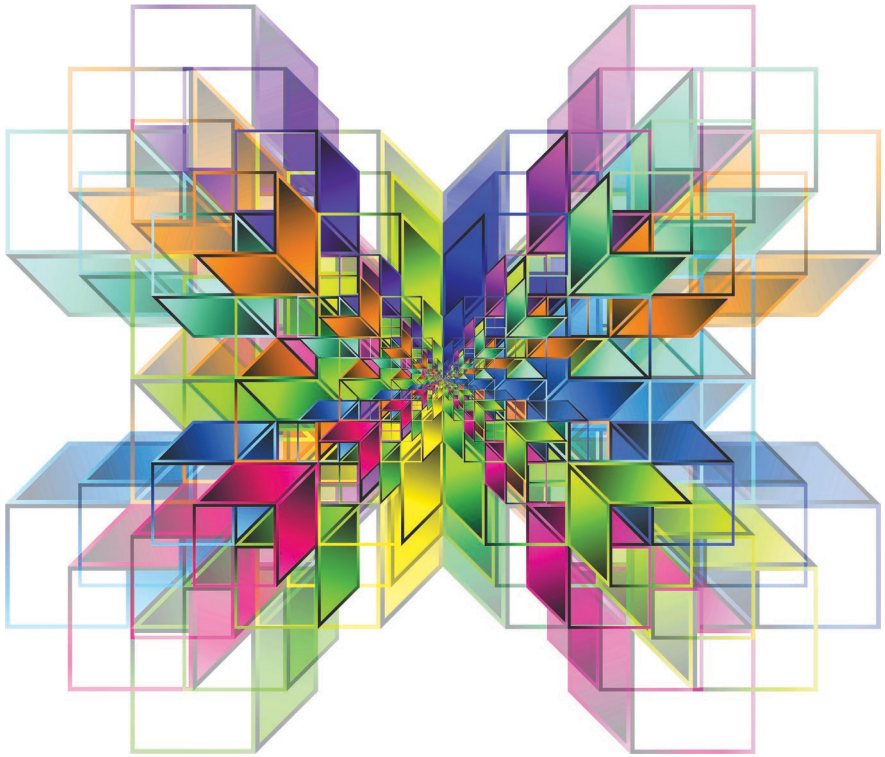
GCSE Maths Virtual Community: KS3 & KS4 – stretch and support in mixed attainment classes

Helen Hindle

Autumn 2022



Welcome

Session structure

- What are mixed attainment maths classes?
- Using progress maps to allow student to regulate their own activity
- Open do now activities / goal free problems
- Teacher explanation and differentiated lesson activities
- Pupil Reflection

What are mixed attainment maths classes?

In this section we will look at what a mixed attainment maths class is and the pros and cons of teaching in mixed attainment classes.

What are mixed attainment maths classes?

Mixed attainment classes are classes that have a range of:

- Prior attainment
- SEN
- Pupil Premium
- Attitude to Learning
- EAL

What are mixed attainment maths classes?

Advantages of mixed attainment classes at KS3 include that they:

- Promote a ‘can do attitude’ among pupils, a growth mindset.
- Ensure that all pupils experience rich activities and ambitious learning.
- Teach pupils how to regulate their own learning.
- Promote social equity, fairness of access to the curriculum.
- Promote collaborative learning and collaborative teaching.

What are mixed attainment maths classes?

Advantages of mixed attainment classes at KS4 include that they:

- Ensure higher students are fully confident with foundation knowledge and skills.
- Give Foundation students opportunities to work on higher material.
- Promote independent learning.
- Better prepare students if their tier is changed (both ways).
- Allow for matching vulnerable or challenging students with the right teachers.

Changing the culture of the classroom

In this class……

We all have different starting points.

We can all learn from one another.

We can all make progress.

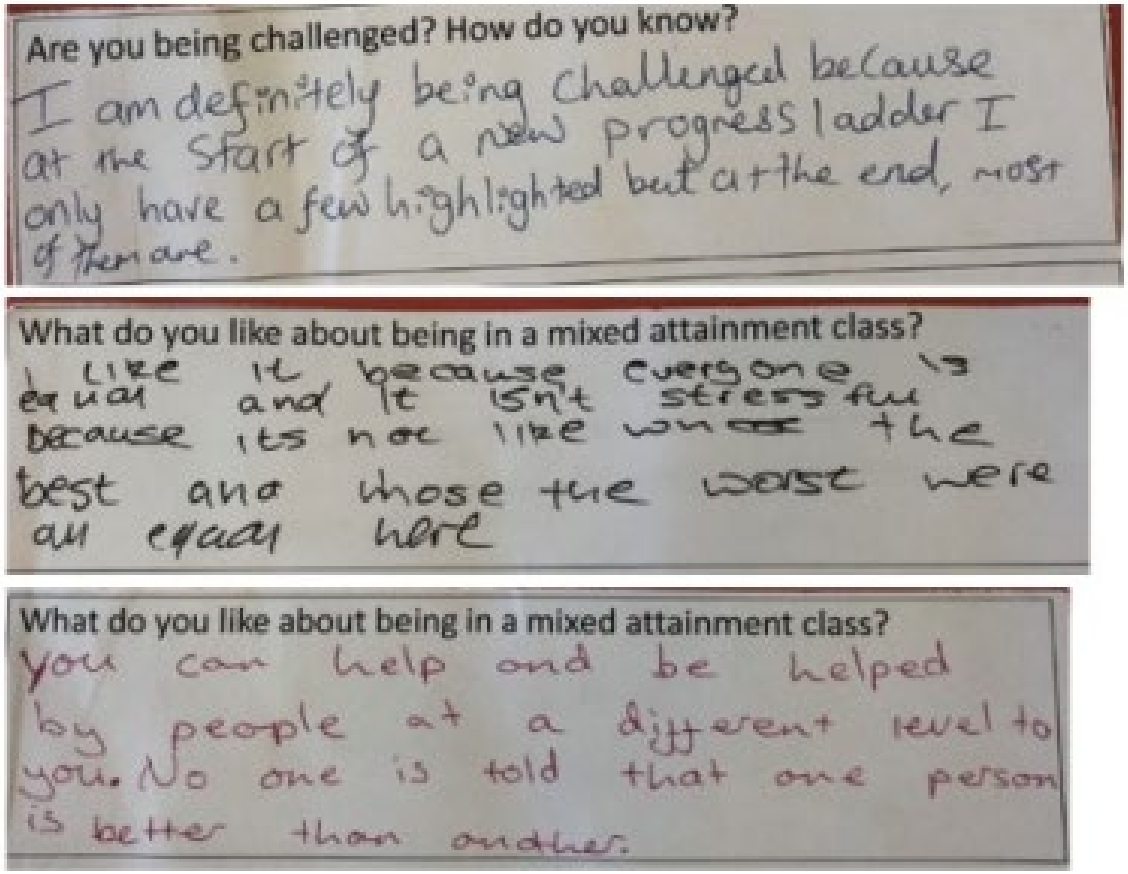
We will value our mistakes because we can learn from them.

We will choose tasks that challenge us because this is how we develop our skills and understanding.

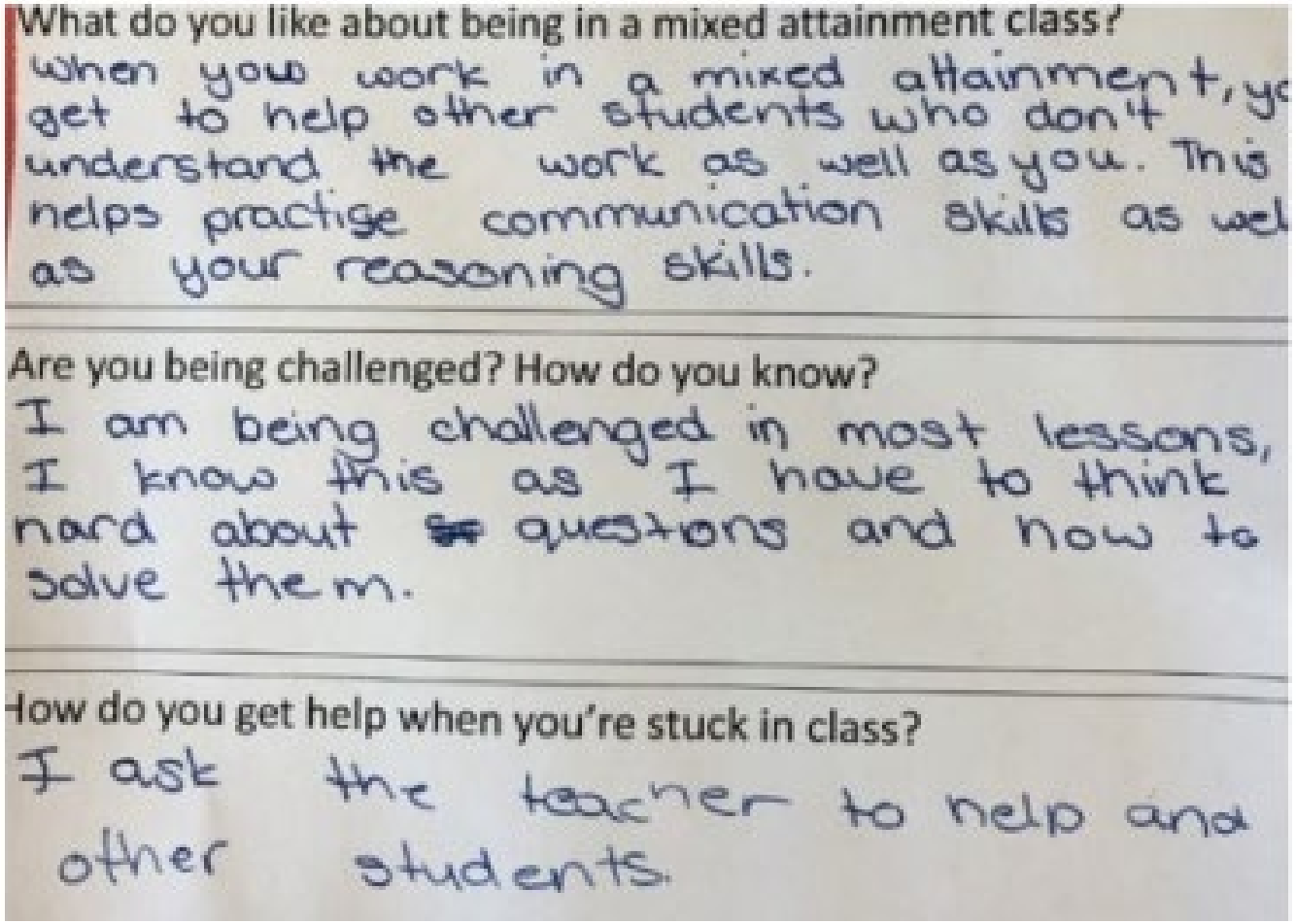
We will keep trying even when we are finding a task difficult because this is how we make progress.

Changing the culture of the classroom

Some of our students' responses to questions about being taught in mixed attainment groups:



Changing the culture of the classroom (continued)



What do you like about being in a mixed attainment class?

When you work in a mixed attainment, yo get to help other students who don't understand the work as well as you. This helps practise communication skills as wel as your reasoning skills.

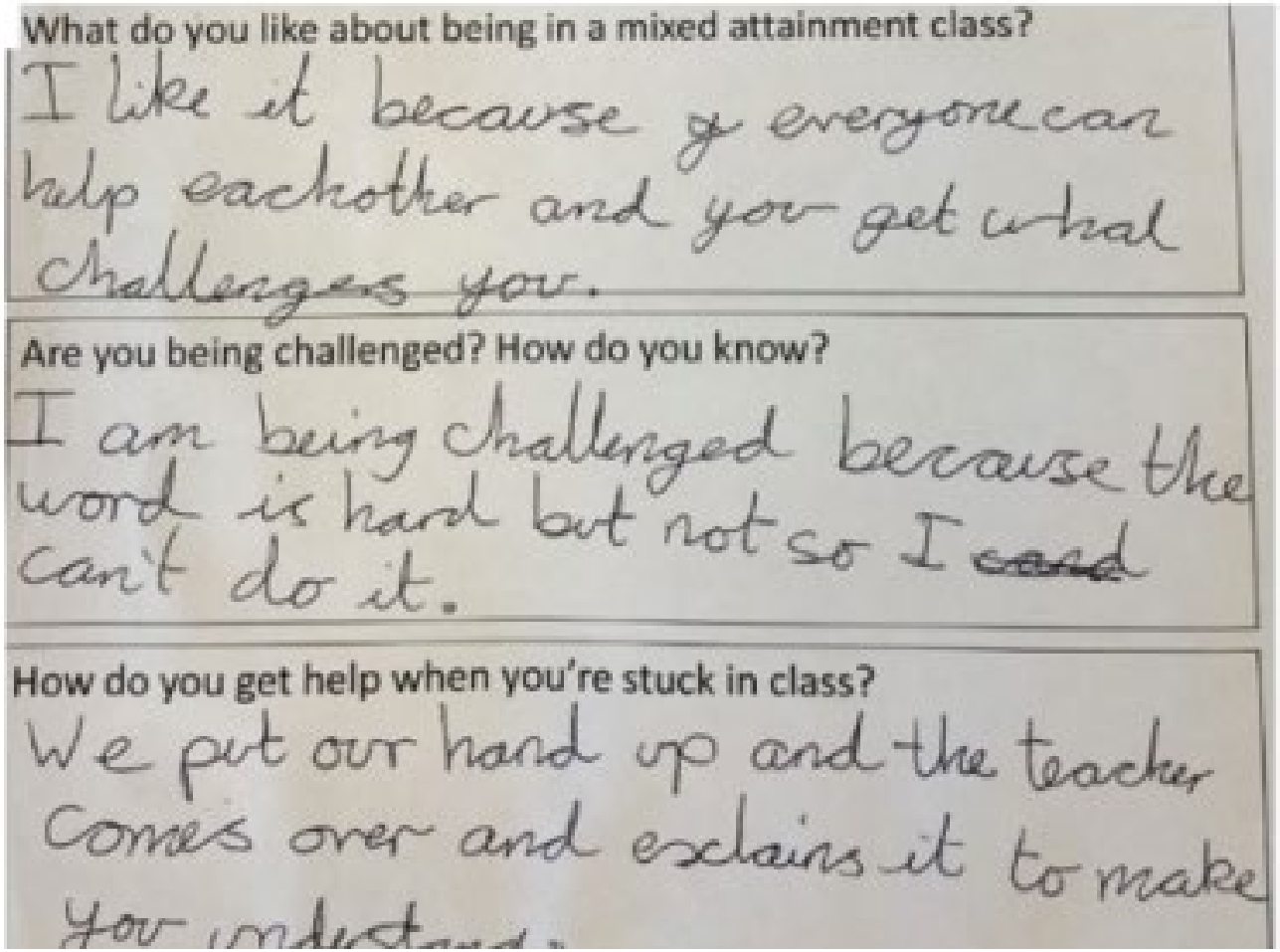
Are you being challenged? How do you know?

I am being challenged in most lessons, I know this as I have to think hard about ~~the~~ questions and how to solve them.

How do you get help when you're stuck in class?

I ask the teacher to help and other students.

Changing the culture of the classroom (continued)



What do you like about being in a mixed attainment class?

I like it because & everyone can help eachother and you get what challenges you.

Are you being challenged? How do you know?

I am being challenged because the word is hard but not so I can't do it.

How do you get help when you're stuck in class?

We put our hand up and the teacher comes over and explains it to make you understand.

Using progress maps

In this section we will look at how progress maps can be used to allow students to regulate their own learning.

Using progress maps to allow student to regulate their own activity

	Foundation	Developing	Secure	Expert
Year 9 **Knowledge** Progress Map – Simplifying, Expanding and Factorising	**a) Simplify** I know how to **simplify expressions** by collecting like terms. ***HM 156 157 158 159*** **b) Expressions** I know the difference between an **equation** and an **expression.** ***HM 154*** c) **Expand** I know how to **expand** a single bracket. ***HM 160***	d) **Factorise** I know how to **factorise** linear expressions. ***HM 168 169 170 171*** e) **Equation** I know the difference between an **identity** and an **equation.** ***HM 154*** f) **Expand and Simplify** I know how to **expand** two single brackets and **simplify**. ***HM 161***	g) **Expand Double Brackets** I know how to expand double brackets to get a **quadratic expression**. ***HM 162 - 164*** h) **Factorise Quadratics** I know how to **factorise** quadratics of the form $x^2 + bx + c$. ***HM 223 & 224,***	i) **Factorise Expressions** I know how to factorise quadratics of the form $ax^2 + bx + c$. ***HM 225 – 228*** j) **Expand Triple Brackets** I know how to expand triple brackets. ***HM 166*** k) **Proofs** I know what it means to **prove** algebraically.

Using progress maps to allow student to regulate their own activity

Year 9 **Knowledge** Progress Map – Simplifying, Expanding and Factorising		Foundation	Develop	**Secure**	Expert
	Problem Solving - **Translate**	a1) I can translate geometric problems into simple linear expressions.	b1) I can translate geometric problems into linear expressions containing a single bracket.	c1) I can translate geometric problems into quadratic expressions.	d1) I can translate 3D geometric problems into cubic expressions.
	Reasoning - **Prove**	a2) I can multiply two terms together to prove a simple statement about numbers, for example, an even number multiplied by an even number = an even number.	b2) I can use expansion to prove a statement about numbers, for example, an odd number multiplied by an odd number = an odd number.	c2) I can use expansion to prove a complex statement about numbers, for example, for any three consecutive numbers the difference between the square of the middle number and the product of the smallest and largest numbers is always 1.	d2) I can prove a geometric statement, for example, Pythagoras' Theorem, by expanding brackets.

Using progress maps to allow student to regulate their own activity

Key points:

- The teacher explanation comes out of the class discussion generated by the ‘do now’ and should include and build upon explanations from pupils.
- The main activity should be differentiated by task or provide multiple entry points.
- Pupils choose their activity by referring to their progress map.
- Pupils must be given the opportunity to self select their activity, but this must be monitored by the teacher so that pupils that select inappropriately can be redirected.
- All pupils should be given access to all tasks and all manipulatives.

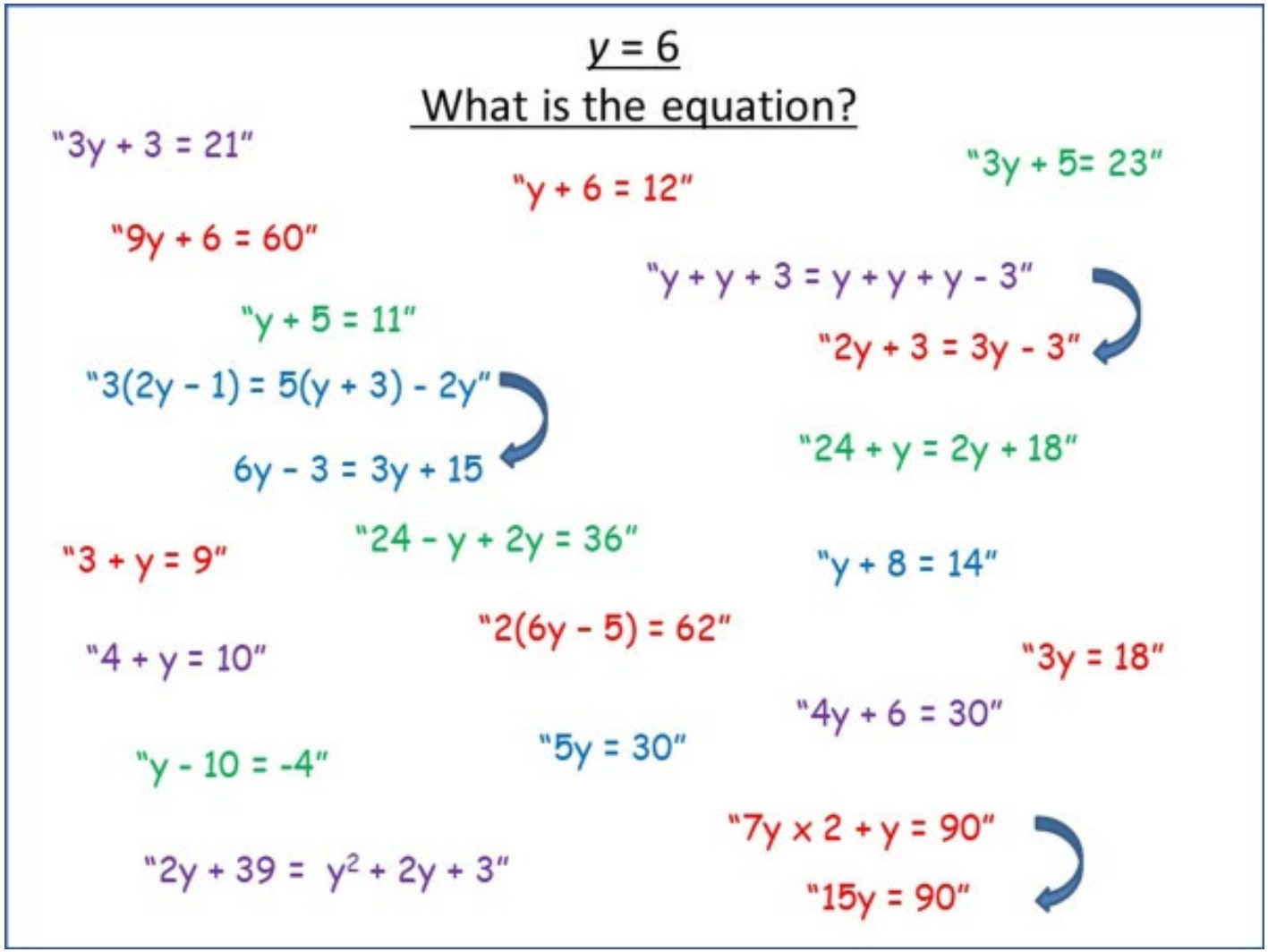
Four crucial stages

- The start of the lesson – the do now activity
- Teacher explanation phase
- Resources for independent student work
- Student reflection

Open do now activities/goal free problems

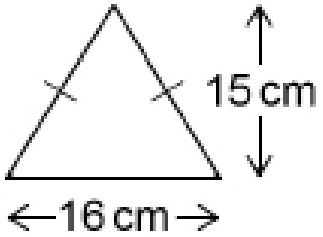
In this section we will look at ways to ensure that the start of a mixed attainment lesson is accessible for all learners whilst also providing challenge for all learners.

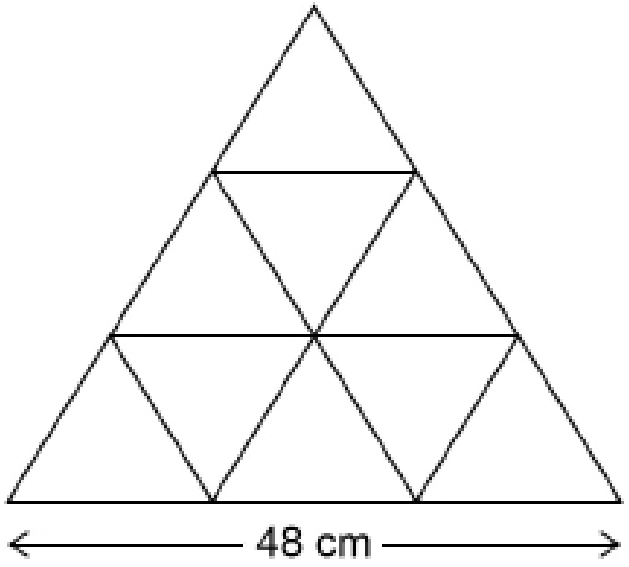
Open do now activities/goal free problems



Open do now activities/goal free problems

- Ask a question or make a comment.
- What do you notice? What do you wonder?

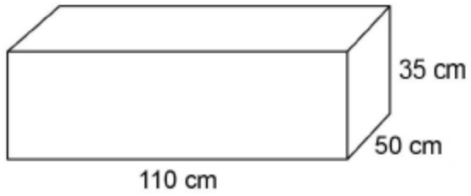




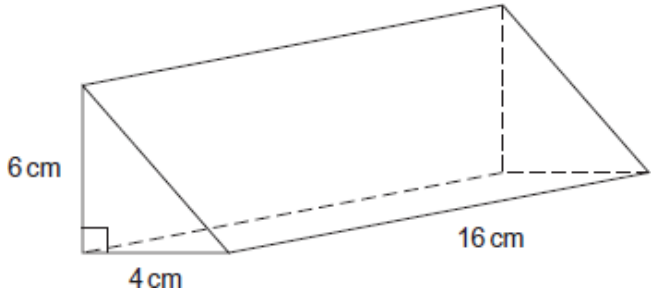
Open do now activities/goal free problems

Do now activity: Choose one of these 4 shapes and tell me everything you can about it.

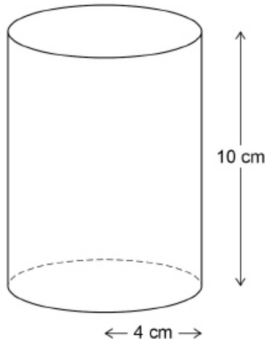
A (**Q17J 2F. 21**)



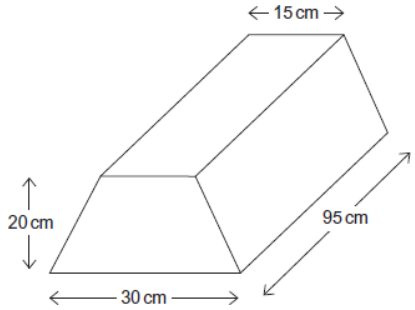
B **(Q13W.LM2H.07)**



C **(Q19N 1F. 28)**

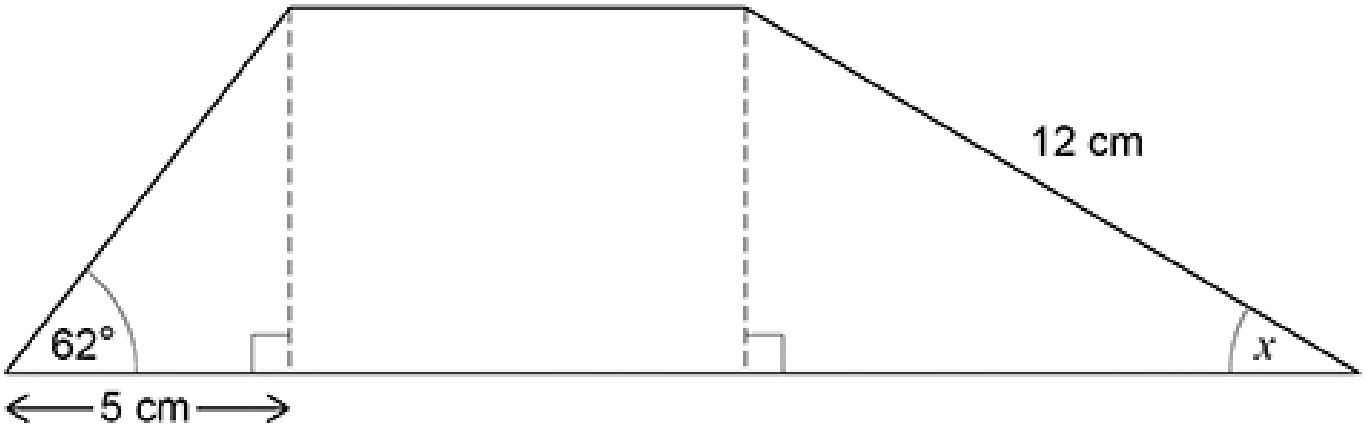


D **(Q14J B2F, 23)**



Open do now activities/goal free problems

This shape is made from two right-angled triangles and a rectangle. What questions might you be asked?



Teacher explanation and differentiated lesson activities

In this section we will be discussing how to deliver a whole class explanation to a mixed attainment class and how this leads into pupils working on differentiated learning activities.

Teacher explanation and differentiated lesson activities

- This should develop out of the do now activity.
- Plan your questioning. Which students will you ask to contribute first?
- Have high expectations of everyone in the class. Don’t let anyone off the hook.
- Do not disregard Foundation students when teaching higher content. Even if the content is not included in the Foundation GCSE, the skills learnt will be useful.
- Not all students need to listen at the same time, some may need to start work whilst you are explaining to the rest of the class. Their explanation will come later.

Teacher explanation and differentiated lesson activities

Differentiation by:

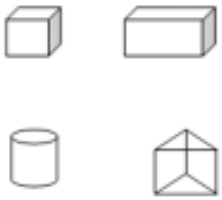
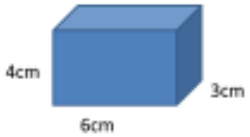
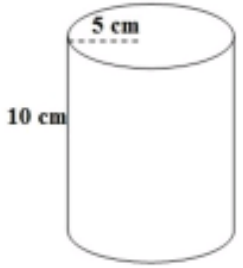
- Task – Pupils work on different tasks / worksheets with the lesson.
- Support – Some pupils may work with a teaching assistant.
- Questioning – Bringing all students in a class into a question and answer exchange.. adjusting the level of questioning to the student in a subtle way.
- Explanation – Pupils receive different teacher input at different times throughout the lesson.
- Outcome – The same stimulus leads to open ended responses (‘Multiple Entry Point Tasks’).
- Expectation – There are various learning goals that are shared with pupils. Pupils are taught how to and encouraged to self select the appropriate learning goal, for example through reference to a learning journey.

Teacher explanation and differentiated lesson activities

Task 1	Task 2	Task 3
Use the 3D shapes to: 1. Name each shape 2. Match each shape to its net 3. Find the number of faces, edges and vertices.	Question What is the same and what is different about the cube and the cuboid? Activity 1. Draw the nets of the cube and the cuboid on squared paper. 2. Use the nets to calculate the surface area of the cube and the cuboid. 3. Build a model of the cube and the cuboid using multi-link cubes. Use these to calculate the volumes.	Question What is the minimum information that you need to know before you can work out the volume and the surface area of the cuboid and the triangular prism? Activity Calculate the surface area and volume of the cuboid and the triangular prism. It may help you to draw the nets of each shape first.
Task 4	**Task 5**	**Task 6**
Question What is the minimum information that you need to know before you can work out the volume and the surface area of the cylinder? Activity Calculate the surface area and volume of the cylinder. It may help you to draw the net of the cylinder first.	Question What is the same and what is different about each prism? Activity Calculate the volume and the surface area of the: Pentagonal Prism Hexagonal Prism Octagonal Prism Which 2D shapes did you have to split the Pentagon, Hexagon and Octagon into ?	Question How are the cone and the pyramid different from the prisms? How are they the same? Activity Work out the surface area of the cone and the pyramid. You can ask for the hint cards to help you.

Teacher explanation and differentiated lesson activities

Y8 Knowledge Progress Map – Surface Area and Volume

Foundation	Developing	Secure	Expert
a) **3-D Shapes** I know the names of simple **3-D shapes.** Task 1 ***HM 832*** b) **Nets** I know what the **nets** of different **3-D shapes** look like. Task 1 ***HM 833-836*** Example Name these shapes. 	c) **Identifying parts of a shape** I know / can identify **edges, faces** and **vertices.** Task 1 ***HM 830, 831*** Example How many:- Faces Edges Vertices does a cuboid have? d) **Volume by counting** I know how to find the **volume** of a 3D shape by **counting cubes.** Task 2 ***HM 567***	e) **Volume and Surface Area** I know the **difference** between **volume** and **surface area.** Task 2 f) **Surface Area/Volume of Cubes/Cuboids** I know how to calculate the **volume** and **surface area** of **cubes** and **cuboids.** Task 3 ***HM 568, 569, 584*** Example Find the volume and the surface area of this cuboid.  	g) **Surface Area/Volume of Prisms and Cylinders** I know how to calculate the **volume** and **surface area** of **prisms** and **cylinders.** Task 3, 4 & 5 ***HM 570, 571, 585, 572, 573, 574, 586*** Example Find the volume and surface area of this cylinder. 

Teacher explanation and differentiated lesson activities

	8, 15, 22,	 ★	3, 6, 11, 18, ★
		2, 7, 14, 23, 34 ★	 ★
	5, 7, 9, 11, 13	4, 8, 14, 22, 32 ★	★ 

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Teacher explanation and differentiated lesson activities

Task 1 1. Draw or build the next two patterns in each sequence. 2. What do you notice about each sequence?	Task 2 1. Describe the sequence in words. 2. Find the term to term rule for each sequence. 3. What is the same and what is different about each sequence?
Task 3 1. Find the position to term rule for each sequence and explain how you worked it out. 2. Find the 20^{th}, 50^{th} and 100^{th} term of each sequence and explain how you did it. 3. What is the same and what is different about each sequence?	Task 4 1. What is different about the starred sequences? 2. Can you find the next two terms in these sequences? 3. Can you find a position to term rule for these sequences and explain how you worked it out?

Teacher explanation and differentiated lesson activities

Year 7 **Skills** Progress Map – Sequences
Reasoning - **Explore; Find examples and counter-examples**

Foundation	Develop	Secure	Expert
a) Drawing linear / arithmetic sequences I can draw the next two **patterns** in **linear / arithmetic** sequence **Task 1** **b) Describing linear / arithmetic sequences** I can **describe** a **linear / arithmetic** sequence in words. **Task 2**	**c) Generating Sequences** I can **generate** important sequences; Fibonacci, Even, Odd, Triangular, Square and Cube. **d) Generating Geometric Sequences** I can **generate** a **geometric sequence**.	**E) Generating linear / arithmetic sequences** I can **generate** a **linear / arithmetic** sequence from a **position to term rule**. **F) Use a position to term rule** I can use a **position to term rule** to decide whether a number is part of a sequence and to find any term in a sequence. **Task 3**	**G) Quadratic sequences** I can find the next two terms in a **quadratic sequence**. **Task 4**

Teacher explanation and differentiated lesson activities

Do Now – Ask a question or make a comment

‘ ***The product of two numbers divided by their highest common factor is their lowest common multiple.’***

'If the numbers were 20 and 5 it would be true.
The product of 5 and 20 is 100.
The highest common factor is 5.
The lowest common multiple is 20.
The product of 5 and 20 is 100
100 ÷ 5 = 20.'

'It works for 6 and 9
Product = 54
HCF = 3
LCM = 18
54 ÷ 3 = 18.'

'Does the prompt mean that this would work for any two numbers?'

'Would this work for 3 or more numbers?'

'Would it work for bigger numbers e.g. 234 and 456?'

'What does product mean?'

'What does the highest common factor mean?'

'Product means multiply.'

'The highest common factor is the biggest factor that is a factor of both of the numbers.'

'Is there another way of finding the lowest common multiple so that we can check if the prompt is true?'

What if the numbers don't have a common factor?

This prompt is from the Inquiry Maths website.
https://www.inquirymaths.com/home/number-prompts/lowest-common-multiple-inquiry

Teacher explanation and differentiated lesson activities

Task A	**Task B**
Write down all of the factors of these numbers:- **10, 30, 80, 17, 19, 25, 100,** How can you be sure that you haven't missed out any factors? What do you notice?	Find the Highest Common Factor and Lowest Common Multiple of these pairs of numbers:- **12 & 20** **24 & 40** **36 & 60** Find the Highest Common Factor and Lowest Common Multiple of this set of numbers. **48, 60 & 80**
Task D	**Task E**
Write the following numbers as products of their prime factors:- 24 36 135 154 2310	Show me how you would use prime factors to find the Highest Common Factor and Lowest Common Multiple of these pairs of numbers :- 36 and 50 16 and 72 90 and 175.

Teacher explanation and differentiated lesson activities

Year 7 **Knowledge** Progress Map – Types of Number

Foundation	Develop	Secure	Expert
a) Rounding I know how to **round** whole numbers to the nearest 10, 100 or 1000. ***HM 17*** **b) Multiples and Factors** I know what **multiples** and **factors** are. Task A ***HM 33 & 27*** **c) Squares and Cubes** I know what **square numbers** and **square roots** are. I know what **cube numbers** and **cube roots** are. ***HM 99, 100, 101***	**d) Rounding** I know how to round numbers to a given number of **decimal** places or **significant figures.** ***HM 56 and 130*** **e) Index Form** I know how to read and write numbers in index form. **HM 102**	**f) Prime Numbers** I know what a prime number is. **HM 28** **g) HCF and LCM** I know the meaning of **Highest Common Factor** and **Lowest Common Multiple** Task B ***HM 28, 31, 34***	**h) Prime Factors** I know how to write a number as a **product** of its **prime factors**. Task C ***HM 29 and 30*** **i) Irrational Numbers** I know that not all numbers will have an exact square root. ***HM 111***

Teacher explanation and differentiated lesson activities

Year 7 **Skills** Progress Map – Types of Number	Foundation	Developing	Secure	Expert
Reasoning - **Explore; Find examples and counter-examples**	**a) Multiples and Factors** I can find **all the factors** of a number by checking for divisibility. I can decide if a number is a multiple of another number by checking for divisibility. ***HM 33 & 27*** **Task A**	**b) Powers** I know how to evaluate **powers** (square, cube and higher). **HM 102**	**c) HCF, LCM** I know when to solve a problem by finding the **highest common factor or lowest common multiple** of two or more numbers. ***HM 28, 31, 34***	**d) Prime Factor Decomposition** I know how to use prime factor **decomposition** to find the **LCM and HCF** . ***HM 32, 35*** **Task D**

Pupil reflection

In this section we are going to discuss the importance of pupil reflection.

Pupil reflection

Pupil self regulation – key questions:

- What are you learning about today?
- Why did you choose the task you are working on?
- Where are you on your progress map?
- Where are you trying to get to on your progress map?
- How will you get there?

Pupil reflection

Red Pen Reflection

1. I made progress today because I learnt/discovered...

2. The steps to do this are/ this means...

3. I am still unsure about...

4. To fill in this gap I intend to...

Use my Progress Map to revise at home	Look up the topic on Hegartymaths and complete a task	Ask my friends or family to help me	Look up the meaning of the keywords from the lesson

Pupil reflection

Colour in the arrow, up to the statement which best describes your current understanding.

I'm so confident - I could explain this to someone else!
I can get to the right answer but I don't understand well enough to explain it yet.
I understand some of this but I don't understand all of it yet.
I tried hard and I listened but I am finding this challenging. I will make sure that I get help with this next lesson.
I do not understand any of this yet. There are things I could do to be a better learner next lesson.

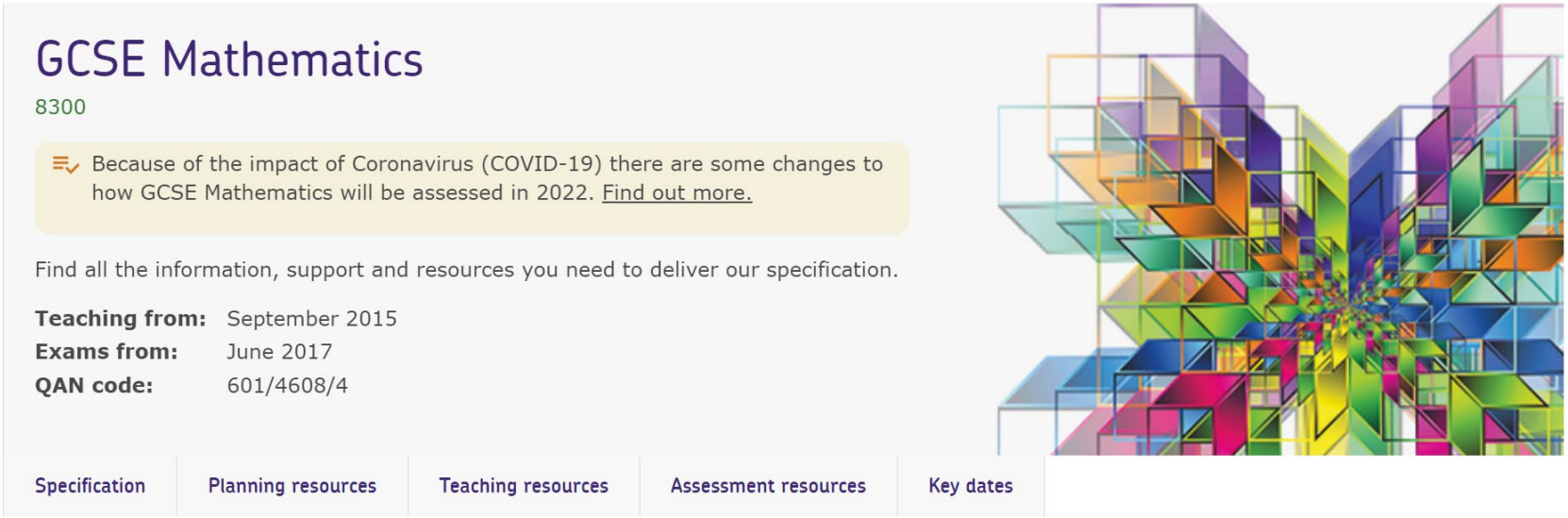
Key points

- All pupils must have access to the full range of differentiated tasks.
- Pupils must be given the opportunity to select the appropriate task for themselves (the teacher should re-direct when necessary).
- Pupils should be aware that every lesson they should be engaged in a task which challenges them but which is also achievable.
- Pupils should be given frequent opportunities to reflect on their learning / progress against their Progress Map.

Any questions?

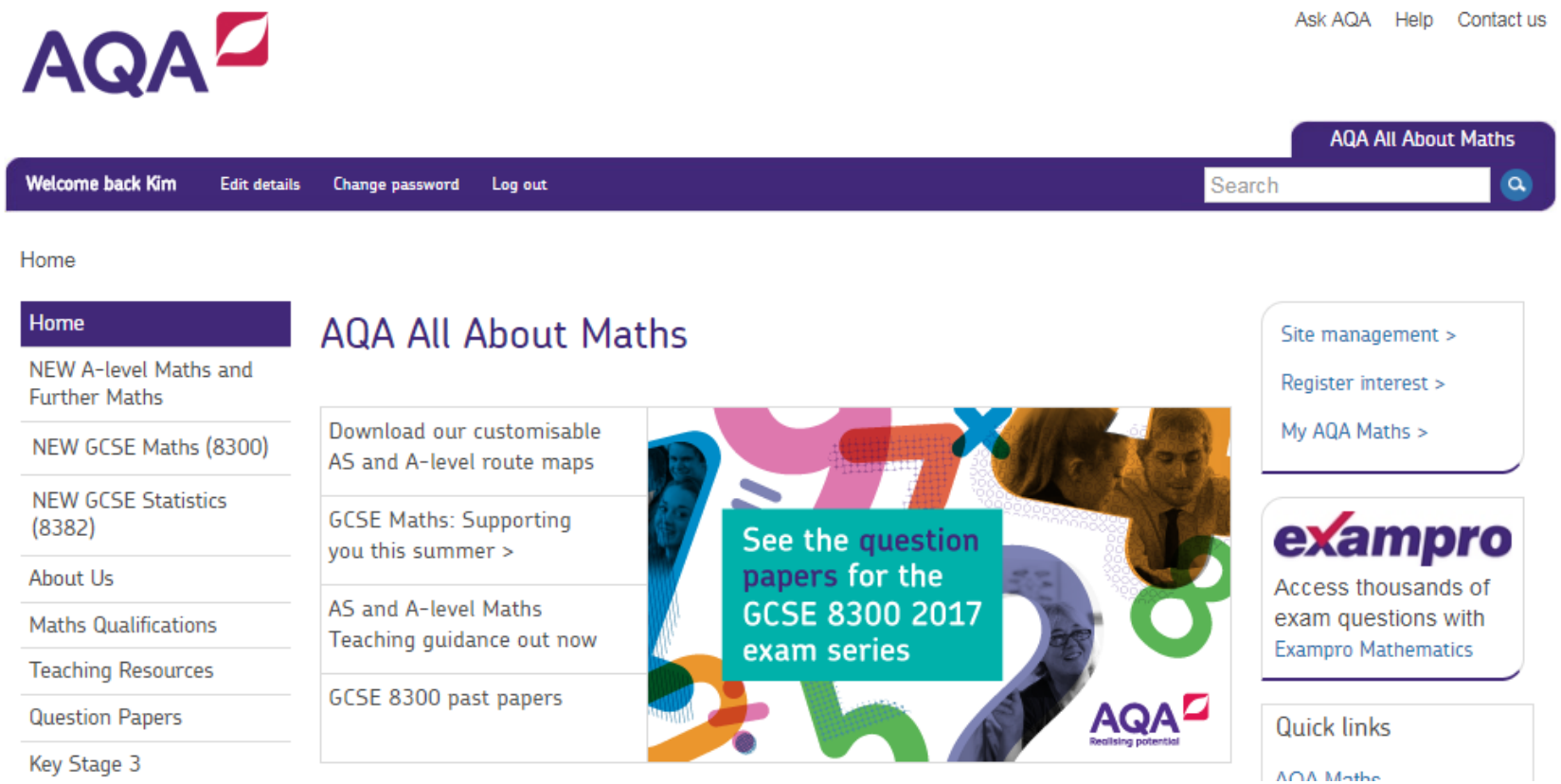
Resources

Take advantage of our extra resources in the ‘Plan’, ‘Teach’ and ‘Assess’ sections of our website.



AQA all about maths

Our dedicated website for maths resources: aqamaths.aqa.org.uk



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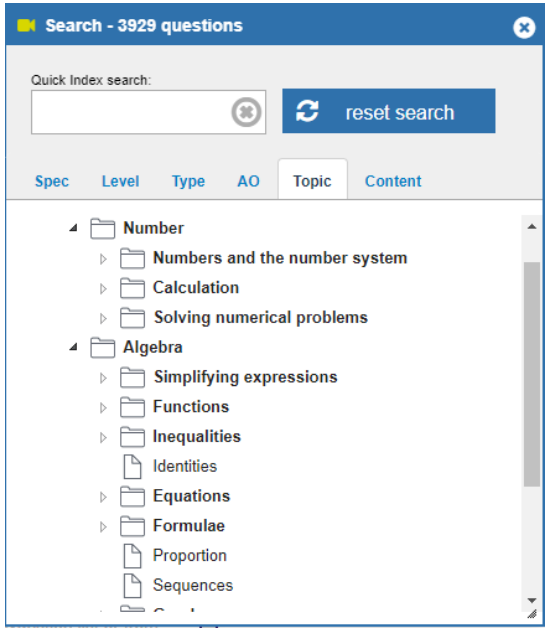

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