Have you registered your car at reception?

Heads of Maths Network Meeting
March 23rd 2022
Spring 2 meeting

Jo.Lees@hants.gov.uk

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HIAS SCHOOL IMPROVEMENT

Hampshire HoDs: Date schedule
All meetings start at 1315 with approximate finish of 1600

Date	
Thursday 07-10-21	**Holiday Inn Eastleigh**
Tuesday ~~30-11-21~~ 11-01-22	**MSTeams**
Wednesday 02-02-22	**MS Teams**
Wednesday 23-03-22	**Holiday Inn Eastleigh**
Thursday 05-05-22	**Holiday Inn Eastleigh**
Tuesday 05-07-22	**MSTeams**

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Materials for Hampshire HoDs Meetings

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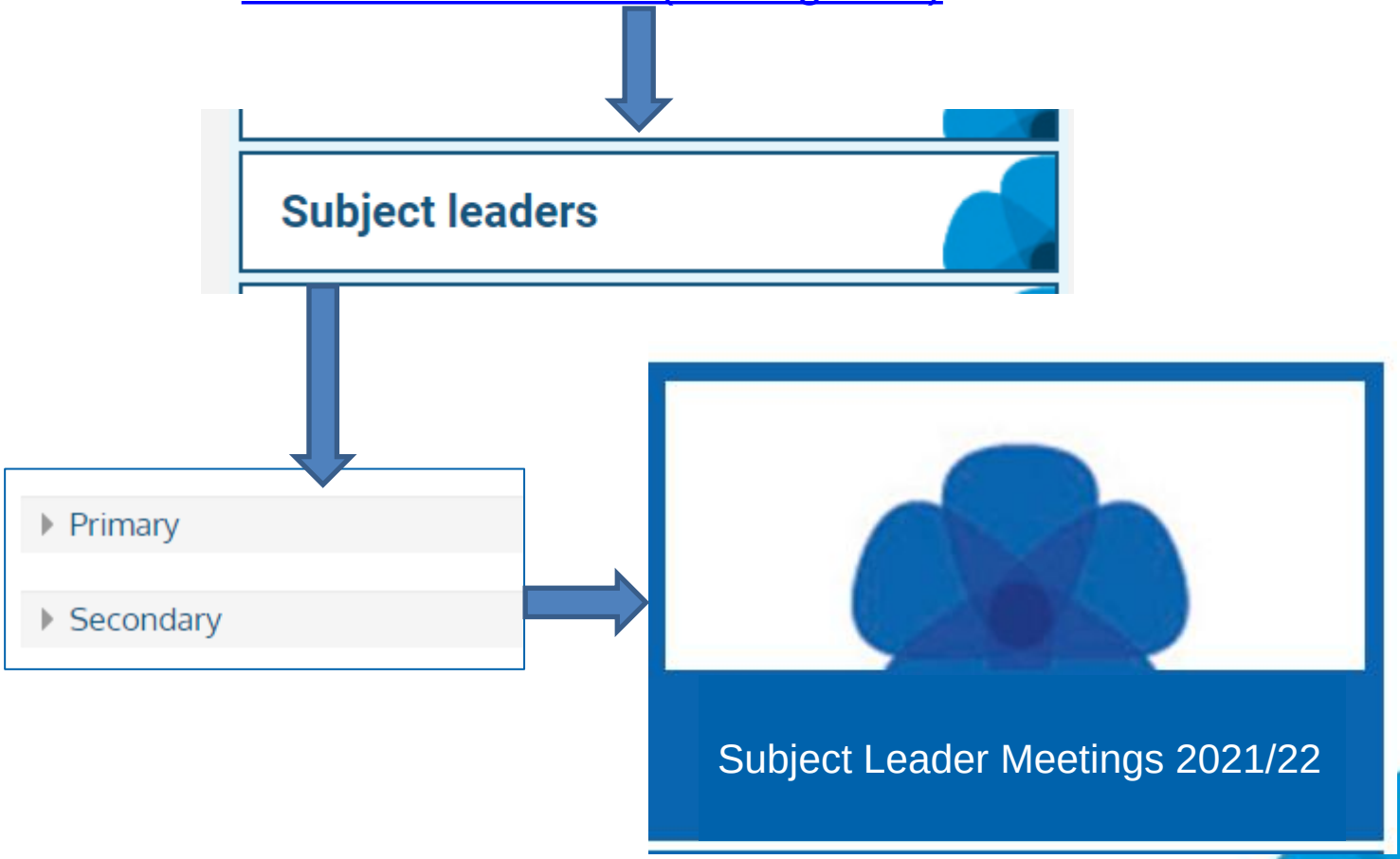
HIAS Maths Moodle (hants.gov.uk)



HH2122

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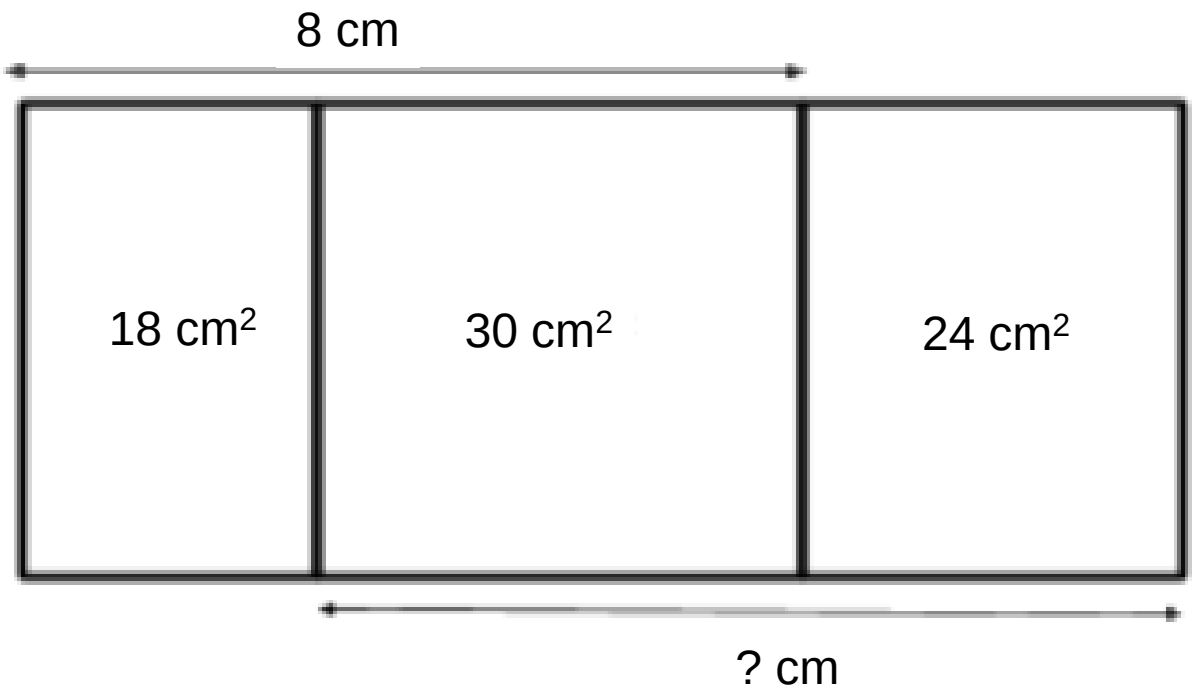
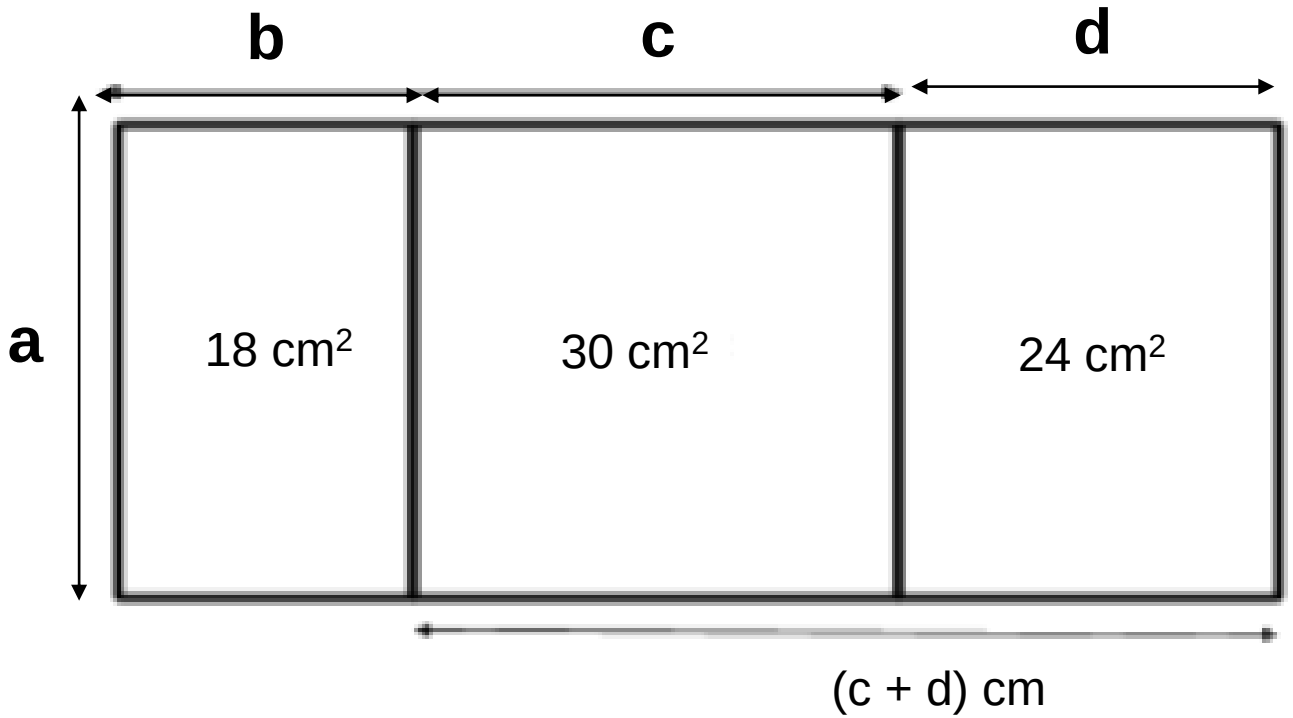
Agenda : March 23rd

- Subject enjoyment: Some maths to get us started
- NCETM update ~ good department materials
- Teaching and Learning: Task design for mixed, or broad, attainment classes. Sharing good practice and designing tasks. Presenting in groups.
- Leadership: Department CPD: a look at best practice using the EEF guidance on professional development . Opportunity to design department PD and present to group.
  EEF-Effective-Professional-Development-Guidance-Report.pdf
- Assessment: Mock results / impact on teaching programme . GCSE arrangements and resources available - be prepared to share good ideas for revision, curriculum coverage, interventions, gap analysis etc
- AOB

Area Maze problem



Area Maze problem



Givens
ab = 18
ac = 30
ad = 24
b + c = 8

a (b + c) = 48
8a = 48
a = 6

So a = 6 ; b = 3 ; c = 5 ; d = 4

c + d = 9 cm

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NCETM Materials update

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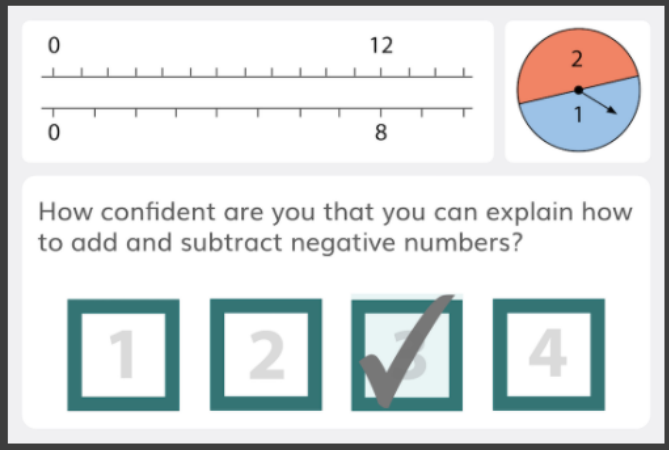
Effective subject knowledge of maths underpins high-quality teaching.

MASTERY PD MATERIALS

SECONDARY SUBJECT KNOWLEDGE AUDIT

Assess your confidence in teaching the content of the KS3 maths curriculum



A resource for teachers in training, those new to the profession or to the teaching of mathematics or those who wish to develop and improve their practice.

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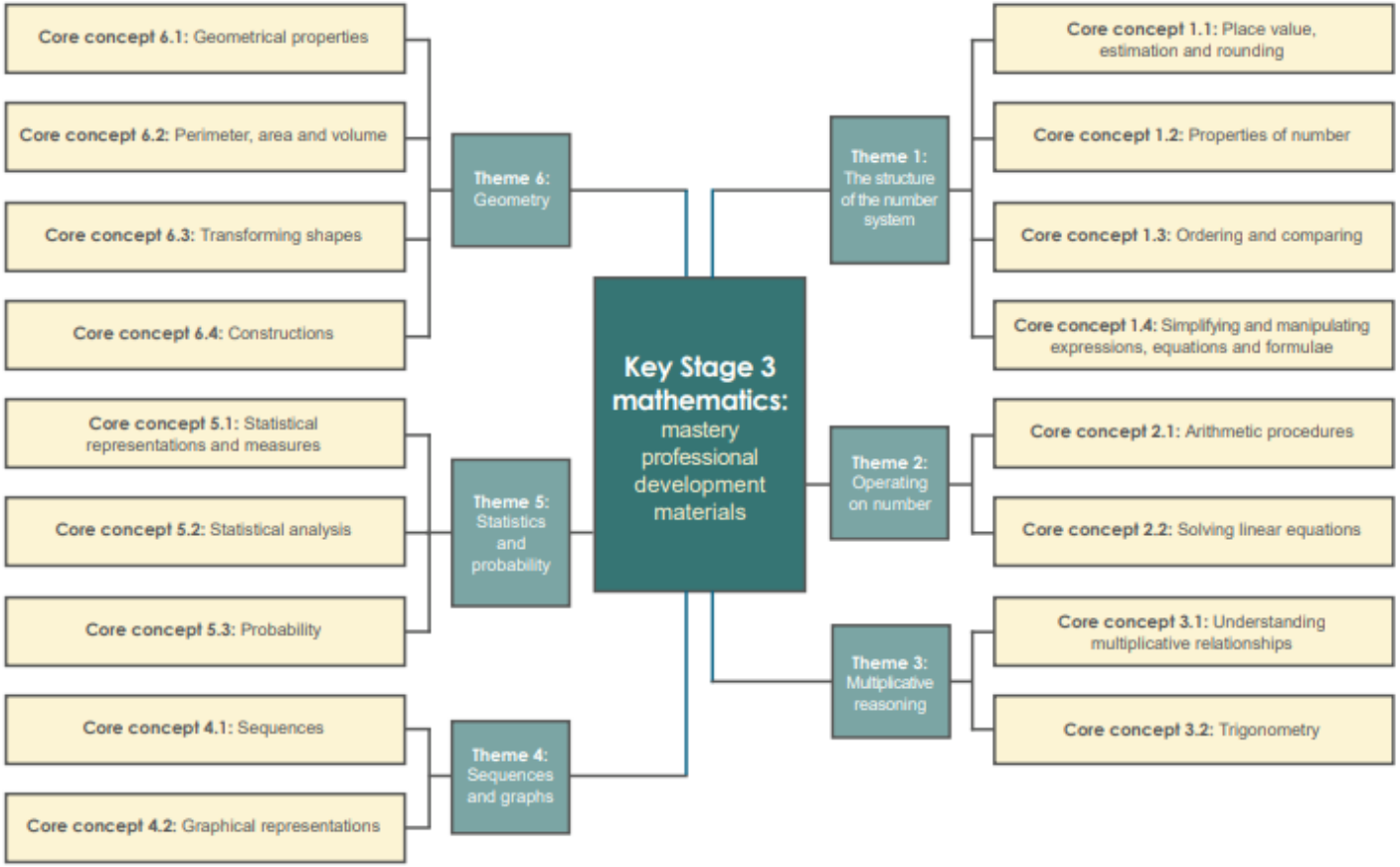
[Secondary Subject Knowledge Audit | NCETM]

Professional Development Materials

KS3 structure



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[Secondary Mastery Professional Development | NCETM]

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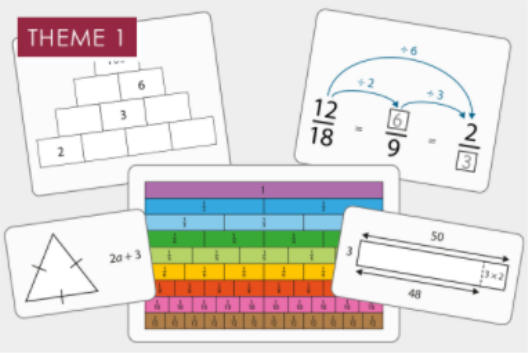
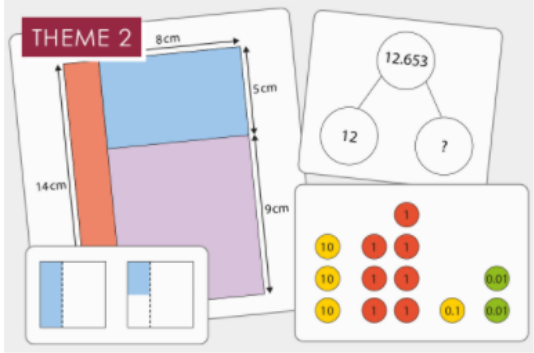
MATERIALS AND GUIDANCE



The structure of the number system

Theme 1 comprises four core concepts: place value, estimation and rounding; properties of number; ordering and comparing; simplifying and manipulating expressions, equations and formulae.



Operating on number

Theme 2 comprises two core concepts: arithmetic procedures; solving linear equations.

Multiplicative reasoning

Theme 3 comprises two core concepts: understanding multiplicative relationships; trigonometry.

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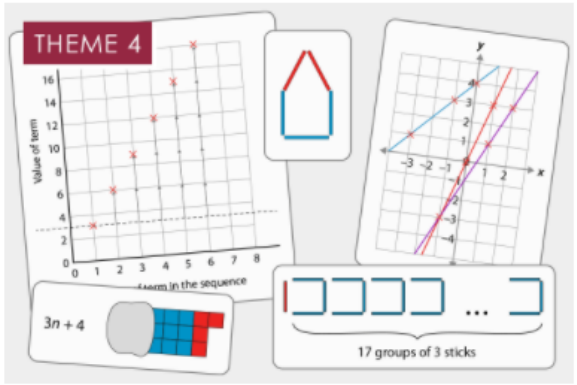
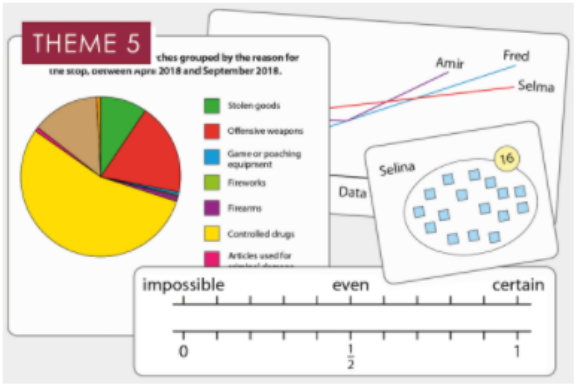


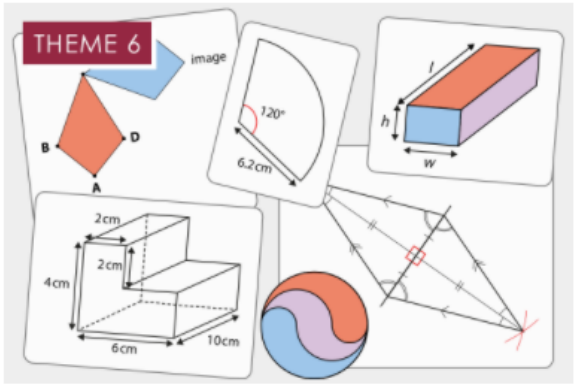
Sequences and graphs

Theme 4 comprises two core concepts: sequences; graphical representations.



Statistics and probability

Theme 5 comprises three core concepts: statistical representations and measure; statistical analysis; probability.



Geometry

Theme 6 comprises four core concepts: geometrical properties; perimeter, area and volume; transforming shapes; constructions.

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Core concept 1.1: Place value, estimation and rounding

1.1.1 Understand the value of digits in decimals, measure and integers

How confident are you that you can explain, using representations if appropriate, the place value of integers and decimals including using exponent and fractional representations for the column headings?

1 ☐ 2 ☐ 3 ☐ 4 ☐

How confident are you that you can explain how to order and compare numbers using inequality notation?

1 ☐ 2 ☐ 3 ☐ 4 ☐

Understanding place value is a fundamental skill and at the heart of a strong sense of number. Students need to be able to correctly say any number and understand where it fits in the number system (i.e., in an ordered list of numbers and on a number line). The focus in this set of key ideas is understanding the structure of the system (that each column value is a power of ten and that multiplying or dividing by ten shifts digits from one column to the adjacent one).

For example, students should be able to reason that in the number 4.763:

- the value of the digit 4 is four ones
- the value of the digit 7 is seven tenths
- the value of the digit 6 is six hundredths
- the value of the digit 3 is three thousandths

and that the number can be represented like this:

1	10^{-1}	10^{-2}	10^{-3}
1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
4.	**7**	**6**	**3**

Dienes, place value counters, the Gattengo chart, place-value charts and single number lines are all common representations used in schools for place value.

Students should be able to order sets of numbers such as 9, 7.5, −4, −11, 11.2, 7, 6.81 by first comparing the digits with the greatest place value.

Students should also be able to select the correct symbol to complete number sentences, e.g. $-4 > -5$ and $2.03 < 2.1$.

Further support links

- NRICH: Learn about Number Bases: https://nrich.maths.org/1368
- NCETM Secondary Professional Development materials: 1.1 Place value, estimation and rounding, pages 6–9
- NCETM: Using mathematical representations at KS3: Single number lines, Dienes and place value counters, The Gattegno chart (structure of the number system page 3), Place Value Charts

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Subject Knowledge Audit
(Key Stage 3 Mathematics)

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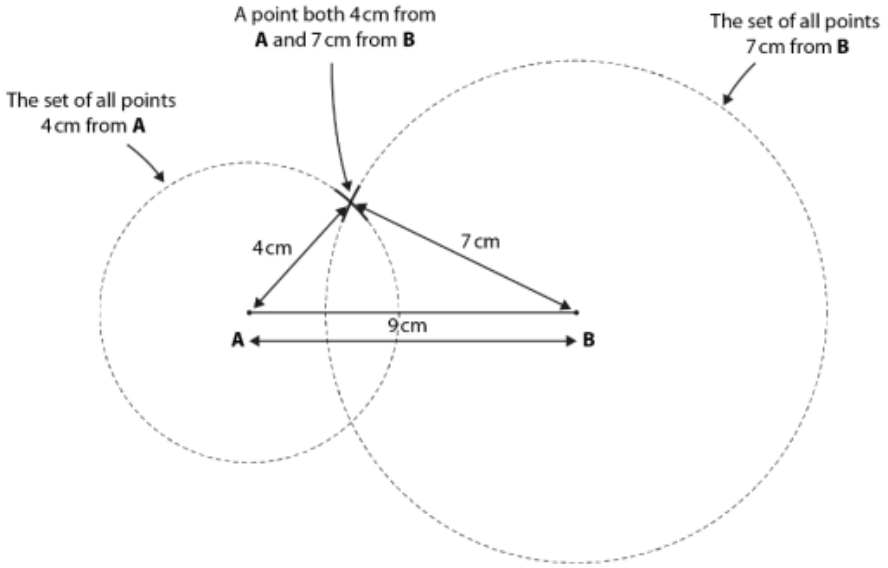
Core concept 6.4: Constructions

6.4.1 Use the properties of a circle in constructions

How confident are you that you can explain how to construct triangles and rhombuses from given lengths using the properties of a circle?

1 ☐ 2 ☐ 3 ☐ 4 ☐

A key awareness is that drawing a circle creates an infinite set of points, all of which are equidistant from its centre. Students will need plenty of experience of using a ruler and a pair of compasses to appreciate the nature of the construction, and to explore the different ways drawn circles can be used to identify points that are a specified distance away from one or more points. Students should also become aware that drawing full circles is not necessary – the drawing of carefully placed arcs is more efficient.



Once students can construct a scalene triangle with ease and efficiency, they can be challenged to construct other shapes (for example, equilateral and isosceles triangles and rhombuses). This will not only provide opportunities for students to become fluent with the construction processes, but also, importantly, to engage in some early discussions about the basic properties of these shapes.

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Getting Year 7 students off to a secure start in maths is important for the rest of their time in secondary school

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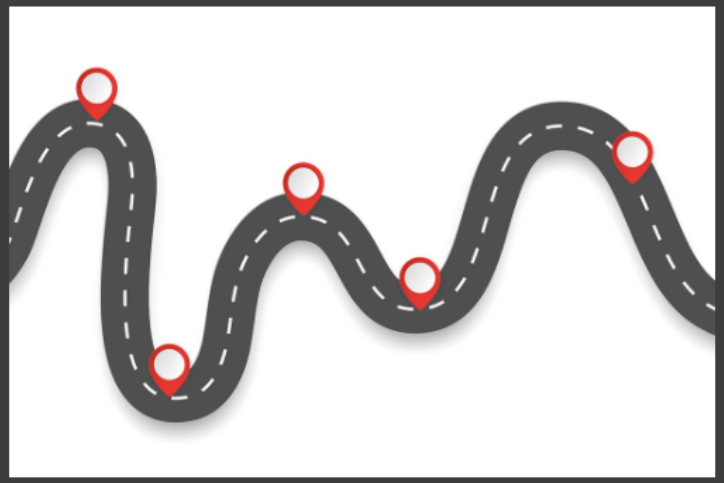
COVID RECOVERY

CHECKPOINTS

A year's worth of Year 7 maths activities to help teachers assess understanding and lay foundations for KS3



Checkpoints are diagnostic activities that will help teachers assess the understanding students have brought with them from primary school and suggest ways to address any gaps that become evident.

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Checkpoints | NCETM

Hampshire

IMPROVEMENT

Place value

Properties of number: factors, multiples, squares and cubes

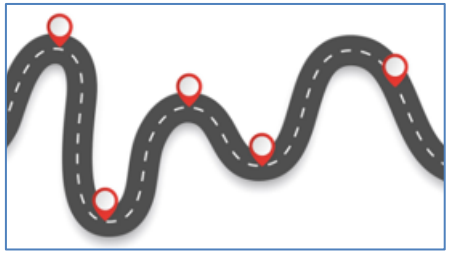
Arithmetic procedures with integers and decimals

Expressions and equations

Plotting coordinates

Perimeter and area

Arithmetic procedures including fractions



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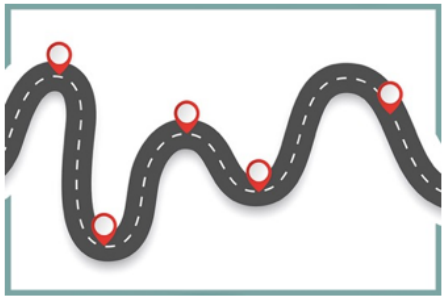
Checkpoints

Year 7 diagnostic mathematics activities

Arithmetic procedures including fractions

Thirty-one Checkpoint activities
Fifteen additional activities



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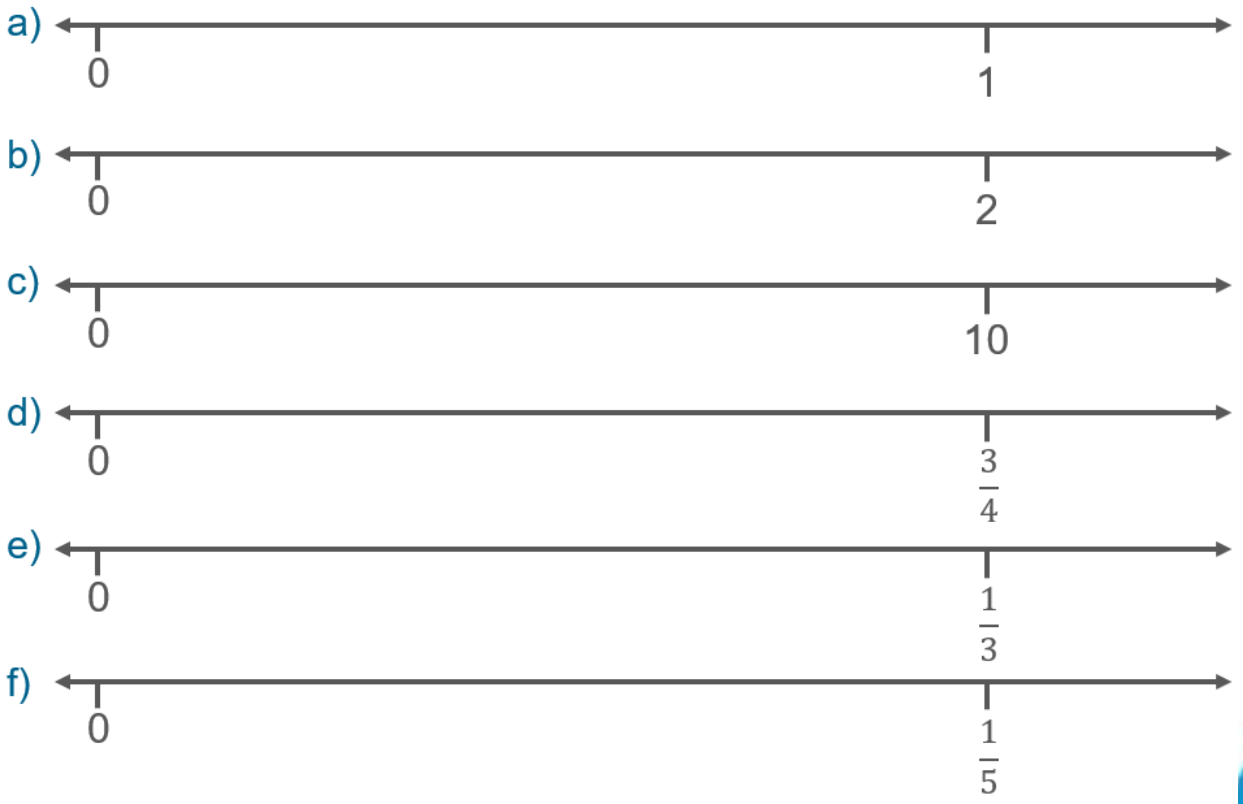
Checkpoint 2: Where is one-quarter?

Where is the number $\frac{1}{4}$ on each of these number lines?



?

What value is $\frac{1}{4}$ of the way along each number line?

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Checkpoint 5: Same value, different appearance

Which of these are equivalent?

$$\frac{5}{100} + \frac{6}{10}$$

10 000s	1 000s	100s	10s	1s	$\frac{1}{10}$s	$\frac{1}{100}$s
				5	.	6

$$\frac{56}{1\,000}$$

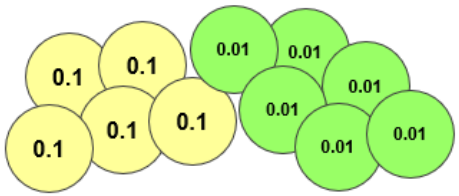
fifty-six tenths

0.56

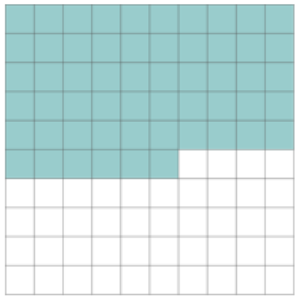
$$\frac{5}{10} + \frac{6}{100}$$

$$\frac{56}{100}$$

fifty-six hundredths



1 000	2 000	3 000	4 000	5 000	6 000	7 000	8 000	9 000
100	200	300	400	500	600	700	800	900
10	20	30	40	50	60	70	80	90
1	2	3	4	5	6	7	8	9
0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09



? For those that aren't equivalent to another, write some statements that are.

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Task Design

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How do we design a sequence of tasks to support mathematical thinking and understanding ?

How do we 'Teach for Mastery'?

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Teaching for Mastery: **Variation**

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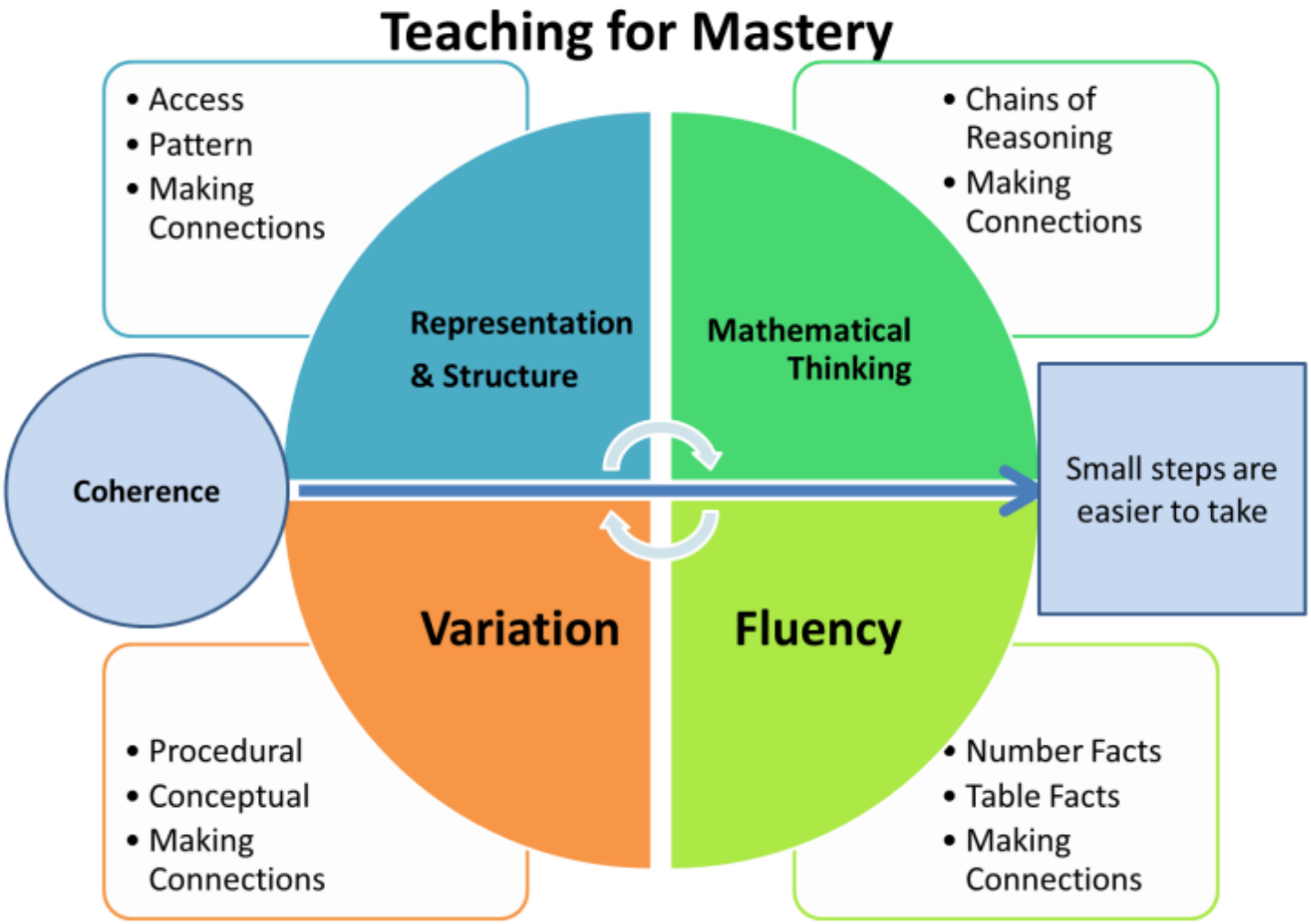

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Key Messages : Variation

1. The central idea of teaching with variation is to highlight the essential features of a concept or idea through varying the non-essential features.

2. Variation is not the same as variety – careful attention needs to be paid to what aspects are being varied (and what is not being varied) and for what purpose.

3. When giving examples of a mathematical concept, it is useful to add variation to emphasise **what it is** (both standard and non-standard examples) and **what it is not.**

4. When constructing a set of activities or questions it is important to consider what connects the examples; what mathematical structures are being highlighted? Students are encouraged to avoid mechanical practice and, instead, to practise the thinking process (intelligent practice)

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Strategy 1: procedural variation practice sets:

- Strategically varies one thing at a time to draw attention to underlying structure of the concept
- Prompts students to attend to the variation by asking **'what is the same and what is different?'**
- May appear easy at first glance
- Not 'variety' (unconnected examples for procedural practice)

$(y+1)(y+24)$

$(y+2)(y+12)$

$(y+3)(y+8)$

$(y+4)(y+6)$

$(y+1)(y+9)$

$(y+2)(y+8)$

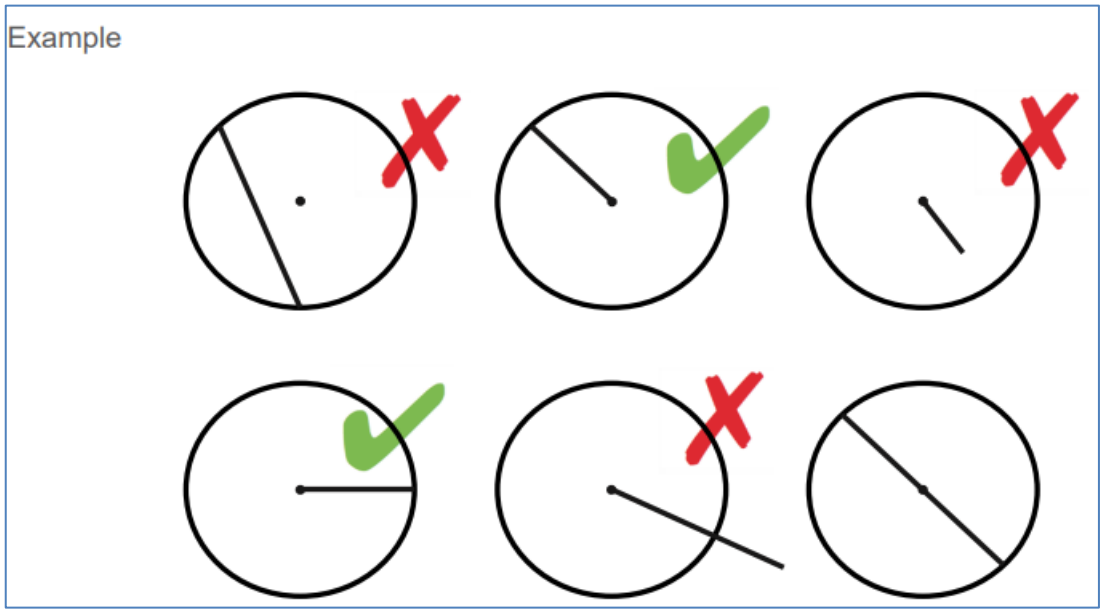
$(y+3)(y+7)$

$(y+4)(y+6)$

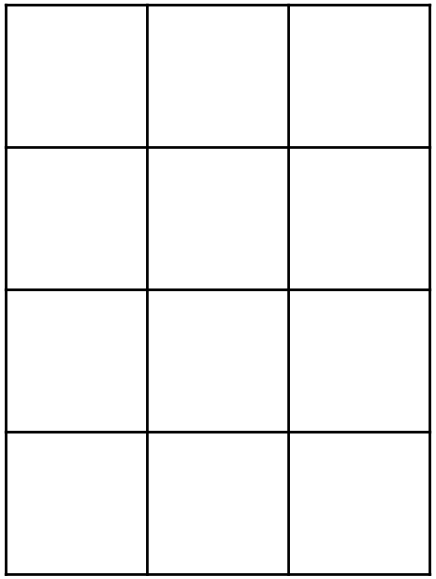
$(y+5)(y+5)$

Strategy 2: concept/non-concept

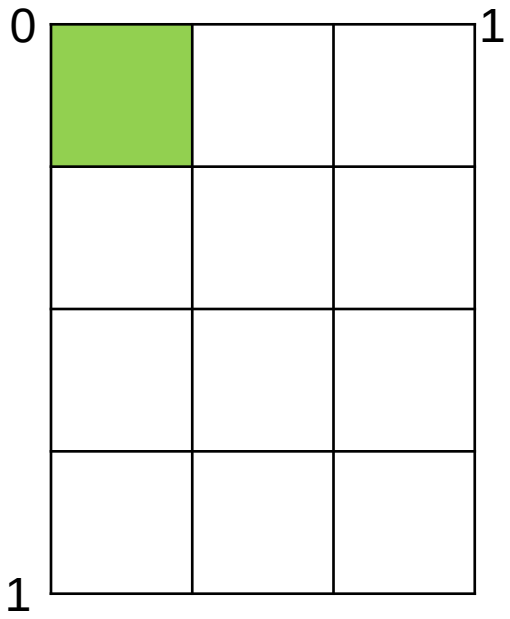
- A set of examples of what the concept is and what the concept isn't
- Helps students gain deeper understanding of concept



This is a picture for 4 x 3:

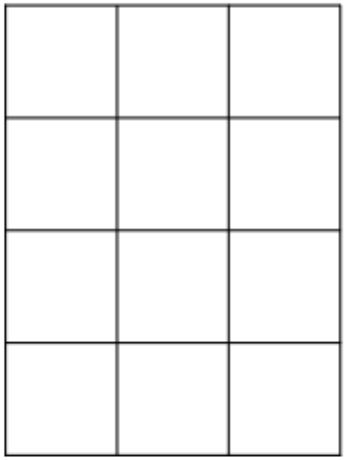


This is a picture for $\frac{1}{4}$ x $\frac{1}{3}$:



How can we use variation to get from one model to the next?

This is a picture for 4 x 3:



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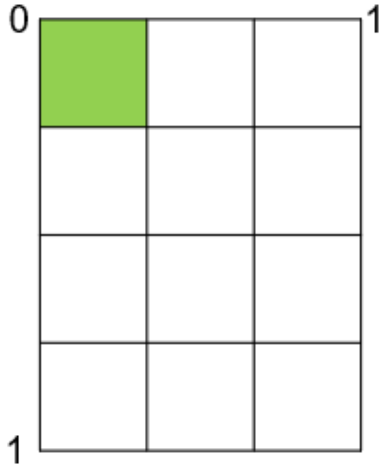

Subject Knowledge:

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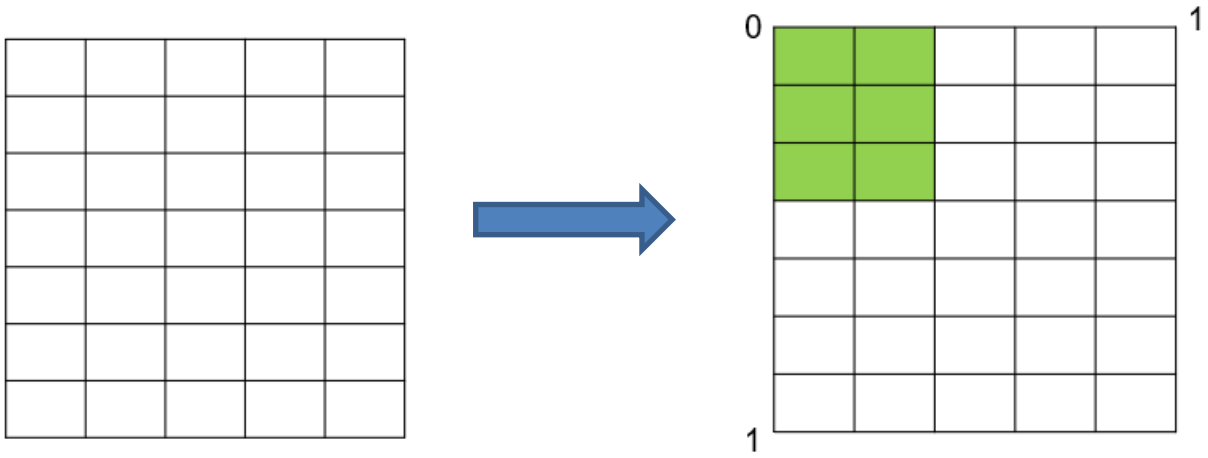
Teachers need to know and understand that the area model used for multiplication with whole numbers can also be used for fractions.

For example, $\frac{3}{7} \times \frac{2}{5}$ can be represented as a unit array building on the 7 x 5 array.



How do we support pupils through task design to **generalise** for any array ?

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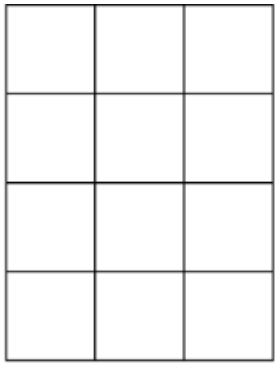
This is a picture for 4×3:



Draw a similar picture for each of these and use it to state each product.

a) 4×2 b) 4×1 c) $4 \times \frac{1}{2}$ d) $4 \times \frac{1}{3}$ e) $4 \times \frac{1}{7}$

f) 3×3 g) 2×3 h) 1×3 i) $\frac{1}{2} \times 3$ j) $\frac{1}{5} \times 3$

k) 1×1 l) $\frac{1}{2} \times \frac{1}{3}$ m) $\frac{1}{3} \times \frac{1}{5}$ n) $\frac{1}{7} \times \frac{1}{5}$

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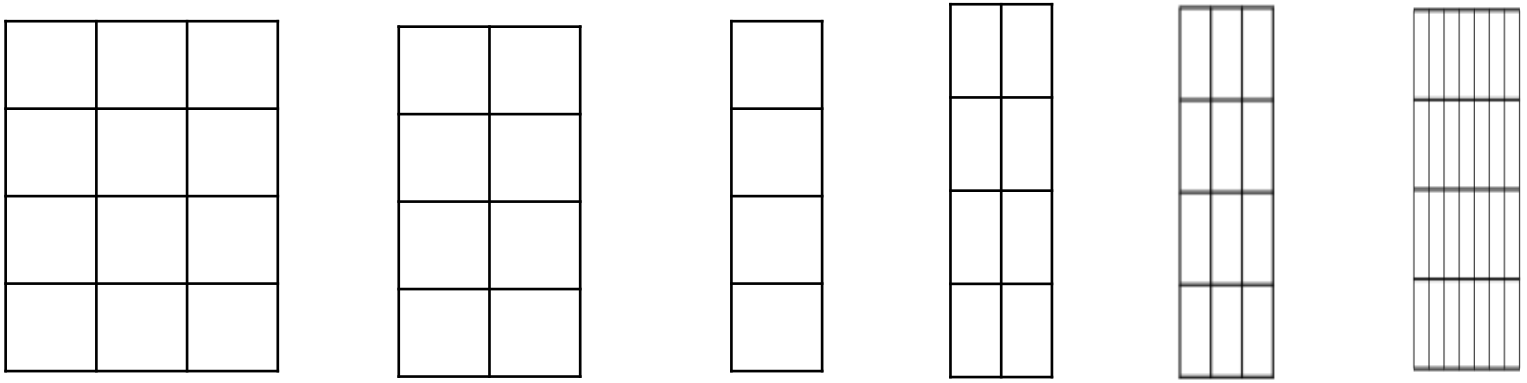
4×3 4×2 4×1 $4 \times \frac{1}{2}$ $4 \times \frac{1}{3}$ $4 \times \frac{1}{7}$



What is the same/different about this set of calculations?

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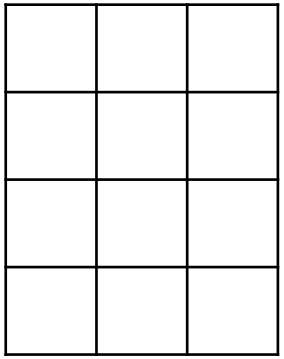
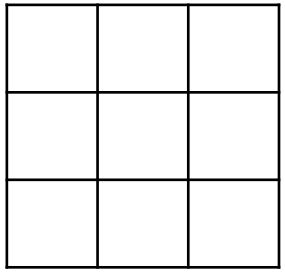
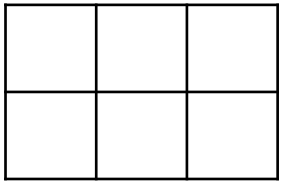
4 x 3



3 x 3



2 x 3



1 x 3

$\frac{1}{2}$ x 3

$\frac{1}{5}$ x 3

What is the same/different about this set of calculations?
How does this connect to the first set of calculations ?

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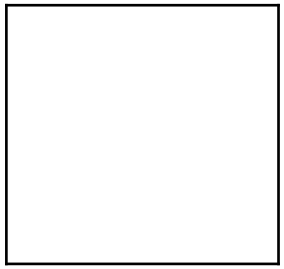
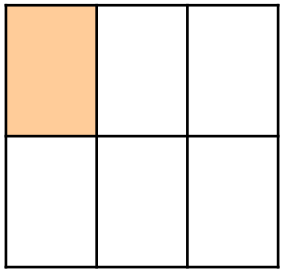
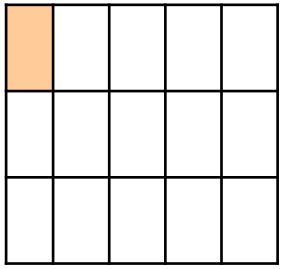
1×1



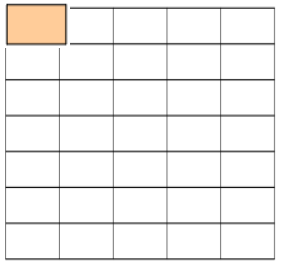
$\frac{1}{2} \times \frac{1}{3}$



$\frac{1}{3} \times \frac{1}{5}$



$\frac{1}{7} \times \frac{1}{5}$



What is the same/different about this set of calculations?

How does this connect to the previous sets of calculations ?

How can this lead into multiplying non-unitary fractions ?

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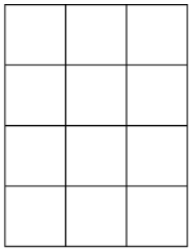
This is a picture for 4 × 3:



Draw a similar picture for each of these and use it to state each product.

a) 4×2 b) 4×1 c) $4 \times \frac{1}{2}$ d) $4 \times \frac{1}{3}$ e) $4 \times \frac{1}{7}$

f) 3×3 g) 2×3 h) 1×3 i) $\frac{1}{2} \times 3$ j) $\frac{1}{5} \times 3$

k) 1×1 l) $\frac{1}{2} \times \frac{1}{3}$ m) $\frac{1}{3} \times \frac{1}{5}$ n) $\frac{1}{7} \times \frac{1}{5}$

What is the effect of the number choice and sequencing in this sequence of tasks?

What language will you use to support pupils' understanding of the unit square to model multiplication of fractions?

Questions count !

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Suggested questioning:

What is the same/different about the first five sets of calculations?

How can you draw a picture for each one?

Which calculations 'reduce' the side of your rectangle? Why?

Why do you get sixths when you multiply halves and thirds?

Why do you get fifteenths when you multiply thirds and fifths?

My product has a denominator of 24.

What two fractions might I have multiplied together?

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Task on tables / in small groups

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Factorise : $x^2 - 47x - 48$

Create a sequence of linked problems to draw attention to structure

Factorise

$x^2 - 47x - 48$
$x^2 - 22x - 48$
$x^2 - 13x - 48$
$x^2 - 8x - 48$
$x^2 - 2x - 48$

$(x - 48)(x + 1)$
$(x - 24)(x + 2)$
$(x - 16)(x + 3)$
$(x - 12)(x + 4)$
$(x - 8)(x + 6)$

Factorise

$x^2 + 47x - 48$
$x^2 + 22x - 48$
$x^2 + 13x - 48$
$x^2 + 8x - 48$
$x^2 + 2x - 48$

$(x + 48)(x - 1)$
$(x + 24)(x - 2)$
$(x + 16)(x - 3)$
$(x + 12)(x - 4)$
$(x + 8)(x - 6)$

What else ?
What next ?

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Inclusion : How do we promote access and success for all ?

Scaffolding

‘Scaffolding’ is a metaphor for temporary support that is removed when it is no longer required. Initially, a teacher would provide enough support so that pupils can successfully complete tasks that they could not do independently.

This requires effective assessment to gain a precise understanding of the pupil’s current capabilities. Support could be visual, verbal, or written.
The teacher will gradually remove the support (the scaffold) as the pupil becomes able to complete the task independently.

Scaffold the main task:

- **Use of part –whole models e.g. bar models and ‘cherry’ models to show the structure of the mathematics**
- **A model answer using a CPA approach to support learning preferences**
- **Breaking down process into smaller , more manageable steps**

Inclusion : How do we promote access and success for all ?

Deepening

Deepening is the way in which the teacher offers an insight into mathematical structure and connections to **develop a pupils' ability to generalise.** It is not about 'harder maths' , it is about having deep and secure foundations to your understanding so that you can not only solve the current problem, but future problems that are related to this one, seeing those relationships for yourself.

Deepen the main task:

- **Encourage a range of representations or methods to explore the structure of the mathematics**
- **Connect to other areas of mathematics**
- **Explore alternative versions of the same problem to see it from different perspectives**
- **Ask insightful questions to develop 'noticing' and 'wondering'**

Consider this sequence of fraction problems

$\frac{1}{3}$ of $48 =$

$\frac{1}{6}$ of $48 =$

$\frac{5}{6}$ of $48 =$

$\frac{5}{6}$ of $96 =$

$\frac{5}{12}$ of $96 =$

What is the task before?

What is the next task?

How can this task be scaffolded?

How can this task be deepened ?

Discuss

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Ensuring access and success for all

What is the scaffolded version of this task?

Which task goes before this?

$\frac{1}{3}$ *of* 48 =

$\frac{1}{6}$ *of* 48 =

$\frac{5}{6}$ *of* 48 =

$\frac{5}{6}$ *of* 96 =

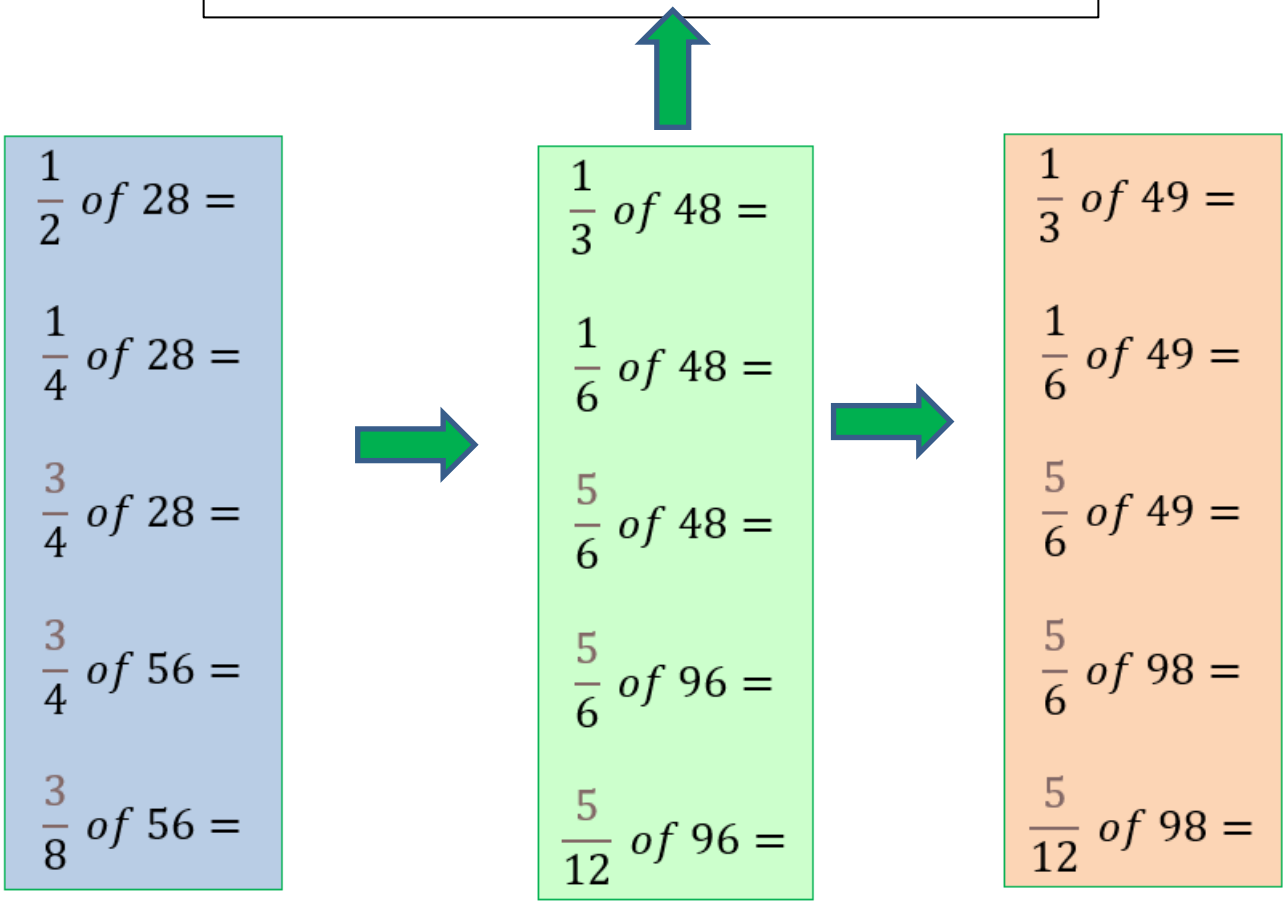
$\frac{5}{12}$ *of* 96 =

Which task goes next ?

What is the deeper version of this task?

Ensuring access and success for all

What is the scaffolded version of this task?



What is the deeper version of this task?

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$\frac{1}{2}$ of 28 =

$\frac{1}{4}$ of 28 =

$\frac{3}{4}$ of 28 =

$\frac{3}{4}$ of 56 =

$\frac{3}{8}$ of 56 =

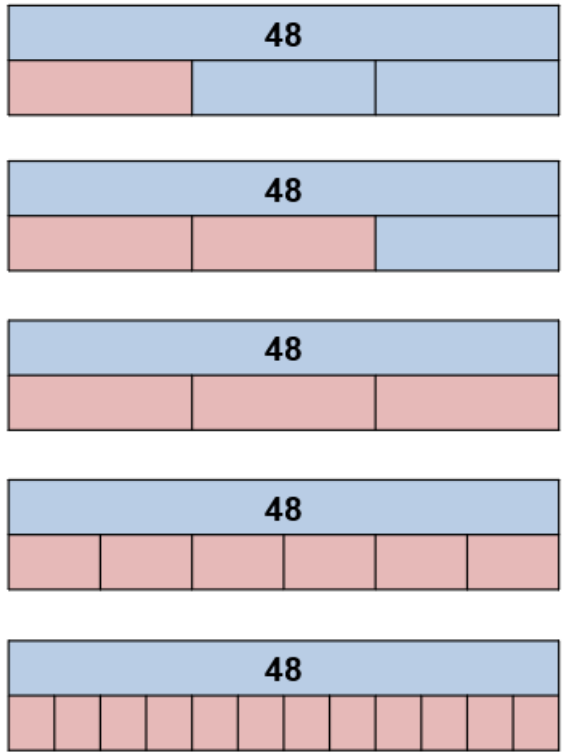
$\frac{1}{3}$ of 48 =

$\frac{2}{3}$ of 48 =

$\frac{3}{3}$ of 48 =

$\frac{1}{6}$ of 48 =

$\frac{1}{12}$ of 48 =



Scaffolded

$\frac{1}{3}$ of 48 =

$\frac{1}{6}$ of 48 =

$\frac{5}{6}$ of 48 =

$\frac{5}{6}$ of 96 =

$\frac{5}{12}$ of 96 =

f 49 =

f 49 =

f 49 =

f 98 =

of 98 =

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$\frac{1}{2}$ of 28 =

$\frac{1}{4}$ of 28 =

$\frac{3}{4}$ of 28 =

$\frac{3}{4}$ of 56 =

$\frac{3}{8}$ of 56 =

$\frac{1}{3}$ of 48 =

$\frac{1}{6}$ of 48 =

$\frac{5}{6}$ of 48 =

$\frac{5}{6}$ of 96 =

$\frac{5}{12}$ of 96 =

$\frac{1}{6}$ of 360 =

$\frac{1}{6}$ of 384 =

$\frac{5}{6}$ of 384 =

$\frac{5}{6}$ of 444 =

$\frac{5}{12}$ of 444 =

$\frac{1}{3}$ of 49 =

$\frac{1}{6}$ of 49 =

$\frac{5}{6}$ of 49 =

$\frac{5}{6}$ of 98 =

$\frac{5}{12}$ of 98 =

Deeper

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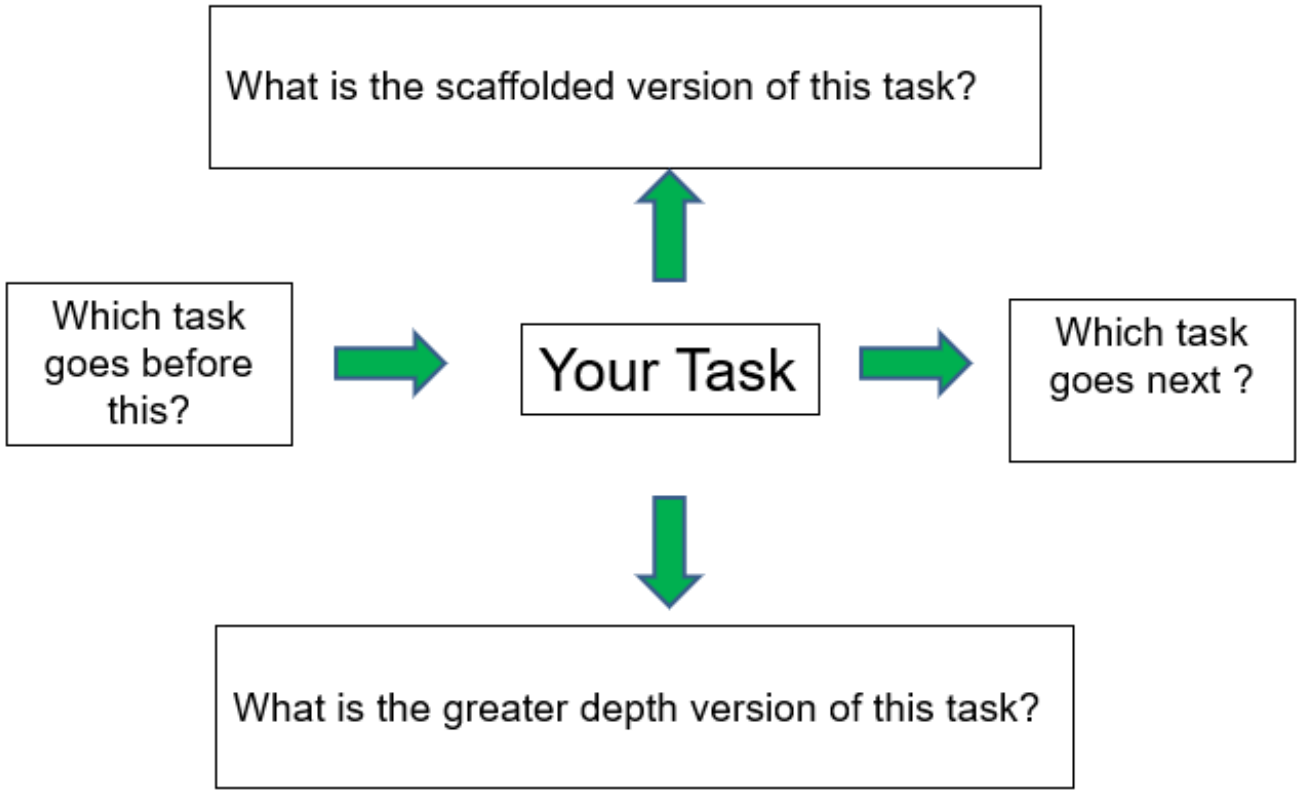
Task Design: Over to you



Decide which core concept you wish to draw attention to (what are you teaching ?)
Take one question / task / problem
Design a short sequence of connected tasks
Consider how all students will access the ideas (scaffolding and deepening)
Share on your table and be prepared to share with the group

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Designing Effective PD

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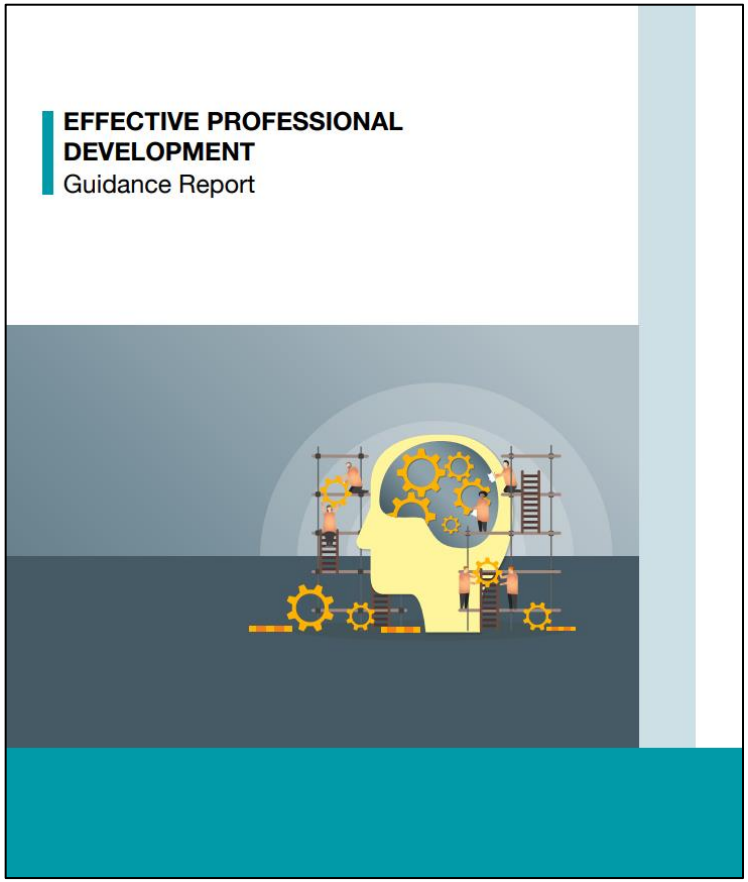

EEF-Effective-Professional-Development-Guidance-Report.pdf

What do we mean by ‘Professional Development ?

‘PD’ may take a variety of different meanings in different contexts.

This report defines teacher PD as a structured, facilitated activity for teachers intended to increase their **teaching ability.**

The emphasis on teaching ability is key

The focus on teaching ability rather than SK is intended to include a broad range of skills:

- Communicating and modelling
- Exploring ideas
- Instruction
- Assessment

This definition perceives PD as structured activities aiming to improve outcomes in classrooms rather than updates, briefings and ‘how to use this equipment or programme’ type training.

What do we mean by ‘Professional Development ?

Think of examples of what PD *is* and what it *is not*.

PD *is*…….	**PD *is not* …….**
School-wide, monthly twilight sessions on how to improve formative assessment in the classroom	A briefing provided to practitioners on how to use new smartboards
A training day provided by an in-school expert on how to use strategies to improve pupils’ subject specific language	An information session for teachers on the new school admissions code
A series of webinars delivered by an external provider on how to improve behaviour management in the classroom	Teachers receiving a new curriculum programme via email, complete with schemes of work and assessment materials

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1

When designing and selecting professional development, focus on the mechanisms.

2

Ensure that professional development effectively builds knowledge, motivates staff, develops teaching techniques, and embeds practice.

3

Implement professional development programmes with care, taking into consideration the context and needs of the school.

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1

When designing and selecting professional development, focus on the mechanisms.

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The importance of mechanisms

A key finding of the review underpinning this report and guidance was that the more mechanisms a PD programme had, the greater the impact on pupil attainment. The more ‘building blocks’ incorporated, the better the chance of success

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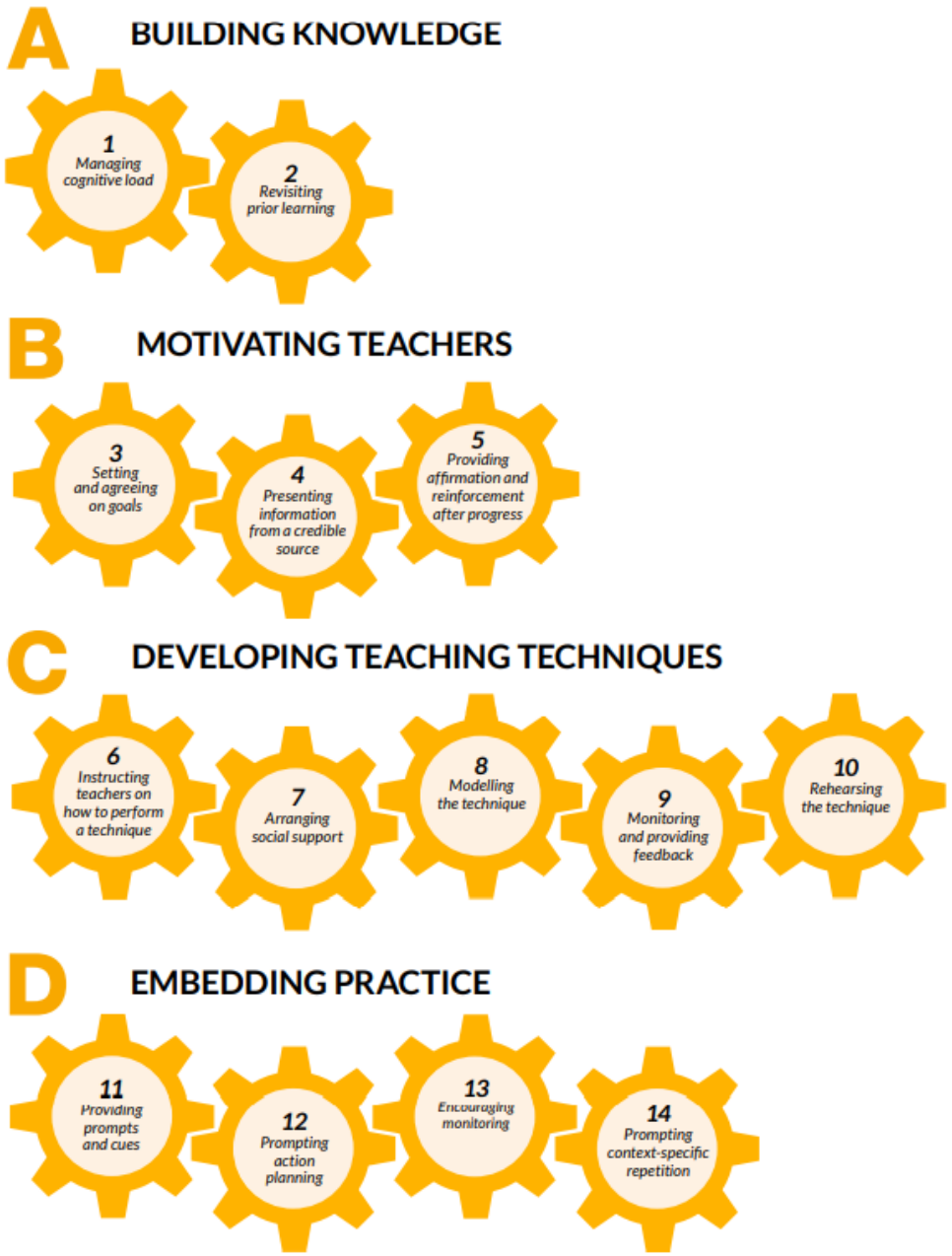

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A. BUILD KNOWLEDGE
B. MOTIVATE TEACHERS
C. DEVELOP TEACHING TECHNIQUES
D. EMBED PRACTICE

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A. BUILD KNOWLEDGE

When designing and delivering PD, it is likely to be important to present new knowledge in ways that support understanding. As any teacher would with their own class, PD facilitators must pay close attention to how they structure and build the knowledge taught through the programme. Specifically, two mechanisms that are likely to improve PD are (1) managing cognitive load and (2) revisiting prior learning.

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A. BUILD KNOWLEDGE
B. MOTIVATE TEACHERS
C. DEVELOP TEACHING TECHNIQUES
D. EMBED PRACTICE

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B. MOTIVATE TEACHERS

Once teachers have built knowledge (using a method that manages cognitive load and revisits prior learning), they still need to be motivated to act upon that knowledge, and that is where three mechanisms may be used:

- setting and agreeing on goals;
- presenting information from a credible source; and
- providing affirmation and reinforcement after progress.

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A. BUILD KNOWLEDGE
B. MOTIVATE TEACHERS
C. DEVELOP TEACHING TECHNIQUES
D. EMBED PRACTICE

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C. DEVELOP TEACHING TECHNIQUES

Effective professional development is likely to provide teachers with the techniques they require to improve practice. Following building knowledge, and then being motivated to act upon it, these techniques will provide the tools required to take action and change practice.

The review underpinning this guidance identified five mechanisms that develop teaching techniques:

- instructing teachers on how to perform a technique;
- arranging practical social support;
- modelling the technique;
- providing feedback; and
- rehearsing the technique.

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A. BUILD KNOWLEDGE
B. MOTIVATE TEACHERS
C. DEVELOP TEACHING TECHNIQUES
D. EMBED PRACTICE

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D. EMBED PRACTICE

Once teachers have built knowledge, been motivated, and been taught techniques, PD programmes then need to support teachers to effectively embed practice to ensure that they continue to change their behaviour and improve their teaching. Four mechanisms may be deployed to support this:

- Providing prompts and cues;
- Prompting action planning;
- Encouraging self-monitoring; and
- Prompting context specific repetition.

"I would say as well, a lot of the training, it's kind of relevant for that day and then it suddenly trickles away and it's lost in the noise, sort of thing. So, it has a big push on the day and then it fades and it's forgotten about."

Headteacher of an early years and primary setting noting the importance of properly embedding practice[34]

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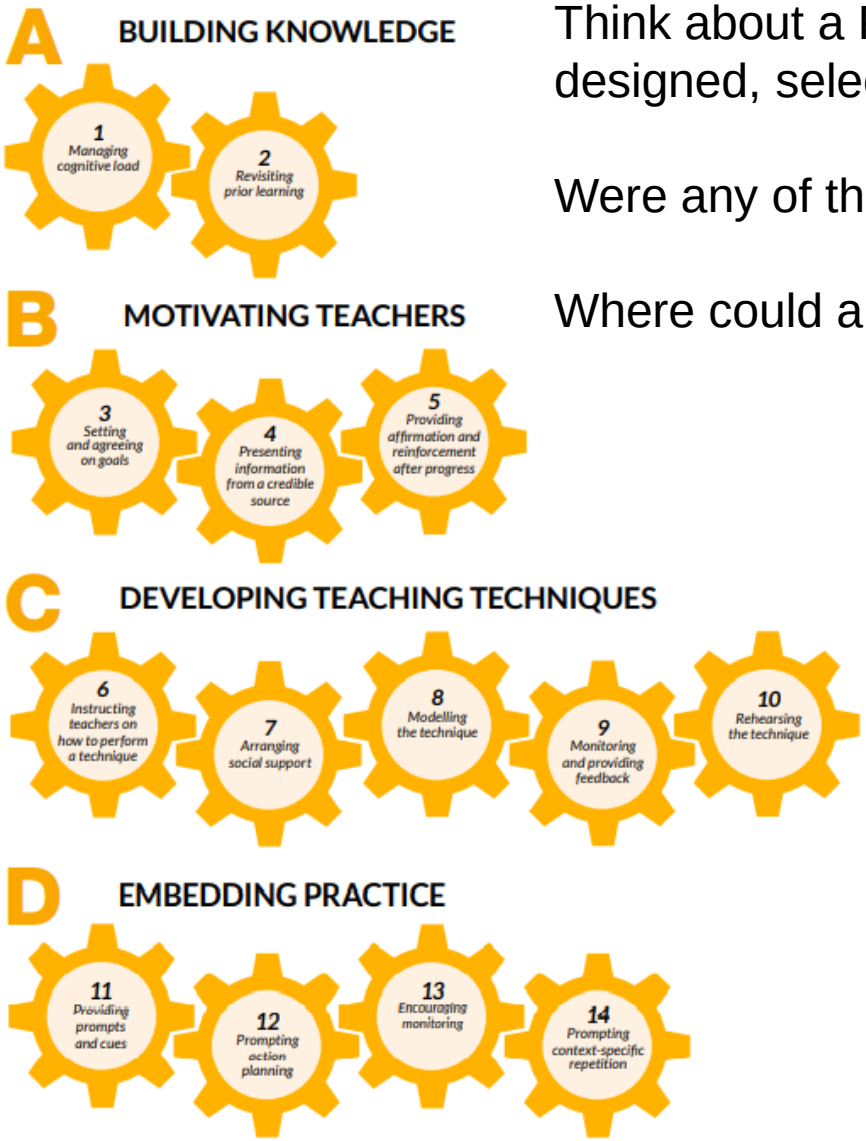
A PD programme that includes a mechanism from each group is more likely to be effective



Think about a PD programme that you have designed, selected, or participated in.

Were any of the 14 mechanisms present ?

Where could a mechanism have improved the PD?

A PD programme that includes a mechanism from each group is more likely to be effective

A. BUILD KNOWLEDGE
B. MOTIVATE TEACHERS
C. DEVELOP TEACHING TECHNIQUES
D. EMBED PRACTICE

With a colleague, agree a common departmental need
Questioning, AfL , problem-solving and reasoning, the teaching of fractions….

Work with a colleague and plan a PD programme or session
Use the four groups and 14 mechanisms to map out what you will do

Be ready to feedback to the group

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Revision and final curriculum provision for Year 11

What are your plans ?

Mock exam arrangements and strategies, approaches to grade boundaries etc.

Sharing good tips for revision / interventions / last minute ‘make the difference’ ideas.

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A.O.B

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Next Meeting : Holiday Inn, Eastleigh
Thursday 5th May 2022 : 1315 start
Remember to register your car reg when you go in !

Look forward to seeing you all there

Please let me know if there is anything you would like to address at that meeting and I will add it to the agenda.

(email me at jo.lees@hants.gov.uk)

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