KING'S MATHS SCHOOL

Welcome to GCSE 7+

Tuesday 13 April 2021

Session 7:

Ratio, percentages, proportion

A puzzle to ponder

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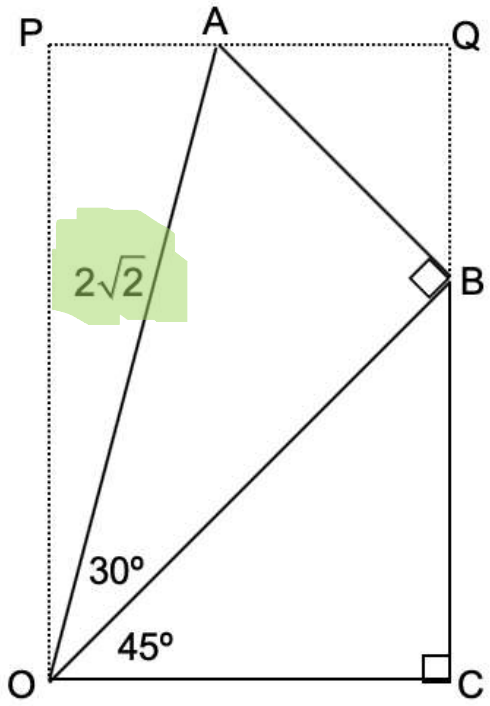
In the diagram, OCQP is a rectangle, OA = $2\sqrt{2}$, angle AOB = 30° and angle BOC = 45°.
Use this diagram to find exact values for the sine, cosine and tangent ratios for 15° and 75°.



Keep GCSE 7+ safe for everyone

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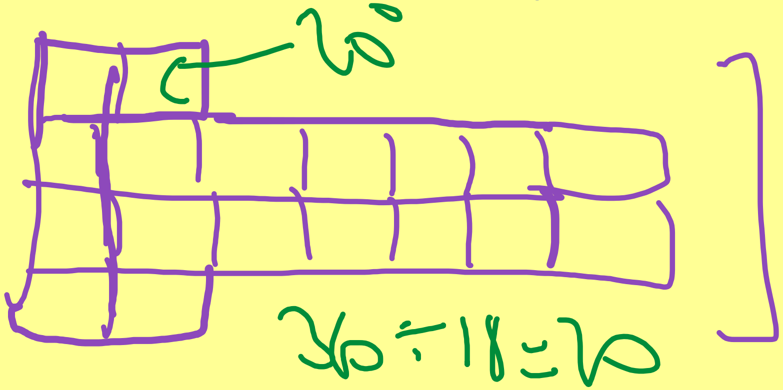
- **Do not <u>ASK</u>** anyone for **their** personal contact details: email, 'phone number, social media name, Instagram address etc.
- **Do not <u>GIVE</u>** anyone **your** personal contact details: email, 'phone number, social media name, Instagram address etc.
- If **anyone** asks you, in the Chat or directly, for your personal contact details, or
- If you read in the Chat, or if you overhear, **anyone** asking for or giving out personal contact details, or
- If you have any concerns about the welfare/wellbeing of any participant, including yourself, then you must **as soon as possible**
  - email the Head teacher dan.abramson@kcl.ac.uk or text him 07902 911144 and say what your concern is,
  - or email kclmsoutreach@kcl.ac.uk and ask Dan to contact you.

Quadrilaterals

- a) The interior angles of a quadrilateral are in the ratio 2 : 7 : 7 : 2 (in order). What is the quadrilateral?

360°



$= 360°$

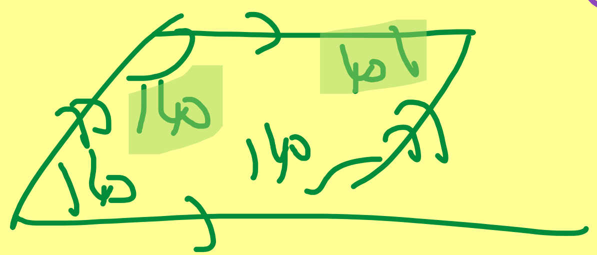
$360 \div 18 = 20$

60°, 140°, 140°, 40°

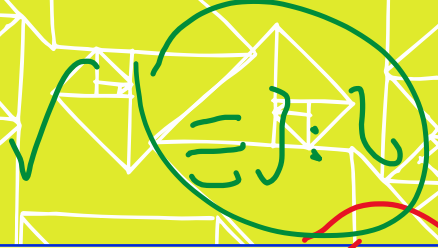
- b) The interior angles of a quadrilateral are in the ratio 2 : 7 : 2 : 7 (in order). What is the quadrilateral?

360°

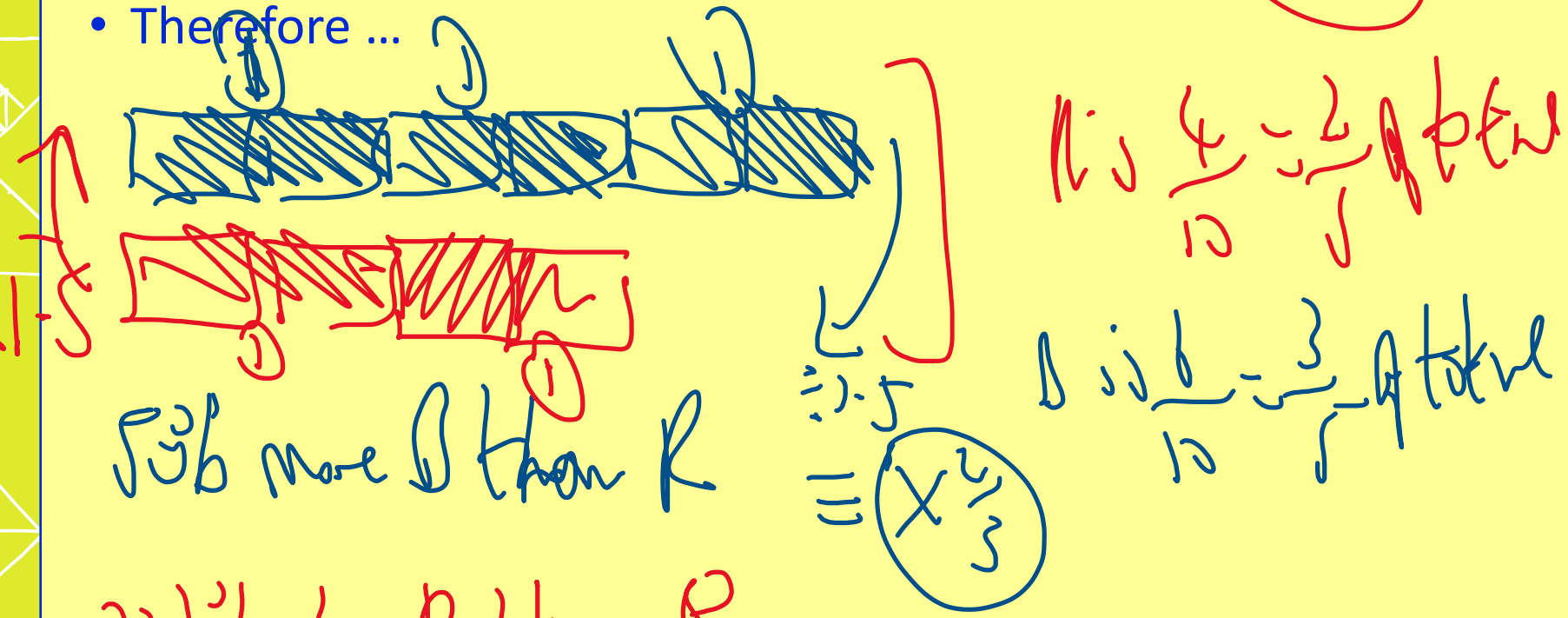
40°, 140°, 40°, 140°



One ratio tells us a lot!



- In a box of Lego™, the ratio of blue to red pieces is 6 : 4
- Therefore …



One ratio tells us a lot!

- In a box of Lego™, the ratio of blue to red pieces is 6 : 4
- Therefore …

$b : r = 6 : 4$

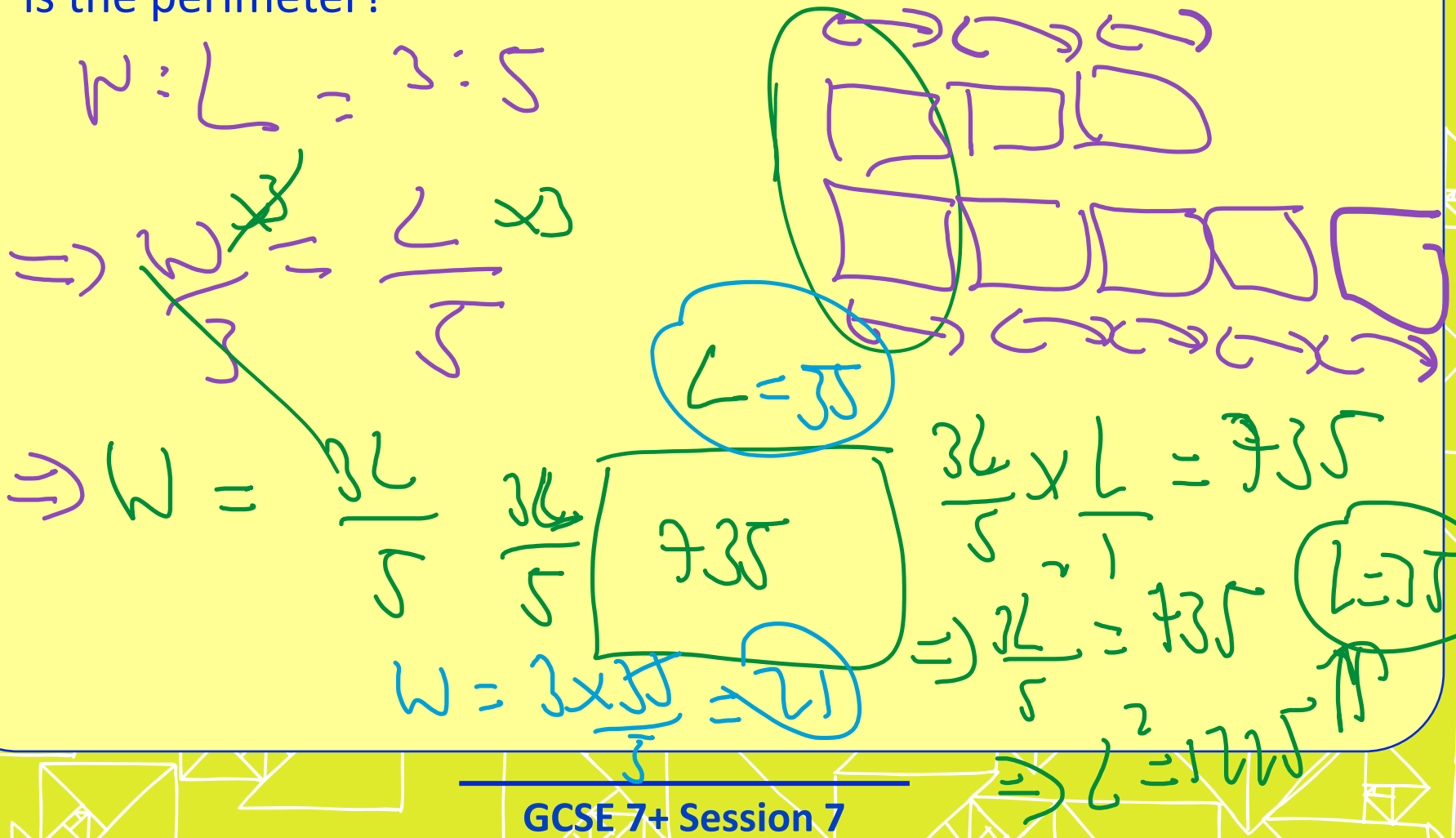
$$\frac{b}{6} = \frac{r}{4}$$

One ratio tells us a lot!

- In a box of Lego™, the ratio of blue to red to green pieces is 6 : 9 : 15
- Therefore …

Interpreting ratios

- A rectangle has sides in the ratio 3 : 5. The area is 735 cm^2. What is the perimeter?



Interpreting ratios

- A has co-ordinates $(-3, 8)$ and B has co-ordinates $(1, 2)$.
- C is on the line AB, and AB : BC = 2 : 5
- What are the co-ordinates of C?

Interpreting ratios

- The ratio of the sum to the difference of two numbers is 5 : 2. What is the ratio of the numbers?

x, y

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

$\Rightarrow 2(x+y) = 5(x-y)$

$\Rightarrow 2x + 2y = 5x - 5y$

$\Rightarrow 7y = 3x \Rightarrow \frac{7y}{3} = \frac{3x}{3} \Rightarrow \frac{7y}{7} = \frac{3x}{7}$

$\Rightarrow y : x = 3 : 7$

Changing ratios

- A and B share some money in the ratio 7 : 3.
- A gives B £10. The ratio of their shares is now 3 : 2.
- How much do they each have?

Combining ratios

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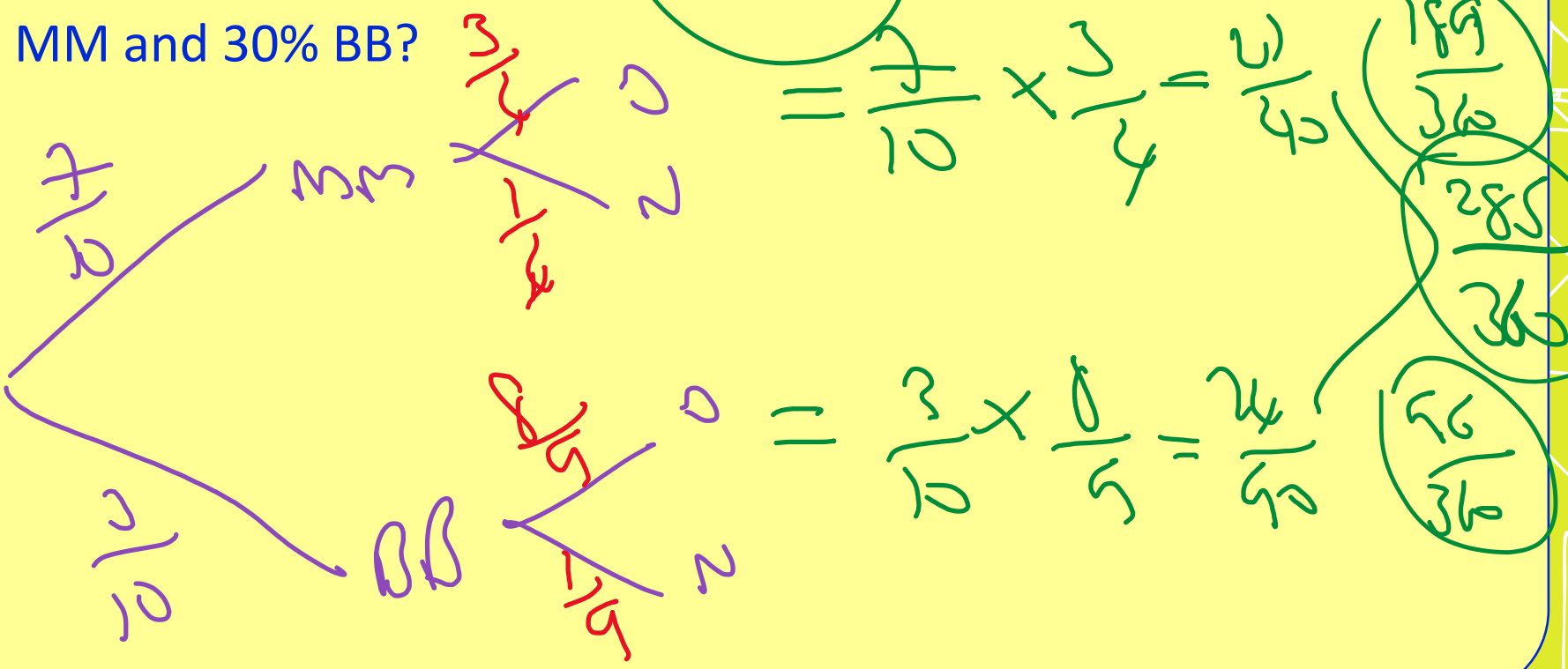
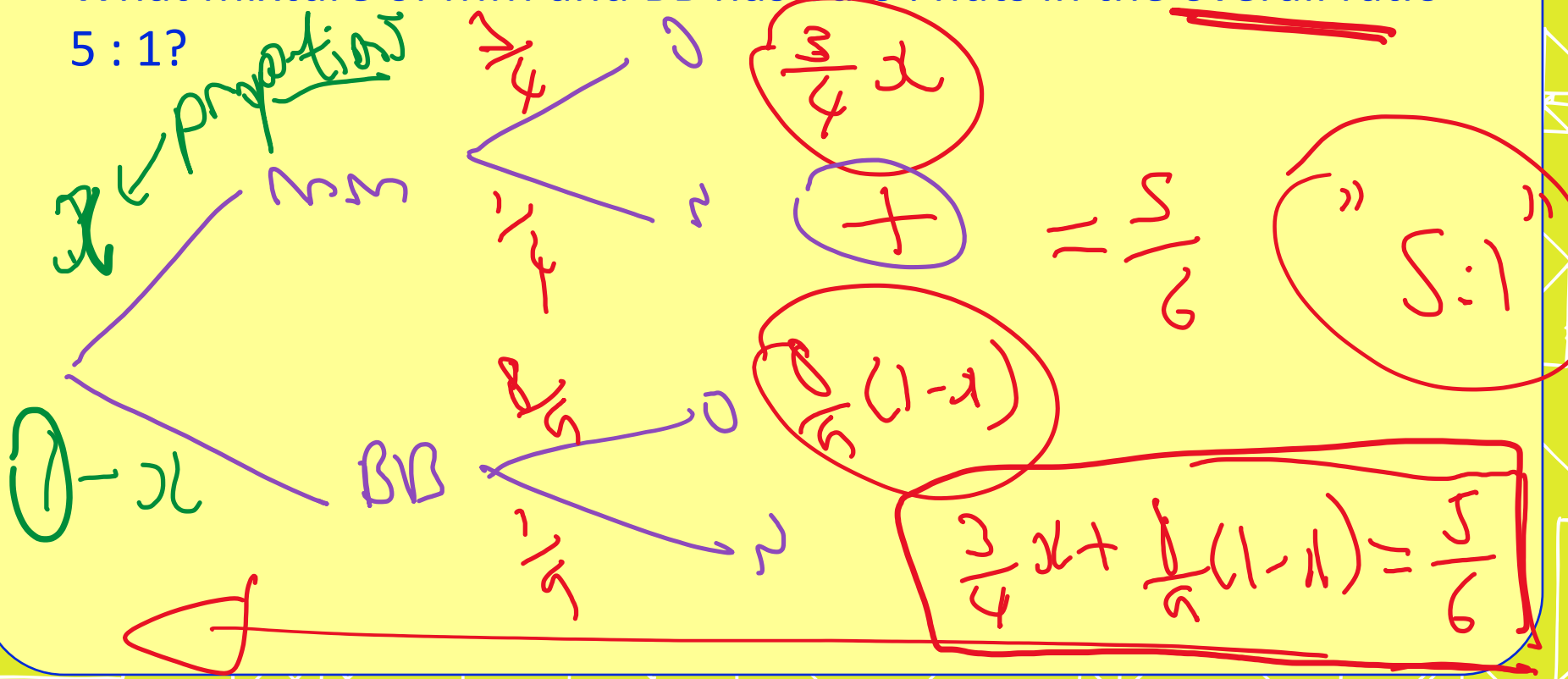
- *Morning Munch* contains oats : nuts in the ratio 3 : 1
- *Breakfast Boost* contains oats : nuts in the ratio 8 : 1
- What is the overall ratio of oats : nuts in a mixture that is 70% MM and 30% BB?



Combining ratios

KING'S MATHS SCHOOL

- *Morning Munch* contains oats : nuts in the ratio 3 : 1
- *Breakfast Boost* contains oats : nuts in the ratio 8 : 1
- What mixture of MM and BB has oats : nuts in the overall ratio 5 : 1?



Percentage changes …

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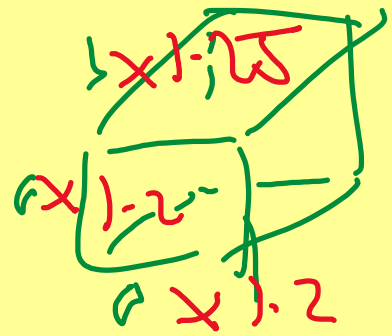
- A cuboid has dimensions a cm by a cm by b cm.
- When a increases by 20% and b increases by 25%, what is the percentage increase in the volume?



$V = a^2 b$

$V = 1.2a \times 1.2a \times 1.25b$

$= 1.44 \times 1.25\, b$

$= 1.8a^2b$

80% inc

Proportional relationships

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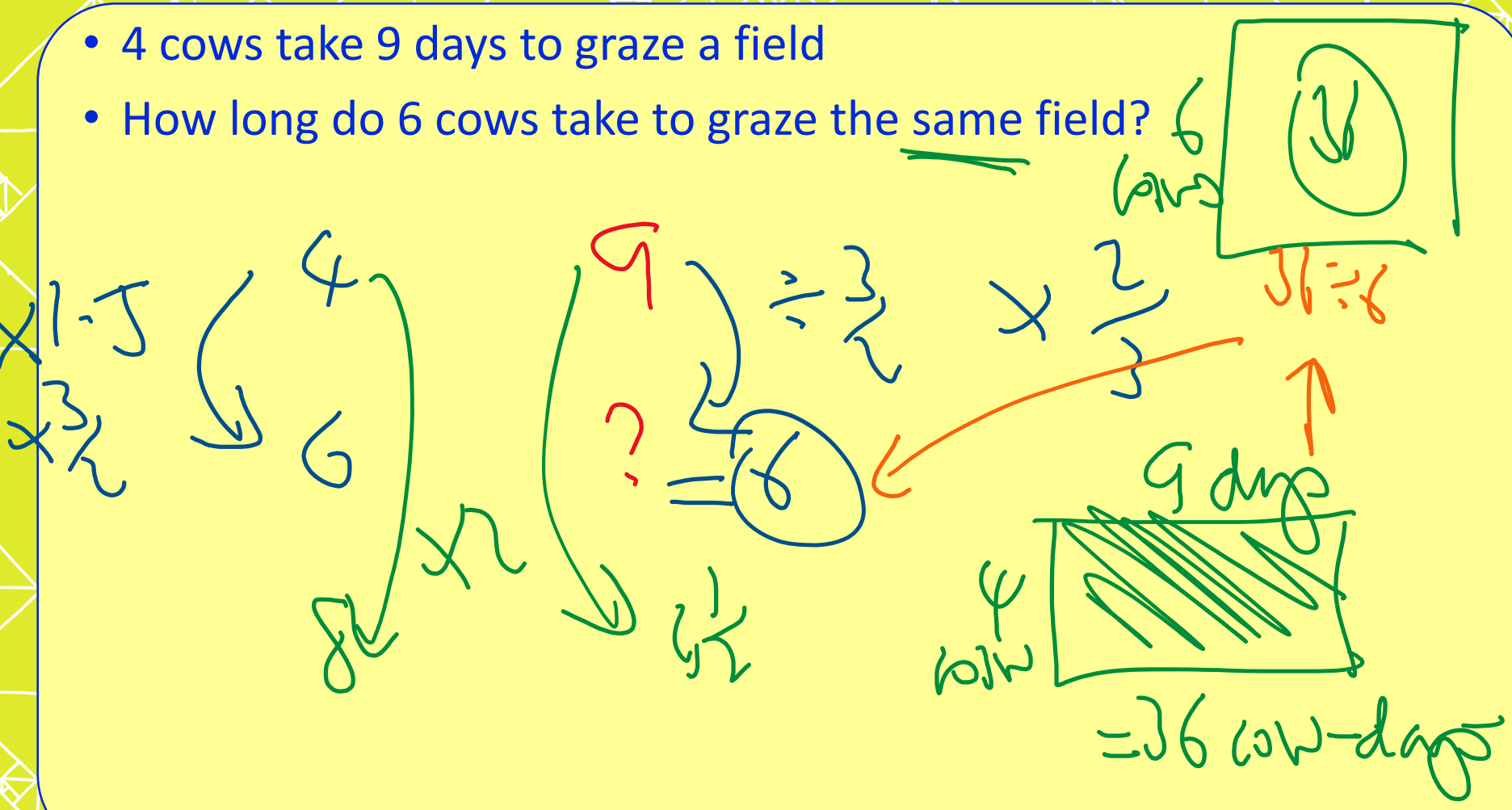
- 4 cows take 9 days to graze a field
- How long do 6 cows take to graze the same field?



Proportional relationships

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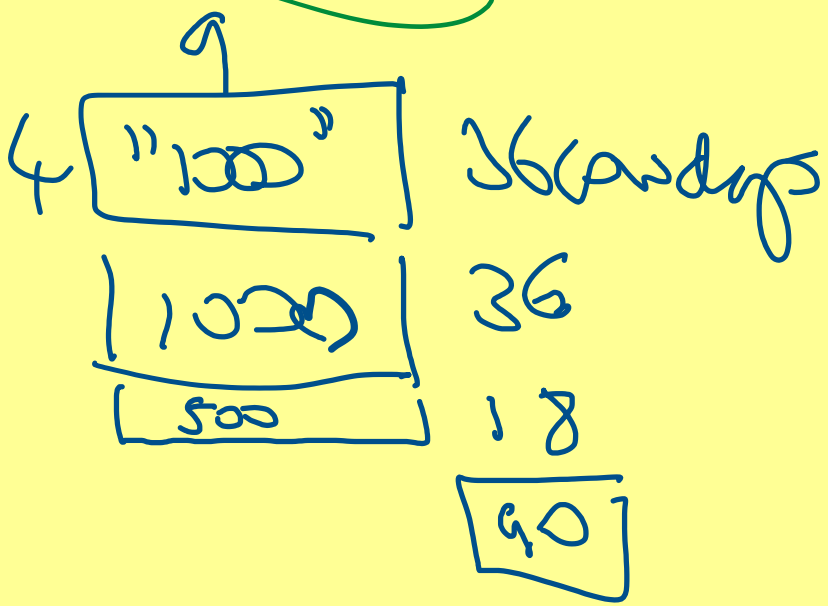
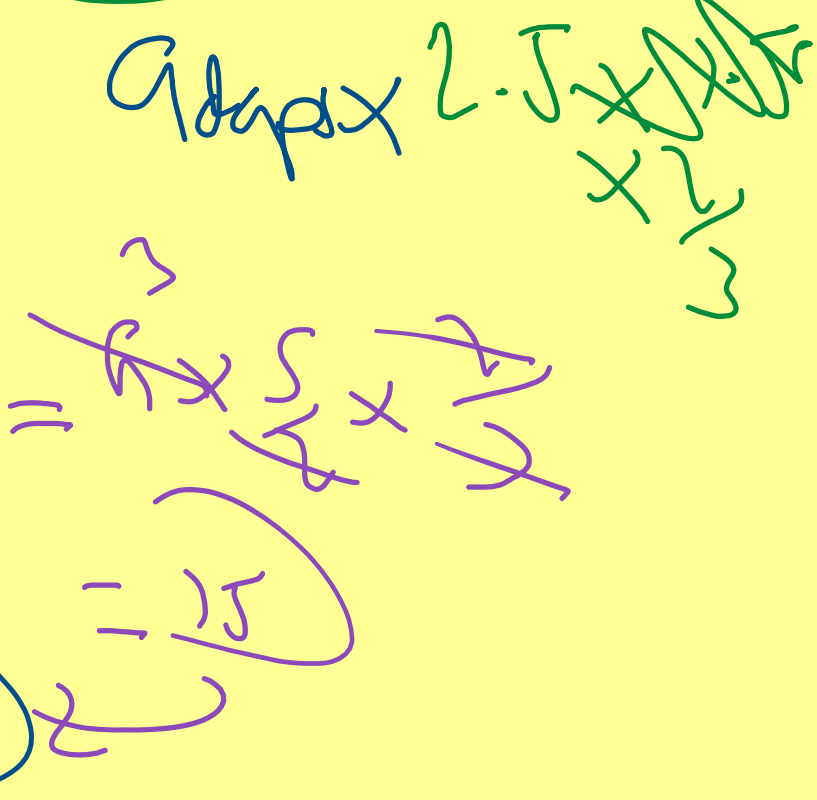
- 4 cows take 9 days to graze 1000m^2.
- How long do 6 cows take to graze 2500m^2?





Proportional relationships

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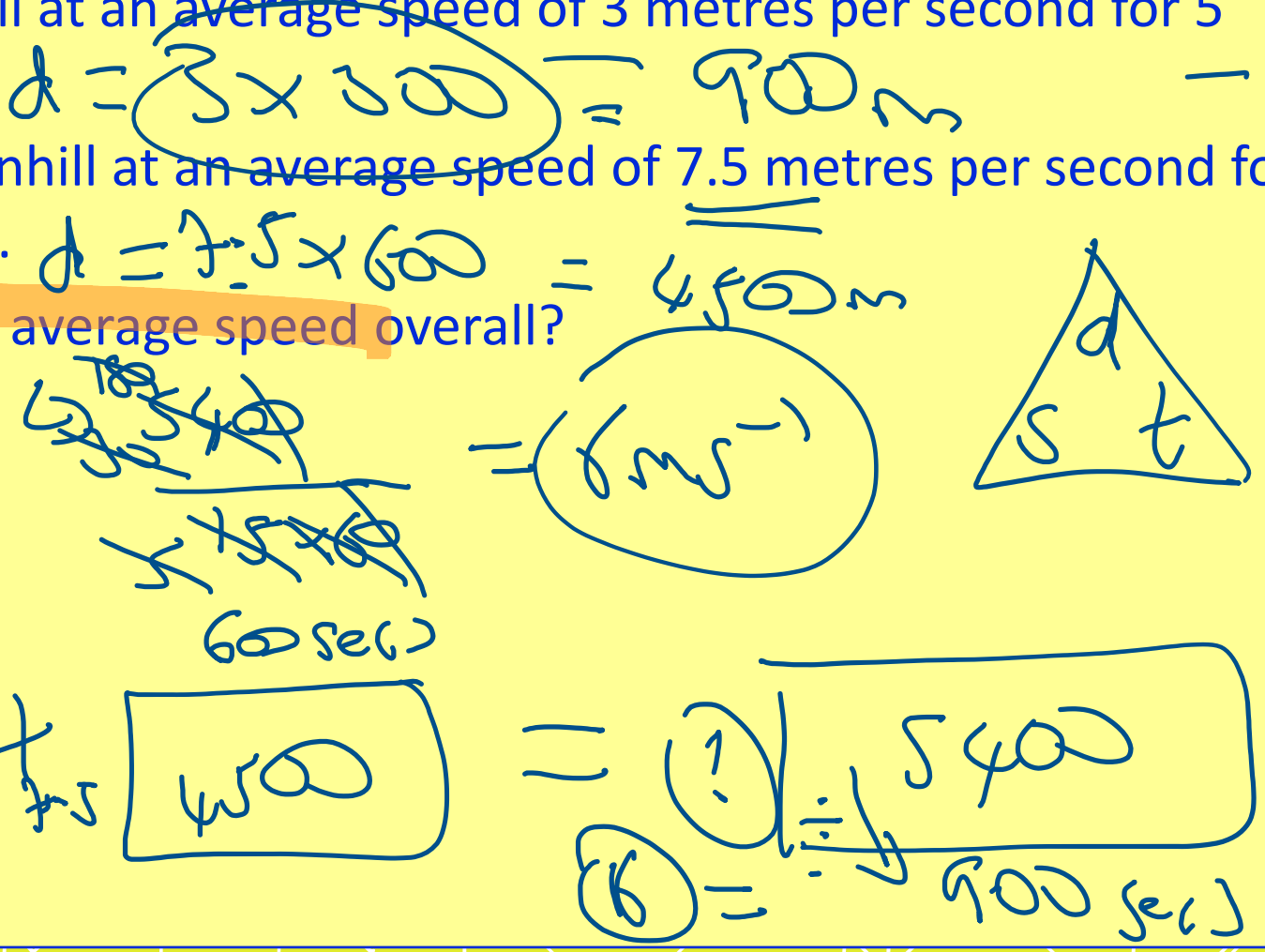
- I cycle uphill at an ~~average~~ speed of 3 metres per second for 5 minutes.
- I cycle downhill at ~~an average~~ speed of 7.5 metres per second for 10 minutes.
- What is my average speed overall?



Proportional relationships and % change

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- I cycle at an average speed of v metres per second for t minutes.
- I then cycle 25% faster for 20% shorter period of time.
- Do I cycle a longer, shorter or the same distance?