# Factorising (Common Factor)

There are three methods you need to be able to use to factorise expressions at National 5:

1. Take a common factor outside of the brackets (the National 4 method)
2. Difference of two squares
3. Trinomials

You should always check your answer by multiplying out the brackets.

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Example

**Factorise: (a)** $m^2 + 7m$ **(b)** $2x^2 + 4xy$

**Solution**

In (a), the common factor is $m$. The answer is $m(m+7)$

In (b), $x$ is a common factor. However so is 2. Therefore we need to take $2x$ out of the bracket as a common factor. The answer is $2x(x+2y)$.

**Note:** the answers $2(x^2 + 2xy)$ and $x(2x+4y)$ are both technically 'correct', but would only get half marks as they have not been *fully* factorised: you must take *every* possible common factor outside of the bracket.

***Exercise 1***

**1.** Factorise by first finding a common factor:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **a)** | $2x + 2y$ | **(b)** | $3c + 3d$ | **(c)** | $6s + 6t$ | **(d)** | $12x + 12y$ |
| **e)** | $9a + 9b$ | **(f)** | $8b + 8c$ | **(g)** | $5p + 5q$ | **(h)** | $7g + 7h$ |
| **i)** | $4m + 4n$ | **(j)** | $9e + 9f$ | **(k)** | $13j + 13k$ | **(l)** | $14v + 14w$ |

**2**. Factorise by finding the common factor:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **a)** | $2x + 4$ | **(b)** | $3d + 9$ | **(c)** | $6s + 3$ | **(d)** | $12x + 4$ |
| **e)** | $6 + 9a$ | **(f)** | $2b + 8$ | **(g)** | $5y + 10$ | **(h)** | $10 + 15c$ |
| **i)** | $12x + 16$ | **(j)** | $18m + 24$ | **(k)** | $30 + 36a$ | **(i)** | $14y + 21$ |

**3**. Factorise by finding the common factor:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **a)** | $3x - 6$ | **(b)** | $4y - 8$ | **(c)** | $16 - 8a$ | **(d)** | $10c - 15$ |
| **e)** | $9s - 12$ | **(f)** | $2b - 14$ | **(g)** | $12x - 20$ | **(h)** | $22m - 33$ |
| **i)** | $15x - 10$ | **(j)** | $18 - 12y$ | **(k)** | $25b - 20$ | **(l)** | $18d - 30$ |

**4**. Factorise by finding the common factor:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **a)** | $2a + 4b$ | **(b)** | $10x - 12y$ | **(c)** | $18m + 24n$ | **(d)** | $10c + 15d$ |
| **e)** | $6a - 9x$ | **(f)** | $18s - 12t$ | **(g)** | $12x + 15y$ | **(h)** | $14a - 7b$ |
| **i)** | $25c + 10d$ | **(j)** | $9b - 15y$ | **(k)** | $18x + 24y$ | **(i)** | $6a + 28b$ |

**5**. Factorise by finding the common factor

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $ax + ay$ | **(b)** | $xy^2 + xa^2$ | **(c)** | $pqr + pst$ |
| **d)** | $xay - bac$ | **(e)** | $pq + p$ | **(f)** | $y^2 + y$ |
| **g)** | $a^2 - ab$ | **(h)** | $ab - bc$ | **(i)** | $n^2 - 3n$ |
| **j)** | $xy + y^2$ | **(k)** | $abc - abd$ | **(l)** | $fgh - efg$ |

**6**. Factorise by finding the highest common factor:

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $2ax + 6a$ | **(b)** | $3y + 9y^2$ | **(c)** | $24a - 16ab$ |
| **d)** | $pq^2 - pq$ | **(e)** | $12xy - 9xz$ | **(f)** | $6b^2 - 4b$ |
| **g)** | $3a^2 + 27ah$ | **(h)** | $15abc + 20abd$ | **(i)** | $3s^3 - 9s^2$ |
| **j)** | $14x - 12xyz$ | **(k)** | $10b^2c - 15bcd$ | **(l)** | $2\pi r^2 + 2\pi rh$ |

**7.** Factorise by finding the highest common factor:

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $ap + aq - ar$ | **(b)** | $2a + 2b + 2c$ | **(c)** | $6e - 2f + 4g$ |
| **d)** | $p^2 + pq + xp$ | **(e)** | $3ab - 6bc - 9bd$ | **(f)** | $\frac{1}{2} ah + \frac{1}{2} bh + \frac{1}{2} ch$ |
| **g)** | $5x^2 - 8xy + 5x$ | **(h)** | $4ac + 6ad - 10a^2$ | **(i)** | $15p^2 + 10pq + 20ps$ |

## Difference of two Squares

This method is really basic, but is easily forgotten if you don't practice it regularly. It is called **Difference of Two Squares**. You can spot it because:

- There are only **two** terms
- They are being taken away (a **difference**)
- Both terms are **squares** (letters ($x^2$, $a^2$, ...), square numbers (25, 81,...) or both)

The method:
Step 1 – write down two brackets
Step 2 – put a + sign in one bracket and a – sign in the other. (it does not matter which way around they go).
Step 3 – identify what goes at the start and end of each bracket.

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Example 1

**Factorise $a^2 - b^2$**

**Solution**

Step 1 – write a pair of brackets ( ) ( )
Step 2 – write '+' in one bracket and '–' in the other ( + ) ( – )
*(it does not matter which order they go in)*

Step 3 – what do we square to make $a^2$? Write this at the beginning of both brackets.
( $a$ + ) ( $a$ – )

Step 4 – what do we square to make $b^2$? Write this at the end of both brackets.
( $a$ + $b$ ) ( $a$ – $b$ )

**Final answer:** $(a + b)(a - b)$

Example 2

**Factorise $4x^2 - 25$**

**Solution**

Step 1 – write a pair of brackets ( ) ( )

Step 2 – write '+' in one bracket and '–' in the other ( + ) ( – )

*(it does not matter which order they go in)*

Step 3 – what do we square to make $4x^2$? Write this at the beginning of both brackets.

( $2x$ + ) ( $2x$ – )

Step 4 – what do we square to make 25? Write this at the end of both brackets.

( $2x$ + 5 ) ( $2x$ – 5 )

**Final answer:** $(2x+5)(2x-5)$

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Example 3 – where we must take out a common factor first

**Factorise $2x^2 - 32$**

**Solution**

2 and 32 are not square numbers, so we cannot use this method (yet). However we can take out a common factor of 2, to give $2(x^2 - 16)$. We can use the difference of two squares method on $x^2 - 16$, so we can complete the factorising.

**Final answer:** $2(x+4)(x-4)$

***Exercise 2***

**1.** Factorise the following expressions, which c

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **a)** | $a^2 - b^2$ | **(b)** | $x^2 - y^2$ | **(c)** | $p^2 - q^2$ | **(d)** | $s^2 - t^2$ |
| **e)** | $a^2 - 3^2$ | **(f)** | $x^2 - 2^2$ | **(g)** | $p^2 - 9^2$ | **(h)** | $c^2 - 5^2$ |
| **i)** | $b^2 - 1$ | **(j)** | $y^2 - 16$ | **(k)** | $m^2 - 25$ | **(l)** | $a^2 - 9$ |
| **m)** | $36 - d^2$ | **(n)** | $4 - q^2$ | **(o)** | $49 - w^2$ | **(p)** | $x^2 - 64$ |

**2.** Factorise the following expressions, which contain a difference of squares:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **a)** | $a^2 - 4b^2$ | **(b)** | $x^2 - 25y^2$ | **(c)** | $p^2 - 64q^2$ | **(d)** | $16c^2 - d^2$ |
| **e)** | $81 - 4g^2$ | **(f)** | $36w^2 - y^2$ | **(g)** | $4a^2 - 1$ | **(h)** | $g^2 - 81h^2$ |
| **i)** | $49x^2 - y^2$ | **(j)** | $9c^2 - 16d^2$ | **(k)** | $4p^2 - 9q^2$ | **(l)** | $b^2 - 100c^2$ |
| **m)** | $25 - 16a^2$ | **(n)** | $4d^2 - 121$ | **(o)** | $225 - 49k^2$ | **(p)** | $9x^2 - 0{\cdot}25$ |

**3.** Factorise the following expressions containg a common factor & a difference of two squares:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **a)** | $2a^2 - 2b^2$ | **(b)** | $5p^2 - 5$ | **(c)** | $45 - 5x^2$ | **(d)** | $4d^2 - 36$ |
| **e)** | $2y^2 - 50$ | **(f)** | $4b^2 - 100$ | **(g)** | $3q^2 - 27$ | **(h)** | $8a^2 - 32b^2$ |
| **i)** | $ab^2 - 64a$ | **(j)** | $xy^2 - 25x$ | **(k)** | $abc^2 - ab$ | **(l)** | $8p^2 - 50q^2$ |
| **m)** | $2x^2 - 2{\cdot}88$ | **(n)** | $ak^2 - 121a$ | **(o)** | $10s^2 - 2{\cdot}5$ | **(p)** | $\frac{1}{2}y^2 - 450$ |

## Factorising Trinomials: Basic Method

A **trinomial** is one that contains a squared letter. Examples include $x^2 + 4x + 3$, $b^2 - 4b - 5$ or $3p^2 + 7p - 6$. These factorise into **two brackets**.

**Method when there is no number in front of $x^2$:**
To factorise $x^2 + bx + c$, we need one number to go in each bracket. The two numbers that we need will:

- Multiply to make $c$
- Add to make $b$

**Always double check your answer by multiplying the brackets back out.**

Example 1

**Factorise $x^2 - x - 12$**

**Solution**

We need two numbers that multiply to give –12 and add to give –1.

Step 1 – To make $x^2$, we need $x \times x$, so write $x$ and $x$ at the start of each bracket.

$(x \quad )(x \quad )$

Step 2 – make a list of all possible pairs of numbers that multiply to give –12:

| | |
|---|---|
| –12 and +1, | –1 and +12, |
| –6 and +2, | –2 and +6, |
| –3 and +4 | –4 and +3. |

Step 3 – look for a pair of numbers that add to make –1.
Out of the six possibilities, we find that –4 and +3 work.

Step 4 – put these numbers into the two brackets and double check they work.
**Final answer:** $(x - 4)(x + 3)$

Multiplying these double brackets back out does give the answer $x^2 - x - 12$, which tells us that our answer is correct

***Exercise 3***

**1**. Factorise the following quadratic expressions:

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $x^2 + 3x + 2$ | **(b)** | $a^2 + 2a + 1$ | **(c)** | $y^2 + 5y + 4$ |
| **d)** | $x^2 + 8x + 7$ | **(e)** | $x^2 + 6x + 9$ | **(f)** | $b^2 + 8b + 12$ |
| **g)** | $a^2 + 9a + 14$ | **(h)** | $w^2 + 10w + 9$ | **(i)** | $d^2 + 7d + 10$ |
| **j)** | $x^2 + 10x + 21$ | **(k)** | $p^2 + 9p + 20$ | **(l)** | $c^2 + 10c + 24$ |
| **m)** | $s^2 + 12s + 36$ | **(n)** | $x^2 + 11x + 28$ | **(o)** | $y^2 + 10y + 25$ |

**2**. Factorise the following quadratic expressions:

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $a^2 - 8a + 15$ | **(b)** | $x^2 - 9x + 8$ | **(c)** | $c^2 - 9c + 18$ |
| **d)** | $y^2 - 4y + 4$ | **(e)** | $b^2 - 6b + 5$ | **(f)** | $x^2 - 15x + 14$ |
| **g)** | $c^2 - 10c + 16$ | **(h)** | $x^2 - 7x + 6$ | **(i)** | $y^2 - 12n + 32$ |
| **j)** | $p^2 - 11p + 24$ | **(k)** | $a^2 - 13a + 36$ | **(l)** | $x^2 - 15x + 36$ |
| **m)** | $b^2 - 4b + 3$ | **(n)** | $q^2 - 11q + 10$ | **(o)** | $a^2 - 7y + 12$ |

**3**. Factorise the following quadratic expressions:

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $b^2 + 3b - 10$ | **(b)** | $x^2 + 6x - 7$ | **(c)** | $y^2 - y - 6$ |
| **d)** | $a^2 - a - 20$ | **(e)** | $q^2 + 2q - 8$ | **(f)** | $x^2 - 8x - 20$ |
| **g)** | $d^2 + 4d - 21$ | **(h)** | $c^2 + 9c - 36$ | **(i)** | $p^2 - 5p - 24$ |
| **j)** | $y^2 - 7y - 8$ | **(k)** | $a^2 + 5a - 6$ | **(l)** | $x^2 - 5x - 36$ |
| **m)** | $b^2 - 4b - 5$ | **(n)** | $s^2 + 2s - 24$ | **(o)** | $d^2 + 6d - 16$ |

**Key fact:**
To factorise $ax^2 + bx + c$ (when there is a number in front of the $x^2$), we need one number to go in each bracket. The two numbers that we need:

- WILL multiply to make $c$ but they WILL NOT add to make $b$

**The key to this method is to experiment and check**

Example 2 – where there is a number before $x^2$

**Factorise $3x^2 + 11x + 6$**

**Solution**

Step 1 – make a list of all possible pairs of numbers – **order matters**.

The two numbers in the bracket will multiply to give +6. So possibilities are:

+6 and +1, +1 and +6,
+2 and +3 +3 and +2.

*(technically we should also consider –6 and –1; –3 and –2 etc. As these also multiply to give +6. However in this question we can ignore negative numbers as there are no negative signs)*

Step 2 – To make $3x^2$, we need $3x \times x$, so write $3x$ and $x$ at the start of each bracket.

$(3x \quad )(x \quad )$

Step 3 – experiment – try different pairs of numbers in the bracket. Multiply the brackets out to see if you can get $3x^2 + 11x + 6$.

e.g. first you might try $(3x + 6)(x + 1)$. But this multiplies out to give $3x^2 + 9x + 6$, so this is NOT the answer.

e.g. now you might try switching the '6' and '1' about to get $(3x + 1)(x + 6)$. But this multiplies out to give $3x^2 + 19x + 6$, so this is NOT the answer.

e.g. next you might try $(3x + 2)(x + 3)$. This multiplies out to give $3x^2 + 11x + 6$, which is want we want, so this is the answer.

**Final Answer:** $(3x + 2)(x + 3)$

***Exercise 4***

**1.** Factorise the following quadratic expressions:

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $3x^2 + 7x + 2$ | **(b)** | $2a^2 + 5a + 2$ | **(c)** | $3c^2 + 8c + 5$ |
| **d)** | $2p^2 + 11p + 9$ | **(e)** | $2y^2 + 11y + 5$ | **(f)** | $3d^2 + 11d + 6$ |
| **g)** | $5q^2 + 9q + 4$ | **(h)** | $4b^2 + 8b + 3$ | **(i)** | $6x^2 + 13x + 6$ |
| **j)** | $3a^2 + 14a + 15$ | **(k)** | $10x^2 + 17x + 3$ | **(l)** | $9c^2 + 6c + 1$ |
| **m)** | $6y^2 + 11y + 3$ | **(n)** | $3b^2 + 5b + 2$ | **(o)** | $8x^2 + 14x + 3$ |

**2.** Factorise the following quadratic expressions:

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $2x^2 - 7x + 3$ | **(b)** | $2a^2 - 5a + 3$ | **(c)** | $5p^2 - 17p + 6$ |
| **d)** | $5b^2 - 7b + 2$ | **(e)** | $6x^2 - 7x + 2$ | **(f)** | $4y^2 - 11y + 6$ |
| **g)** | $7c^2 - 29c + 4$ | **(h)** | $4m^2 - 9m + 2$ | **(i)** | $16a^2 - 10a + 1$ |
| **j)** | $8y^2 - 22y + 5$ | **(k)** | $3p^2 - 37p + 12$ | **(l)** | $4x^2 - 25x + 6$ |
| **m)** | $15a^2 - 16a + 4$ | **(n)** | $24c^2 - 22c + 3$ | **(o)** | $6b^2 - 35b + 36$ |

**3**. Factorise the following quadratic expressions:

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $3x^2 - 2x - 1$ | **(b)** | $2a^2 - a - 3$ | **(c)** | $4p^2 - p - 3$ |
| **d)** | $2c^2 + 7c - 4$ | **(e)** | $6y^2 - 11y - 2$ | **(f)** | $3w^2 + 10w - 8$ |
| **g)** | $3m^2 + 2m - 5$ | **(h)** | $4q^2 + 5q - 6$ | **(i)** | $6b^2 + 7b - 20$ |
| **j)** | $4t^2 - 4t - 3$ | **(k)** | $12z^2 + 16z - 3$ | **(l)** | $4d^2 - 4d - 15$ |
| **m)** | $7s^2 - 27s - 4$ | **(n)** | $15x^2 + 16x - 15$ | **(o)** | $36v^2 + v - 2$ |
| **p)** | $3v^2 + 10v + 7$ | **(q)** | $2l^2 - 11l + 5$ | **(r)** | $12m^2 - 31m + 7$ |
| **s)** | $3n^2 - 19v + 28$ | **(t)** | $4b^2 - 20b + 25$ | **(u)** | $9c^2 + 18c + 8$ |
| **v)** | $3q^2 + 14q - 5$ | **(w)** | $6a^2 + a - 12$ | **(x)** | $8b^2 - 2b - 15$ |
| **y)** | $12m^2 - 8m - 15$ | **(z)** | $2n^2 - n - 28$ | | |

## *Mixed Exercise*

**1**. Fully factorise these expressions:

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $3x^2 - 3$ | **(b)** | $2p^2 + 12p + 10$ | **(c)** | $9x^2 - 36$ |
| **d)** | $5x^2 + 25x + 30$ | **(e)** | $ax^2 + 5ax + 6a$ | **(f)** | $3y^2 - 12y - 15$ |
| **g)** | $15c^2 + 27c + 12$ | **(h)** | $16b^2 + 28b + 6$ | **(i)** | $9q^2 + 33q + 18$ |
| **j)** | $10s^2 - 35s + 15$ | **(k)** | $8m^2 - 20m + 12$ | **(l)** | $8a^2 - 36a + 36$ |
| **m)** | $4t^2 + 2t - 56$ | **(n)** | $90d^2 - 60d - 80$ | **(o)** | $400x^2 - 4$ |

## *Answers*

## *Exercise 1*

**1.** **a)** $2(x + y)$ **(b)** $3(c + d)$ **(c)** $6(s + t)$ **(d)** $12(x + y)$

**e)** $9(a + b)$ **(f)** $8(b + c)$ **(g)** $5(p + q)$ **(h)** $7(g + h)$

**i)** $4(m + n)$ **(j)** $9(e + f)$ **(k)** $13(j + k)$ **(l)** $14(v + w)$

**2.** **a)** $2(x + 2)$ **(b)** $3(d + 3)$ **(c)** $3(2s + 1)$ **(d)** $4(3x + 1)$

**e)** $3(2 + 3a)$ **(f)** $2(b + 4)$ **(g)** $5(y + 2)$ **(h)** $5(2 + 3c)$

**i)** $4(3x + 4)$ **(j)** $6(3m + 4)$ (**k)** $6(5 + 6a)$ **(i)** $7(2y + 3)$

**3.** **a)** $3(x – 2)$ **(b)** $4(y – 2)$ **(c)** $8(2 – a)$ **(d)** $5(2c – 3)$

**e)** $3(3s – 4)$ **(f)** $2(b – 7)$ **(g)** $4(3x – 5)$ **(h)** $11(2m – 3)$

**i)** $5(3x – 2)$ **(j)** $6(3 – 2y)$ **(k)** $5(5b – 4)$ **(l)** $6(3d – 5)$

**4.** **a)** $2(a + 2b)$ **(b)** $2(5x – 6y)$ **(c)** $6(3m + 4n)$ **(d)** $5(2c + 3d)$

**e)** $3(2a – 3x)$ **(f)** $6(3s – 2t)$ **(g)** $3(4x + 5y)$ **(h)** $7(2a – b)$

**i)** $5(5c + 2d)$ **(j)** $3(3b – 5y)$ **(k)** $6(3x + 4y)$ **(i)** $2(3a + 14b)$

**5.** **a)** $a_(x + y)$ **(b)** $x(y^2 + a^2)$ **(c)** $p(qr + st)$

**d)** $a(xy – bc)$ **(e)** $p(q + 1)$ **(f)** $y(y + 1)$

**g)** $a(a – b)$ **(h)** $b(a – c)$ **(i)** $n(n – 3)$

**j)** $y\ (x + y)$ **(k)** $ab(c – d)$ **(l)** $fg(h – e)$

**6.** **a)** $2a(x + 3)$ **(b)** $3y(1 + 3y)$ **(c)** $8a(3 – 2b)$

**d)** $pq(q – 1)$ **(e)** $3x(4y – 3z)$ **(f)** $2b(3b – 2)$

**g)** $3a(a + 9h)$ **(h)** $5ab(3c + 4d)$ **(i)** $3s^2(s – 3)$

**j)** $2x(7 – 6yz)$ **(k)** $5bc(2b – 3d)$ **(l)** $2\pi r(r + h)$

**7.** **a)** $a(p + q - r)$ **(b)** $2(a + b + c)$ **(c)** $2(3e - f + 2g)$

**d)** $p(p + q + x)$ **(e)** $3b(a - 2c - 3d)$ **(f)** $\frac{1}{2} h(a + b + c)$

**g)** $x(5x - 8y + 5)$ **(h)** $2a(2c + 3d - 5a)$ **(i)** $5p(3p + 2q + 4s)$

## *Exercise 2*

**1.** **a)** $(a - b)(a + b)$ **(b)** $(x - y)(x + y)$ **(c)** $(p - q)(p + q)$

**d)** $(s - t)(s + t)$ **(e)** $(a - 3)(a + 3)$ **(f)** $(x - 2)(x + 2)$

**g)** $(p - 9)(p + 9)$ **(h)** $(c - 5)(c + 5)$ **(i)** $(b - 1)(b + 1)$

**j)** $(y - 4)(y + 4)$ **(k)** $(m - 5)(m + 5)$ **(l)** $(a - 3)(a + 3)$

**m)** $(6 - d)(6 + d)$ **(n)** $(2 - q)(2 + q)$ **(o)** $(7 - w)(7 + w)$

**p)** $(x - 8)(x + 8)$

**2.** **a)** $(a - 2b)(a + 2b)$ **(b)** $(x - 5y)(x + 5y)$ **(c)** $(p - 8q)(p + 8q)$

**d)** $(4c - d)(4c + d)$ **(e)** $(9 - 2g)(9 + 2g)$ **(f)** $(6w - y)(6w + y)$

**g)** $(2a - 1)(2a + 1)$ **(h)** $(g - 9h)(g + 9h)$ **(i)** $(7x - y)(7x + y)$

**j)** $(3c - 4d)(3c + 4d)$ **(k)** $(2p - 3q)(2p + 3q)$ **(l)** $(b - 10c)(b + 10c)$

**m)** $(5 - 4a)(5 + 4a)$ **(n)** $(2d - 11)(2d + 11)$ **(o)** $(15 - 7k)(15 + 7k)$

**p)** $(3x - 0{\cdot}5)(3x + 0{\cdot}5)$

**3.** **a)** $2(a - b)(a + b)$ **(b)** $5(p - 1)(p + 1)$ **(c)** $5(3 - x)(3 + x)$

**d)** $4(d - 3)(d + 3)$ **(e)** $2(y - 5)(y + 5)$ **(f)** $4(b - 5)(b + 5)$

**g)** $3(q - 3)(q + 3)$ **(h)** $8(a - 2b)(a + 2b)$ **(i)** $a(b - 8)(b + 8)$

**j)** $x(y - 5)(y + 5)$ **(k)** $ab(c - 1)(c + 1)$ **(l)** $2(2p - 5q)(2p + 5q)$

**m)** $2(x - 1{\cdot}2)(x + 1{\cdot}2)$ **(n)** $a(k - 11)(k + 11)$ **(o)** $2{\cdot}5(2s - 1(2s + 1)$

**p)** $\frac{1}{2}( y - 30)(y + 30)$

## *Exercise 3*

**1.**

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $(x + 1)(x + 2)$ | **b)** | $(a + 1)(a + 1)$ | **c)** | $(y + 1)(y + 4)$ |
| **d)** | $(x + 7)(a + 1)$ | **e)** | $(x + 3)(x + 3)$ | **f)** | $(b + 6)(b + 2)$ |
| **g)** | $(a + 7)(a + 2)$ | **h)** | $(w + 1)(a + 9)$ | **i)** | $(d + 5)(d + 2)$ |
| **j)** | $(x + 7)(x + 3)$ | **k)** | $(p + 4)(p + 5)$ | **l)** | $(c + 4)(c + 6)$ |
| **m)** | $(s + 6)(s + 6)$ | **n)** | $(x + 7)(x + 4)$ | **o)** | $(y + 5)(y + 5)$ |

**2.**

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $(a - 5)(a - 3)$ | **b)** | $(x - 1)(x - 8)$ | **c)** | $(a - 6)(a - 3)$ |
| **d)** | $(y - 2)(y - 2)$ | **e)** | $(b - 5)(b - 1)$ | **f)** | $(x - 14)(x - 1)$ |
| **g)** | $(c - 2)(c - 8)$ | **h)** | $(x - 6)(x - 1)$ | **i)** | $(y - 4)(y - 8)$ |
| **j)** | $(p - 8)(p - 3)$ | **k)** | $(a - 9)(a - 4)$ | **l)** | $(x - 3)(x - 12)$ |
| **m)** | $(b - 1)(b - 3)$ | **n)** | $(q - 10)(q - 1)$ | **o)** | $(a - 4)(a - 3)$ |

**3.**

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $(b + 5)(b - 2)$ | **b)** | $(x + 7)(x - 1)$ | **c)** | $(y + 2)(y - 3)$ |
| **d)** | $(a + 4)(a - 5)$ | **e)** | $(q + 4)(q - 2)$ | **f)** | $(x + 2)(x - 10)$ |
| **g)** | $(d + 7)(d - 3)$ | **h)** | $(c + 12)(c - 3)$ | **i)** | $(p + 3)(p - 8)$ |
| **j)** | $(y + 1)(y - 8)$ | **k)** | $(a + 6)(a - 1)$ | **l)** | $(x + 4)(x - 9)$ |
| **m)** | $(b + 1)(b - 5)$ | **n)** | $(s + 6)(s - 4)$ | **o)** | $(d + 8)(d - 2)$ |

## *Exercise 4*

**1.**

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $(3x + 1)(x + 2)$ | **b)** | $(2a + 1)(a + 2)$ | **c)** | $(3c + 5)(c + 1)$ |
| **d)** | $(2p + 9)(p + 1)$ | **e)** | $(2y + 1)(y + 5)$ | **f)** | $(3d + 2)(d + 3)$ |
| **g)** | $(5q + 4)(q + 1)$ | **h)** | $(2b + 3)(2b + 1)$ | **i)** | $(3x + 2)(2x + 3)$ |
| **j)** | $(3a + 5)(a + 3)$ | **k)** | $(5x + 1)(2x + 3)$ | **l)** | $(3c + 1)(3c + 1)$ |
| **m)** | $(3y + 1)(2y + 3)$ | **n)** | $(3b + 2)(b + 1)$ | **o)** | $(4x + 1)(2x + 3)$ |

**2.**

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $(2x - 1)(x - 3)$ | **(b)** | $(2a - 3)(a - 1)$ | **(c)** | $(5p - 2)(p - 3)$ |
| **d)** | $(5b - 2)(b - 1)$ | **(e)** | $(3x - 2)(2x - 1)$ | **(f)** | $(4y - 3)(y - 2)$ |
| **g)** | $(7c - 1)(c - 4)$ | **(h)** | $(4m - 1)(m - 2)$ | **(i)** | $(8a - 1)(2a - 1)$ |
| **j)** | $(4y - 1)(2y - 5)$ | **(k)** | $(3p - 1)(p - 12)$ | **(l)** | $(4x - 1)(x - 6)$ |
| **m)** | $(5a - 2)(3a - 2)$ | **(n)** | $(6c - 1)(4c - 3)$ | **(o)** | $(3b - 4)(2b - 9)$ |

**3.**

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $(3x + 1)(x - 1)$ | **(b)** | $(a + 1)(2a - 3)$ | **(c)** | $(4p + 3)(p - 1)$ |
| **d)** | $(c + 4)(2c - 1)$ | **(e)** | $(6y + 1)(y - 2)$ | **(f)** | $(3w - 2)(w + 4)$ |
| **g)** | $(3m + 5)(m - 1)$ | **(h)** | $(q + 2)(4q - 3)$ | **(i)** | $(2b + 5)(3b - 4)$ |
| **j)** | $(2t + 1)(2t - 3)$ | **(k)** | $(2z + 3)(6z - 1)$ | **(l)** | $(2d + 3)(2d - 5)$ |
| **m)** | $(7s + 1)(s - 4)$ | **(n)** | $(3x + 5)(5x - 3)$ | **(o)** | $(4v + 1)(9v - 2)$ |
| **p)** | $(3v + 7)(v + 1)$ | **(q)** | $(2l - 1)(l - 5)$ | **(r)** | $(3m - 7)(4m - 1)$ |
| **s)** | $(3n - 7)(n - 4)$ | **(t)** | $(2b - 5)(2b - 5)$ | **(u)** | $(3c + 4)(3c + 2)$ |
| **v)** | $(3q - 1)(q + 5)$ | **(w)** | $(2a + 3)(3a - 4)$ | **(x)** | $(4b + 5)(2b - 3)$ |
| **y)** | $(6m + 5)(2m - 3)$ | **(z)** | $(2n + 7)(n - 4)$ | | |

## *Mixed Exercise*

**1.**

| | | | | | |
|---|---|---|---|---|---|
| **a)** | $3(x - 1)(x + 1)$ | **(b)** | $2(p + 5)(p + 1)$ | **(c)** | $9(x - 2)(x + 2)$ |
| **d)** | $5(x + 2)(x + 3)$ | **(e)** | $a(x + 2)(x + 3)$ | **(f)** | $3(y - 5)(y + 1)$ |
| **g)** | $3(5c + 4)(c + 1)$ | **(h)** | $2(4b + 1)(2b + 3)$ | **(i)** | $3(3q + 2)(q + 3)$ |
| **j)** | $5(2s - 1)(s - 3)$ | **(k)** | $4(2m - 3)(m - 1)$ | **(l)** | $4(2a - 3)(a - 3)$ |
| **m)** | $2(2t - 7)(t + 4)$ | **(n)** | $10(3d + 2)(3d - 4)$ | **(o)** | $4(10x - 1)(10x + 1)$ |