KING'S MATHS SCHOOL

Welcome to GCSE 7+

Thursday 8 April 2021

Session 1:
Simplifying surds and indices

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.

Remember that you have agreed

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I will treat all other participants, students and teachers alike, with respect and with compassion.

I will, both during these sessions and afterwards, treat all participants equally regardless of their background or identity.

I will not, either during these sessions or afterwards, bully, harass, intimidate or discriminate against any participant in these sessions.

I will not record or capture any video or images (e.g. screenshots) during these sessions.

I will follow all instructions given to me to the best that I can.

I will engage in these sessions with tenacity and resilience. I will always 'have a go'.

If you choose otherwise

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If you choose **not** to meet these expectations, e.g. if in the Chat or by microphone you

- talk about **non-mathematical topics**
- **swear** or use **slang** or **are disrespectful**
- use language that might **cause offence** or **distress**
- **make comments** about other participants or their maths

you will be **removed** from the current session.

We will speak with you and you might be **invited to join** the next session. But if you choose again not to meet the expectations

- You will be **removed from all the remaining sessions**.
- There will be **follow-up consequences**.

GCSE 7+: the programme

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- **Thursday 8 April, session 1: fluency with indices and surds**
- Thursday 8 April, session 2: algebra with indices and surds

- Friday 9 April, session 3: fluency with quadratic expressions
- Friday 9 April, session 4: quadratic graphs

- Monday 12 April, session 5: lines and circles
- Monday 12 April, session 6: angles and circles

- Tuesday 13 April, session 7: ratios, percentages and proportion
- Tuesday 13 April, session 8: probability

Evaluating indices

Evaluate

- $4^0 = 1$
- $4^{-2} = \frac{1}{4^2}$ $\quad \frac{1}{16} \div \frac{1}{1} = \frac{1}{16} \times \frac{16}{1} = 16$
- $-\frac{1}{4}^{-2} = -\frac{1}{\left(\frac{1}{4}\right)^2} = -\frac{1}{\left(\frac{1}{16}\right)} = -16$
- $4^{-\frac{1}{2}} = \frac{1}{\sqrt{4}} = \frac{1}{2}$
- $-4^{-\frac{3}{2}} = -\frac{1}{4^{\frac{3}{2}}} = -\frac{1}{\sqrt{4}^3} = -\frac{1}{8} = -\frac{1}{8}$

Evaluating indices

Evaluate

- $8^0 = 1$
- $\left(\frac{3}{8}\right)^{-2} = \frac{1}{\left(\frac{3}{8}\right)^2} = \frac{1}{\left(\frac{9}{64}\right)} = \frac{64}{9} = 7\frac{1}{9}$
- $(-8)^{-\frac{1}{3}} = \frac{1}{\sqrt[3]{-8}} = \frac{1}{-2} = -\frac{1}{2}$
- $-8^{-\frac{4}{3}} = -\frac{1}{8^{\frac{4}{3}}} = -\frac{1}{\sqrt[3]{8}^4} = -\frac{1}{2^4} = -\frac{1}{16}$
- $\left(3\frac{3}{8}\right)^{-\frac{2}{3}} = \left(\frac{27}{8}\right)^{-\frac{2}{3}} = \frac{1}{\left(\frac{27}{8}\right)^{\frac{2}{3}}} = \frac{1}{\left(\frac{9}{4}\right)} = \frac{4}{9}$

Simplifying indices

Simplify

- $2^7 \times 2^5 = 2^{12}$
- $2^7 \div 2^5 = 2^2$
- $(2^7)^5 = 2^{35}$
- $2^7 \times 4^5 = 2^7 \times (2^2)^5 = 2^7 \times 2^{10} = 2^{17}$
- $4^7 \div 8^5 = (2^2)^7 \div (2^3)^5 = 2^{14} \div 2^{15} = 2^{-1} = \frac{1}{2}$

Simplifying indices

Simplify

- $\sqrt{2^{16}}$ $= (2^{16})^{\frac{1}{2}} = 2^{8}$
- $\sqrt[3]{8^{27}}$ $= (8^{27})^{\frac{1}{3}} = 8^{9}$
- $\sqrt{16^{25}}$ $= (16^{25})^{\frac{1}{2}} = 16^{12\frac{1}{2}} = (2^{4})^{12\frac{1}{2}} = 2^{50}$
- $\sqrt[3]{100^{17} \times 50^{35}}$ $\rightarrow (2^{69} \times 5^{104})^{\frac{1}{3}} = (2^{69})^{\frac{1}{3}} (5^{104})^{\frac{1}{3}}$ $= 5^{35} \times 2^{69} \times 5^{69}$

HCF and LCM of …

- $A = 100$ and $B = 125$

HCF $= 5^2 = 25$

$A = 2^2 \times 5^2 = 2 \times 2 \times 5 \times 5$

$B = 5^3 = 5 \times 5^2 = 5 \times 5 \times 5$

LCM $= 5^3 \times 2 \times 2$

$= 500$

- $A = 2^5 \times 3^3 \times 7^2$ and $B = 2^3 \times 3^7 \times 5^2 \times 7^3$

HCF $= 2^3 \times 3^3 \times 7^2$

LCM $= 2^3 \times 3^3 \times 7^2 \times 2^2 \times 3^4 \times 5^2 \times 7$

HCF and LCM of …

- $A = 40^2 \times 9^3$ and $B = 6^4 \times 15^3$

$(4 \times 10)^2$ $(3^2)^3$

$= (8 \times 5)^2$

$= (2^3 \times 5)^2$

$= 2^6 \times 5^2 \times 3^6$

$B = (2 \times 3)^4 \times (3 \times 5)^3$

$= 2^4 \times 3^4 \times 3^3 \times 5^3$

$= 2^4 \times 3^7 \times 5^3$

etc ...

AB ÷ HCF of A and B = …

- $A = 100$ and $B = 125$

$100 \times 125 = 4 \times 125 = 500 = LCM$

$1 \quad 25$

- $A = 2^5 \times 3^3 \times 7^2$ and $B = 2^3 \times 3^7 \times 5^2 \times 7^3$

$2^3 3^3 7^2$

- $A = 40^2 \times 9^3$ and $B = 6^4 \times 15^3$

- Hence $AB \div$ HCF of A and B = LCM

Simplifying surds

$\sqrt{2}$ is **a** number which equals 2 when it is squared

- $(\sqrt{2})^2 =$ 2
- $(\sqrt{2})^4 =$ $\sqrt{2}^2 \times \sqrt{2}^2 = 2 \times 2 = 4$
- $(3\sqrt{2})^2 =$ $3\sqrt{2} \times 3\sqrt{2} = 9 \times 2 = 18$
- $(2\sqrt{2})^3 =$ $2\sqrt{2} \times 2\sqrt{2} \times 2\sqrt{2}$

  $= 8 \times 2 \times \sqrt{2} = 16\sqrt{2}$

Simplifying surds

$\sqrt{2}$ is **a** number which equals 2 when it is squared

- $4(3+2\sqrt{2})-2(5-3\sqrt{2})=$

$=12+8\sqrt{2}-10+6\sqrt{2}=2+14\sqrt{2}$

- $(3+2\sqrt{2})(5-3\sqrt{2})=$

= "FOIL"

$=3+\sqrt{2}$

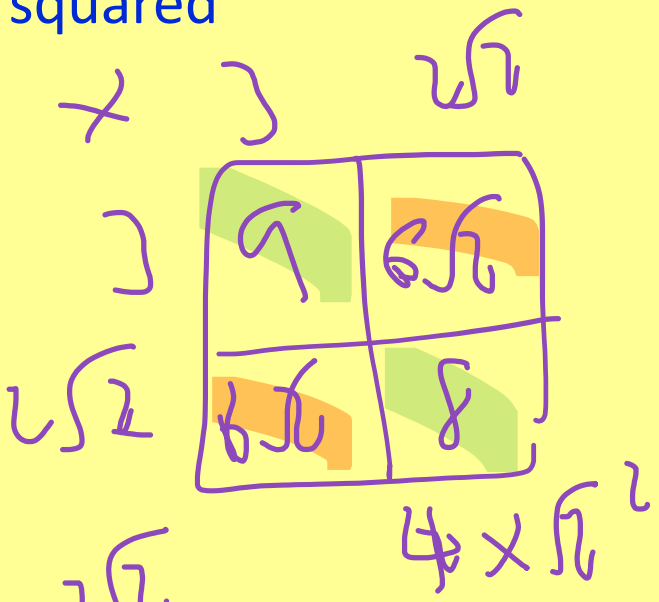
×	3	$\sqrt{2}$
5	15	$10\sqrt{2}$
$-3\sqrt{2}$	$-9\sqrt{2}$	-6×2

$=-1$

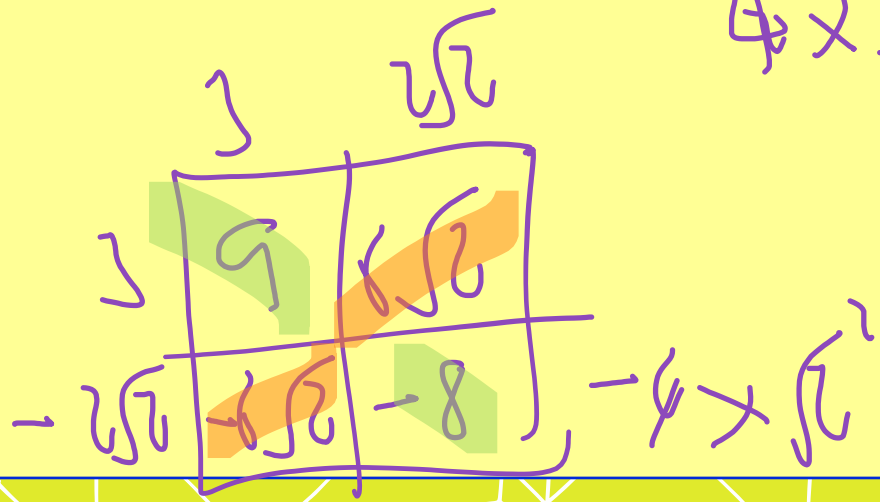
Simplifying surds

$\sqrt{2}$ is **a** number which equals 2 when it is squared

- $(3 + 2\sqrt{2})^2 =$



- $(3 + 2\sqrt{2})(3 - 2\sqrt{2}) =$



Simplifying surds

- $5\sqrt{2} =$
- $2\sqrt{5} =$
- $\sqrt{90} =$
- $\sqrt{300} =$
- $\frac{1}{4}\sqrt{32} =$

Simplifying surds

- $\sqrt{8}+\sqrt{2}=$ $2\sqrt{2}+\sqrt{2}=3\sqrt{2}$
- $\sqrt{27}-\sqrt{12}=$ $3\sqrt{3}-2\sqrt{3}=\sqrt{3}$

$\sqrt{9\times3}-\sqrt{4\times3}$

- $(\sqrt{72}-\sqrt{18})^3=$ $(6\sqrt{2}-3\sqrt{2})^3=(3\sqrt{2})^3$

$\sqrt{36\times2}-\sqrt{9\times2}$

$=27\times\sqrt{2}\sqrt{2}\sqrt{2}$

$=54\sqrt{2}$

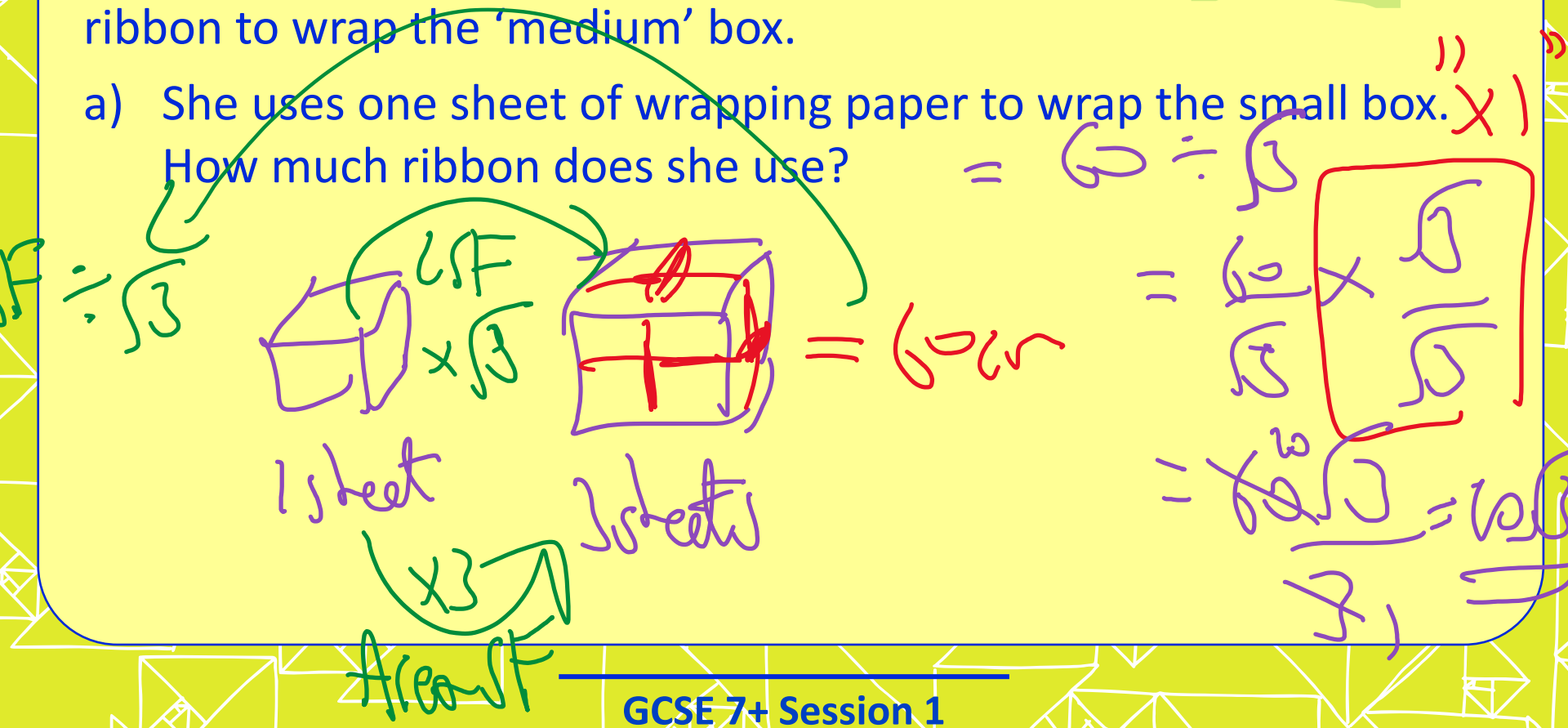
- $(\sqrt{50}-\sqrt{8})^{-2}=$

Similar shapes

Goldilocks is wrapping three boxes. She has lots of identical sheets of wrapping paper. The boxes are mathematically similar.

Goldilocks uses three sheets of wrapping paper and 60cm of ribbon to wrap the 'medium' box.

a) She uses one sheet of wrapping paper to wrap the small box. How much ribbon does she use?



Similar shapes

Goldilocks is wrapping three boxes. She has lots of identical sheets of wrapping paper. The boxes are mathematically similar.

Goldilocks uses three sheets of wrapping paper and 60cm of ribbon to wrap the 'medium' box.

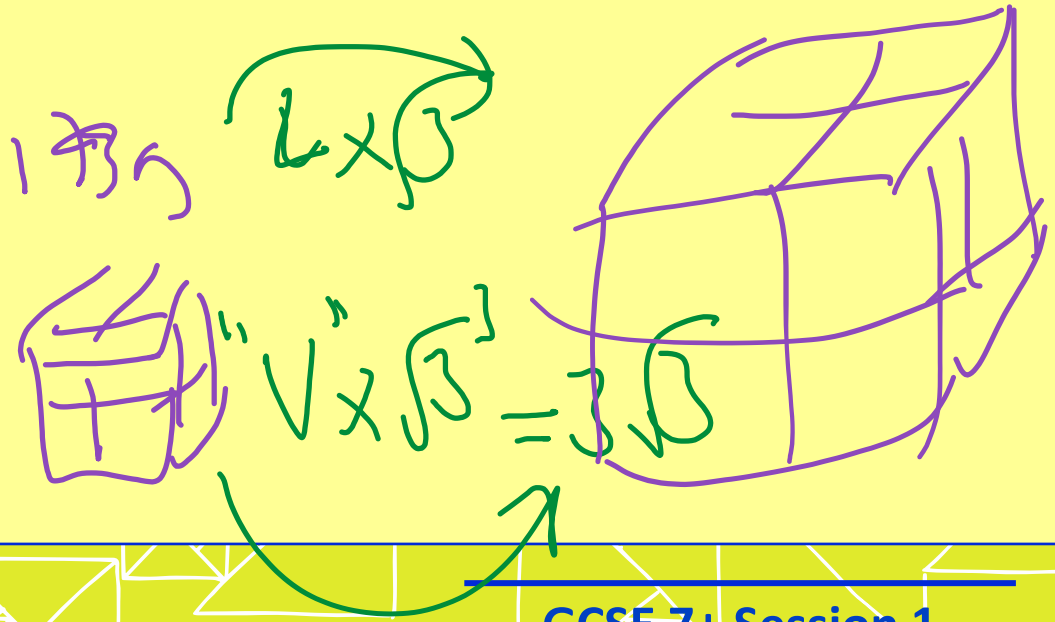
b) She uses 80cm of ribbon to wrap the 'large' box. How many sheets of wrapping paper does she use?

Similar shapes

Goldilocks is wrapping three boxes. She has lots of identical sheets of wrapping paper. The boxes are mathematically similar.

Goldilocks uses three sheets of wrapping paper and 60cm of ribbon to wrap the 'medium' box.

c) The 'small' box has a mass of 173g. What are the masses of the 'medium' and the 'large' boxes?



Rationalising the denominator

- $\frac{1}{\sqrt{6}} = \frac{\sqrt{6}}{6}$
- $\frac{20}{\sqrt{5}} = 4\sqrt{5}$
- $\frac{8}{5\sqrt{2}} = \frac{4\sqrt{2}}{5}$
- $\frac{28}{3\sqrt{7}} = \frac{4\sqrt{7}}{3}$

Rationalising the denominator

- $1 - \frac{2}{\sqrt{6}} =$

- $\frac{5}{\sqrt{2}} + \frac{3}{\sqrt{8}} =$

Rationalising the denominator

- $\frac{5}{2+\sqrt{3}} =$ $\times \frac{2-\sqrt{3}}{2-\sqrt{3}}$ ...
- $\frac{11}{5-\sqrt{3}} =$ ...
- $\frac{10}{\sqrt{8}-\sqrt{3}} =$ ...

Simplifying surds … with Pythagoras

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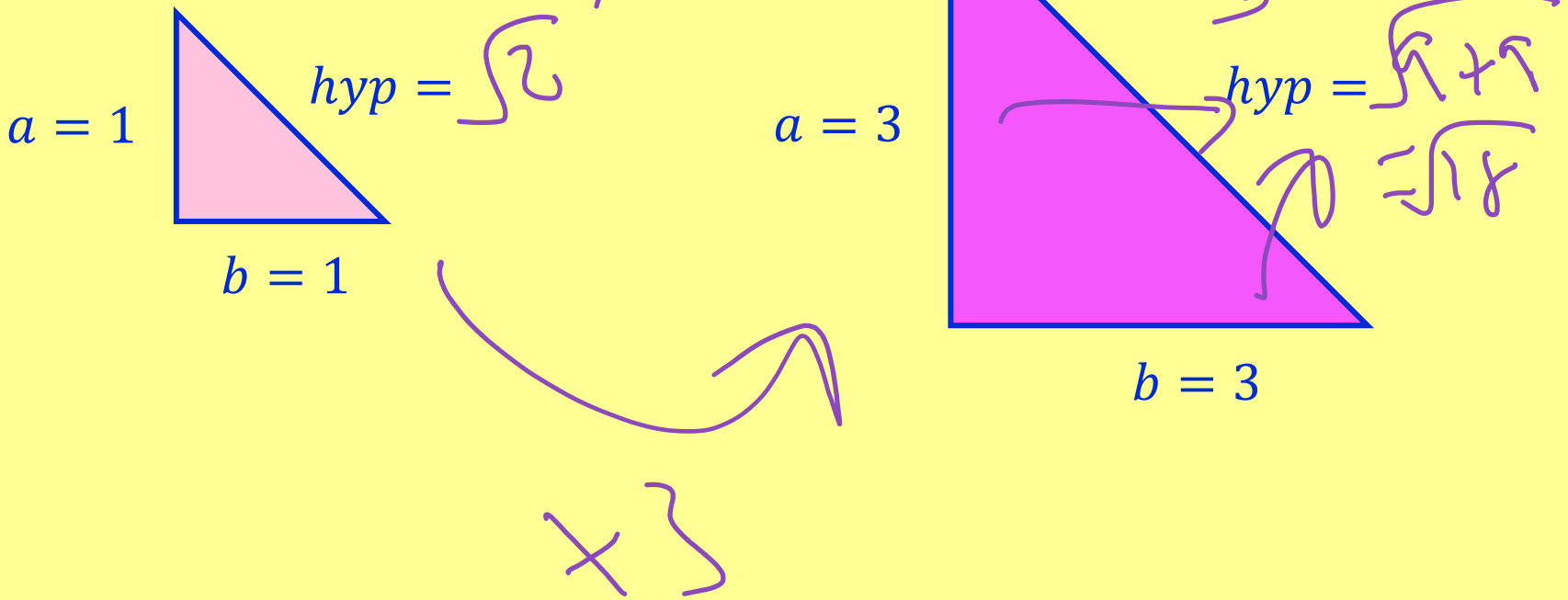
- $3\sqrt{2} =$



Simplifying surds … with Pythagoras

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- $2\sqrt{5} =$