AQA
Realising potential

GCSE
MATHS

Virtual community: KS3 & KS4 – stretch and support in mixed attainment classes

Facilitation pack

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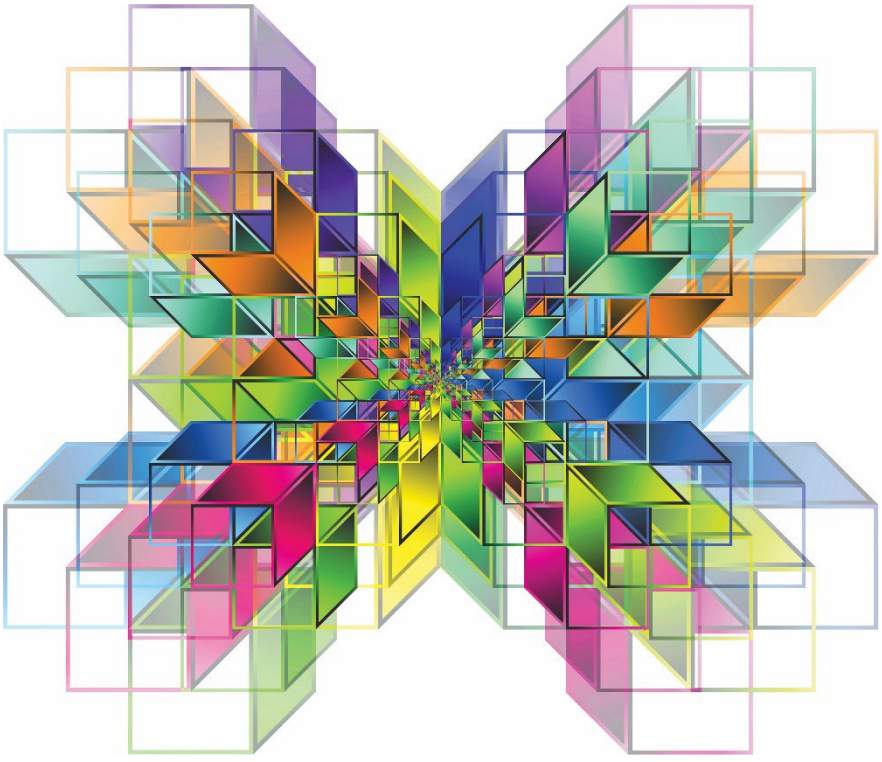


About this resource

We know that your time is limited, so we've designed this resource to make it easy for you to share what you've learned from our virtual community event.

This resource will enable you to deliver your own CPD session for your colleagues and it includes activities and resources linked to the virtual community topics to:

- Remind you of the topics covered during the event so you can brief colleagues or run a similar session with your team.
- Provide follow on activities and discussion areas for you and your team so the content can be taken further and applied or embedded in your school or college.

Resources available

- A copy of the PowerPoint from the meeting with notes for the presenter.
- Follow on pathways showing the topics covered during the meeting and ways to develop them.
- A pre and post meeting confidence check questionnaire to benchmark confidence of colleagues around the topic of your session.

We hope this gives you the opportunity to make the most of the time you invested in attending the event.

Follow on pathways

This section takes topics, discussion or activities from the virtual communities meeting and provides suggestions of areas for development and follow on activities you can do with your colleagues.

Activity 1

Area for development - using progress maps to enable pupils to regulate their learning.

Description of activity:

- Look at the progress maps provided in this pack.
- Discuss ways which you could use these in your lessons.
- Attempt to create a progress map for a future unit of work, alternatively look at the progress maps available on mixedattainmentmaths.com/mixed-attainment-lessons.html and adapt one of these to suit a future unit of work.

Activity 2

Area for development – engaging all pupils in the class discussion element of the lesson through open, 'do now', starter activities.

Description of activity:

- Look at the examples of the 'ask a question/make a comment' 'do now' activities.
- Consider/discuss the range of responses the pupils in your classes might give.
- Design your own 'ask a question/make a comment' try to adapt one of your existing 'do now' activities when doing this.

Activity 3

Area for development – using a range of different types of differentiation within a lesson.

Description of activity:

- Read the description of the different types of differentiation which can take place in a lesson.
- Discuss whether there any which you use more than others, why is this?
- Discuss whether are any which you rarely or never use, why is this?

Activity 4

Area for development – creating multiple entry point tasks.

Description of activity:

- Look at the examples of multiple entry point tasks.
- Discuss: Which is the most open?
- Discuss: Which provides the greatest opportunities for problem solving and/or reasoning.
- Discuss: What further adaptions might you make.
- Consider the concrete resources/manipulatives that are available to you in your department. Create a multiple entry point task using these.

Activity 1

Area for development: Using progress maps to enable pupils to regulate their learning.

Progress maps are a useful tool in classes with a range of attainment as they ensure that all pupils are supported and challenged. Progress maps make the teacher aware of each individual pupil's prior knowledge at the start of a unit of work and they enable the teacher to track individual progress across a unit of work.

Progress maps also make progress visible to students, they can 'see' themselves developing new knowledge and skills over time and this helps to foster a growth mindset. Progress maps also support pupils to regulate their own learning by making clear the next steps in learning.

Steps for using progress maps:

1. Pupils complete a mini assessment at the start of a unit of work to identify their start point on the progress map.

2. Pupils then choose their task each lesson based upon what they need to learn next in order to make progress. (It is very important that pupils do not all start on task one and work their way through the easier tasks in order to reach the harder tasks).

3. Pupils tick and date the statements from the progress map when they feel that they have developed each skill/knowledge.

4. The teacher should encourage pupils to select tasks for themselves and foster a classroom culture in which pupils seek challenge.

5. It remains the teacher's responsibility to monitor task choice and redirect pupils who have selected inappropriately.

6. Pupils are assessed again at the end of each unit of work. The teacher and the pupils can then compare the start of unit and end of unit Progress Map to see which skills/knowledge the pupil gained developed across the unit of work.

The next three pages contain examples of progress maps, you can also find further progress maps, including the pre-teaching mini assessments and the end of unit assessment tasks here: mixedattainmentmaths.com/mixed-attainment-lessons.html

Discussion Points

Would you consider using Progress Maps in your lessons? Would your pupils find these useful?

Task

Attempt to create a progress map for a future unit of work, alternatively adapt one of the examples available on the website to suit a future unit of work.

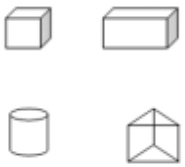
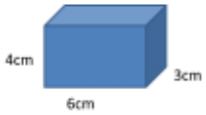
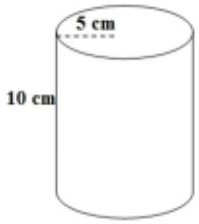
Year 7 **Knowledge** Progress Map – Number Line and Place Value

Foundation	Developing	Secure	Expert
a) **Integers** I know how to order **integers** from 0 to 100 using terms such as greater, less than and in between. ***HM 13*** **Example** Put these numbers in order from smallest to biggest: 12, 57, 23, 89, 46 b) **Place Value** I know how to order **integers** greater than 100. ***HM 14*** **Example** What value does the digit 7 hold in the number 178?	c) **Decimals and Negative Numbers** I know how to order **negative** numbers and **decimal numbers** to two or three places. ***HM 37 & 46*** **Example** Put these numbers in order from smallest to biggest: 0.1, 0.5, 0.412, 0.25, 0.12, -3, -7 d) **Equivalent Values** I know how to match simple fractions, decimals and percentages. ***HM 45*** **Example** 0.1, 0.5, 0.412, 0.25, 0.12, -3, -7 Which of the numbers listed above means the same as: ½? ¼?	e) **Terminating Decimals** I know how to match **terminating decimals** to a fraction and a percentage. ***HM 52 & 55*** **Example** Write each fractions as a decimal and a percentage: $\frac{7}{10}$ $\frac{3}{20}$ $\frac{4}{5}$ $\frac{1}{8}$ f) **Order Numbers** I know how to order any numbers including positive and negative integers, fractions, **mixed numbers** and decimals. ***HM 73, 74, 75, & 76*** **Example** Put these numbers in order from smallest to biggest: $2\frac{3}{4}$, -0.33, $-1\frac{1}{3}$, 22%, -0.033, $\frac{9}{4}$	g) **Recurring Decimals** I know which fractions are terminating decimals and which are recurring. I know how to match **recurring decimals** to fractions. I know what rational and irrational numbers are. ***HM 53 & 54*** **Example** Which of these fractions are recurring decimals? $\frac{3}{50}$ $\frac{3}{8}$ $\frac{5}{7}$ $\frac{1}{11}$ Can you explain why?

Year 7 **Skills** Progress Map – Number Line and Place Value
Reasoning - **Explore; Find examples and counter-examples**

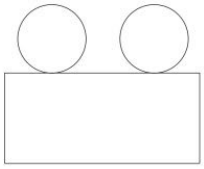
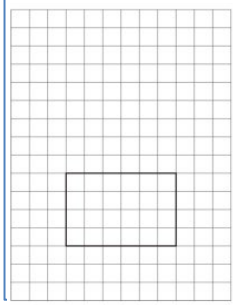
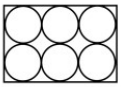
Foundation	Developing	Secure	Expert
Sa) I can create examples and counter examples to explain place value with positive integers. ***HM 13 & 14*** **Example** Always/sometimes/never: A number with 9 units is going to be bigger than one with 6 units?	Sb) I can create examples and counter examples to explain place value with terminating decimals. ***HM 37, 45, 46,*** **Example** Explain whether the following is true or false: *10 is greater than 9, so 0.10 is greater than 0.9*	Sc) I can use my knowledge of equivalent fractions and / or converting between fractions and recurring decimals to justify comparisons. ***HM 52, 55, 73, 74, 75, 76*** **Example** Write down a fraction between $\frac{1}{7}$ and $\frac{1}{3}$ How did you do it? Which is it closer to? How do you know?	Sd) I can give reasons why some fractions represent terminating decimals and others represent recurring decimals. I can explain why some numbers cannot be written as a fraction. ***HM 53 & 54*** **Example** Decide whether the statement below is true or false. You must give a reason for your answer All numbers can be written as a fraction.

Y8 Knowledge Progress Map – Surface Area and Volume

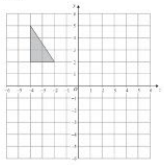
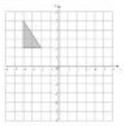
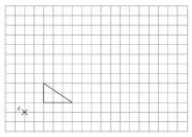
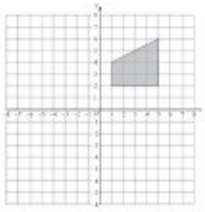
Foundation	Developing	Secure	Expert
a) **3-D Shapes** I know the names of simple **3-D shapes**. ***HM 832*** b) **Nets** I know what the **nets** of different **3-D shapes** look like. ***HM 833-836*** Example Name these shapes. 	c) **Identifying parts of a shape** I know / can identify **edges, faces** and **vertices.** ***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.** ***HM 567***	e) **Volume and Surface Area** I know the **difference** between **volume** and **surface area.** f) **Surface Area/Volume of Cubes/Cuboids** I know how to calculate the **volume** and **surface area** of **cubes** and **cuboids.** ***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.** ***HM 570, 571, 585, 572, 573, 574, 586*** Example Find the volume and surface area of this cylinder. 

Y8 Skills Progress Map – Surface Area and Volume

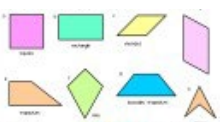
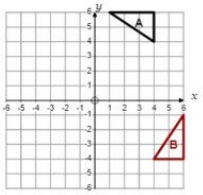
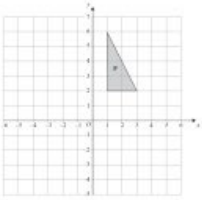
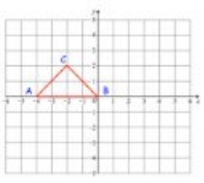
Problem Solving - Interpret

Foundation	Developing	Secure	Expert
a) I can decide when a net is not a possible match for a 3D shape by considering faces, edges and vertices. Example Christopher wants to make a solid shape and drew this shape. Explain why this shape is not a correct net. 	b) I can draw an accurate net of a 3D shape when given the dimensions of the shape. Example A cuboid has a length 6cm, width 4cm and height 1cm. Complete an accurate net of the cuboid. Each square represents 1cm². One face has been drawn for you. 	c) I can identify whether a multistep problem involving cuboids is about volume or surface area and I can use my knowledge to solve the problem. Example An empty swimming pool is going to be filled with water. The swimming pool is a cuboid, that is 25 metres long, 10 metres wide and 2 metres deep. It is being filled at a rate of 800 litres per minute. Given $1m^3 = 1000$ Litres, how long it will take to fill the swimming pool? Give your answer in hours and minutes.	d) I can identify whether a multistep problem involving prisms or cylinders is about volume or surface area and I can use my knowledge to solve the problem. Example 6 cylinders are placed in a crate as shown below. The radius of each cylinder is 4cm and the height of each cylinder is 14cm. The crate also has a height of 14cm. What percentage of space in the crate is empty? 

Y10 Knowledge Progress Map – Transformations

Foundation	Developing	Secure	Expert
a) **Symmetry** I know how to draw lines of **symmetry** on basic 2D shapes. ***HM 827*** b) **Rotational Symmetry** I know how to find the order of **rotational symmetry** for basic 2D shapes. ***HM 828*** c) **Reflect** I know how to **reflect** a 2D shape in the x-axis or the y-axis. ***HM 639*** Example Kc) Reflect this triangle in the y axis. 	d) **Enlarge** I know how to enlarge a shape by a **positive scale factor**. ***HM 642. 644*** e) **Rotate** I know how to **rotate** a 2D shape about the **origin**. ***HM 648*** f) **Reflect in line** I know how to **reflect** a 2D shape in a line x = a or y = b. ***HM 640*** g) **Reflect in y=x** I know how to reflect a 2D shape in the line y = x or y = -x . ***HM 641*** Example Ke) Rotate this triangle 90 degrees clockwise around the origin. 	h) **Centre of Rotation** I know how to rotate a 2D shape using a **Centre of Rotation**. ***HM 649*** i) **Translate** I know how to **translate** a 2D shape by a **vector**. ***HM 638*** j) **Enlarge** I know how to **enlarge** a 2D shape from a Centre of Enlargement. ***HM 643*** Example Kj) On the grid enlarge the triangle by a scale factor of 3 using A as the Centre of Enlargement. 	k) **Negative Scale Factor** I know how to enlarge a 2D shape by a **negative scale factor** from a centre of enlargement. ***HM 645, 646, 647*** l) **Invariant Points** I know what invariant points are and I can recognise them. ***HM 655*** Example Kk) Enlarge the shaded shape by a scale factor -½ using the Centre of Enlargement (-1, -2) 

Y10 Skills Progress Map – Reasoning – **Conjecture**

Foundation	Developing	Secure	Expert
a) I can recognise when shapes do not have line symmetry or have rotational symmetry of order 1 **HM 639, 640, 641** Example Circle the shapes which do not have rotational symmetry. On the other shapes write down the order of rotational symmetry. 	b) I know the minimum information required to carry out a single transformation. I can use this information to describe fully single transformations using formal mathematical language. **HM 650, 651, 652, 653, 654** Example Describe the single transformation that maps shape A onto shape B 	c) I can carry out combined transformations to create an image. I can recognise and describe fully, using formal mathematical language, a single transformation that could have been used to create the same image. **HM 650, 651, 652, 653, 654** Example Triangle P is drawn on a coordinate grid. The triangle P is reflected in the line x = –1 and then reflected in the line y = 1 to give triangle Q. Describe fully the single transformation which maps triangle P onto triangle Q. 	d) I can carry out transformations and describe which points are invariant. I can see which transformations to carry out to arrive at a given number of invariant points. **HM 655** Example ABC is a triangle. Describe fully a **single** transformation of ABC so that: (a) None of the vertices are invariant. (b) Exactly one vertex is invariant. (c) Exactly two vertices are invariant. 

Activity 2

Area for development – Engaging all pupils in the class discussion element of the lesson through 'open' do now/starter activities.

In a class with a wide range of prior knowledge, it is useful to start with an open discussion point that is accessible to all students:

- Open discussion points provide opportunities for pupils to explain their reasoning and ensure that all students can contribute in a meaningful way.
- They are a great way for teachers to assess prior understanding and identify and address misconceptions.

Whilst students are thinking about the discussion point, I find it really helpful to circulate the room listening to students' conversations and noticing what they are writing down. This enables me to identify which students to call upon to contribute first, so that each contribution builds upon the previous ones.

I also find it useful to think about the types of questions and comments I expect to hear, and the type of misconceptions pupils commonly have. This prepares me to respond to my pupils' contributions and draw out any key ideas that I want to make sure are shared.

Below are some examples of Inquiry Prompts that I created. An Inquiry Prompt provides an 'Open' discussion point and when used to its fullest extent can develop into a lesson or series of lessons in which pupils follow their chosen line of Inquiry. To find out more about Mathematical Inquiry visit inquirymaths.org, where the Inquiry Prompts below can be found. Click on the hyperlinks to go find each one. An inquiry approach is ideal for a mixed attainment class because it supports and challenges all students and allows them to direct their own learning

Product of Factors Inquiry	Fractions of a Number Inquiry	Base and Index Inquiry
Ask a Question / Make a Comment	Ask a Question / Make a Comment	Ask a Question / Make a Comment
The Product of the factors of $24 = 24^4$	$\frac{4}{10}$ of $70 = \frac{7}{10}$ of 40	$2^5 \times 5^2 = 10^2$

Discussion Point

How might the pupils in your class respond when invited to ask a question or make a comment about each of the prompts below?

Activity

Design your own 'Ask a question/Make a comment' prompt or design an Open 'Do Now' activity by adapting one of the examples in the presentation.

Activity 3

Area for development – using a range of different types of differentiation within a lesson.

In a mixed attainment class, it is important to differentiate to meet the needs of all learners. Some students will take longer to grasp new skills and knowledge and may not be ready to move along their Progress Map for several lessons. Other students will grasp new skills and knowledge rapidly and will be ready to move along their Progress Map quite quickly.

Differentiation does not have to mean that pupils are working on different sets of questions or solving different sets of problems from one another. This is one form of differentiation but there are others that are equally effective. It is worth considering which stage of the lesson the class are in as different forms of differentiation can be more effective at different stages of the lesson. For example, differentiation by questioning is effective during the class discussion stage while differentiation by explanation is effective when pupils are working independently whilst the teacher is circulating.

Differentiation may take any of these forms:

- Task - Pupils work on different tasks / worksheets with the lesson.
- Outcome - The same stimulus leads to open ended responses (multiple entry point tasks).
- 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.
- 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.

Key Points to remember:

- 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 in 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.

Discussion Points

Which of the differentiation strategies described do you use the most, why is this?
Are there any which you rarely or never use, why is this?

Activity 4

Area for development– creating multiple entry point tasks.

In the Presentation we looked at the following examples of Multiple Entry Point tasks.

Example 1 – Pupils are given a set of these 3D shapes and nets.

Pupils then chose from the following tasks:

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.

Example 2 – Pupils are given a set of these images of sequences.

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

They then choose from the following tasks:

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?

Discussion Points

Which task is the most open?
Which task provides the greatest opportunities for problem solving and/or reasoning?
What further adaptions might you make?

Activity

Consider the concrete resources / manipulatives that are available to you in your department.
Create a multiple entry point task using these.

Confidence checks

Rate the area of development statements according to your confidence where 0 is not confident at all and 5 is very confident.

Before the meeting

	Rating	Reasons/notes
Objective 1 Developmental statement – I know how to use progress maps as a tool to enable pupils to regulate their own learning.		
Objective 2 Developmental statement – I know a range of strategies to ensure lessons are differentiated to meet the needs of all learners.		
Objective 3 Developmental statement – I know what an open 'do now' is, how to create one and how to facilitate a discussion which will enable pupils to build upon each other's contributions.		
Objective 4 developmental statement – I know what a multiple entry point task is and how to create one.		

After the meeting

	Rating	Reasons/notes
Objective 1 Developmental statement – I know how to use progress maps as a tool to enable pupils to regulate their own learning.		
Objective 2 Developmental statement – I know a range of strategies to ensure lessons are differentiated to meet the needs of all learners.		
Objective 3 Developmental statement – I know what an open 'do now' is, how to create one and how to facilitate a discussion which will enable pupils to build upon each other's contributions.		
Objective 4 developmental statement – I know what a multiple entry point task is and how to create one.		

Planning for the future

Questions for consideration

- What areas have you identified as strengths using the confidence check?
- How might you develop these further?
- What areas have you identified as areas for development?
- How might you build confidence in these areas?
- How might some of the learning from the virtual community/CPD session impact your department?
- What changes could you make based on outcomes of the CPD session?

Notes

Contact us

Our friendly team will be happy to support you between 8am and 5pm, Monday to Friday.

Tel: 0161 957 3852
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Twitter: @AQAMaths

aqa.org.uk