Exercise 7.6

Factorize each of the following algebraic expressions.

1. $4x^2 + 12xy + 9y^2 = (2x)^2 + 2 \times 2x \times 3y + (3y)^2$

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

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

2. $9a^2 - 24ab + 16b^2 = (3a)^2 - 2 \times 3a \times 4b + (4b)^2$

$= (3a-4b)^2$

$= (3a-4b)(3a-4b)$

3. $p^2q^2 - 6pqr + 9r^2 = (pq)^2 - 2 \times pq \times 3r + (3r)^2$

$= (pq-3r)^2 = (pq-3r)(pq-3r)$

4. $36a^2 + 36a + 9 = (6a)^2 + 2 \times 6a \times 3 + (3)^2$

$= (6a+3)^2$

$= \{3(2a+1)\}^2 = 9(2a+1)(2a+1)$

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(5) $a^2 + 2ab + b^2 - 16$

$= \{a^2 + 2 \times a \times b + (b)^2\} - (4)^2$

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

$= (a+b+4)(a+b-4)$

(6) $9x^2 - x^2 + 4xy - 4y^2$

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

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

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

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

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

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

(7) $9a^4 - 24a^2b^2 + 16b^4 - 256$

$= \{(3a^2)^2 - 2 \times 3a^2 \times 4b^2 + (4b^2)^2\} - (16)^2$

$= (3a^2 - 4b^2)^2 - (16)^2$

$= (3a^2 - 4b^2 + 16)(3a^2 - 4b^2 - 16)$

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(8) $16 - a^6 + 4a^3b^3 - 4b^6$

$= 16 - [a^6 - 4a^3b^3 + 4b^6]$

$= 16 - [(a^3)^2 - 2 \times a^3 \times 2b^3 + (2b^3)^2]$

$= 16 - (a^3 - 2b^3)^2$

$= (4)^2 - (a^3 - 2b^3)^2$

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

(9) $(a^2 - 2ab + b^2) - (c^2)$

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

$= (a-b+c)(a-b-c)$

(10) $x^2 + 2x + 1 - 9y^2$

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

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

$= (x+1+3y)(x+1-3y)$

(11) $a^2 + 4ab + 3b^2$ Adding and subtracting b^2

$= a^2 + 4ab + 3b^2 + b^2 - b^2$

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

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

$= (a+2b)^2 - (b)^2 = \{a+2b+b\}\{a+2b-b\}$

$= (a+3b)(a+b)$

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(12) $96-4x-x^2$

$= -(x^2+4x-96)$

$= -\{x^2+12x-8x-96\}$

$= -\{x(x+12)-8(x+12)\}$

$= -(x+12)(x-8)$

13 a^4+3a^2+4

$= a^4+4a^2-a^2+4$

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

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

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

(14) $4x^4+1$

Adding and Subtracting $4x^2$

$\Rightarrow \{4x^4+4x^2+1\}-4x^2$

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

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

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

(15) $4x^4+y^4$

Adding and Subtracting $4x^2y^2$

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

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$\Rightarrow \{4x^4 + 4x^2y^2 + y^4\} - 4x^2y^2$

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

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

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

(16) $(x+2)^2 - 6(x+2) + 9$

Let $x+2 = y$

$\Rightarrow y^2 - 6y + 9$

$= (y)^2 - 2xyx3 + (3)^2$

$= (y-3)^2$

putting $y = x+2$

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

(17) $25 - p^2 - q^2 - 2pq$

$= 25 - (p^2+q^2+2pq)$

$= (5)^2 - (p+q)^2$

$= (5+p+q)(5-p-q)$

(18) $x^2 + 9y^2 - 6xy - 25q^2$

$= \{(x)^2 + (3y)^2 - 2xxx3y\} - (5q)^2$

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

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(19) $49 - a^2 + 8ab - 16b^2$

$\Rightarrow (7)^2 - \{a^2 - 8ab + 16b^2\}$

$= (7)^2 - \{(a)^2 - 2 \times a \times 4b + (4b)^2\}$

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

$= \{7 + a - 4b\}\{7 - (a - 4b)\}$

$= (7 + a - 4b)(7 - a + 4b)$

(20) $a^2 - 8ab + 16b^2 - 25c^2$

$= \{(a)^2 - 2 \times a \times 4b + (4b)^2\} - (5c)^2$

$= (a - 4b)^2 - (5c)^2$

$= (a - 4b + 5c)(a - 4b - 5c)$

(21) $x^2 - y^2 + 6y - 9$

$= x^2 - (y^2 - 6y + 9)$

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

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

$= \{x + y - 3\}\{x - (y - 3)\}$

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

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(22) $25x^2 - 10x + 1 - 36y^2$

$= (25x^2 - 10x + 1) - (36y^2)$

$= \{(5x)^2 - 2 \times 5x \times 1 + (1)^2\} - (6y)^2$

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

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

(23) $a^2 - b^2 + 2bc - c^2$

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

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

$= (a+b-c)\{a-(b-c)\}$

$= (a+b-c)(a-b+c)$

(24) $a^2 + 2ab + b^2 - c^2$

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

$= (a+b+c)(a+b-c)$

(25) $49 - x^2 - y^2 + 2xy$

$= 49 - (x^2 + y^2 - 2xy)$

$= (7)^2 - (x-y)^2$

$= (7+x-y)(7-x+y)$

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(26) $a^2 + 4b^2 - 4ab - 4c^2$

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

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

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

(27) $x^2 - y^2 - 4xz + 4z^2$

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

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

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

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

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