

Simplifying surds

Learning objective

To practise simplifying expressions involving surds

Overview

The matching card exercise contains a mixture of expressions which simplify to one of eight square roots. The exercise can be done individually, in pairs or small groups.

It only goes as far as fractions with a single surd in the denominator.

Context

This exercise can be used at GCSE or A level. It can be used as an introductory exercise using the calculator to do all the simplifying or as a plenary without calculators, using the calculator to check work.

Activity

This activity has 32 cards which have to be matched into sets of four cards.

For example,

$\sqrt{5}$	$\sqrt{\frac{25}{5}}$	$\frac{1}{7}\sqrt{245}$	$\frac{5}{\sqrt{5}}$	$3\sqrt{5} - \sqrt{20}$
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The activity can be made easier by providing learners with the optional learner worksheet containing a list of the square roots. It can be done without this list, and followed by sorting the groups into order of size (as in the answer table in the Solutions section). Learners should be encouraged to think in exact terms rather than decimal values.

Optional learner worksheet – page 2

Cards – page 3

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Aims

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Using the fx-CG50

Dealing with the unexpected

Prompts

Extension questions

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Simplifying surds: Learning resource objective

Be able to simplify surds

Match the cards into eight groups of four cards.

<i>Root</i>	<i>Cards</i>			
$\sqrt{5}$				
$\sqrt{10}$				
$\sqrt{12}$				
$\sqrt{24}$				
$\sqrt{32}$				
$\sqrt{36}$				
$\sqrt{48}$				
$\sqrt{64}$				

Follow-up

Write more expressions for each of the groups – try to think of one that no one else will have!

Cards

$\sqrt{3} + \frac{\sqrt{27}}{3}$	$2\sqrt{6}$	$4\sqrt{2}$	$4\sqrt{3}$
8	$2\sqrt{9}$	$\sqrt{\frac{25}{5}}$	$\frac{1}{7}\sqrt{245}$
$\frac{1}{3}\sqrt{90}$	$\frac{\sqrt{3}}{\sqrt{2}}\sqrt{24}$	$\frac{1}{\sqrt{3}}\sqrt{192}$	$\frac{2\sqrt{5}}{\sqrt{2}}$
$\frac{8}{\sqrt{2}}$	$\frac{6}{\sqrt{3}}$	$\frac{\sqrt{72}}{\sqrt{2}}$	$\frac{\sqrt{1000}}{\sqrt{10}\sqrt{10}}$
$\sqrt{2}\sqrt{5}$	$\frac{1}{2}\sqrt{48}$	$\frac{\sqrt{256}}{2}$	$\frac{24}{\sqrt{24}}$
$\frac{4\sqrt{3}}{\sqrt{2}}$	$\frac{5}{\sqrt{5}}$	$\frac{1}{2}\sqrt{128}$	$\frac{\sqrt{144}}{\sqrt{3}}$
$\frac{1}{5}\sqrt{1200}$	6	$2\sqrt{3}$	$\frac{\sqrt{512}}{2\sqrt{2}}$
$\sqrt{2} + \sqrt{18}$	$2\sqrt{3} + \sqrt{12}$	$3\sqrt{5} - \sqrt{20}$	$\sqrt{216} - \sqrt{96}$

Aims

The exercise encourages learners to consider how to simplify surds and to recognise when expressions are equal. The follow up is open ended which some learners find difficult, but working backwards from the surd develops a deeper understanding of the processes.

This exercise can also be done with a scientific calculator.

Resources

Supporting resources are available in our Resource Centre.

Before the lesson

How-To Video

- Calculation and Reset – Getting Started

Learner support material

- Indices and Surds Confidence Builder

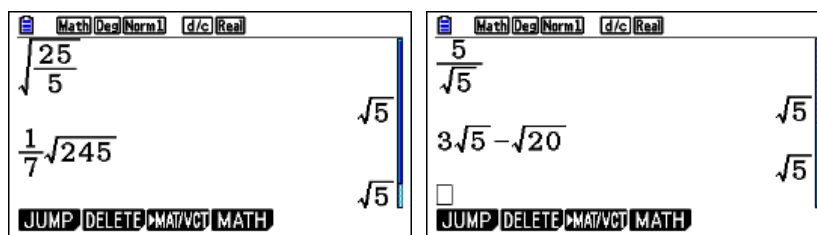
During the lesson

- Cards
- Learner worksheet

Using the fx-CG50

From **MENU**, choose **Run-Matrix**.

Use the fraction template ; and (L-s) for the square root. The order in which you type the fraction and root will affect the expression you type. Take care that the onscreen display is exactly the same as the written expression.



Dealing with the unexpected

Learners may type the expressions inaccurately – be clear about which numbers are under a root sign and which are not.

Prompts

Ask, “How could you do this without a calculator?”

“Can you cancel terms in the numerator with those in the denominator if they are both under the square root sign?”

“Can you cancel a number under the square root sign with a number which is not under the sign?”

Extension questions

Formulate the rules for simplifying surds.

Solutions

Root	Cards			
$\sqrt{5}$	$\sqrt{\frac{25}{5}}$	$\frac{1}{7}\sqrt{245}$	$\frac{5}{\sqrt{5}}$	$3\sqrt{5} - \sqrt{20}$
$\sqrt{10}$	$\frac{1}{3}\sqrt{90}$	$\frac{2\sqrt{5}}{\sqrt{2}}$	$\frac{\sqrt{1000}}{\sqrt{10}\sqrt{10}}$	$\sqrt{2}\sqrt{5}$
$\sqrt{12}$	$\frac{1}{2}\sqrt{48}$	$\frac{6}{\sqrt{3}}$	$2\sqrt{3}$	$\sqrt{3} + \frac{\sqrt{27}}{3}$
$\sqrt{24}$	$2\sqrt{6}$	$\frac{24}{\sqrt{24}}$	$\frac{4\sqrt{3}}{\sqrt{2}}$	$\sqrt{216} - \sqrt{96}$
$\sqrt{32}$	$4\sqrt{2}$	$\frac{8}{\sqrt{2}}$	$\frac{1}{2}\sqrt{128}$	$\sqrt{2} + \sqrt{18}$
$\sqrt{36}$	$2\sqrt{9}$	$\frac{\sqrt{3}}{\sqrt{2}}\sqrt{24}$	$\frac{\sqrt{72}}{\sqrt{2}}$	6
$\sqrt{48}$	$\frac{\sqrt{144}}{\sqrt{3}}$	$4\sqrt{3}$	$2\sqrt{3} + \sqrt{12}$	$\frac{1}{5}\sqrt{1200}$
$\sqrt{64}$	$\frac{\sqrt{512}}{2\sqrt{2}}$	8	$\frac{1}{\sqrt{3}}\sqrt{192}$	$\frac{\sqrt{256}}{2}$