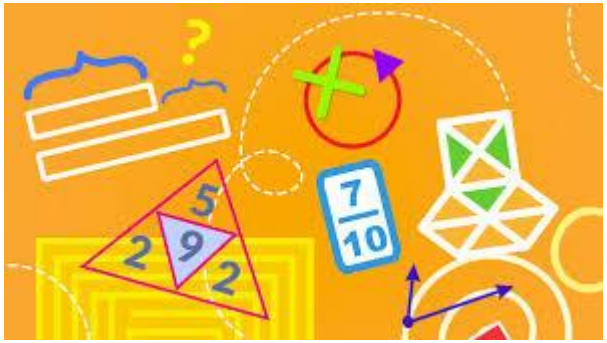
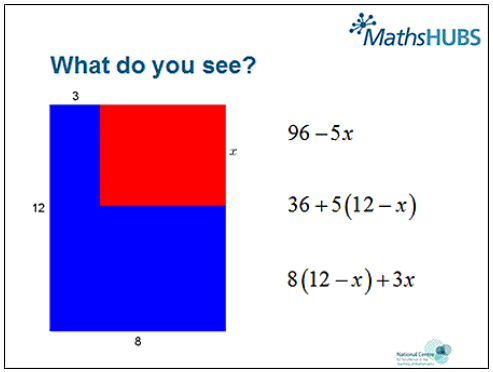


How to plan lessons effectively using the 5 big ideas

Boolean Conference 2019

Ella Keddie

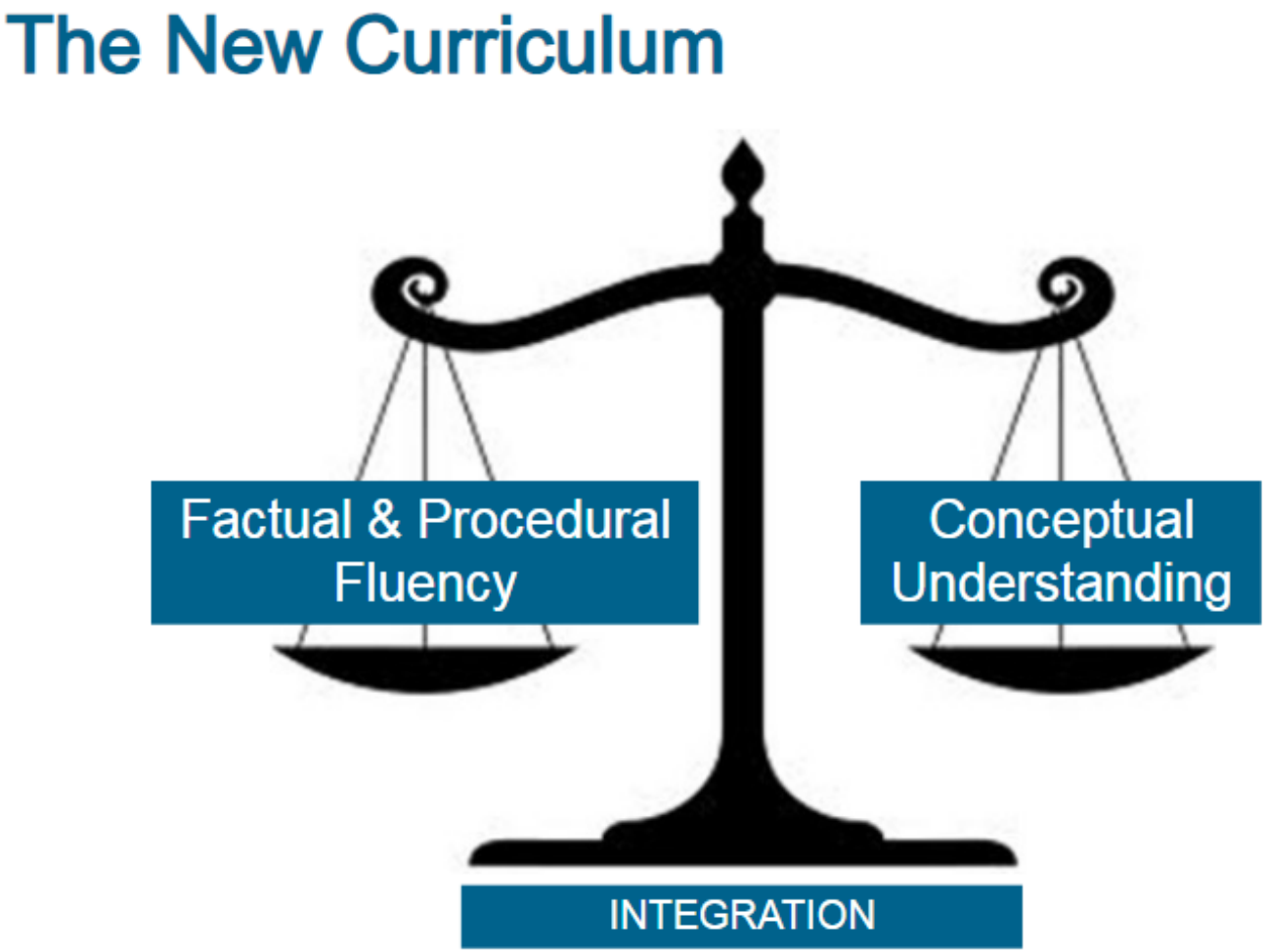
ella.keddie@colstonsgirls.org



How do you currently do it?

Developing and planning a mastery curriculum that is effective.

Teaching for Mastery is…



Debbie Morgan

How we can plan effectively:

S-Planning: Incorporating well structured and thought through learning objectives and outcomes.

Features of Mastery

Curriculum design	Longer units of work, prioritising key topics
Lesson design	Carefully structured lesson to develop the detail and depth
	Quick intervention
ces	Carefully chosen examples and activities. Application of variation theory. Effective use of representations
Teaching methods differentiation	Keeping the class together and aiming for depth
Productivity and practice	Intelligent practice

4

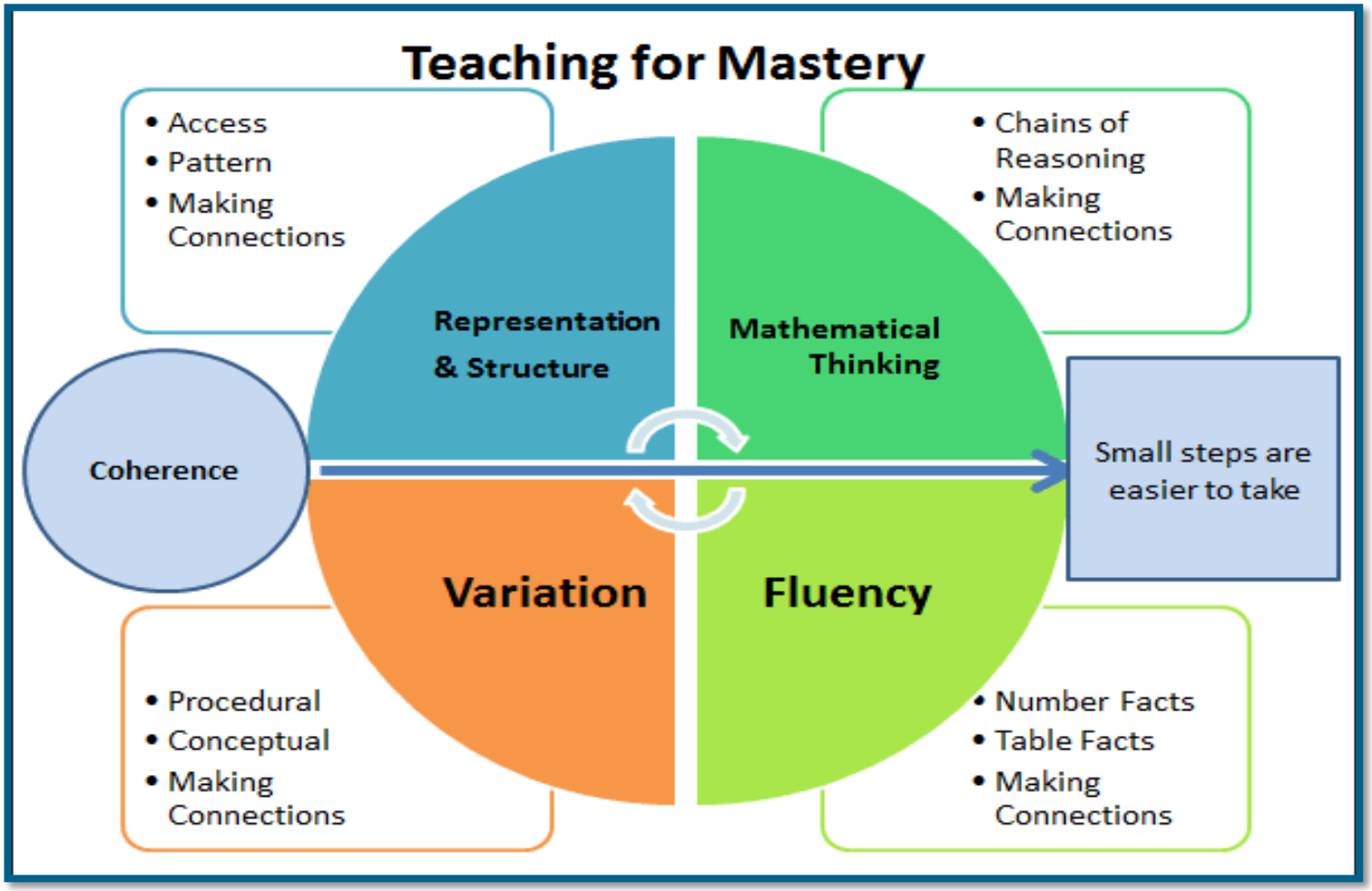
Looking at the 5 Big Ideas to generate depth of learning within the classroom.

Debbie Morgan

Curriculum Design (S-Planning)

Shallow Learning	• Surface learning, • Temporary, often lost
Meeting Expectations	• With support being able to meet the objectives outlined in the National Curriculum
Mastery	• Obtaining greater level of understanding and being able to apply learning in different context
Working at Greater Depth	Learning be transferred and applied in different contexts Pupils can explain their understanding to others

The 5 big ideas



https://www.ncetm.org.uk/resources/50042

What areas are you prioritising in schools?

Year 7 Only

Number and Place Value
Addition and Subtraction
Multiplication and Division
Fractions and ratio

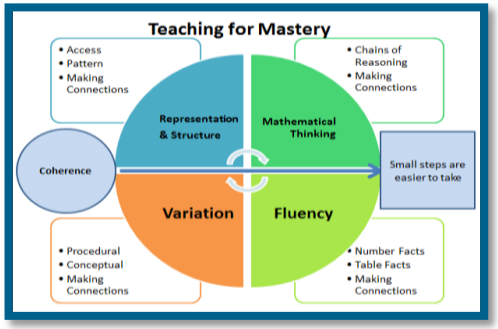
Measurement
Geometry
Statistics
Algebra

What about you and your schools?

S-plan: Identifying the connections between lessons in a topic area.

Hook to motivate building on what learners already know

Aspects of prior learning that may need to be checked or revisited to set the scene for the new learning



Each small step along the "learning journey" can be reflected upon in terms of variation, mathematical representation & structure and fluency.

Problem or applied activity to show what they can now achieve

Your S-Plan: Learning Journey (Topic Plan)

Planning

- Spend longer time on topics
- Prioritise key topics
- Focus on relationships
- Make Connections
- Ensure intelligent practice

The Key:

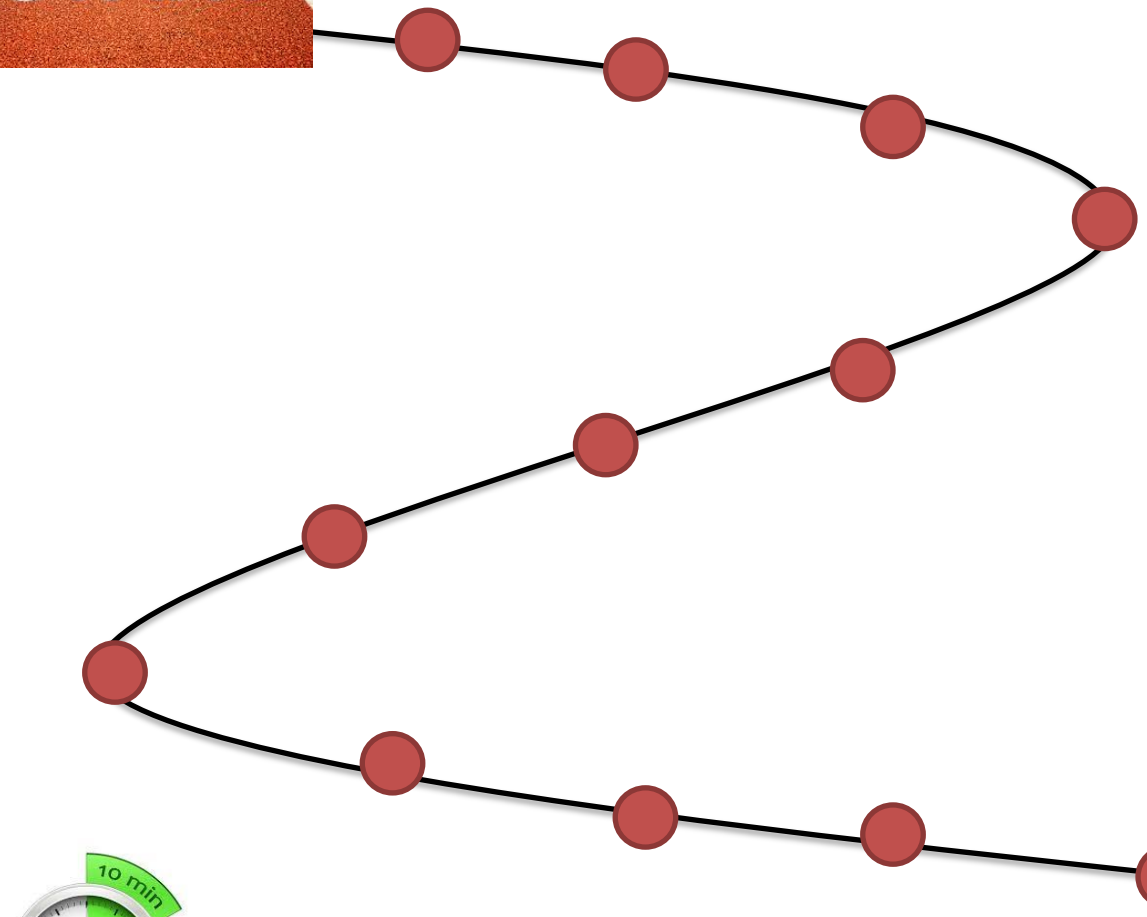
What's your hook?

What are the individual small steps you need the students to achieve? (label on diagram)

Prior Learning Needed? When will you cover this on the plan?

How are you going to approach these task? **Representation & Structure, variation, mathematical thinking, fluency**

Your S-Plan: Learning Journey (Topic Plan)



The Key:

What's your hook?

What are the individual small steps you need the students to achieve? (label on diagram)

Prior Learning Needed? When will you cover this on the plan?

How are you going to approach these task?
Representation & Structure, variation, mathematical thinking, fluency

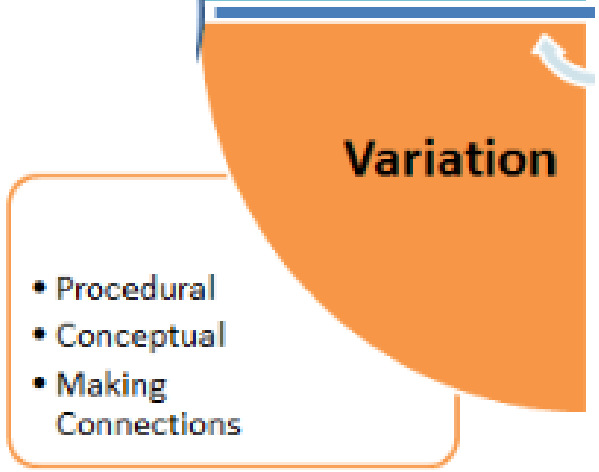
Lesson Planning & Resources available

Big Idea: Variation

Key Messages:

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:**
   a. **What it is (both standard and non-standard examples);**
   b. **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 practice the thinking process (intelligent practice)**

Variation in Greater Depth



MathsHUBS

Recap

Purpose of Variation

Develop deep learning rather than superficial learning

Provide the necessary repetition to embed and sustain learning

Make connections between concepts

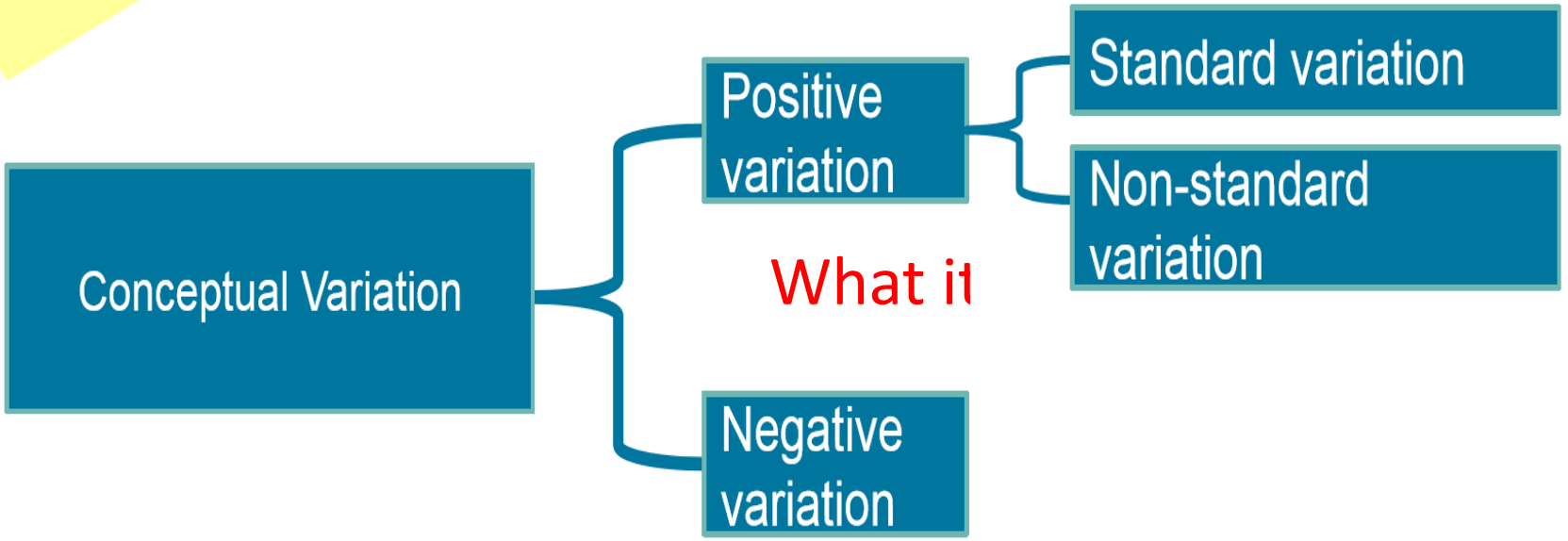
National Centre

Conceptual Variation:

Drawing attention to what is to be learnt – the object of the learning, the essence of the concept.

Leading to generalisation

Recap



What it

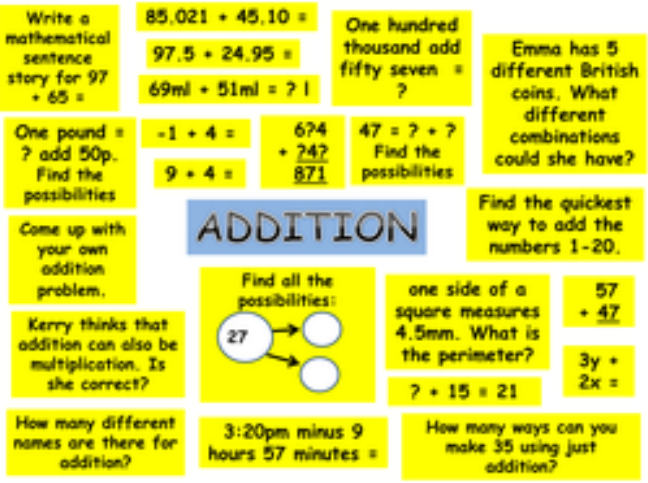
What it **is not**

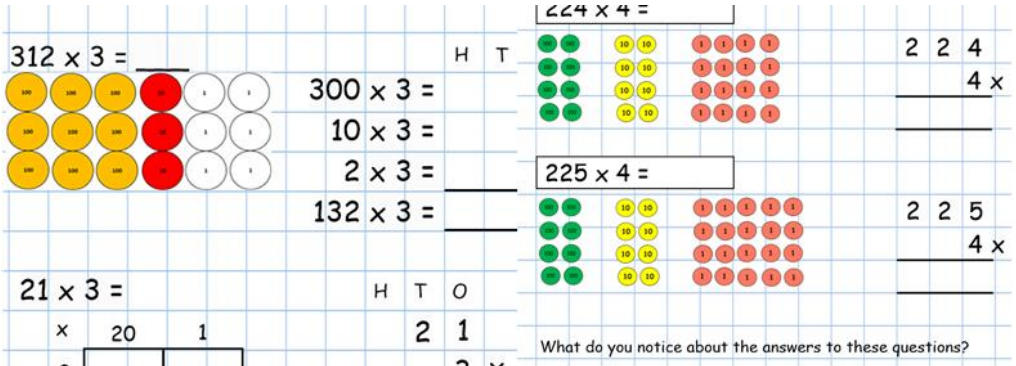
Procedural Variation

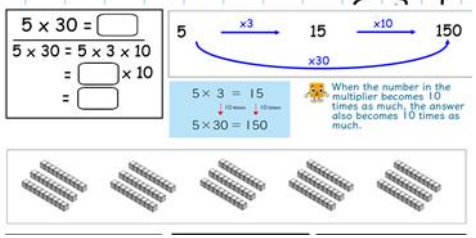
Provides the opportunity

- for practice (intelligent rather than mechanical);
- to focus on relationships, not just the procedure;
- to make connections between problems;
- to use one problem to work out the next;
- to create other examples of their own.

Variation to create depth: it's the subtle changes….







a) 43 x 7 =

b) 421 x 6 =

c) 5 x 731 =

d) 845 x 6 =

e) ☐ = 4 x 368

Greater Depth through Variation:

- Example 1: Fluency

Fluency:

x	2	4	8	3	6	9
5						
7						
11						
12						

Greater Depth through Variation:

- Example 1: Reasoning

x	2			5	6	
	20		40	50		
9		27				
8						
	14					49

Greater Depth through Variation:

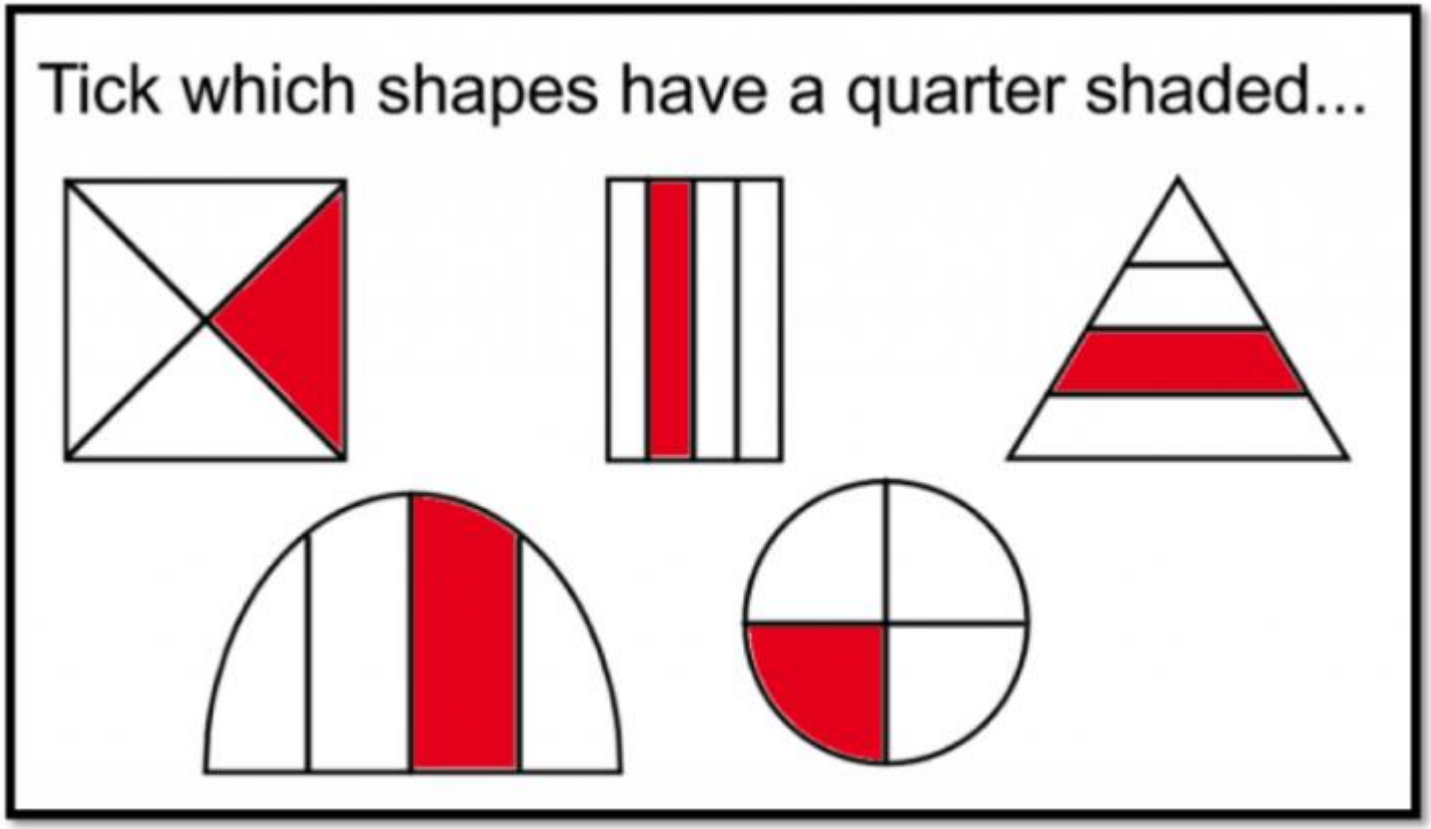
- Example 1: Problem Solving

  Using the digits 1 – 9 only once, find the missing factors in this grid.

X					
	16				
		7			
				18	

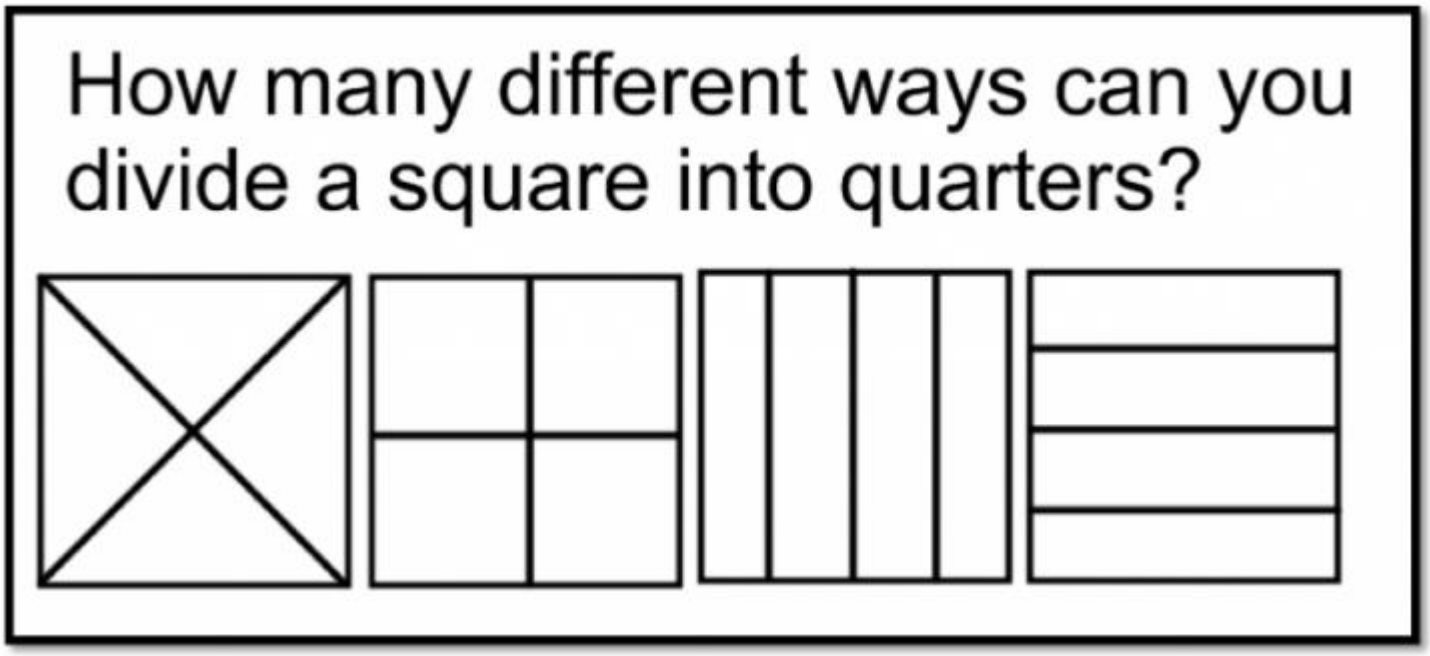
Greater Depth through Variation:

- Example 2: Fluency



Greater Depth through Variation:

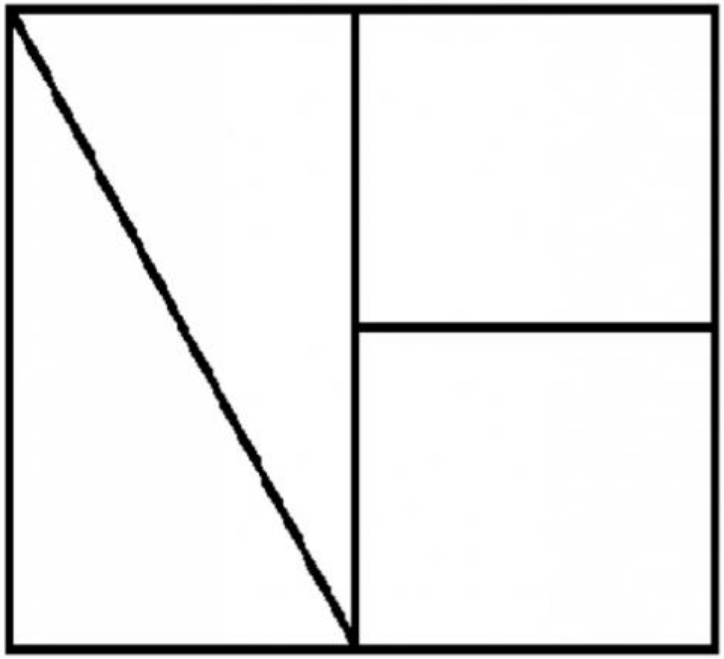
- Example 2: Reasoning



Greater Depth through Variation:

- Example 2: Problem Solving

Dani says this square is split into quarters. Ryan says that can't be correct. Who do you agree with?



Example 1: Discuss

What are these examples examples of ?

Q1 Solve the following simultaneous equations:

a) $4x + 6y = 16$
$x + 2y = 5$

b) $3y - 8x = 24$
$3y + 2x = 9$

c) $3y - 10x - 17 = 0$
$\frac{1}{3}y + 2x - 5 = 0$

d) $\frac{x}{2} - 2y = 5$
$12y + x - 2 = 0$

e) $3x - 4y = 5x - 14$
$2y + x = 11y - 26$

f) $3x + 4y = 10$
$5x - 7y = 3$

g) $2y - 3x = 1$
$4x + 5y = 37$

h) $10x - 7y = -9$
$8x + 9y = 22$

i) $\frac{3}{5}x + 2y = 21$
$2x - \frac{2}{3}y = 4$

Example 2: Discuss

Standard or Non-standard

$3x + 1 = x + 5$

$3x + 2 = x + 6$

$4x + 1 = 2x + 5$

$6x + 2 = 2x + 10$

$3x + 1 = x$

$x + 2 = 3x + 6$

$2x + 1 = 4x + 5$

$6x = 2x + 10$

Example 3: Discuss

True or False

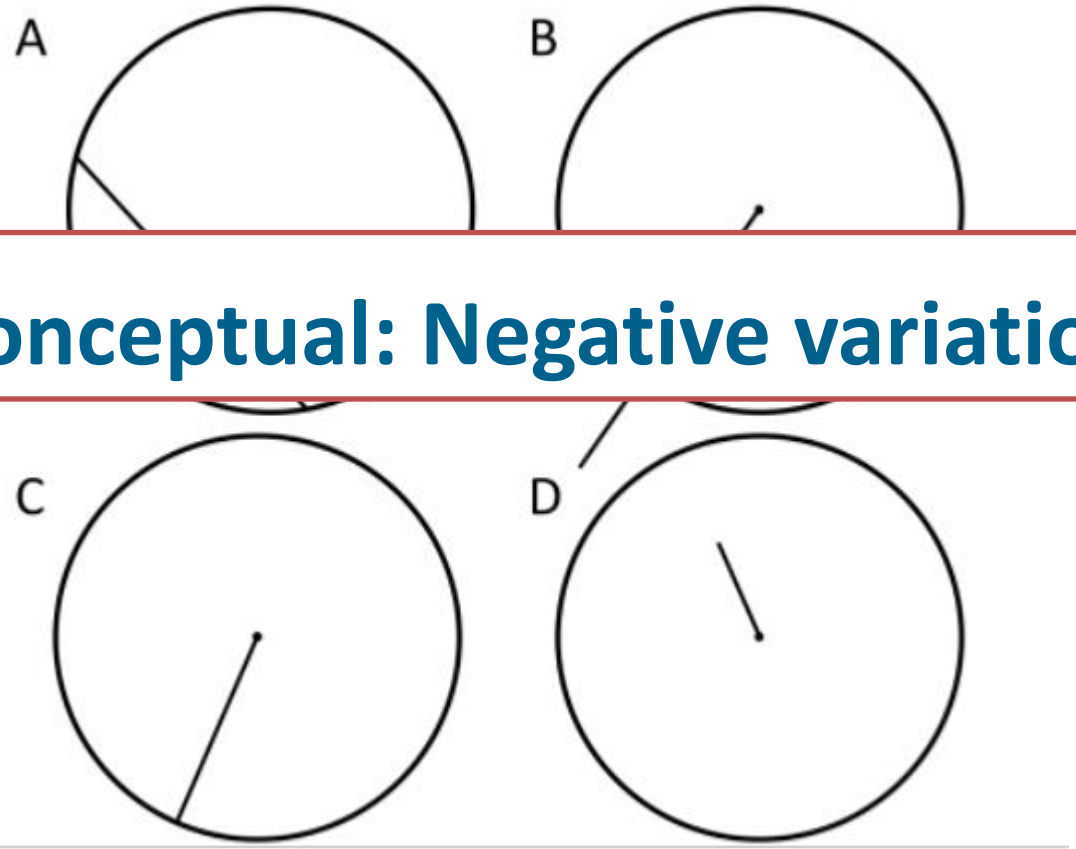
$$\frac{4}{9} = \frac{5}{10} \qquad \frac{6}{8} = \frac{3}{16}$$

$$\frac{3}{5} = \frac{3}{10} \qquad \frac{3}{7} = \frac{6}{14}$$

Conceptual: Negative variation

Example 4: Discuss

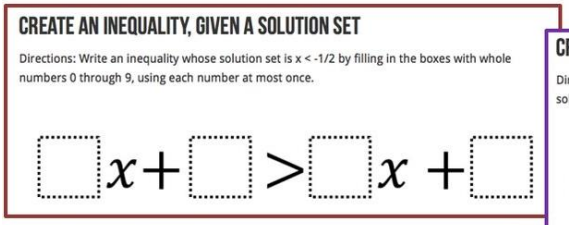
Concept / non concept radius of a circle

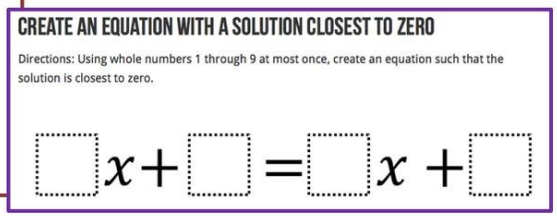


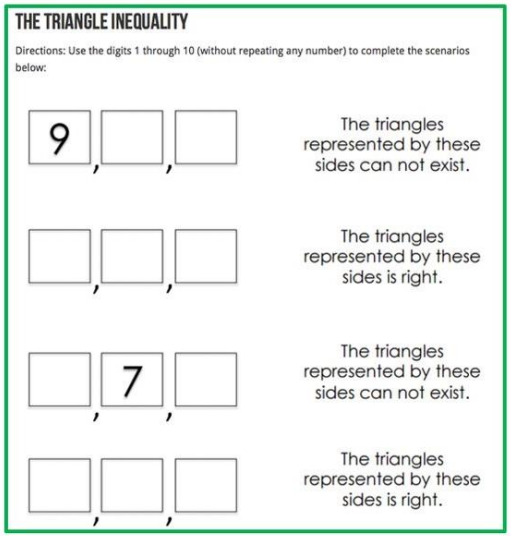
Conceptual: Negative variation

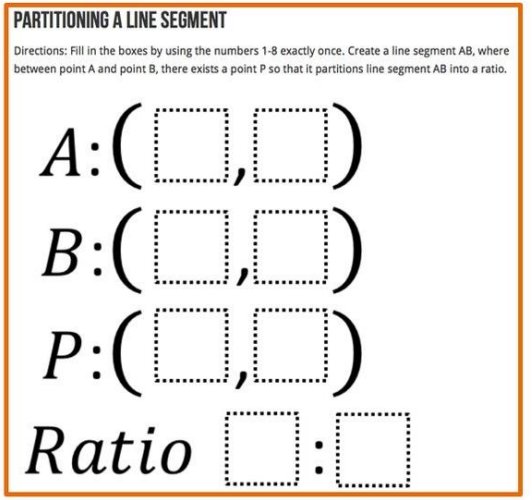
Now it's your turn!

- On your tables there is a planning sheet incorporating variation theory into your lessons.
- You need to **create** an activity that will suuport.
- **Think about**: How can you adapt it?

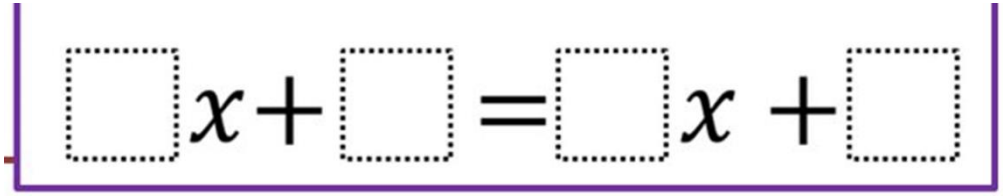




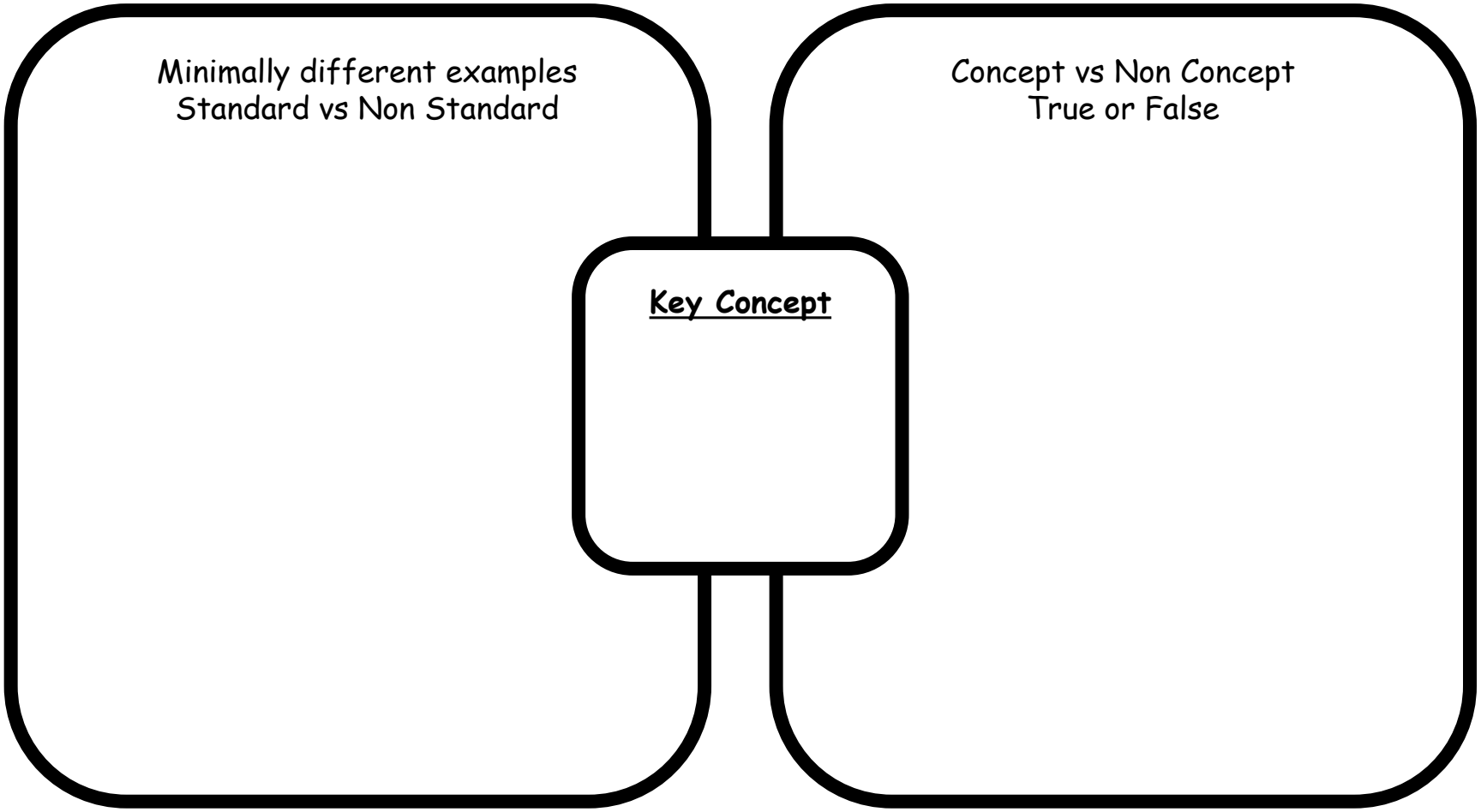




www.openmiddle.com



Variance Planning Sheet



Useful sites:

- Increasingly Difficult Questions
- Open Middle
- MathsPad (subscription approx. £50?)
- Jo Morgan (Resourceaholic): Topics in Depth project
- Mathsbot
- Naveen Rizvi blog
- Kris Boulton blog

Additional Online Resources to help to support:

- Increasingly difficult questions: http://taylorda01.weebly.com/increasingly-difficult-questions.html
- Don Stewart: http://donsteward.blogspot.co.uk/
- The Maths Shed: http://www.mathematicshed.com/the-singapore-maths-shed.html
- NCETM- Secondary: https://www.ncetm.org.uk/files/66633120/secondary_assessment_materials_november_2017.pdf
- Jurassic Maths Hub work: http://www.jurassicmaths.com/resources/mastery/variation/
- Gareth Metcalfe (primary school blogger): https://garethmetcalfe.wordpress.com/2014/12/28/mastery-in-mathematics-deep-learning-for-the-able-mathematician/
- Same but different questions: https://ssddproblems.com/
- Variation theory. Com https://variationtheory.com/
- https://nonexamples.com/

Creating Activities / Questions that Promote Depth

Alternative Options/ Ideas

Change into improper fractions:

1) $1\frac{3}{4}$

2) $2\frac{3}{4}$

3) $3\frac{3}{4}$

4) $5\frac{1}{3}$

5) $5\frac{2}{7}$

6) $2\frac{1}{3}$

Challenge:

$$28\frac{3}{17} = \frac{479}{17}$$

Using this information, write the following as improper fractions:

a) $26\frac{3}{17}$

b) $30\frac{2}{17}$

Can you match up the calculations with each of the descriptions?

π x 3.5^2

Finds the area of a circle with radius 7cm

Finds the area of a circle that fits perfectly inside a 4cm square

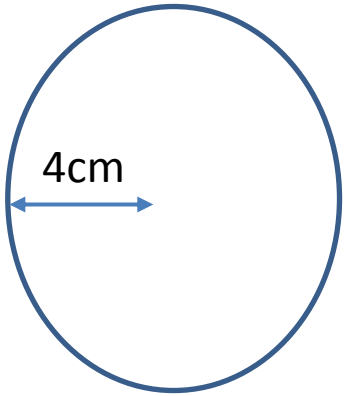
Finds the area of a circle with diameter 7cm

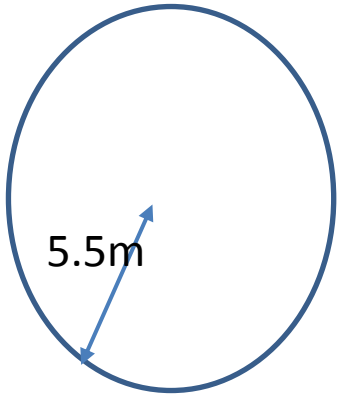
π x 4^2

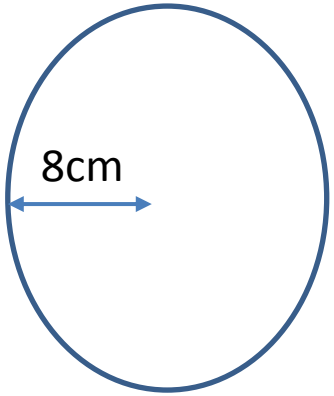
π x 7^2

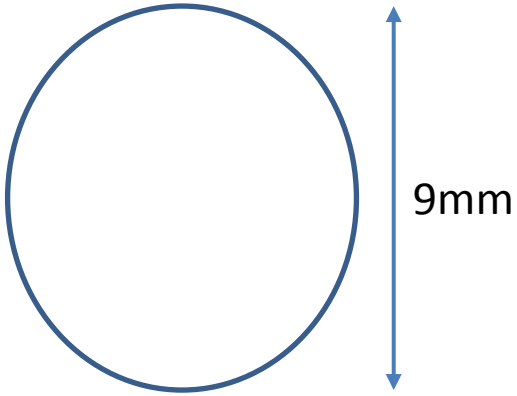
Finds the area of a circle with radius 4cm

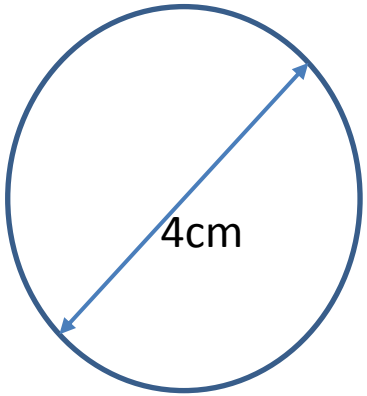
There should be one description left over. Can you write a calculation for it?





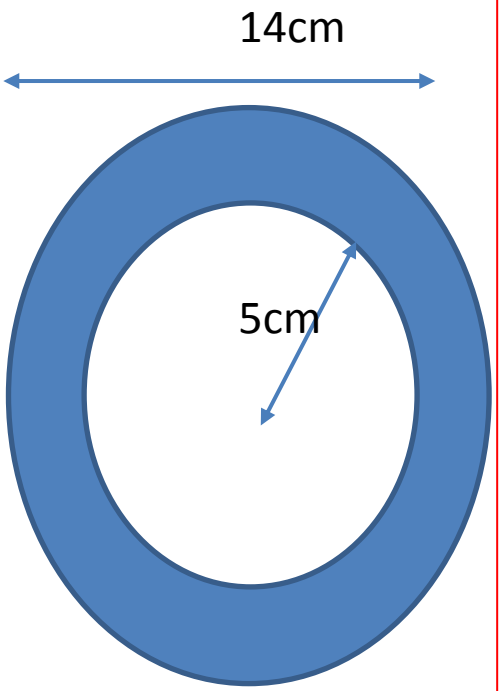


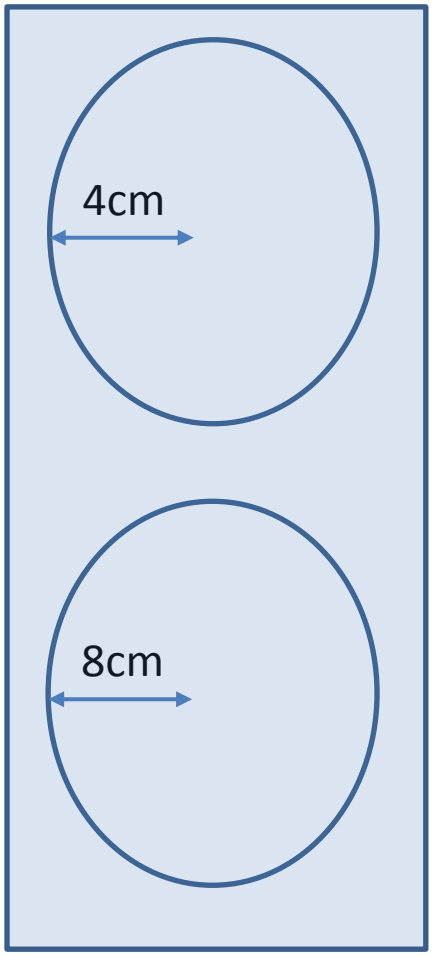




The diagram below is made from two concentric circles (circles with the same centre).

Calculate the Area of the blue section of the diagram:





50.3

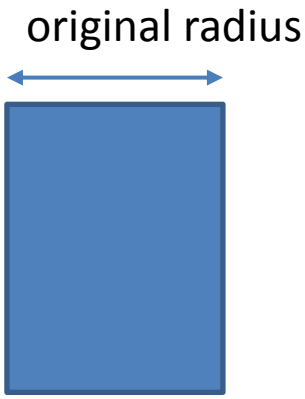
201

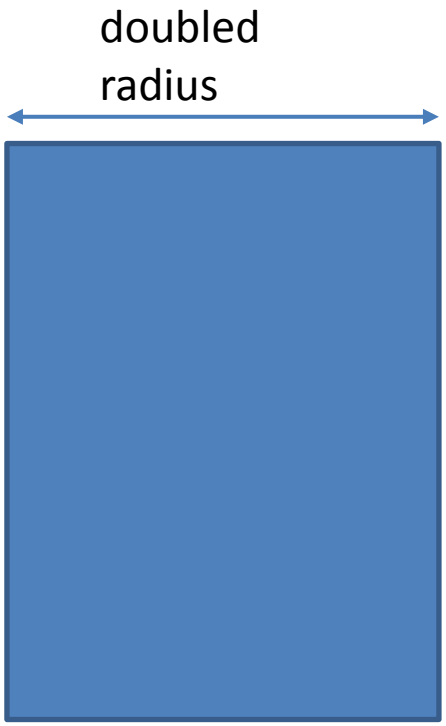
Dave is unhappy with the answers to Q1 and Q2.

He says:

"Because the radius on Q2 is twice as big as the radius on Q1, our answer for Q2 should be double Q1."

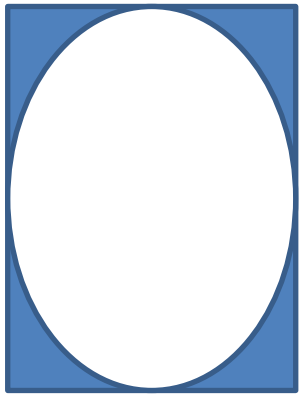
"I can see that the second answer is not double the first answer, so ethering must gone ng."





Because we are squaring, is lengths double, Areas will x4 (2 squared)

10cm

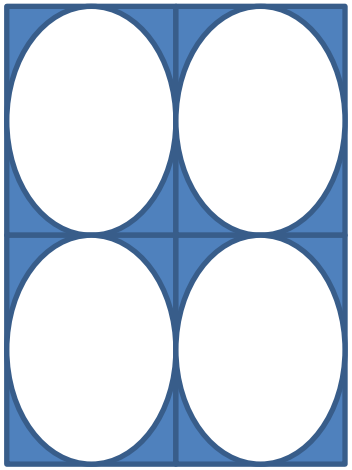


The circle fits perfectly inside the square. Can you find the shaded area?

10cm

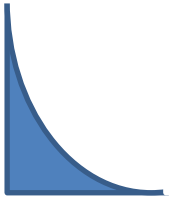
5cm

20cm



20cm

5cm



5cm

Once you have finished the initial question, can you solve the other three questions by doing one simple extra calculation each time?

Potential Task: Solve the following quadratic equations:

$y^2 - 14 = 5y$

$y(y - 5) = 14$

$y^2 + y = 2(3y + 7)$

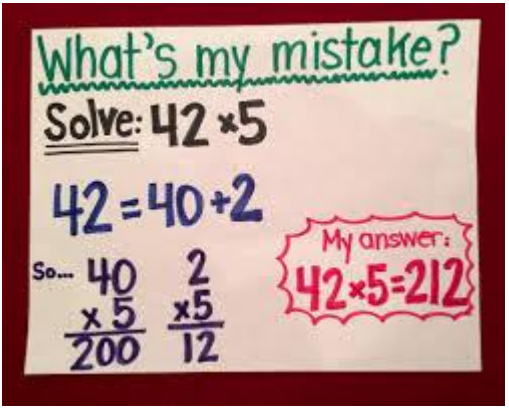
$2y^2 - 10y - 28 = 0$

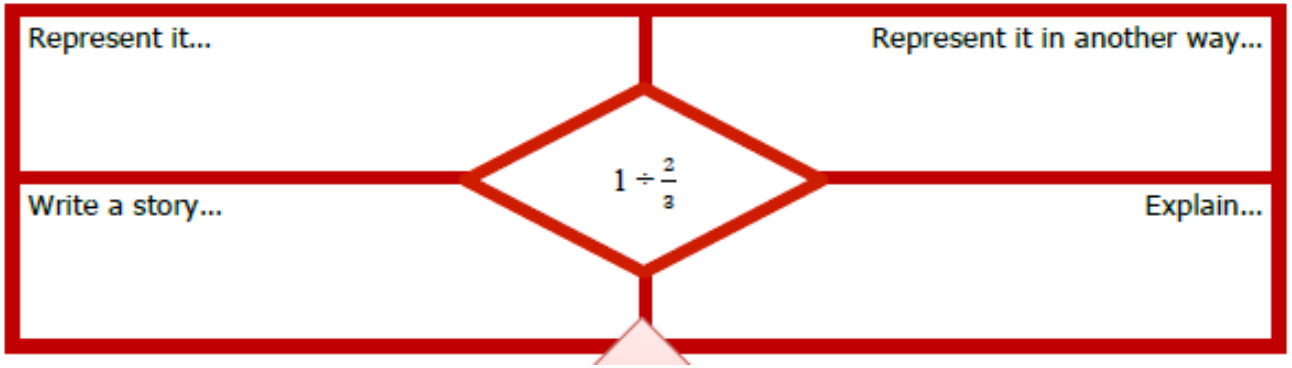
Probing Questions:
What are the differences?
What are the similarities?
What do you notice?

Other Examples to demonstrate depth of understanding:

- True/ False
- Fill in the missing blank
- Correct my mistakes
- Prove that…. Why?
- Represent in a different way…

1, 2, 3, 4, 6, 7, 9, 0
__ __ + 8 = __ __
__ __ X 5 = __ __





To summarise:

Features of Mastery

Curriculum design	Longer units of work, prioritising key topics
Lesson design	Carefully structured lesson to develop the detail and depth
Pupil support	Quick intervention
Teaching resources	Carefully chosen examples and activities. Application of variation theory. Effective use of representations
Teaching methods differentiation	Keeping the class together and aiming for depth
Productivity and practice	Intelligent practice


Thank
you!!