and $8 - 9 = -1$

$x^2 - x - 72 = x^2 + 8x - 9x - 72$

$= x(x + 8) - 9(x + 8)$

$= (x + 8)(x - 9)$

So $x^3 - 73x - 72 = (x + 1)(x + 8)(x - 9)$

Ans: $(x + 1)(x + 8)(x - 9)$

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18. Factorize $81x^4 + 9x^2 + 1$. [3]

$81x^4 + 9x^2 + 1 = (9x^2)^2 + 2(9x^2)(1) + 1^2 - 9x^2$

$= (9x^2 + 1)^2 - (3x)^2$

$= (9x^2 + 1 + 3x)(9x^2 + 1 - 3x)$

$= (9x^2 + 3x + 1)(9x^2 - 3x + 1)$

Ans: $(9x^2 + 3x + 1)(9x^2 - 3x + 1)$

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19. Factorize $(4m - 3n)^3 + (3n - 1)^3 + (1 - 4m)^3$. [1]

Here $(4m - 3n) + (3n - 1) + (1 - 4m) = 0$

If $a + b + c = 0$, then $a^3 + b^3 + c^3 = 3abc$

$\therefore (4m - 3n)^3 + (3n - 1)^3 + (1 - 4m)^3 = 3(4m - 3n)(3n - 1)(1 - 4m)$

Ans: $3(4m - 3n)(3n - 1)(1 - 4m)$

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20. Factorize $256p^9 - pq^8$. [5]

$256p^9 - pq^8 = p(256p^8 - q^8)$

$= p[(16p^4)^2 - (q^4)^2]$

$= p(16p^4 + q^4)(16p^4 - q^4)$

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

$= p(16p^4 + q^4)(4p^2 + q^2)(4p^2 - q^2)$

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

$= p(16p^4 + q^4)(4p^2 + q^2)(2p + q)(2p - q)$

Ans: $p(16p^4 + q^4)(4p^2 + q^2)(2p + q)(2p - q)$