Introduction to variation

The session will focus on planning using variation theory: we will be promoting discussion around varying practice and mechanical repetition and encouraging you to plan and make resources which encourage students to think.

Rachel Stothard: Lead Practitioner at St Bede's RC School

Hannah Tennet: Lead Practitioner at St Wilfrid's RC College

https://www.youtube.com/watch?v=Ahg6qcgoay4

Attention/ Awareness

Awareness, according to Marton and Booth (1997), has a structure to it. By this they mean that the amount of sensory data that we are subject to cannot all be dealt with at once; some things have to be to the foreground of our awareness, others will not.

We must try and help learners focus their awareness on critical features.

2011, Mike Askew, Transforming Primary Mathematics, chapter 6 “Variation Theory”

When we present a collection of examples or exercises related to some mathematical idea to our pupils what do we want them to be looking for?

What do we want them to pay attention to?

Simultaneous Equations

New Questions | Show Answers

Bronze	Silver	Gold
Solve: Q1) $5x - 5y = 5$ $5x - 6y = -3$	Solve: Q1) $2x + 9y = 48$ $3x - 7y = -10$	Solve: Q1) $y = 8x + 14$ $y = 7x + 11$
Q2) $8x - 8y = 8$ $8x - 4y = 40$	Q2) $3x - 3y = 6$ $2x + 9y = 48$	Q2) $y = 4x + 4$ $y = 8x + 16$
Q3) $4x + 10y = 46$ $4x - 8y = -8$	Q3) $2x + 5y = 33$ $4x + 3y = 45$	Q3) $y = -3x - 12$ $5y + 5x = 10$
Q4) $6x - 4y = 22$ $6x - 8y = 2$	Q4) $2x + 3y = 24$ $3x + 6y = 42$	Q4) $y = -2x + 16$ $y = 2x - 8$
Q5) $3x - 5y = 11$ $3x + 8y = 37$	Q5) $7x - 6y = -19$ $-7x + 2y = 39$	Q5) Find the coordinates of the point of intersection of: $y = 2x - 3$ $y = 5x + 6$
Q6) $3x - 6y = 3$ $3x + 5y = 47$	Q6) $-8x - 2y = -44$ $-3x - 7y = 21$	Q6) Find the coordinates of the point of intersection of: $y = -7x + 17$ $y = 2x - 10$
Q7) $7x - 8y = 6$ $7x - 5y = 30$	Q7) $-9x + 8y = 40$ $-5x + 5y = 20$	
Q8) $3x + 6y = 42$ $3x - 8y = -14$	Q8) $10x + 8y = 18$ $7x + 7y = 7$	

What are these examples examples of?

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

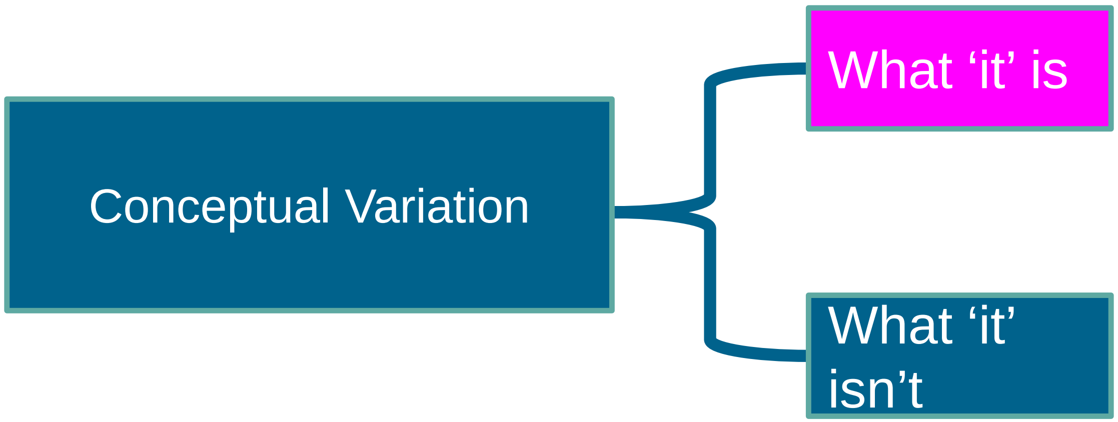
The central idea of teaching with variation is to highlight the essential features of a concept or idea through varying the non-essential features.

Conceptual Variation

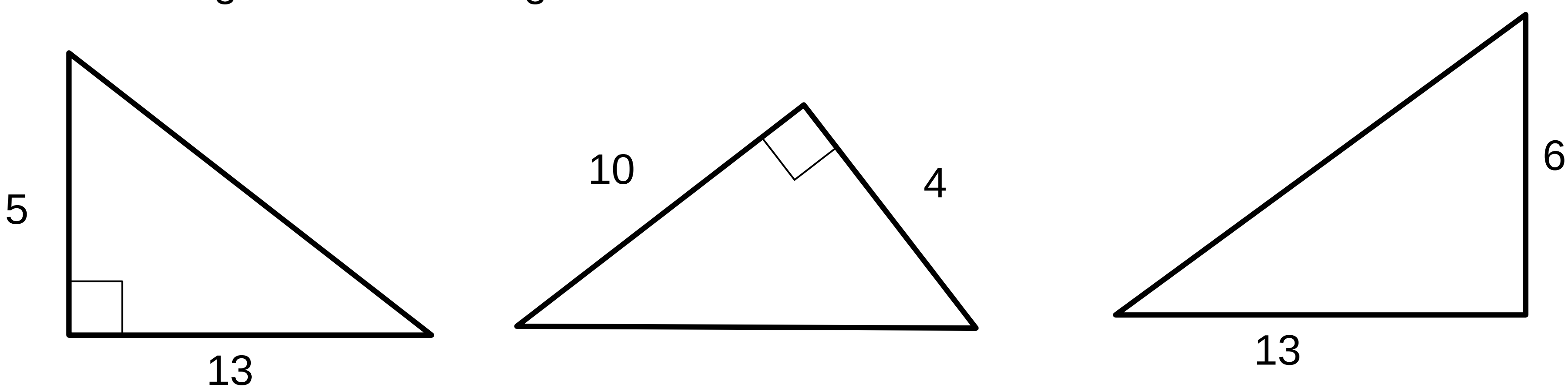
Drawing attention to what is to be learnt – the object of the learning, the essence of the concept.

Leading to generalisation.

Conceptual variation

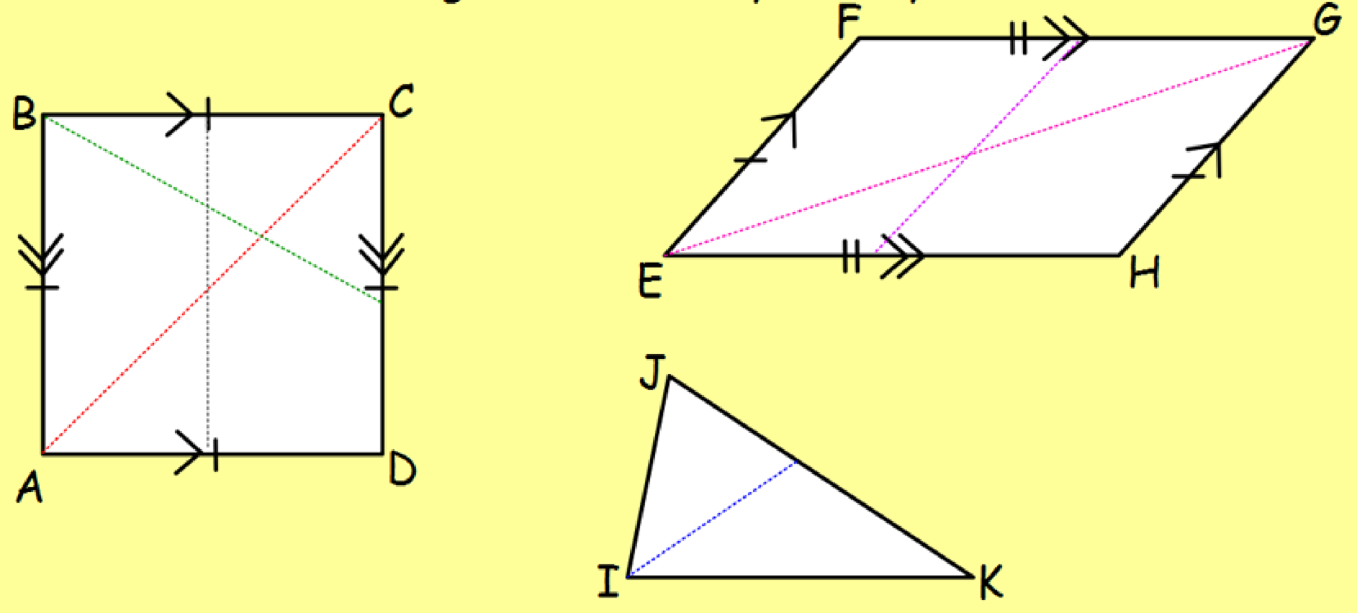


Find the length of the missing side:

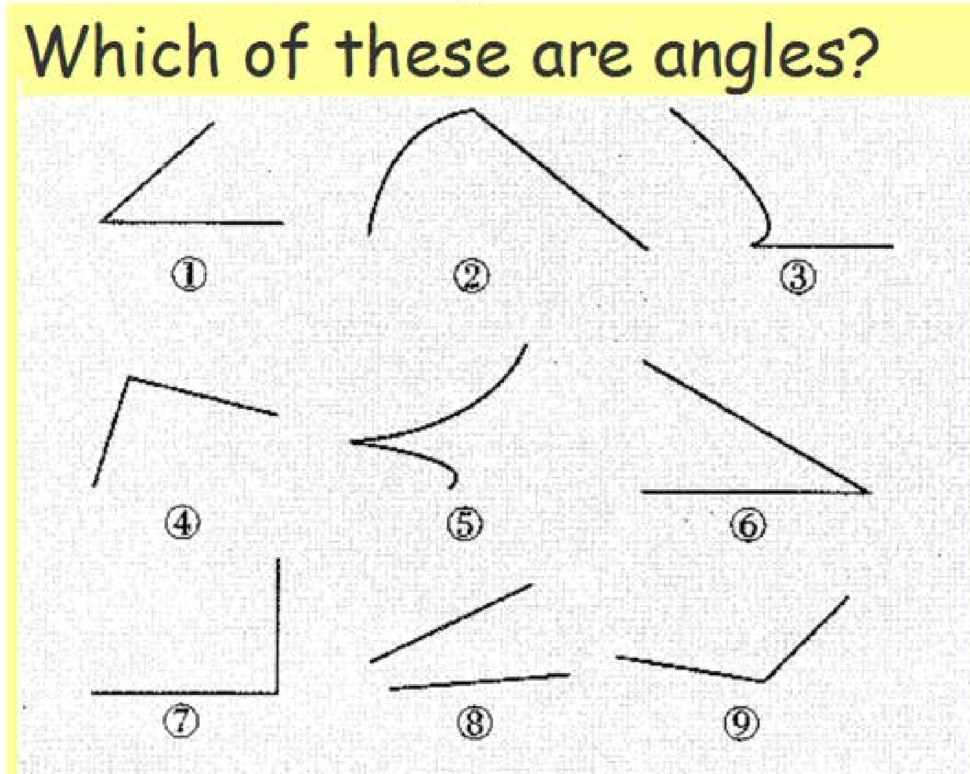


You know what it is... can you tell me what it's not?

Which of the following are lines of symmetry?



You know what it is… can you tell me what it’s not?



You know what it is… can you tell me what it’s not?

Which of these are coordinates and which are not?

If they are not can you identify what they are?

(x, y)

(3, 2)

5.9

(-2, -5)

-3, -7

(a, b)

(0, 0)

(0, -3)

(4.6)

4, 8

(3:5)

5:7

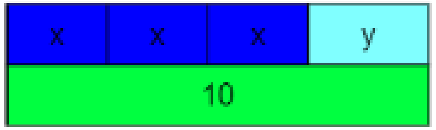
$\left(\frac{1}{2}, -\frac{2}{3}\right)$

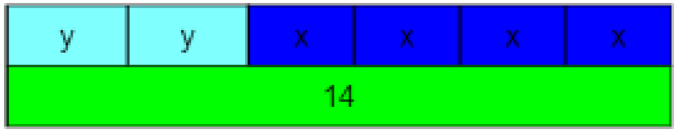
(3.5, 5.8)

Which of these are simultaneous equations?

$$2x - y = 4$$
$$x + y = 5$$

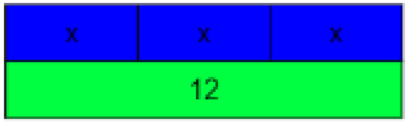
$$y = 4 + 3x$$
$$x + y = 8$$

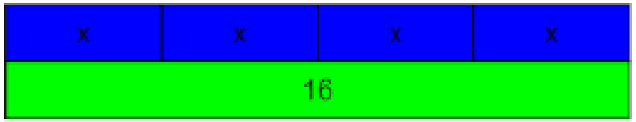




$$2x - 2 = 4$$
$$x + 2 = 5$$

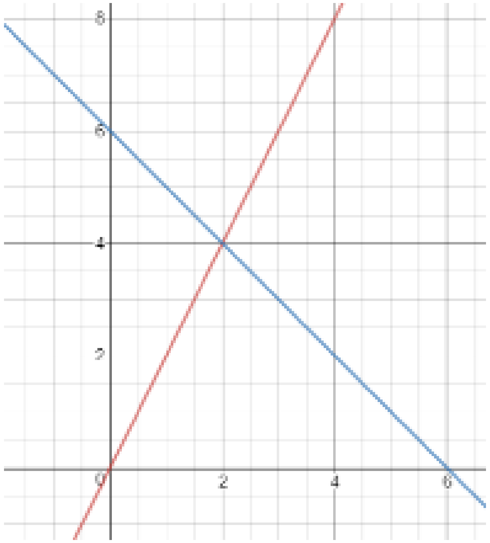
$$2 + y = 7$$
$$x - y = 1$$





$$x + y = 7$$
$$x - y = 1$$

$$x - y = 0.4$$
$$x + y = 5$$



The role of variation

- Encourages a thinking element to practice
- Embeds a deepening element into practice
- Moves from the simple to the more complex – reasoning and making connections along the way, leading to generality
- Results in deep sustainable learning

- Simplifying fractions
- Converting between improper fractions and mixed numbers
- Adding and subtracting fractions
- Calculate a fraction of an amount

What it is? What it isn't?

True or False

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

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

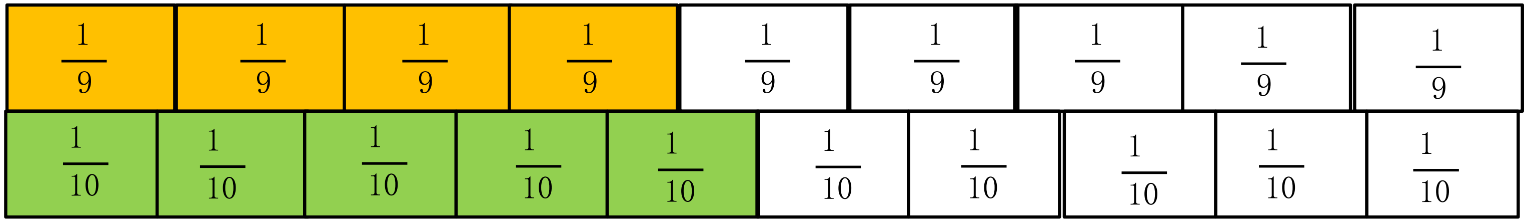
True or False

+1

$$\frac{4}{9} = \frac{5}{10}$$

+1

✗

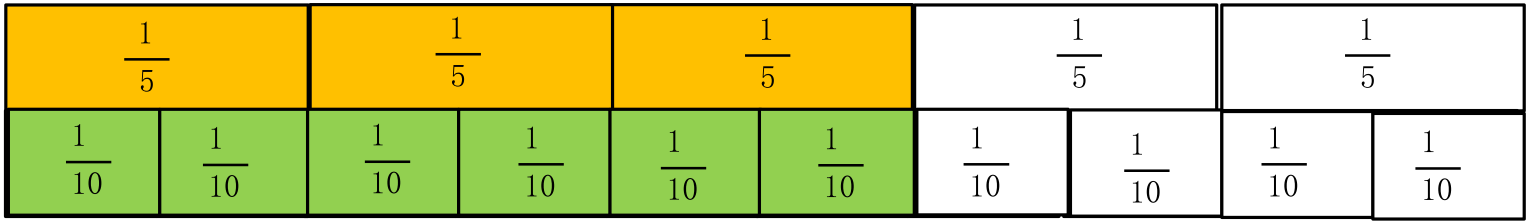


True or False

×2

$$\frac{3}{5} = \frac{6}{10}$$

×2

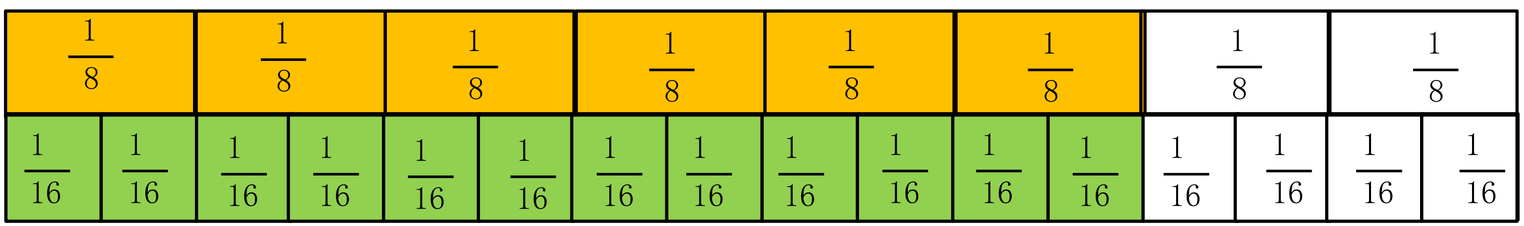


True or False

÷2

$$\frac{6}{8} = \frac{12}{16}$$

×2



True or False

×2

$$\frac{3}{7} = \frac{6}{14}$$

×2

✓

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- Simplifying fractions
- Converting between improper fractions and mixed numbers
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- Calculate a fraction of an amount

Topic:

What ‘it’ is?

What ‘it’ isn’t?

Key Ideas

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. When giving examples of a mathematical concept, it is useful to add variation to emphasise:
a. What it is (as varied as possible);
b. What it is not.
1. When constructing a set of activities / questions it is important to consider what connects the examples; what mathematical structures are being highlighted?
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.