

$$2^\circ = ?$$

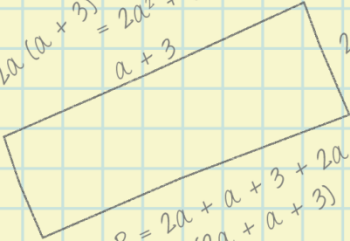
$$a \times a = a^2$$

$$7 > 3$$
$$-7 < 3$$

$$3a + 2a - 2b + 4b = 5a + 2b$$

Understanding Algebra

at year 7

$$A = 2a(a+3) = 2a^2 + 6a$$

$$P = 2a + a + 3 + 2a + a + 3$$
$$= 2(2a + a + 3)$$
$$= 2(3a + 3)$$
$$= 6a + 6$$

$$A = \frac{1}{2}bh$$

$$A = \frac{1}{2} \times 4 \times 7$$
$$= \frac{1}{2} \text{ of } 28$$
$$= 14 \text{ cm}^2$$

$$x^2 = x \times x$$

$$5a^2 = ?$$

$$5a \times 5a$$
$$5 \times a \times a$$
$$5 \times 5 \times a$$
$$5 \times a \times 5 \times a$$

What is the magic total?

$$m \div n = \frac{m}{n}$$

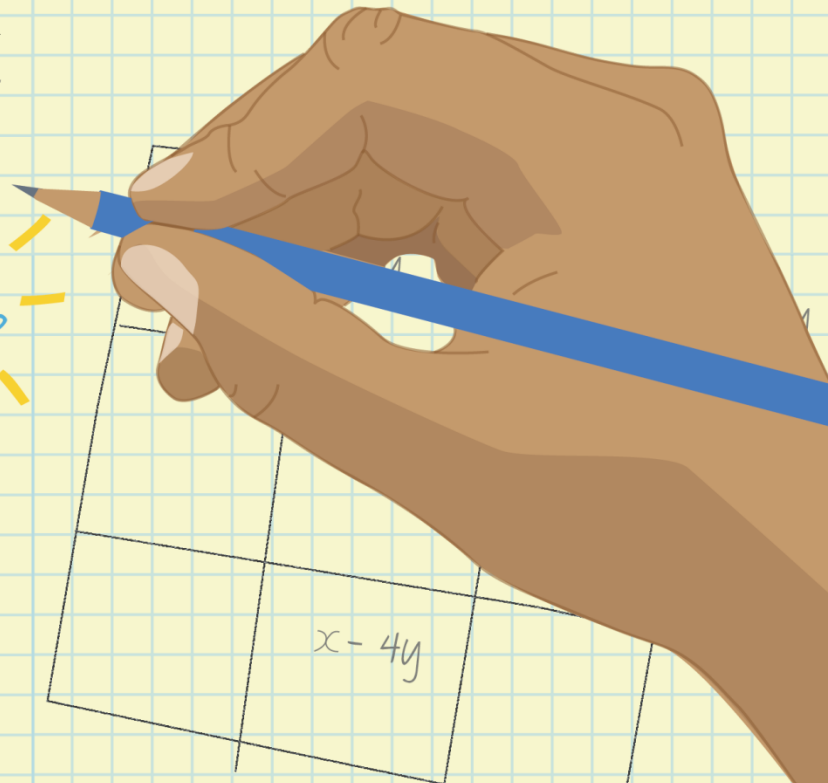
N Z G S H I F O V H L P

A

L

0

Is $n^2 + n$ always even?



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Introduction

Aims

The aims of this pack are to utilise year 7 students' knowledge from primary school to build solid foundations for their understanding of algebra throughout KS3 and 4.

These are not whole lessons, instead 23 mix-and-match activity worksheets with a summative assessment at the end, giving teachers the flexibility they need to tailor this content to their students and teaching style. They are split into the following sections:

Sections

One: Short tasks. These can be used as starters, plenaries or stand-alone tasks.

Two: Developing concepts. Activities intended to be completed with the class, led by the teacher in order to advance students' learning.

Three: Developing fluency. These activities comprise opportunities to practice concepts met in section two and some are there to challenge the most confident learners.

Four: Homework tasks. These can also be used as independent tasks within lessons.

Five: Assessment. A summative assessment covering all content.

Each section is further split into: teaching notes (📖), activities and answers sections (✅❌).

Objectives

The learning objectives for this pack are taken from the national curriculum for KS3. In the teaching notes, objectives for each activity are stated.

Students should be able to:

- | | |
|--------------------------|---|
| 1. Algebraic notation | Use algebra with correct notation, such as not write multiplication signs, use indices, understand division as a fraction and use brackets. |
| 2. Order of operations | Use the correct order of operations in number and algebra. |
| 3. Vocabulary | Understand the difference between expressions, equations, terms, factors and coefficients. |
| 4. Collecting like terms | Simplify expressions by collecting like terms. |
| 5. Expanding a bracket | Multiply out a single bracket and simplify. |
| 6. Common factors | Factorise into a single bracket by taking out a common factor. |
| 7. Substitution | Evaluate expressions and use standard formulae. |
| 8. Modelling | Model situations by converting them into algebraic expressions and formulae. |

Support and challenge

Most of the resources will be accessible to most students, with some requiring teacher input. Challenge questions within activities are clearly shown by a darker shaded background. Resources 3.6 *Class activities*, 3.7 *Dominoes challenge* and 3.8 *Brackets challenge* are aimed at those students who are confident with the subject.

For students who need extra practice, links are given to other Teachit maths resources that may help.



Ideas for discussion:

- Included in the teaching notes for each resource in sections 1, 2 and 3 is a non-exhaustive list of ideas for class discussion. Many will be familiar but they are there as a guide or brief reminder.



Vocabulary

Below is a word bank of vocabulary used in this pack. Some words will be well-known to students, many will be new or misremembered from KS2. Resources in the pack promote the use of correct mathematical terminology throughout and teaching notes contain specific vocabulary for each activity.

To find practical approaches to develop students' comprehension of this vocabulary, look no further than the maths section of our OUP resource [*Closing the Word gap*](#), available for free on Teachit maths.

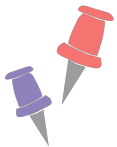
Algebra, algebraic, area, bracket, coefficient, common factor, conclusion, congruent, constant, cube, divisor, equation, evaluate, expand, exponent, expression, factor, factorise, formula, highest common factor, indices, integer, like terms, median, multiplication, multiply out, negative, operator, perimeter, perpendicular, positive, power, powers, prime factors, proof, prove, root, simplify, solution, square, squared, square number, substitute, substitution, surface area, term, unknown, variable, volume.

2.3 Collecting like terms



Aim

This resource introduces the concept of collecting terms while promoting discussion of some of the standard misconceptions that students have around it.



Objectives covered:

1. Algebraic notation
2. Order of operations
3. Vocabulary
4. Collecting like terms

Support and challenge

For consolidation of basic collection of like terms, see resource 3.3 *Walls of expressions* as well as Teachit maths resource [16678, Algebra pyramids](#).

Questions with extra challenge are shaded a darker colour. Some of the ideas for discussion, below, will also challenge students' thinking.



Ideas for discussion:

- Question 1: Order of operations: $3b^2$ means $3 \times b^2$ not $(3b)^2$.
- Questions 1, 8, 9: Terms with different indices are not **like terms**.

Students could use their own numbers to check the above principles.

- The similarities between questions 2-6 and differences in their answers .
- Reminder of area and perimeter.
- Looking at the opposite parallel sides of the hexagon, students could be challenged to explain why $2a^3 = 2a^2 + 8$ and $24a = 5a^3 + 3a + 2$.
- For an extra challenge, students could find the area of the hexagon using algebra, $A = 48a^4 - 10a^5$, and find different ways to get there.
- Vocabulary: constant, exponents, expression, indices, powers, simplify, substitute, substitution, term.

2.4 Expanding brackets



Aim

This resource introduces, and allows for practice of, expanding single brackets. Students are guided to see that $a(b + c) = ab + ac$, using a geometric proof for teachers to demonstrate and an exercise of deliberate practice, including questions which consider common misconceptions.

2.3 Collecting like terms

Suggested method - identify the like terms and calculate each set separately.

$$\boxed{3a} \quad \boxed{-b} \quad \boxed{+2c} \quad \boxed{-a} \quad \boxed{+4b} \quad \boxed{-3c} \quad \boxed{+d} = 2a + 3b - c + d$$

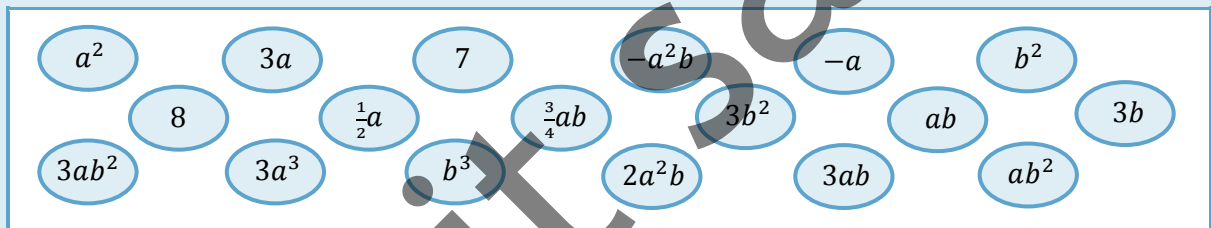
$$\boxed{3a - a} = +2a$$

$$\boxed{-b + 4b} = +3b$$

$$\boxed{2c - 3c} = -c$$

$$\boxed{d} = d$$

1. Place these terms into groups of like terms



Collect the like terms and simplify these expressions

2. $3b + 2a + b + c + 2b + 4c + a$

5. $-3b - 2a - b - c + 2b + 4c + a$

3. $3b - 2a + b - c + 2b - 4c + a$

6. $-3b - 2a - b - c - 2b - 4c - a$

4. $3b + 2a - b + c - 2b + 4c - a$

What similarities and differences can you see in questions 2-6 and your answers to them?

7. $2a + 4a^2 - a + a^2$

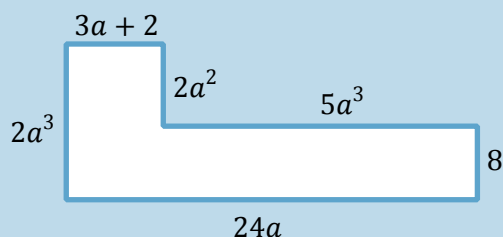
If $a = 2$,

8. $5a + 4a^3 - a + 2a^2 - a^3$

10. Find the perimeter of the hexagon.

9. Find the perimeter of this hexagon [not drawn to scale].

11. Calculate its area.



2.2 Creating formulae



1. $P = a + b + 2c$

4. i. $b = c + 2$

ii. $d = a + 5$

2. $P = a + b + 2c + 2d$

5. $V = a^2b$

3. $P = a + b + c + d + 7$

6. $S_A = 2a^2 + 4ab$

2.3 Collecting like terms



1.

$3a, -a, \frac{1}{2}a$	a^2	$3a^3$	$3b$	$3b^2, b^2$
b^3	$ab, 3ab, \frac{3}{4}ab$	$3ab^2, ab^2$	$-a^2b, 2a^2b$	$8, 7$

2. $3a + 6b + 5c$

9. $7a^3 + 2a^2 + 27a + 10$

3. $-a + 6b - 5c$

10. $7 \times 2^3 + 2 \times 2^2 + 27 \times 2 + 10 = 128 \text{ units}$

4. $a + 5c$

11. $16 \times 48 - 40 \times 8 = 448 \text{ units}^2$

5. $-a - 2b + 3c$

$3 \times 2 + 2 = 8$

6. $-3a - 6b - 5c$

$2 \times 2^3 = 16$

$2 \times 2^2 = 8$

$5 \times 2^3 = 40$

7. $5a^2 + a$

8

8. $3a^3 + 2a^2 + 4a$

$24 \times 2 = 48$

3.5 Error no error



Aim

These questions give students a chance to address misconceptions by looking for errors in working and the validity of statements. Some knowledge and understanding of the whole unit is assumed. It could be used as a classroom discussion lesson or an out of class assignment followed by a classroom discussion.



Objectives covered:

- | | |
|------------------------|--------------------------|
| 1. Algebraic notation | 4. Collecting like terms |
| 2. Order of operations | 5. Expanding a bracket |
| 3. Vocabulary | 6. Common factors |
| | 7. Substitution |

Support and challenge

All resources in sections one and two will prepare students for this activity. Teachit resource [24217, Rules of algebra](#) is also a comprehensive overview of the skills required.

Questions with extra challenge are shaded a darker colour.



Ideas for discussion:

- Due to the diversity of content, discussion is included with the answers as needed.
- Vocabulary: algebra, algebraic, bracket, coefficient, common factor, constant, equation, evaluate, expand, exponent, expression, factor, factorise, formula, indices, like terms, multiply out, power, root, simplify, solution, squared, substitute, term, unknown, variable.

3.6 Class activities



Aim

These tasks develop the skills of algebraic reasoning and lay the foundations for proof. They could be used individually as starters, plenaries or points of interest, or they could be combined to make one whole lesson.



Objectives covered:

- | | |
|--------------------------|------------------------|
| 1. Algebraic notation | 5. Expanding a bracket |
| 2. Order of operations | 6. Common factors |
| 3. Vocabulary | 7. Substitution |
| 4. Collecting like terms | 8. Modelling |