Brombacher & Associates

NumberSense Companion Workbook Grade 5

Sample Pages (ENGLISH)

Working in the NumberSense Companion Workbook

The NumberSense Companion Workbooks address measurement, spatial reasoning (geometry) and data handling.There are 4 NumberSense Companion Workbooks. With the publication of the NumberSense Companion Workbooks we complete the mathematics curriculum coverage for Grades 4 to 7 (one Companion Workbook per grade). It is our hope that the NumberSense Companion Workbooks will provide children with the same challenges and enjoyment that they get from the NumberSense Workbooks helping them to experience mathematics as a meaningful, sense-making, problem solving activity.

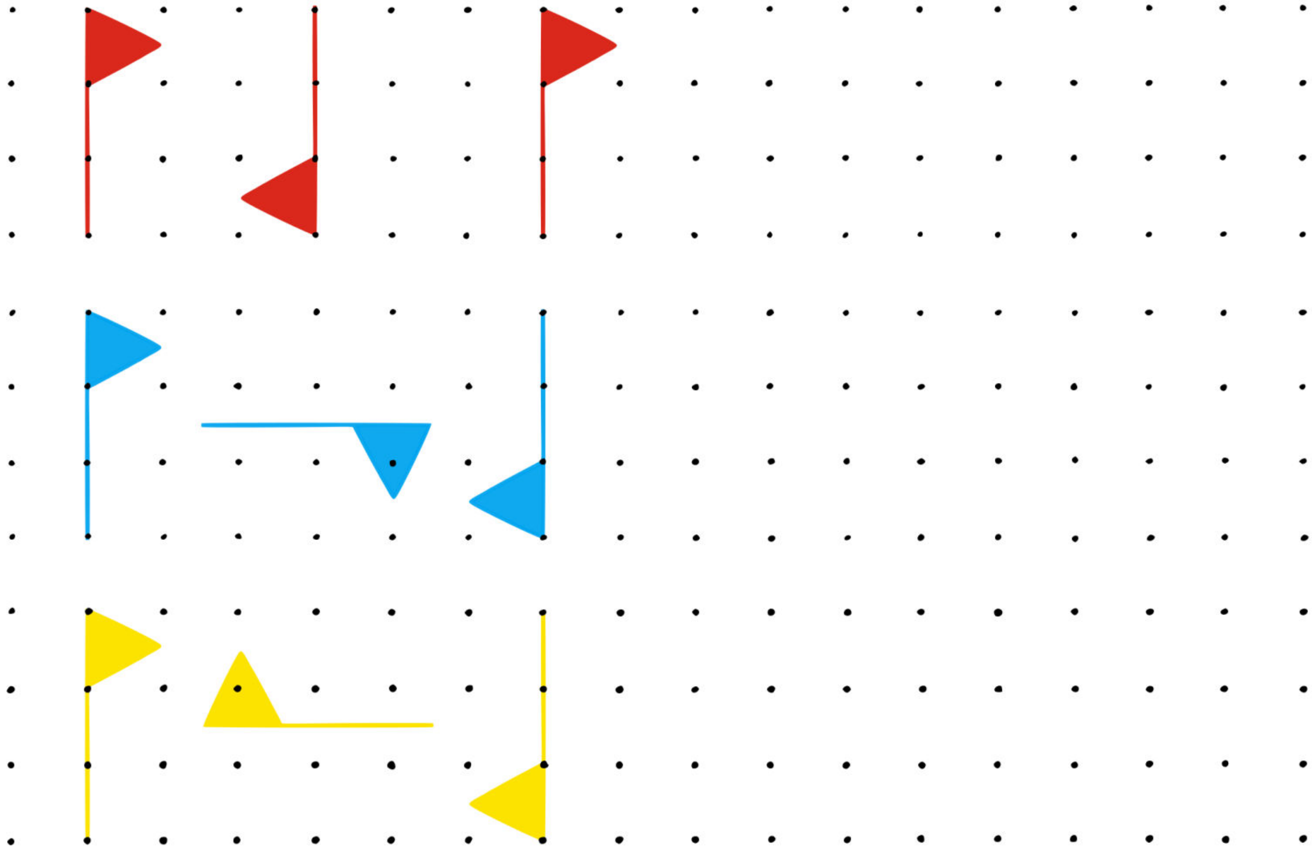
Please note that these sample pages include references from the Companion Workbook Teacher Guide – the actual workbook will not include the Teacher Guide pages. Teachers will be able to download the Teacher Guides, at no charge, from the NumberSense website. You will, however, need to register on the website to access these resources.

To gain optimal benefit from the workbook series it is critical that children are encouraged to reflect on the tasks that they complete. Teachers (and parents) should ask questions such as:

- Did you notice anything as you completed those activities?
- What helped you to answer the question?
- How is this activity similar to or different from activities that you have already completed?

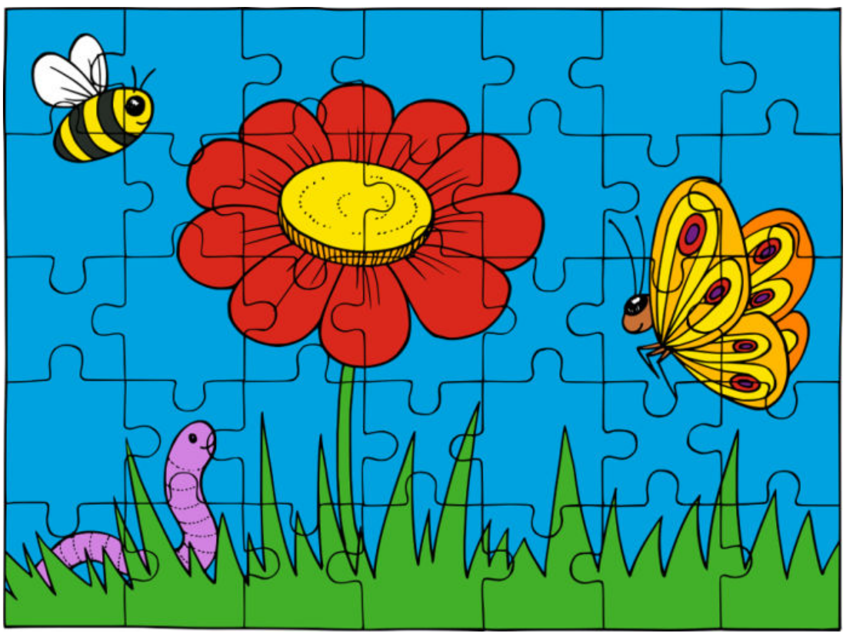
Please mail info@numbersense.co.za for further assistance or information.

1. Extend each pattern. Explain what you do each time.

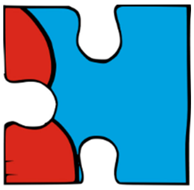


2. What is the same in each of the patterns in question 1 and what is different in each of the patterns in question 1?

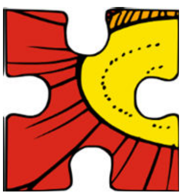
3. Where do the puzzle pieces fit this picture? Write the name of each puzzle piece in the space where it belongs. Explain how the piece must be rearranged to fit into the space.



A

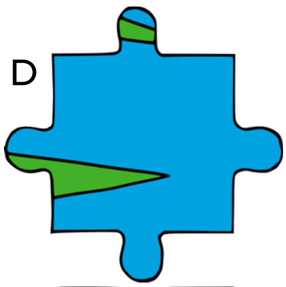


B



C

D



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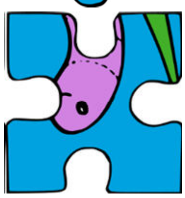


F

On this page, children recognise and describe rotations using geometric figures and puzzle pieces.

Suggested lesson activities

Teachers should observe how children complete the patterns and encourage discussion on how they do it. Children may not be ready to visualise a rotation. Teachers can assist by asking them to trace the first figure in the pattern and then ask them what they need to do so that the tracing fits over the second figure. When children are ready to describe a rotation, ask them by how much they are rotating the figure. At this stage, children could talk about quarter or half rotations. They may be able to describe the direction in terms of forwards or backwards. Children can now be introduced to the terminology clockwise and anti-clockwise. Children should not be expected to explain what they are rotating the figure around (the centre of rotation).

These patterns are made by a combination of a rotation (about a point) and a translation. We want the children's discussion to focus more on the rotation aspect and less on the translation – along the lines of: each element in the pattern is created by rotating (turning) the previous element one quarter of a turn.

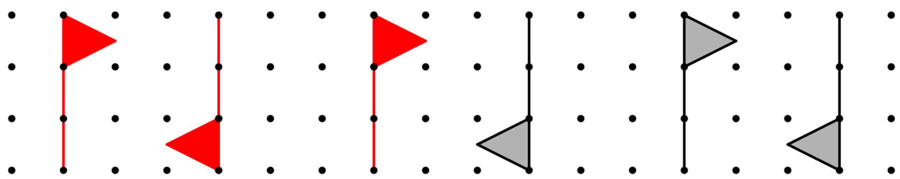
In the second question, children are required to mentally manipulate the pieces of the puzzle. Some children may have to trace the pieces and cut them out, but they have been deliberately drawn larger than the pieces in the puzzle to encourage children to start thinking mentally about what they are doing.

Resources required:

Tracing paper and scissors.

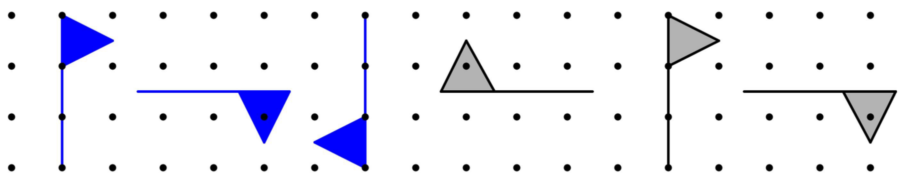
Answers and discussion

1. a.



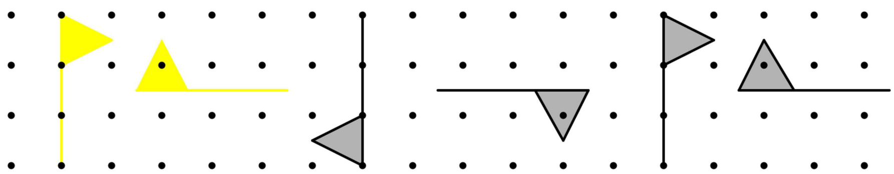
The shape is rotated by a half-turn

b.



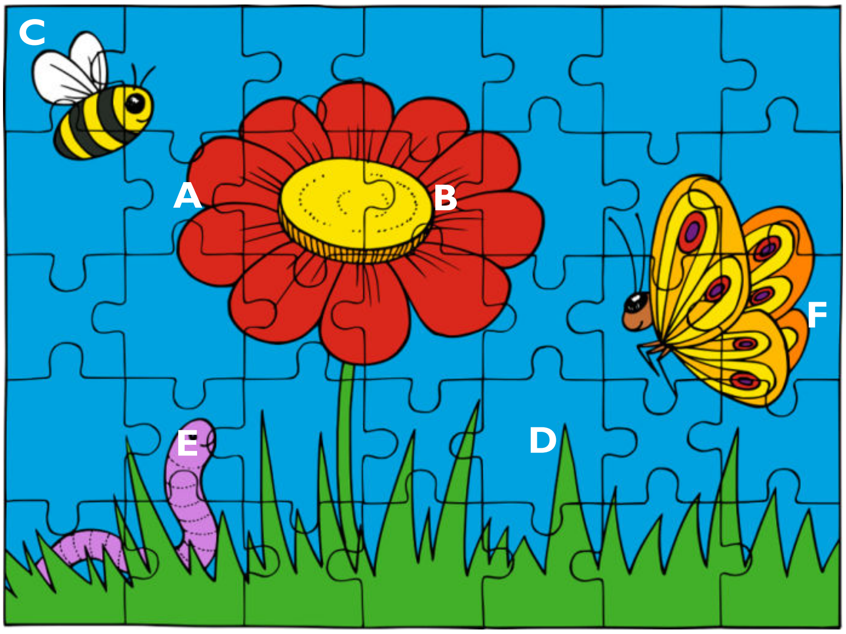
The shape is rotated by a quarter turn in a clockwise direction

c.



The shape is rotated a quarter turn in an anti-clockwise direction.

2. The size and the shape of the figure does not change, it is always a line with a triangle on one end. The orientation of the figure does change. Sometimes the triangle is right of the line, sometimes left of the line, sometimes above the line and sometimes below the line.

3. 

A - The puzzle piece is rotated by a quarter turn in an anti-clockwise direction.

B - The puzzle piece is rotated by a half-turn.

C - The puzzle piece is rotated by a quarter turn in a clockwise direction.

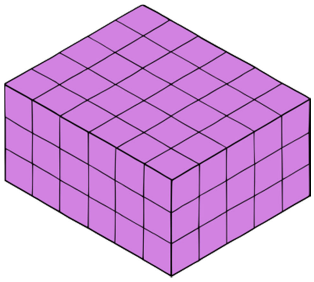
D - The puzzle piece is rotated by a quarter turn in an anti-clockwise direction.

E - The puzzle piece is rotated by a half-turn.

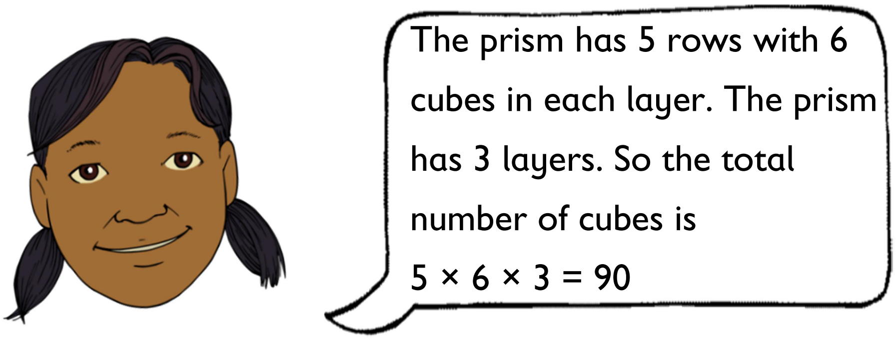
F - The puzzle piece is rotated by a quarter turn in a clockwise direction.

The volume of an object refers to the number of cubic units of a certain size that are needed to fill the interior of the object.

1. Determine the volume of the prism.



2.

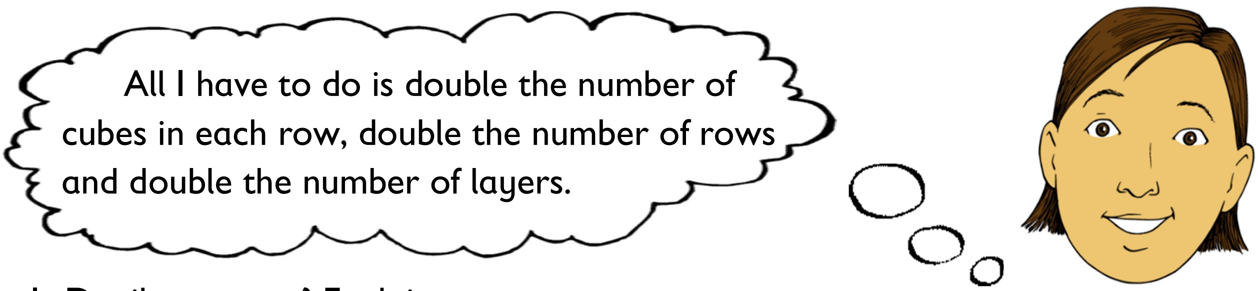


a. Did you get the same number of cubes as Kaye did?

b. A prism has 2 layers of cubes. Each layer has 3 rows with 10 cubes in each row. Determine the volume of the prism.

3. Which prism is larger: a 3 × 3 × 5 prism or a 2 × 3 × 7 prism? Explain.

4. Danika built a 4 × 4 × 4 prism of small cubes. Now she wants to build a prism with double the number of small cubes.



Is Danika correct? Explain.

5. Asavela wants to build a prism with 80 cubes. He packs out 5 rows with 4 cubes in each row for the first layer. How many layers must he make altogether?

6. How many cubes are there altogether in a 50 × 50 × 50 prism of cubes?

On these pages, children investigate volume by packing in order to get an understanding of cubic units.

Suggested lesson activities

At this stage children should understand the question, "Determine the volume" to mean the same as "Determine the number of cubes".

To answer question 4, children may need to build a $4 \times 4 \times 4$ prism and determine the number of small cubes used. Then build an $8 \times 8 \times 8$ stack and determine the number of small cubes used. They may also be able to explain by reasoning.

Although the activity is leaning strongly towards the development of the formula used to calculate the volume of a rectangular prism at no stage do we refer to length $\times$ breadth $\times$ height. Children should think of the formula in terms of packing layers.

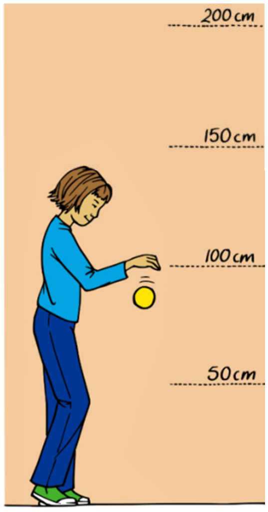
Resources required:

Wooden or foam cubes

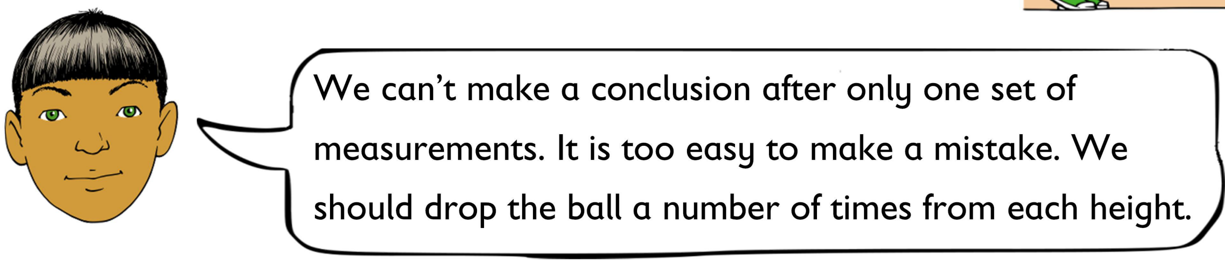
Answers and discussion

1. 90 cubes
2. b. 60 cubes
3. The $3 \times 3 \times 5$ prism is larger because it has 45 cubes whereas the other prism has 42 cubes.
4. No. A $4 \times 4 \times 4$ prism will have 64 cubes. If she wants to double the number of cubes, she is wanting to build a prism with 128 cubes (double 64). But if she doubles the number of cubes in each row and the number of rows and the number of layers she will be building a $8 \times 8 \times 8$ prism which will be 512 cubes.
5. 4 layers
6. $125\ 000$ cubes

1. Sinead dropped a tennis ball from different heights and counted the number of times that it bounced each time. She recorded her results and concluded that the greater the height from which the ball is dropped the larger the number of times it will bounce.



50 cm	8 bounces
100 cm	10 bounces
150cm	10 bounces
200 cm	11 bounces



Do you agree with Shemy? Discuss.

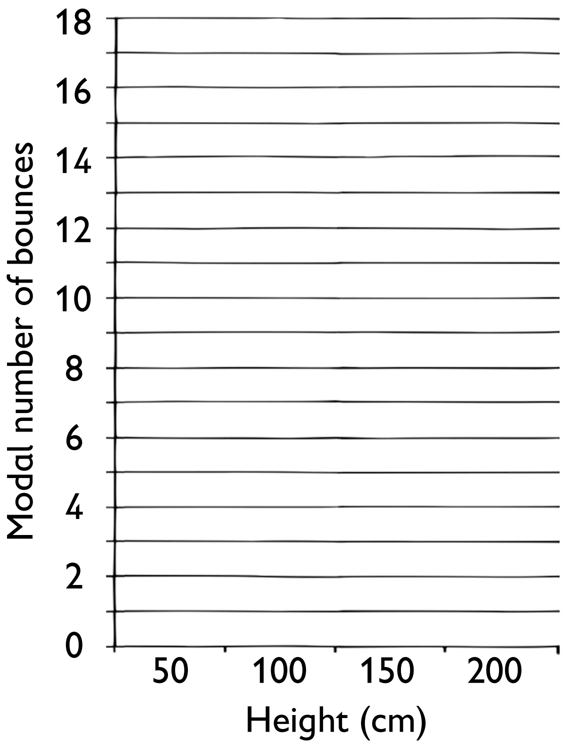
2. Work in groups. Drop a tennis ball ten times from each height and count the number of times that it bounces each time.

Height	Number of bounces for each experiment									
50 cm										
100 cm										
150 cm										
200 cm										

3. Determine the modal number of bounces when the ball is dropped from each height.

4. Graph your results.

5. Do your results agree with Sinead's results? Can you conclude that the greater the height from which the ball is dropped the larger the number of times that it will bounce? Discuss.



On this page, children examine ungrouped numerical data to determine the most frequently occurring score (mode) of the data set in order to describe central tendencies.

Suggested lesson activities

Most typically when we collect data we think about surveys and opinion polls, but data handling also extends to scientific experiments and understanding physical phenomenon. Our intuition tells us that the higher a ball is before it is dropped, the more speed it will pick up as it is falling. A ball hitting the ground with greater speed should bounce higher than a ball striking the ground with less speed; therefore, a ball dropped from a greater height will bounce higher than a ball dropped from a lesser height. When a ball is bouncing high into the air, it will continue to bounce for some time. By contrast, a low-bouncing ball will quickly run out of room between the height of each bounce and the ground, and, as such, will soon stop bouncing altogether. Therefore, it only makes sense that a ball will bounce more often when it is released from a greater height. But to prove our conjecture about the physics behind bouncing balls, we cannot rely on our intuition. We need to use a well-designed experiment to investigate the relationship between the height of a falling ball's release point and how many times the ball bounces before coming to rest.

A well designed experiment should include more than one measurement. Measurements are prone to errors especially where other variables could be introduced. This experiment relies on counting the number of times a tennis ball bounces. This is difficult especially when the bounces are very close to the floor. Also, it is difficult to control whether children have provided an extra downward thrust when dropping the ball.

For this experiment mark 50 cm, 100 cm, 150 cm and 200 cm on a wall. Children should work in pairs. One child holds the ball at a particular height and the other counts and records the number of bounces. Children may have to stand on their chair to drop a ball from 2 metres (200 cm).

Allow children to discuss their results to question 2 before they answer question 3. It is unlikely that they will have the same number of drops every time the ball is bounced from a particular height. This reinforces the idea of the possibility of error in the measurement. Note that it is not a bad thing for error to occur. What is important is that because we know that error does occur in measurement we repeat an experiment many times.

Now that there are many numbers for each height, ask the children to suggest a way that they can best represent the group of numbers. In this case children can used the mode. Of course the median and mean are also possible ways of representing this group of data but because we expect the numbers to be very similar or mostly the same, the mode is an efficient value to use to represent the data.

Now that children have repeated the experiment many times they are in a better position to draw conclusions. They could conclude that the higher the point from which a ball is dropped the more times it will bounce UP TO 200 cm (or 2 m). They cannot conclude that the number of bounces will increase indefinitely as the point from which the ball drops increases.

Resources required:

Measuring tape, tennis ball