KING'S MATHS SCHOOL

# Welcome to GCSE 7+

## Thursday 8 April 2021

## Session 2:
## Algebra with indices and surds

# 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.

# Simplifying expressions with indices

Simplify

- $\sqrt{x^8}$ $= (x^{\frac{1}{2}})^8 = x^4$
- $\sqrt[3]{y^{12}}$ $= (y^{12})^{\frac{1}{3}} = y^4$
- $\sqrt{36x^{36}}$ $= (36x^{36})^{\frac{1}{2}} = 6x^{18}$
- $\sqrt[3]{216y^{216}}$ $= 6(y^{216})^{\frac{1}{3}} = 6y^{72}$
- $\sqrt{25x^{16}} + 3(x^2)^4$ $= (25x^{16})^{\frac{1}{2}} + 3x^8 = 5x^8 + 3x^8 = 8x^8$

# Simplifying expressions with indices

Simplify

- $12x^5y^1 \div 4x^2y^3$
- $\sqrt{25x^{16}} \div 3(x^2)^4$
- $(3x^2y^3)^3 \times (3x^3y^2)^{-2}$
- $(4x^6y^{-8})^{-\frac{1}{2}}$

# Simplifying expressions with indices

Simplify

- $x^{-3}$ $= \frac{1}{x^3}$
- $2x^{-3}$ $= \frac{2}{1} \times \frac{1}{x^3} = \frac{2}{x^3}$
- $2x^{-3} \times (3x)^{-2} = \frac{2}{x^3} \times \frac{1}{(3x)^2} = \frac{2}{x^3} \times \frac{1}{9x^2} = \frac{2}{9x^5}$
- $3x^{-2} \div (2x)^{-3} = \frac{3}{x^2} \div \frac{1}{(2x)^3} = \frac{3}{x^2} \div \frac{1}{8x^3} = \frac{3}{x^2} \times \frac{8x^3}{1} = 24x$

# Simplifying expressions with indices

Simplify

- $2x^{-3} + 3x^{-3}$ $= \frac{2}{x^3} + \frac{3}{x^3} = \frac{5}{x^3}$
- $2x^{-3} + 3x^{-2}$ $= \frac{2x^1}{x^3x^1} + \frac{3x}{x^2x^1} = \frac{2}{x^3} + \frac{3x}{x^3} = \frac{2+3x}{x^3}$

(2) CD

- $(2x)^{-3} + (3x)^{-2}$ $\frac{1}{8x^3} \times \frac{9}{9}$ $\frac{1}{9x^2} \times \frac{8x}{8x} = \frac{9}{72x^3} + \frac{8x}{72x^3} = \frac{9+8x}{72x^3}$

# Simplifying expressions with indices

Simplify

- $\frac{6x^4}{9x}$ =
- $\frac{6x^2y}{9xy^3}$ =
- $\frac{6+2x}{3x+x^2}$ =
- $\frac{4x^2+6x}{10x^4+15x^3}$ =

# Solving equations with indices

Solve

- $x^3 = 3\frac{3}{8}$
- $x^{-2} = 2\frac{1}{4}$
- $x^{\frac{2}{3}} = 6.25$
- $x^{-\frac{3}{2}} = 0.064$

# Solving equations with indices

Solve

- $x^3 = 2^{15}$
- $x^{-2} = 4^7$
- $2^x = 4^{12}$
- $4^x = 2^{12}$
- $4^x = 8^{-4}$

# Solving equations with surds

Solve

- $\sqrt{3}x + 3 = 6$

$\Rightarrow \sqrt{3}x = 3 \Rightarrow x = \frac{3}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{3\sqrt{3}}{3} = \sqrt{3}$

- $\sqrt{3}x + 3 = \sqrt{27}x + 6$

$\Rightarrow \sqrt{3}x + 3 = 3\sqrt{3}x + 6$

$\Rightarrow -3 = 2\sqrt{3}x \Rightarrow x = \frac{-3}{2\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{-3\sqrt{3}}{6} = \frac{-\sqrt{3}}{2}$

# Solving equations with surds

Solve

- $\sqrt{3}x + 3 = 2x + 6$

$\Rightarrow -3 = 2x - \sqrt{3}x$

$\Rightarrow -3 = x(2 - \sqrt{3}) \Rightarrow x = \frac{-3}{2-\sqrt{3}} \times \frac{2+\sqrt{3}}{2+\sqrt{3}}$

"$\times 1$"

conjugate surds

- $\sqrt{3}x + 3 = \sqrt{2}x + 6$

$\Rightarrow -3 = \sqrt{2}x - \sqrt{3}x$

$= x(\sqrt{2} - \sqrt{3}) \Rightarrow x = \frac{-3}{\sqrt{2}-\sqrt{3}} \times \frac{\sqrt{2}+\sqrt{3}}{\sqrt{2}+\sqrt{3}} \ldots$

# Make $x$ the subject of …

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- $ax + b = c$

$\Rightarrow ax = c - b \Rightarrow x = \frac{c-b}{a}$

- $a\sqrt{x} + b = c$

$\Rightarrow a\sqrt{x} = c - b \Rightarrow \sqrt{x} = \frac{c-b}{a} \Rightarrow x = \left(\frac{c-b}{a}\right)^2$

- $a\sqrt{x+b} = c$

$\Rightarrow \sqrt{x+b} = \frac{c}{a} \Rightarrow x + b = \left(\frac{c}{a}\right)^2 \Rightarrow x = \left(\frac{c}{a}\right)^2 - b$

# Make $x$ the subject of ...

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- $ax + bx = c$

$\Rightarrow x(a+b) = c \Rightarrow x = \frac{c}{a+b}$

- $x\sqrt{a} = b$

$\Rightarrow x = \frac{b}{\sqrt{a}}$

- $x\sqrt{a} + bx = c$

$\Rightarrow x(\sqrt{a}+b) = c \Rightarrow x = \frac{c}{\sqrt{a}+b}$

# Make $x$ the subject of ...

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- $\frac{a}{x} + b = c$

$\Rightarrow \frac{a}{x} = c - b \Rightarrow a = x(c-b)$

$\Rightarrow \frac{a}{c-b} = x$

- $\frac{a-bx}{x} = c$

$\Rightarrow a - bx = cx$

$\Rightarrow a = cx + bx \Rightarrow a = x(c+b)$

$\Rightarrow x = \frac{a}{c+b}$

- $\frac{\sqrt{x}}{a} = \frac{\sqrt{x} - b}{c}$

$\Rightarrow c\sqrt{x} = a(\sqrt{x} - b) \Rightarrow c\sqrt{x} = a\sqrt{x} - ab$

$\Rightarrow c\sqrt{x} - a\sqrt{x} = -ab$

# Make $x$ the subject of ...

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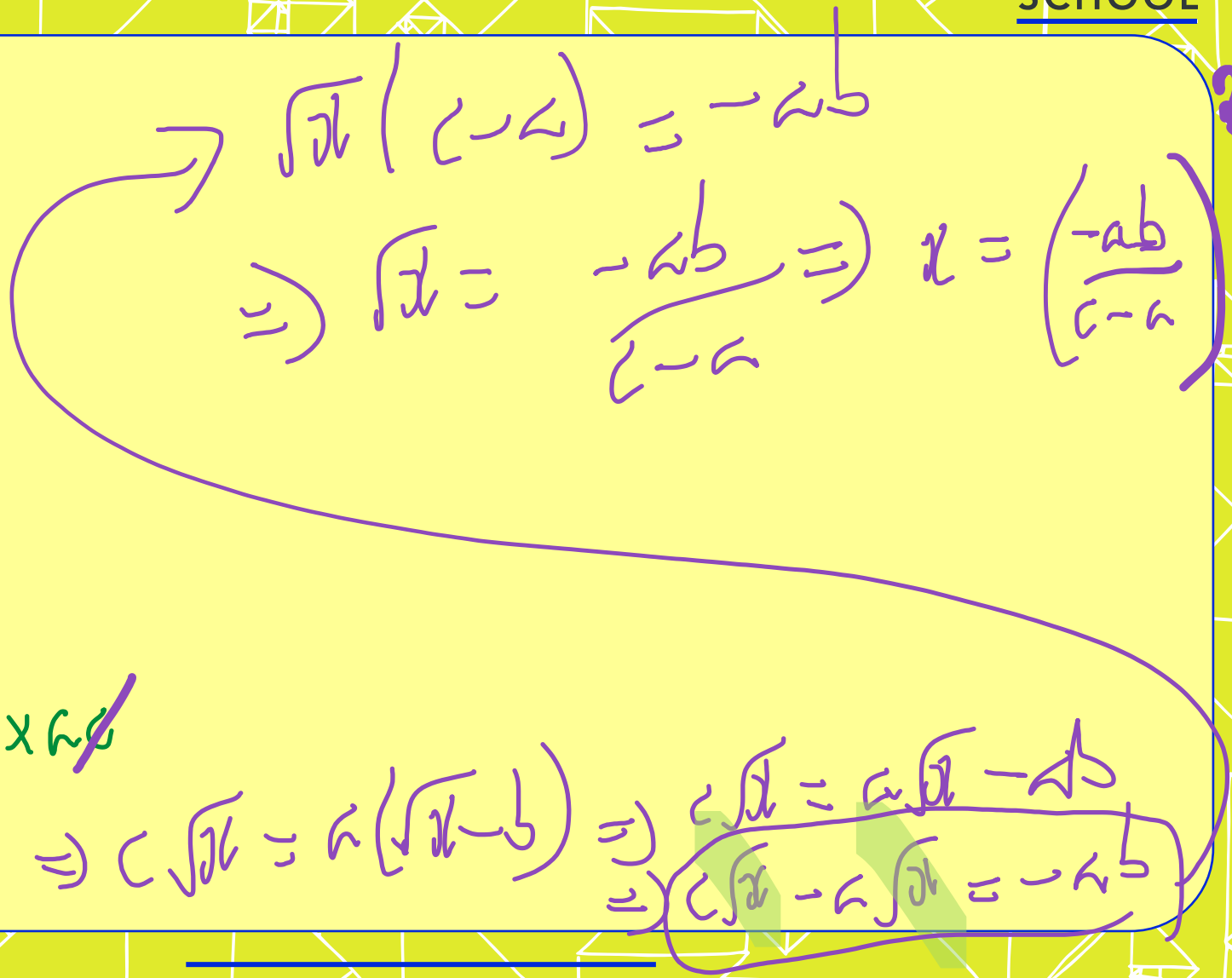
- $\frac{a}{x} + b = c$

- $\frac{a-bx}{x} = c$

- $\frac{\sqrt{x}}{a} = \frac{\sqrt{x}-b}{c}$



# Solving equations with surds

Solve

$\sqrt{2}x + 3y = 1$

$x - \sqrt{2}y = 3\sqrt{2}$

$\times\sqrt{2}$

$\times 3$

$\Rightarrow 2x + 3\sqrt{2}y = \sqrt{2}$

$+ \quad 3x - 3\sqrt{2}y = 6\sqrt{2}$

$5x = 10\sqrt{2}$

$\Rightarrow \boxed{x = 2\sqrt{2}}$

$\sqrt{2}(2\sqrt{2}) + 3y = 1$

$\Rightarrow 4 + 3y = 1$

$\Rightarrow 3y = -3$

$\Rightarrow \boxed{y = -1}$

# Solving equations with surds

Solve

$y = \sqrt{5}x - 8$

$\sqrt{5}y - 2x = \sqrt{5}$