Factorising algebraic expressions

Year 9 Mathematics
Mainstream

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Learning Objectives

By the end of the lesson I hope that you understand and can apply the following to a range of questions from the Year 9 Mathematics course.

- To be able to identify a highest common factor of two or more terms
- To understand what it means to write an expression in factorised form
- To understand the relationship between factorised and expanded form
- To be able to factorise an expression involving a common factor

Recap of past learning

In the last two lessons we looked at expanding binomial products for “perfect squares” and others. We used FOIL or the grid method to expand and started to love it!

The opposite of expanding is factorising.

When we factorise, we **move outside of a set of brackets the highest common factor of all terms**.

This might sound complicated, but we can make it easier!

$$(x+2)(x+3) = x^2 + 5x + 6$$

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

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

Highest common factor

TYPE 1

The highest common factor is a number (and or letters) which can be divided out of some terms.

It's best to look at some examples:

$$2x + 10$$
$$x^2 + 5x$$
$$2x^2 + 10x$$

$$\frac{\cancel{2}x}{\cancel{2}} + \frac{\cancel{10}}{\cancel{2}} = 2(x+5)$$

$$\frac{\cancel{2x^2}}{2x} + \frac{\cancel{10x}}{2x} = 2x(x+5)$$

$$x^2 + 5x =$$

$$\frac{x.\cancel{x}}{x} + \frac{5\cancel{x}}{x} = x(x+5)$$

Examples

Determine the highest common factor (HCF) of the following:

$6a$ and $8ab$
$3x^2$ and $6xy$
$4x$ and $10xy$
$5x^2$ and $15xy$

$6a \quad 8ab \quad \underline{\underline{2a}}$

$3x^2 \quad 6xy \quad \underline{\underline{3x}}$

$4x \quad 10xy \quad \underline{\underline{2x}}$

$5x^2 \quad 15xy \quad \underline{\underline{5x}}$

Examples

Factorise the following

$40 - 16b$
$-8x^2 - 12x$
$28 - 21a$
$-9x^2 - 15x$

$$\left.\begin{matrix} + + \\ - - \end{matrix}\right\} +$$

$$\left.\begin{matrix} + - \\ - + \end{matrix}\right\} -$$

$$40 - 16b = 8(5 - 2b)$$

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

$$28 - 21a = 7(4 - 3a)$$

$$-9x^2 - 15x = -3x(3x + 5)$$

Examples

Factorise the following

$$3(x+y)+x(x+y)$$
$$1\ (7-2x)-x(7-2x)$$
$$4(a+b)+a(a+b)$$
$$1\ (4x+3)-x(4x+3)$$

$$\frac{3\cancel{(x+y)}^{1}}{\cancel{(x+y)}_{1}} + \frac{x\cancel{(x+y)}^{1}}{\cancel{(x+y)}_{1}}$$

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

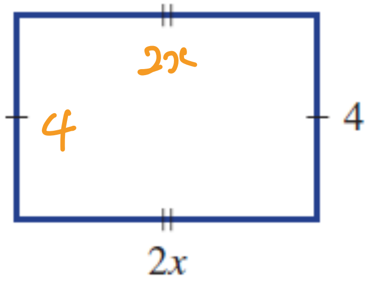
$$\frac{1\cancel{(7-2x)}^{1}}{\cancel{(7-2x)}_{1}} - \frac{x\cancel{(7-2x)}^{1}}{\cancel{(7-2x)}_{1}}$$

$$= (7-2x)(1-x)$$

Throwing a curve call

We can try and trick you by using other examples and then asking you to **factorise** the expressions.

For example: Find the perimeter of the following shape and factorise the expression.



$$P = 2x + 4 + 2x + 4$$
$$= \underline{\underline{4x + 8}}$$
$$= 2(\underline{\underline{2x}} + 4)$$

$$P = 2(\underline{\underline{2x}} + 4)$$

Harder questions

It doesn't matter how many terms we have, if they have a common factor we can move it outside of a set of brackets.

e.g. $3a^2 + 9a + 12$

e.g. $x^2 - 2xy + x^2y$

$$3a^2 + 9a + 12$$

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

$$x^2 - 2xy + x^2y$$

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

Questions to complete

The following work is the **minimum** you are expected to complete in class and at home.

You are welcome to answer more questions if you feel you have the time.

Exercise 8C
Questions: 1, 2aei, 3aeimqu, 4acegikmo, 5adgjk, 6