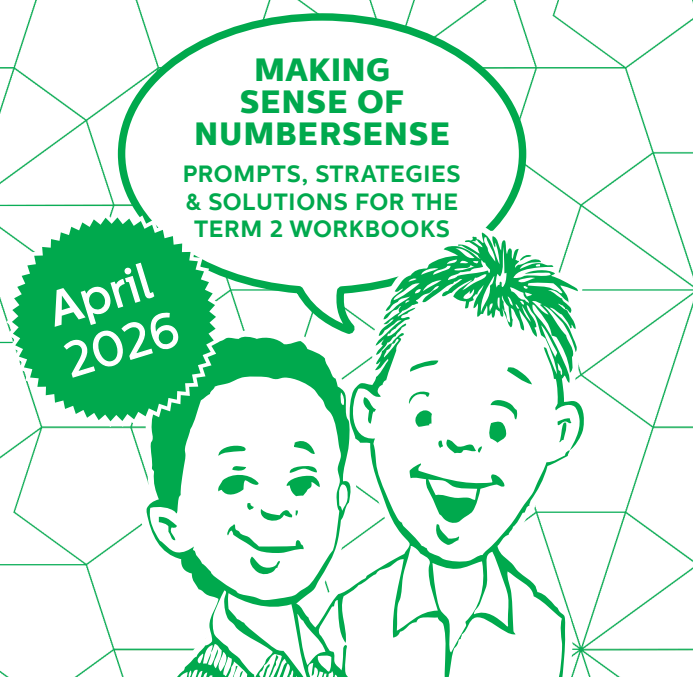
# 18 NumberSense

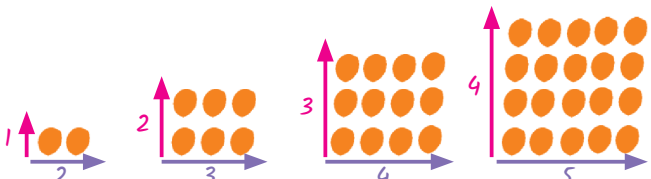
## PROMPTS, STRATEGIES & SOLUTIONS

English

Teacher's Guide



1. Piet makes pictures with dots like this. The first 4 pictures make a pattern.




Picture 1 Picture 2 Picture 3 Picture 4 Picture 5 Picture 6

a. Draw the fifth and sixth pictures in the pattern.

b. Complete the table.

| Picture number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 10 | 12 |
|---|---|---|---|---|---|---|---|---|---|
| Number of dots | 2 | 6 | 12 | 20 | 30 | 42 | 56 | 110 | 156 |

+ 3 + 2

+ 4 + 6 + 8 + 10 + 12 + 14 + 16 + 18 + 20 + 22 + 24

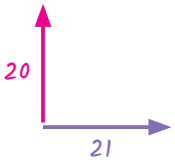
c.

*I get the number of dots for picture 1 like this: 1 × 2 = 2*
*I get the number of dots for picture 2 like this: 2 × 3 = 6.*

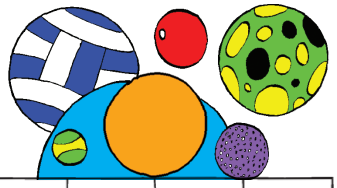
How would Dan write down the number of dots for picture 3? *3 x 4 = 12*

d. Use Dan's method or another method to calculate the number of dots for picture 20.

*Did anyone do it differently to Dan's way? Explain.*




*20 x 21 = 20 x 20 + 20 x 1*
*= 400 + 20*
*= 420*



2. One ball costs R24. Complete the table.

| Number of balls | 1 | 2 | 4 | 8 | 16 | 32 | 64 | 128 | 256 |
|---|---|---|---|---|---|---|---|---|---|
| Cost (R) | 24 | 48 | | | | | | | |

a. What is the cost of 32 balls?

b. What is the cost of 33 balls?

c. What is the cost of 130 balls?

d. How much is 24 × 64?

e. How much is 24 × 63?

f. How much is 24 × 257?

# Things to think about

Activity 1:

This pattern is different to what the children have encountered up to now. This pattern does not have a constant difference and is classified as non-linear (the children do not need to know the name).

Children in Grade 5 can access this type of pattern if it is presented in context. The questions posed to them allow them to make sense of the situation. Exposing children to a variety of complex patterns enriches their mathematical experience and strengthens their problem solving and reasoning skills.

Teachers should:

- encourage different interpretations and strategies when reflecting on this question
- help children make connections between the picture pattern, the table, Dan's explanation and the rule that is emerging.

? How did you draw Picture 5 and 6?

? What will Picture 10 look like?

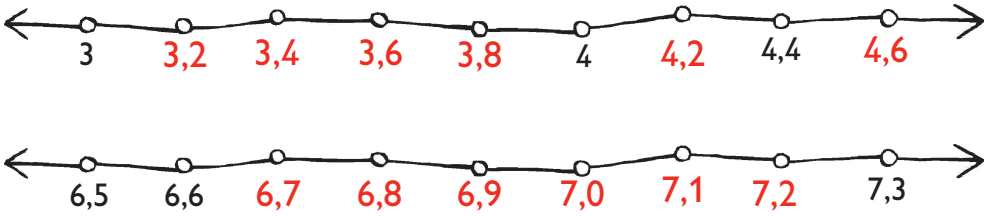
? How did you complete the table?

? How would Dan calculate the number of dots for Picture 15?

1. Complete.

1,7 +0,1 → 1,8 +0,1 → 1,9 +0,1 → 2,0 +0,1 → 2,1 – 0,2 → 1,9 +0,3 → 2,2 +0,1 → 2,3 +0,2 → 2,4 +0,1 → 2,6 +0,4 → 3,0 +0,5 → 3,5 +1,0 → 4,5 +0,5 → 5,0 – 0,1 → 4,9 +1,1 → 6,0 +0,5 → 6,5 –0,6 → 5,9 –0,1 → 5,8 +0,3 → 6,0 +1,5 → 7,5 +0,4 → 7,1 – 0,4 → 6 – 1,1

2. Complete.



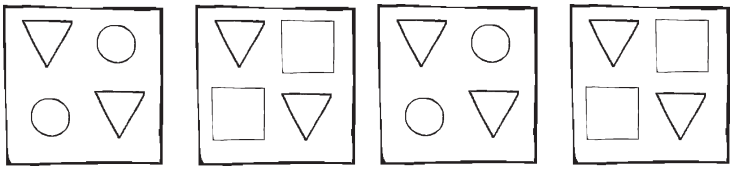

3. Complete. *Explain your thinking.*

a. 16,8 + 0,2 = 7,0
b. 16,8 + 1,2 = 18 (+1, +1)
c. 16,8 + 3,2 = 20 (+2, +2)
d. 16,3 + 0,7 = 17
e. 16,3 + 1,7 = 18 (+1, +1)
f. 16,8 – 0,9 = 15,9
g. 16,8 + 0,3 = 17,1

*How are these the same? How are they different?*

h. 13,1 + 2,9 = 16
i. 13,1 – 3 = 10,1
j. 12,5 – 1,5 = 11
k. 10,2 + 0,8 = 11
l. 10,2 + 1,8 = 8,4
m. 10,2 – 1,2 = 9
n. 9,8 – 1,8 = 8

4. Extend and colour the pattern.



# Things to think about

Activity 4:

The expectation is that the children recognise:

- the core unit that is repeated and,
- that colour plays a significant role in the nature of the pattern.

Which part of the pattern is the repeating unit/part/section?

The piece that repeats is a "square with a small upside-down triangle in the top left corner and a small upside down triangle in the bottom right corner".

Which part of the pattern changes? How does it change?

The circles in the top right corner and bottom left corner alternate with the squares.

Do you think colour is important when repeating this pattern? Explain how you used colours to extend your pattern.

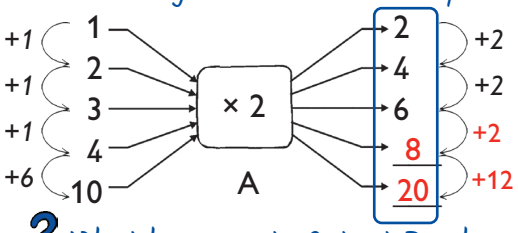
Compare your pattern with your friends. What is the same and what is different about your patterns?

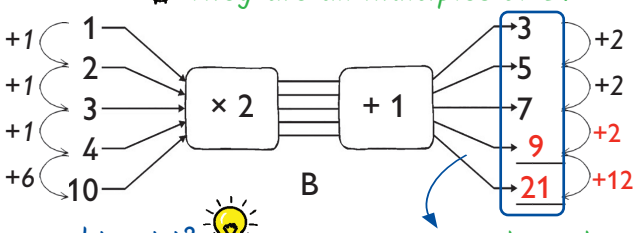
1. a. Complete the following flow diagrams.

For each of the flow diagrams, determine the difference between the consecutive input numbers and output numbers. Write the differences next to the flow diagrams as shown in the first one.

What do you notice about Output A values?

They are all multiples of 2.




What happens to Output B values if you subtract 1?

You get output values that are the same as Output A.

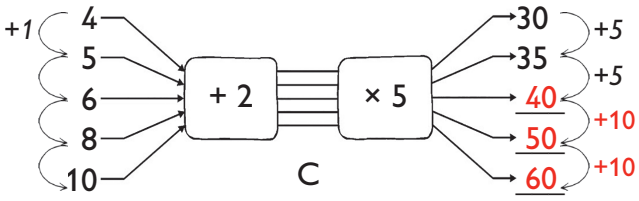
b. Complete the table for flow diagrams A and B.

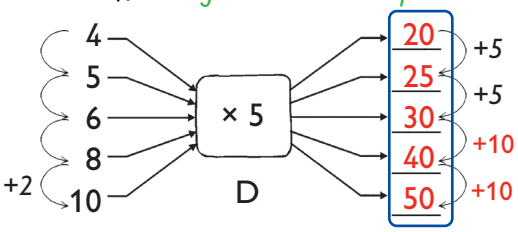
| Input | 1 | 2 | 3 | 4 | 10 | 11 | 12 | 15 | 20 |
|---|---|---|---|---|---|---|---|---|---|
| Output A | 2 | 4 | 6 | 8 | 20 | 22 | 24 | 30 | 40 |
| Output B | 3 | 5 | 7 | 9 | 21 | 23 | 25 | 31 | 41 |

c. Complete.

What do you notice?

They are all multiples of 5.




d. Complete the table for flow diagrams C and D.

| Input | 4 | 5 | 6 | 8 | 10 | 11 | 12 | 15 | 20 |
|---|---|---|---|---|---|---|---|---|---|
| Output C | 30 | 35 | | | | | | | |
| Output D | | | | | | | | | |

How do you know that this is x3?

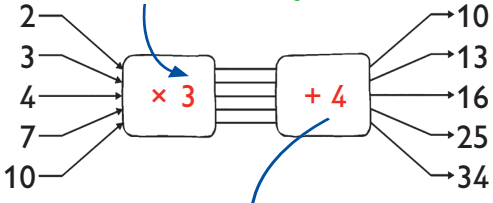
Because the pattern in the table increases by 3 each time.

2. Complete the flow diagram for the table.

| Input | 2 | 3 | 4 | 7 | 10 |
|---|---|---|---|---|---|
| Output | 10 | 13 | 16 | 25 | 34 |

+3 +3

+3 +3 +9 +9




3 groups of 3

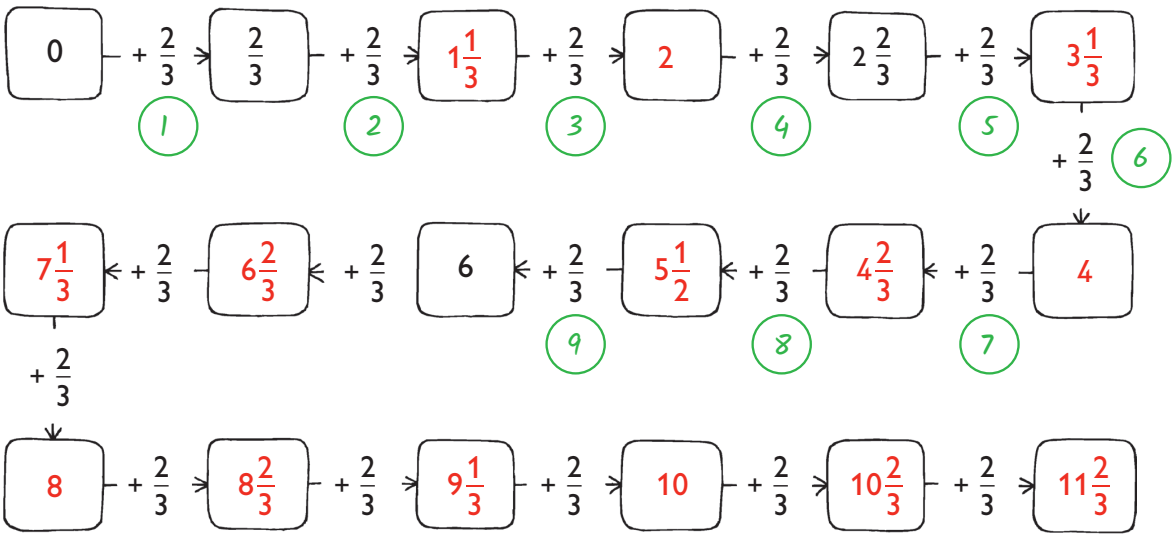
Why do we add 4? Explain.

*What we want children to notice:*

- *That the number pattern represented in the table can be used to determine the rule of the pattern, which can be represented as a flow diagram.*
- *That the flow diagrams with one multiplication operation creates outputs that are multiples of the multiplier.*

? *Do you notice any patterns when counting in 2-thirds? Describe the pattern.*

1. Complete.




? *Explain how you calculated these.*

2. a. How many two-thirds are there in 6? 9

b. How many thirds are there in 6? 18

c. What is $9 \times \frac{2}{3}$ ? 6

*I used the number chain.*

*If there are 9 '$\frac{2}{3}$'s in 6, then to work out how many 1-thirds are in 6 we can just double.*

3. a. A car travels at a constant speed of 80 km per hour. Complete the table.

| Time (hours) | $\frac{1}{4}$ | $\frac{1}{2}$ | $\frac{3}{4}$ | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|
| Distance travelled (km) | | | | | 160 | | | | |

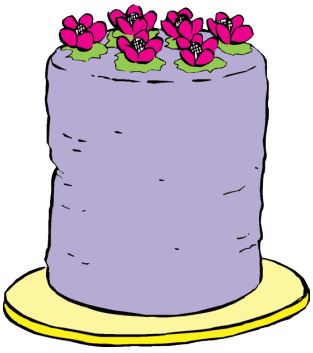
b. Now complete the table for a car that travels at 120 km per hour.

| Time (hours) | $\frac{1}{4}$ | $\frac{1}{2}$ | $\frac{3}{4}$ | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|
| Distance travelled (km) | | | | | 240 | | | | |

4. Mrs Manga uses $\frac{2}{3}$ of a cup of nuts to bake 1 cake.

a. How many cups of nuts did she use if she made 20 cakes?

b. How many cakes can she bake if she has 10 cups of nuts?



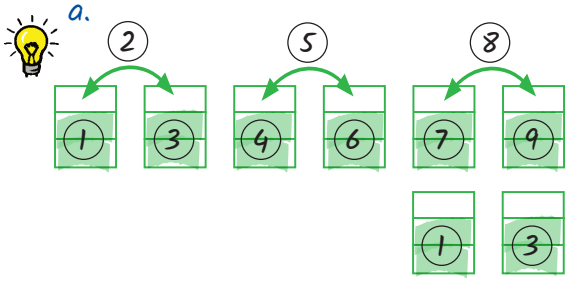
**Did you:**

- ☐ draw a picture?
- ☐ make a list?
- ☐ use the page to help you?

Activity 4: Fraction-type problems

Anticipated strategies could include:

a.




x 2 → 18 cakes

+ 2 → 20 cakes

= 14 cups

From questions 1 and 2:

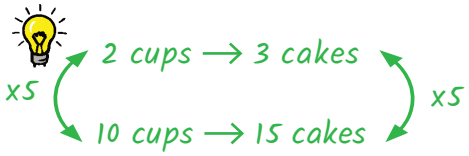
$20 \times \frac{2}{3}$

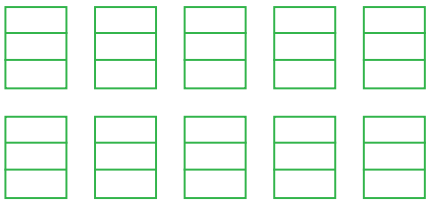
$= \frac{40}{3}$

$= 13\frac{1}{3}$

Mrs Manga needs 14 cups of nuts.

b.



30-thirds ÷ 2 = 15 cakes

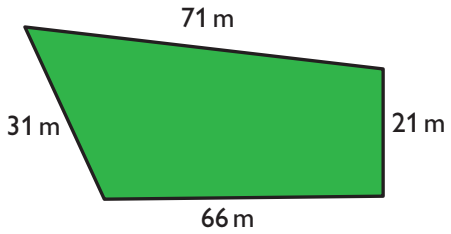
Workbook 14 p.63

The distance around the outside of a shape is called the shape's perimeter.

1. Fences are put around plots of land. The diagrams show the dimensions of a few plots. Determine the length of fencing needed for each plot, i.e. determine the perimeter. Show your thinking.

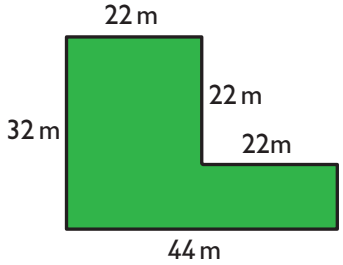
? *Explain how you calculated the perimeter*

a.



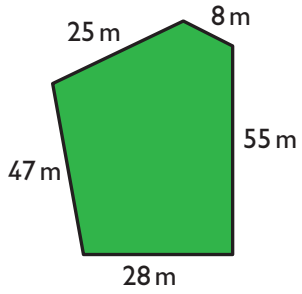

$P = 102 + 87$
$= 189m$
or
$= 137 + 52$
$= 189m$

b.



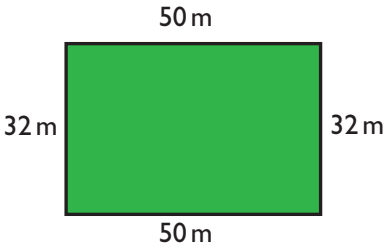

$P = 66 + 76$
$= 142m$
or
$66 + 44 + 32$
$= 110 + 32$
$= 142m$

c.



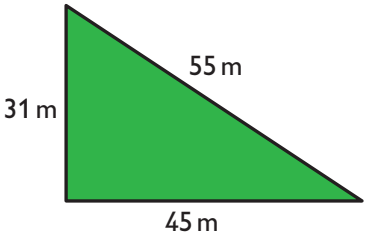

$P = 80 + 36 + 47$
$= 116 + 47 = 163m$

d.



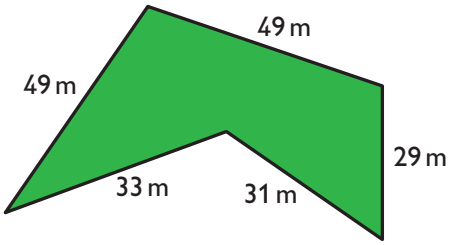

$P = 100 + 64$
$= 164m$
or
$= 82 + 82$
$= 164m$

e.



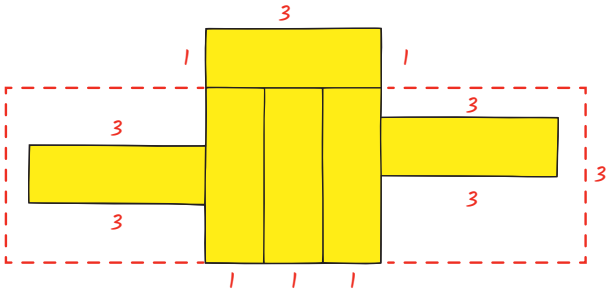

$P = 100 + 31$
$= 131m$

f.



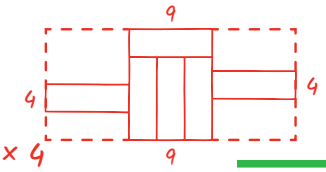

$P = 100 - 2 + 91 - 4$
$= 194 - 3$
$= 191m$
or
$80 + 82 + 29$
$= 162 + 29$
$= 191m$

2. Rectangles with sides 3 cm and 1 cm are used to make this shape. Determine the perimeter of the shape. Explain.




$P = 3+1+3+3+3+1+1+1+3+3+3+1$
$= 21+5$
$= 26m$

or




$P = 2 \times 9 + 2 \times 4$
$= 18 + 18 = 26cm$

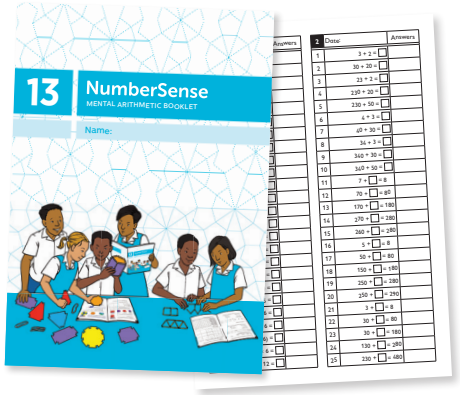
? *Please share your thinking with the class/group.*

Measurement - Length

## Scaffolding Idea

If children are finding question 1 challenging teachers can:

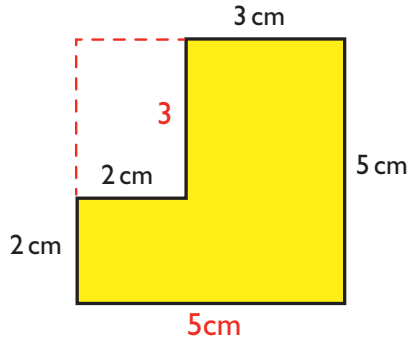
- Check that they understand what perimeter means. Examples in context might be useful here. Examples include, fencing built around a garden, ribbon sewn around a pillow, paving around a swimming pool.
- Do an example using a lower number range. If the child is confident in solving a question with a lower number range, then it suggests that the problem might stem from their lack of confidence in calculating with large values. Teachers might want to provide some additional support to strengthen their mental arithmetic skills
(Mental arithmetic learner book 13)



1. For each shape:
   - Determine the length of the sides that have not been given.
   - Calculate the perimeter. Show your thinking.

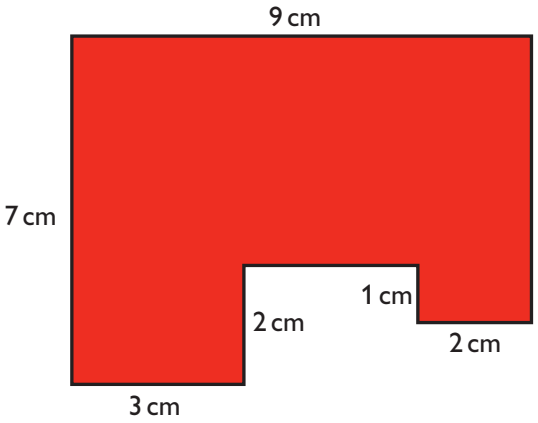
   Note: The sketches are not drawn to scale. Do not use a ruler.

a.

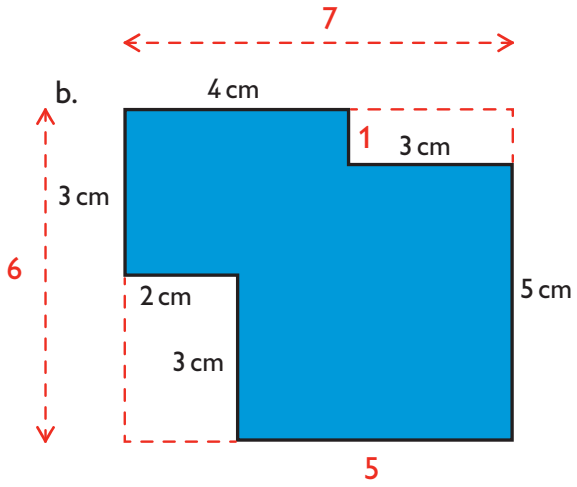



$P = 10 + 10$
$= 20cm$

c.




b.

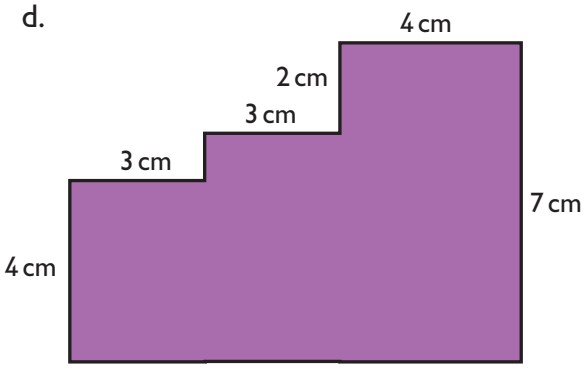



$P = 12 + 14$
$= 26m$

or

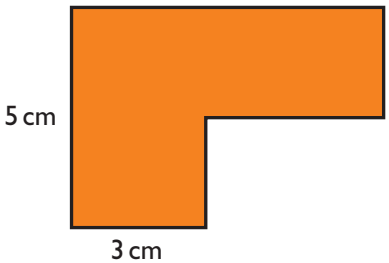
$= 7 + 6 + 7 + 6$
$= 26m$

d.




2. The perimeter of this shape is 24 cm. Determine the lengths of the missing sides. Show your thinking.

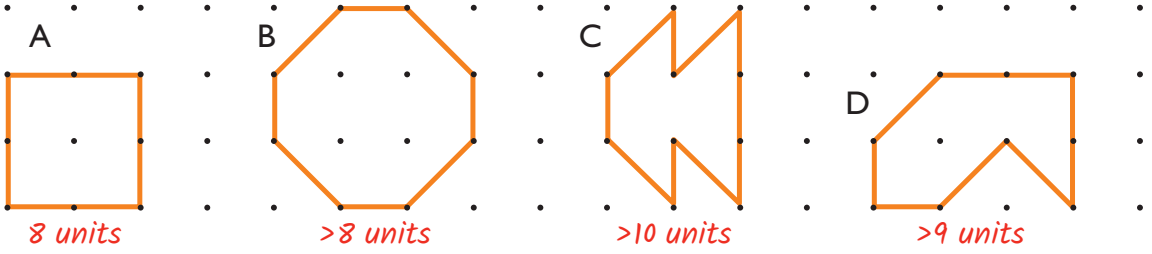
   Is there only one possible solution?




*Allow time for children to investigate. Expect lists; guess and check; working backwards; using the picture. Some children might benefit from using a Geoboard.*

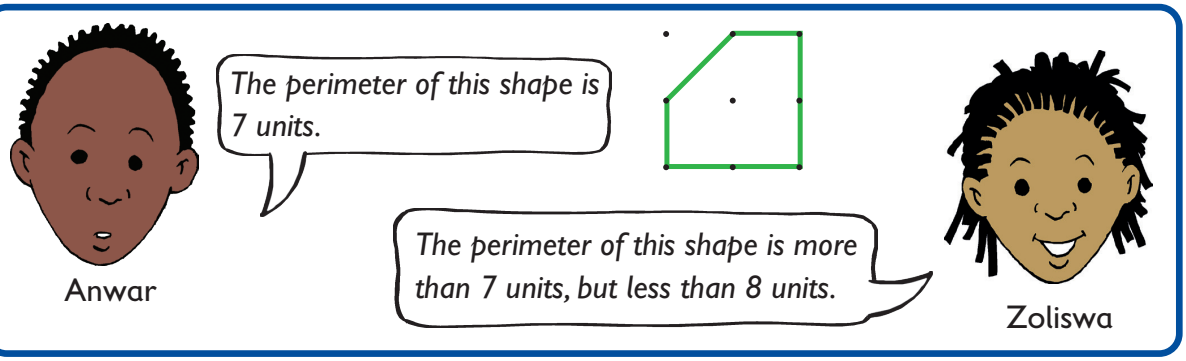
1. Arrange these shapes from the shape with the shortest perimeter to the shape with the greatest perimeter. Justify your thinking.

Discuss different justifications.




A B D C

The diagonals are more than 1 unit, but less than 2 units.




2. Do you agree with Anwar or Zoliswa? Discuss with a friend and record your thinking.

I can see that the diagonal is more than 1 unit, but less than 2 units.

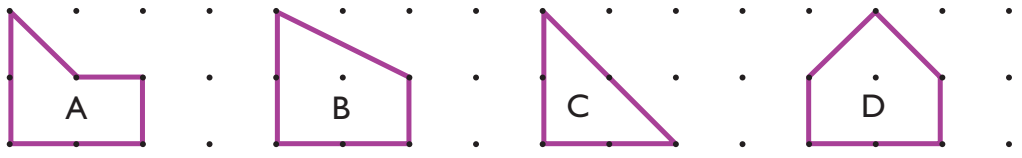
I agree with Zoliswa, because without using my ruler, the diagonal is more than 1 unit.

I agree, from what we did before. (Workbook 14 p.64)

3. Which shape in each set has the greatest perimeter? Explain how you decided.

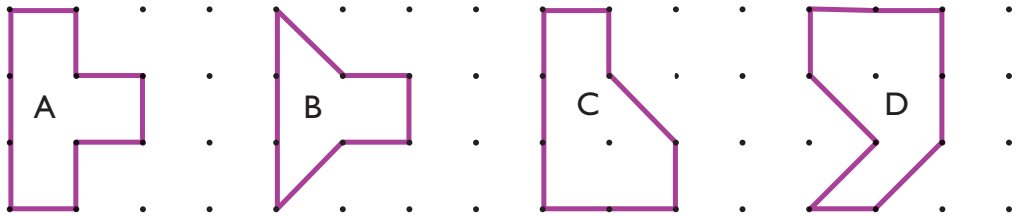
The greatest perimeter is either A or B, because they are both more than 7 and less than 8.

a.




More than 7, less than 8 | More than 7, less than 8 | More than 6, less than 7 | More than 6, less than 7

b.



**Question 3 a**

Manage the discussion focusing on what is the same and what is different between shapes A, B, C and D.

Compare shapes C and D. What is the same and what is different?

C and D have the same perimeter. I know because they each have 4 lines equal to 1 unit each and 2 diagonal lines that are more than 1 unit and less than 2 units.

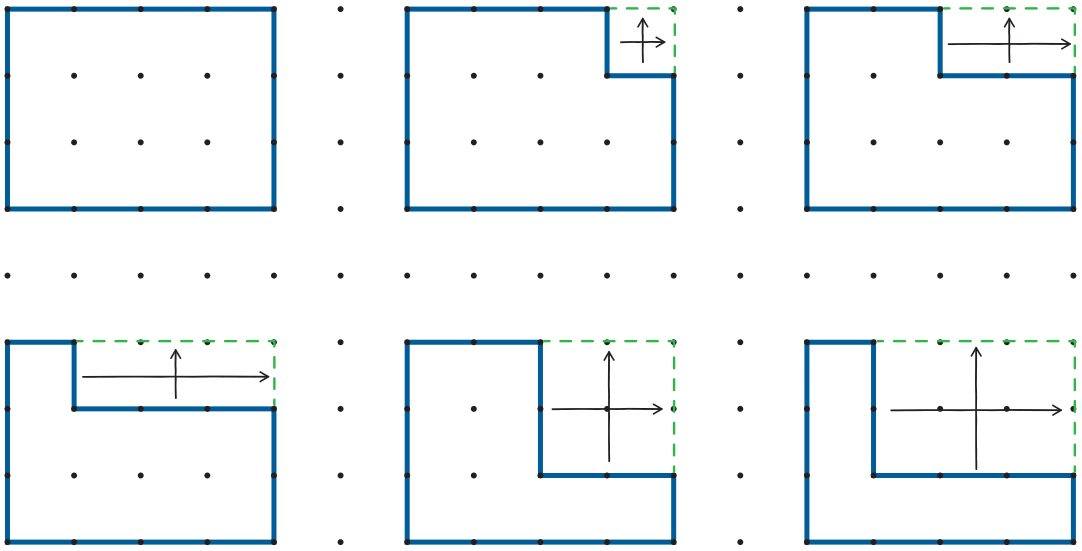
Compare shapes A and B. What is the same and what is different?

A and B have almost the same perimeter. Perimeter A has 6 lines equal 1 unit each plus 1 diagonal line that is a little more than 1 and less than 2 units. Perimeter B has 5 lines equal to 1 unit each and 1 diagonal line that is almost equal to 2 units.

If the class is determined to prove which has the greater perimeter, A or B, then this might be better achieved through:

- using a ruler
- using a geoboard and string
- constructing the shapes A and B on a drawing application such as Geogebra.

1. Determine the perimeter of each shape.

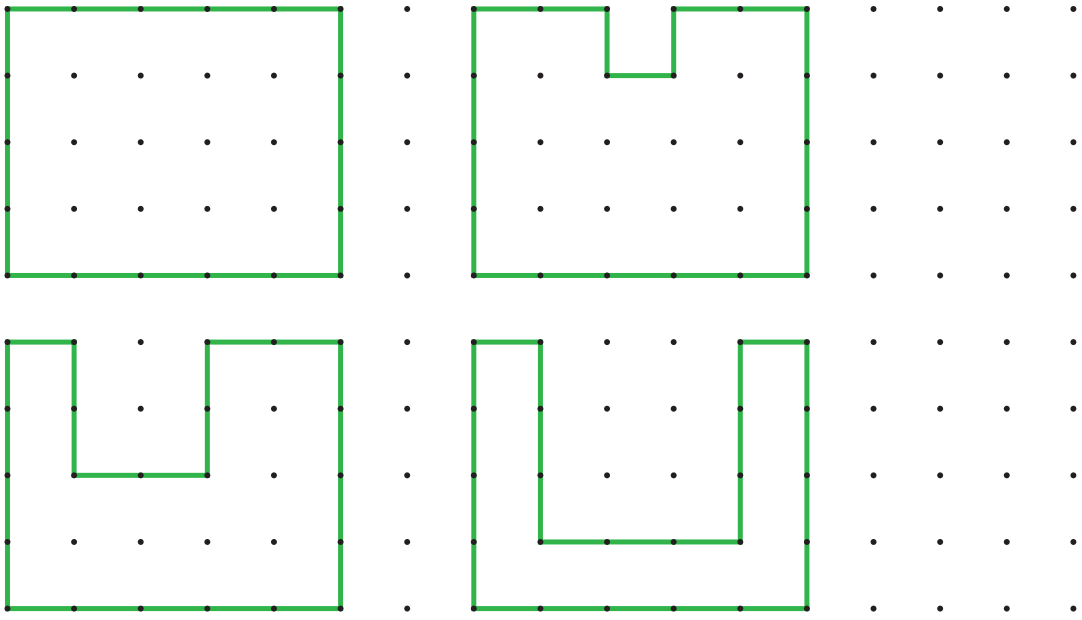


What do you notice?

*All the perimeters are equal to 14 units.*

*I notice that these all make rectangles that are 4 units long and 3 units wide.*

2. Determine the perimeter of each shape.



What do you notice?

*The perimeters are all different.*

*The rectangles have a "cut-out" of one of the sides. The more I cut out, the more the perimeter increases.*

3. What is the same and what is different between what happens in question 1 and question 2?

*Changing a rectangle by "cutting" a corner means the perimeter stays sthe same.*

*Changing a rectangle by "cutting" a piece out of the centre of a side, means the perimeter will increase.*