A13 • Simplifying logarithmic expressions

Mathematical goals

To enable learners to:

- develop their understanding of the laws of logarithms;
- practise using the laws of logarithms to simplify numerical expressions involving logarithms;
- apply their knowledge of the laws of logarithms to expressions involving variables.

Starting points

Learners should have some knowledge of the laws of logarithms as applied to numerical expressions.

Materials required

For each learner you will need:

- mini-whiteboard.

For each small group of learners you will need:

- Card set A – *Logarithms* (3 pages);
- Card set B – *Odd one out*.

Time needed

At least 45 minutes.

Suggested approach

Beginning the session

Start with some 'true or false?' questions to reinforce previous work on logarithms.

Possible statements could include:

$\log_2 8 = 4$ $\qquad$ $\log_2 32 = 5$

$\log_{16} 4 = \frac{1}{4}$ $\qquad$ $\log_3 7 + \log_3 5 = \log_3 12$

$\log_2 30 - \log_2 5 = \log_2 6$ $\qquad$ $\log_2 \frac{1}{8} = -3$

$3 \log_7 4 = \log_7 12$ $\qquad$ $\log_5 6 + \log_4 7 = \log_5 42$

Learners could discuss each question in groups of two, three or four and write their agreed answer on a mini-whiteboard which they show on request. Ask them to justify their answers.

Working in groups (1)

Give each small group of learners Card set A – *Logarithms*. These cards are triangles which can be arranged into a hexagon so that the expressions on adjacent sides of the triangles are equal. Ask learners to arrange the cards into a hexagon.

As learners are piecing the hexagon together, jot down on the board any problems or interesting points that come out of their discussions.

If learners find this activity easy, you could replace two or three of the printed triangles with blanks so that learners have to write expressions on them to create matching sides. Alternatively, they could write expressions to match the sides of the hexagon.

For learners who find this activity difficult, you could mark or delete the outer sides of the hexagon and/or the vertices that go into the centre.

Whole group discussion

When learners have finished the activity, discuss the points you have written on the board. Also ask learners to explain why they matched certain sides, focusing particularly on the ones with algebraic expressions.

Reviewing and extending learning

Give learners Card set B – *Odd one out* cut into horizontal strips. You could give the strips out one at a time or all together. Ask learners,

working in pairs, to identify which is the odd one out in each strip. When they have done this, they should write in the blank space as many expressions as they can think of that are equivalent to the odd one out. Discuss some of the possibilities by asking learners to suggest an equivalent expression and then explain why it is equivalent.

Using mini-whiteboards, ask learners to give possible numbers or variables for the blanks in the statements below.

$$\log_{\square} \square = 3$$

$$\log_{\square} \square + \log_{\square} \square = 24$$

$$\square \log_{\square} \square = \log_{\square} \square$$

$$\log_{\square} \square - \log_{\square} \square = 6$$

What learners might do next

Solve equations such as $ab^x = c$ using logarithms.

Further ideas

The hexagonal jigsaws in this session can be adapted for many topics such as brackets, simplifying algebraic expressions, differentiation and integration, negative numbers, and multiplication tables. The software for producing your own hexagonal jigsaws is included on the DVD-ROM/CD in this pack.

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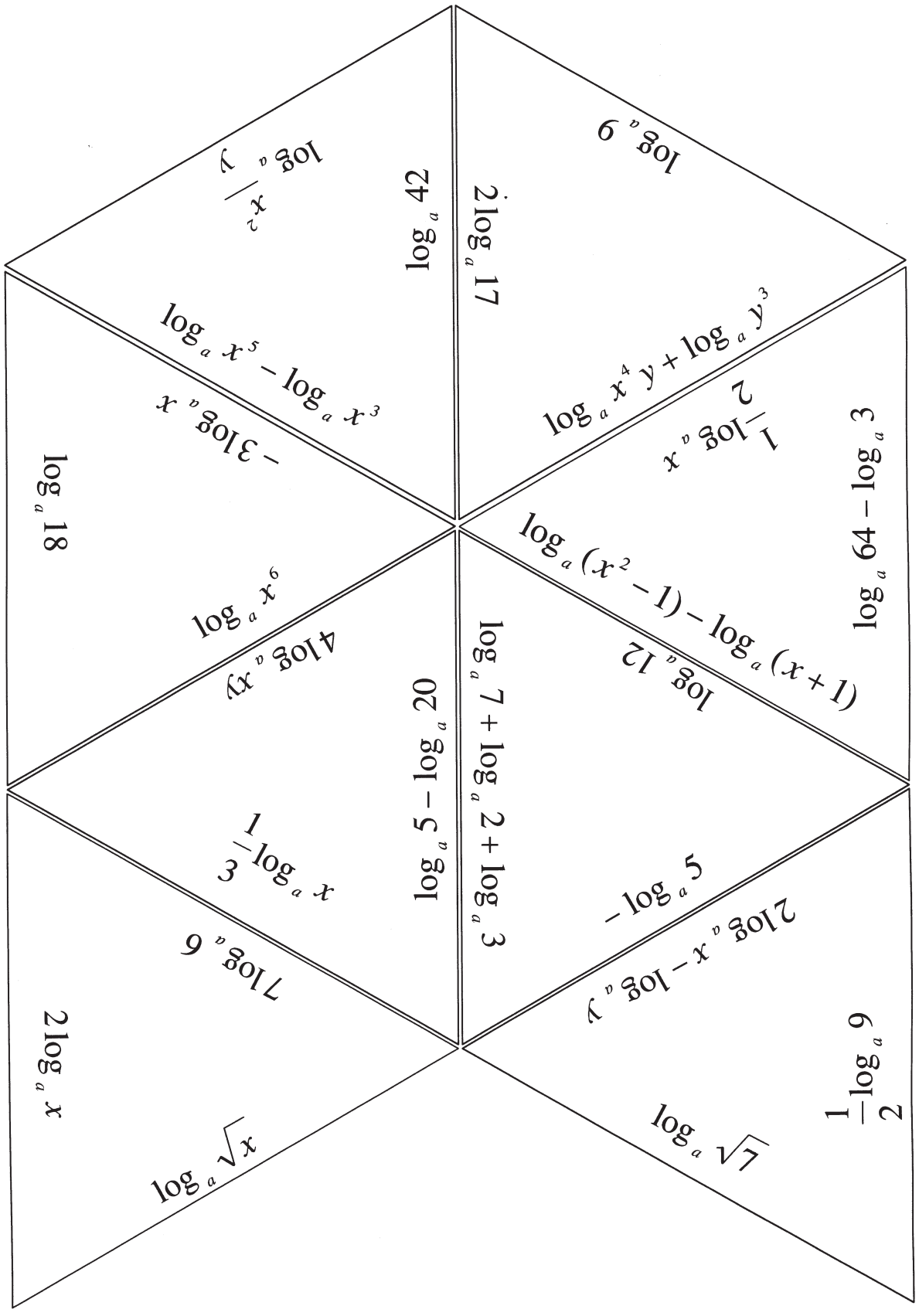
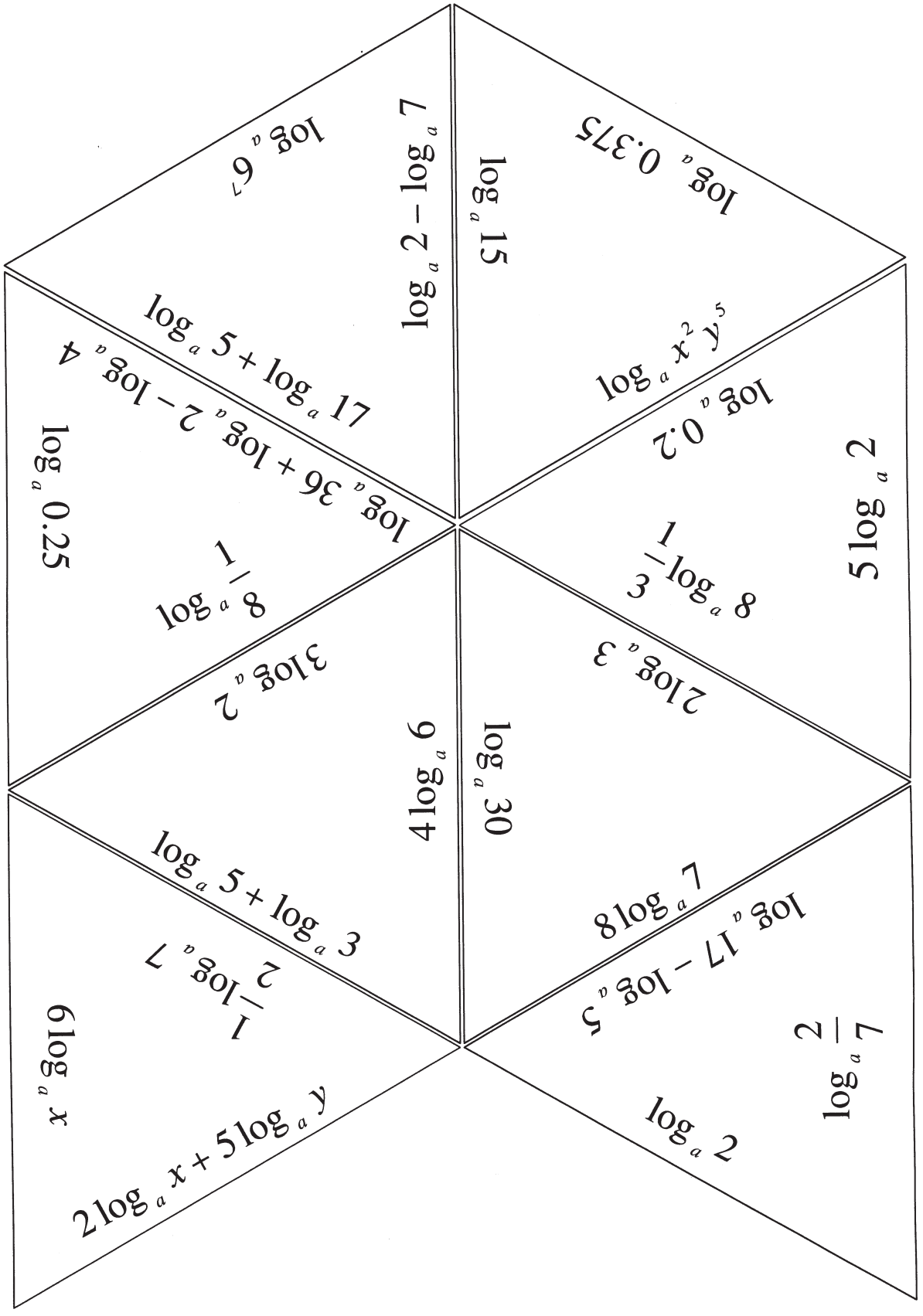
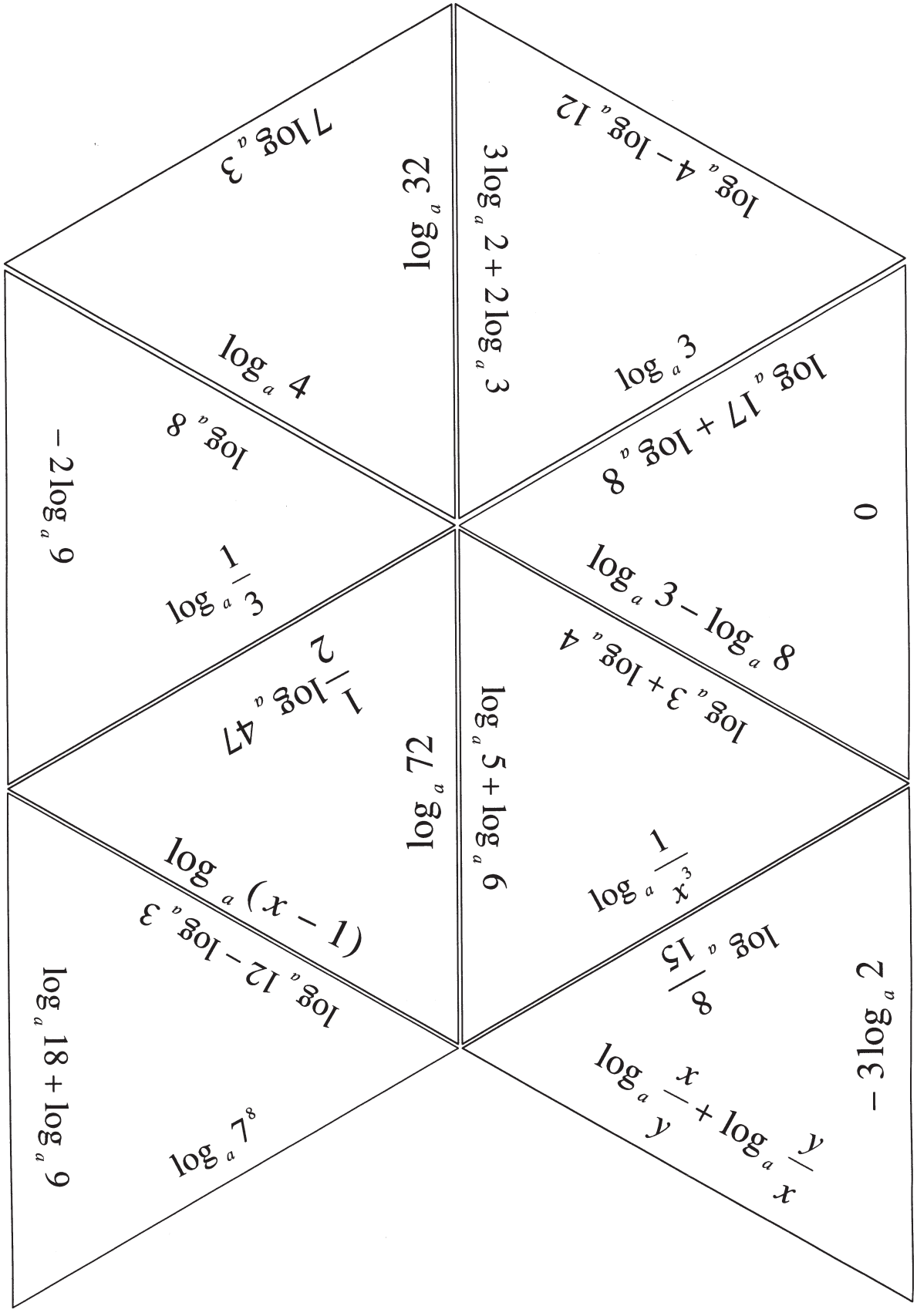
A13 Card set A – *Logarithms* (part 1)



A13 Card set A – *Logarithms* (part 2)



A13 Card set A – *Logarithms* (part 3)



$\log_2 8$	$\log_3 9$	$\log_4 64$	
$\log_2 0.5$	$\log_4 0.25$	$\log_8 0.5$	
$\log_2 8^3$	$\log_2 4^4$	$\log_2 2^9$	
$\log_2 x^6$	$\log_2 x^2 + \log_2 x^3$	$\log_2 x^2 + \log_2 x^4$	
$-2 \log_2 x$	$\log_2 \frac{1}{x^2}$	$\log_2 \sqrt{x}$	