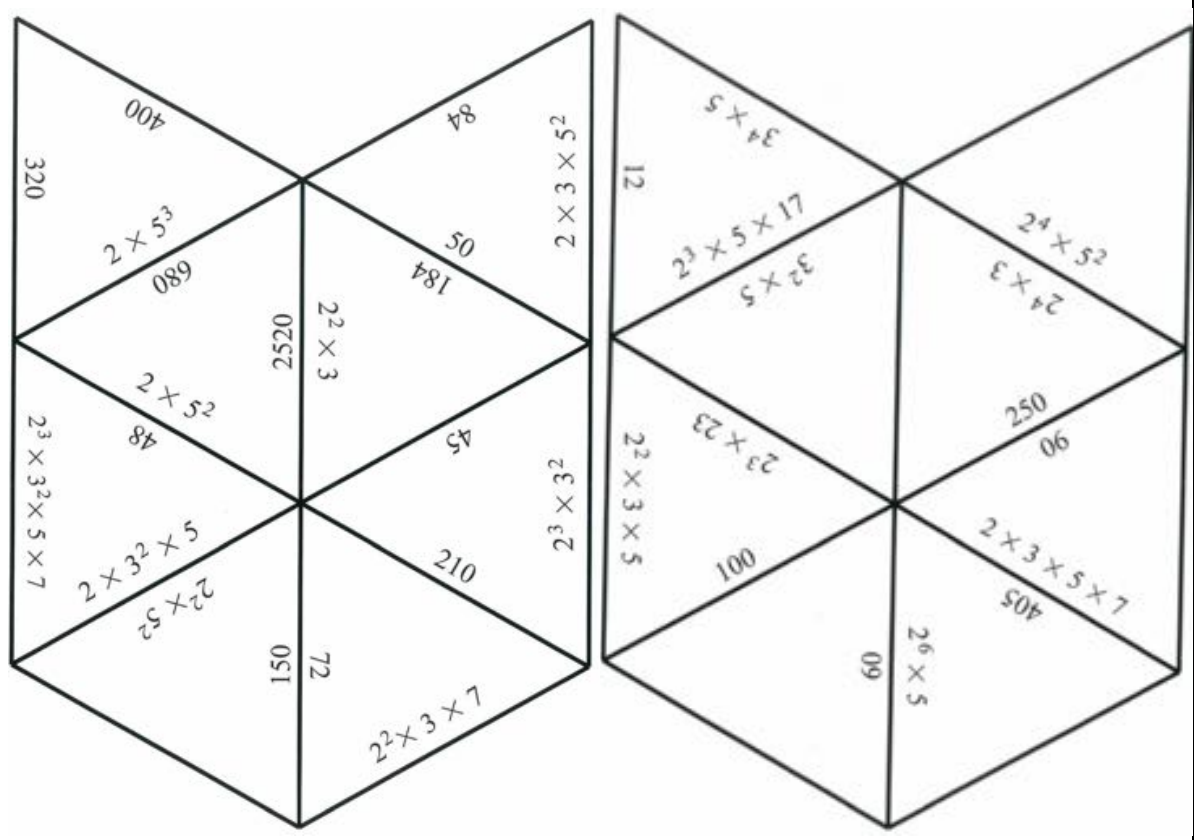
POWER MATCHING

Cut out the 16 small triangles. Arrange the 16 pieces into a larger triangle so that the numbers on matching edges are the same, for example $2^2 \times 3 \times 7 = 84$



HELP

If you are struggling, that's OK. You just need to keep trying.

Read the instructions. Look for the piece that has 84 on an edge and the piece that has $2^2 \times 3 \times 7$ on an edge and put them together.

That's two pieces out of 16, you are on your way.

You are trying to make one big triangle and it won't have any numbers on the outer edge. A good strategy would be to sort out the pieces that have numbers on one edge only, then the pieces with numbers on 2 edges and then the pieces with numbers on 3 edges.

Where do you think the pieces go that only have numbers on one edge? They can only touch one other triangular piece.

What about the pieces with numbers on 2 edges? Where do they go?

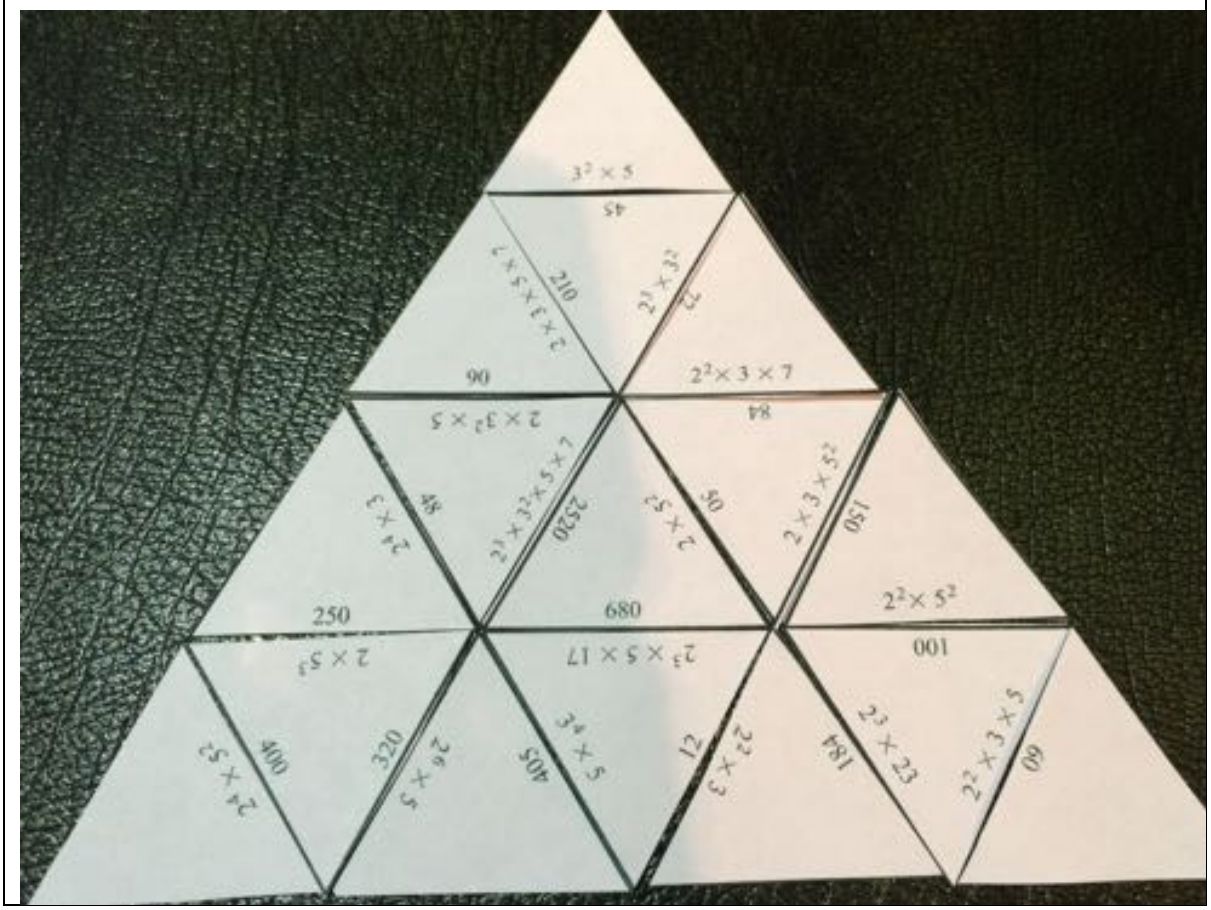
Now look for 2^2 x 3 x 5 and calculate it's value. Find the piece with that number on the edge and put the matching edges together. Then work out 2^3 x 23 and look for the next piece.

NEXT

If you have finished this puzzle then make up your own similar puzzle, perhaps with 4 triangles or 9 triangles. You could then exchange your puzzle with another learner so you both solve each other's puzzles.

NOTES FOR TEACHERS

SOLUTION



Why do this activity?

Learners will enjoy solving this puzzle and at the same time they will get practice in working with exponents and in mental arithmetic. The activity is good for learners of all attainment levels if you give them sufficient time to finish the puzzle.

Learning objectives

In doing this activity students will have an opportunity to revise the notation for powers (exponents) and the methods of working out expressions involving powers.

Generic competences

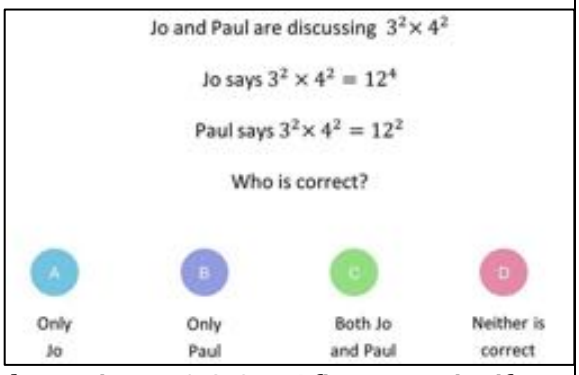
We need to prepare children for a job market where existing knowledge and skills have limited value unless they can be applied in novel ways to produce new knowledge that solves today's complex problems to improve the quality of life for all.

In doing this activity students will have an opportunity to:

- **think flexibly** and apply knowledge and skills;
- **solve problems** – to interpret and solve problems in a variety of situations;
- **work and learn independently** and prepare for lifelong learning.

Diagnostic Assessment This should take about 5–10 minutes.

1. Write the question on the board, say to the class:
   "Put up 1 finger if you think the answer is A, 2 fingers for B, 3 fingers for C and 4 fingers for D".
2. Notice how the learners responded. Ask a learner who gave answer A to explain why he or she gave that answer and DO NOT say whether it is right or wrong but simply thank the learner for giving the answer.
3. It is important for learners to explain the reason for their answer to develop the skills of communication and mathematical thinking.
4. Then do the same for answers B, C and D. Try to make sure that learners listen to these reasons and try to decide if their own answer was right or wrong.



5. **Ask the class again to vote for the right answer by putting up 1, 2, 3 or 4 fingers. Notice if there is a change and who gave right and wrong answers.**
6. If the concept is needed for the lesson to follow, explain the right answer or give a remedial task.

The correct answer is B.
Possible misconceptions:

A. Jo's answer is wrong. The value is 144 and $12^4 = 144^2 = 20736$

D. Paul's answer is correct: $(3^2 \times 4^2) = (3 \times 4)^2 = 12^2$

https://diagnosticquestions.com

Suggestions for teaching

Cut out 16 very large triangles for demonstration purposes and to finish the lesson. Write the numbers on the edges exactly like the small version and, if possible, make the writing large enough for learners to read from the back of the classroom. You will need some putty-like adhesive, for example Prestik, to stick the large triangles up on the board.

You may ask learners to work in pairs or in groups of 3 or 4. It is worth preserving the pieces so that the learners can do this puzzle several times as they will get quicker and get more number work practice each time. Give out the worksheet with a small envelope or small bag so that the learners can cut out the pieces and at the end of the lesson put them in the envelope so you can collect them to use another time. Ultimately you may want the learners to stick the pieces into their workbooks to record the solution.

You could help the learners to get started by telling them that the final shape is a big triangle. Tell them that they must work out the expressions involving exponents, find the matching numbers and place them edge to edge.

It is important to give the slower learners time to finish this activity so you may like to give the learners who finish early the challenge of creating their own similar puzzles. (See possible extension)

To finish the lesson, spread the big demonstration triangles on a table at the front or stick them up on one side of the board in a random order. Then invite learners to come up to the front and each learner to stick one piece in the right place on the board to solve the puzzle. You could start by sticking one of the vertex pieces, for example $3^2 \times 5$, on the board at the top in a suitable position so that there will be enough space for the rest of the pieces.

Key questions

- What does 2 to the power 3 mean?
- What does 3 to the power 3 mean?
- What do you notice about the pieces that only have numbers on one edge? Where do you think they go?
- What about the pieces with numbers on 2 edges? Where do they go?
- Have you checked your pieces are correctly matched? (If you spot a mistake)

Follow-up ideas

Water lilies https://aiminghigh.aimssec.ac.za/water-lilies/
Exponents https://aiminghigh.aimssec.ac.za/exponents/
Powerful Thinking 1
https://aiminghigh.aimssec.ac.za/years-7-10-powerful-thinking-1/
Powerful Thinking 2
https://aiminghigh.aimssec.ac.za/powerful-thinking-2/
Powerful Thinking
https://aiminghigh.aimssec.ac.za/powerful-thinking-3/
Powerful Thinking 4
https://aiminghigh.aimssec.ac.za/years-10-12-powerful-thinking-4/

Go to the **AIMSSEC AIMING HIGH** website for lesson ideas, solutions and curriculum links: http://aiminghigh.aimssec.ac.za
Subscribe to the **MATHS TOYS YouTube Channel**
https://www.youtube.com/c/MathsToys/videos
Download the whole AIMSSEC collection of resources to use offline with the **AIMSSEC App** see https://aimssec.app or find it on Google Play.

Note: The Grades or School Years specified on the AIMING HIGH Website correspond to Grades 4 to 12 in South Africa and the USA, to Years 4 to 12 in the UK and school years up to Secondary 5 in East Africa.
New material will be added for Secondary 6.
For resources for teaching A level mathematics (Years 12 and 13) see https://nrich.maths.org/12339
Mathematics taught in Year 13 (UK) & Secondary 6 (East Africa) is beyond the SA CAPS curriculum for Grade 12

	Lower Primary Approx. Age 5 to 8	Upper Primary Age 8 to 11	Lower Secondary Age 11 to 15	Upper Secondary Age 15+
South Africa	Grades R and 1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
East Africa	Nursery and Primary 1 to 3	Primary 4 to 6	Secondary 1 to 3	Secondary 4 to 6
USA	Kindergarten and G1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
UK	Reception and Years 1 to 3	Years 4 to 6	Years 7 to 9	Years 10 to 13