

Mathematics

Grade 5

Learner Book



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Mathematics Learner Book Grade 5

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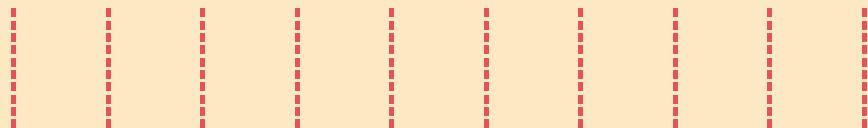
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1.1 Counting

Look at the next four pages. You will see four arrays (arrangements) of stripes. You will soon find out how many stripes there are!

You already know that ten tens are 100.



Ten hundreds are 1 000. You can see this in Array A on the next page.

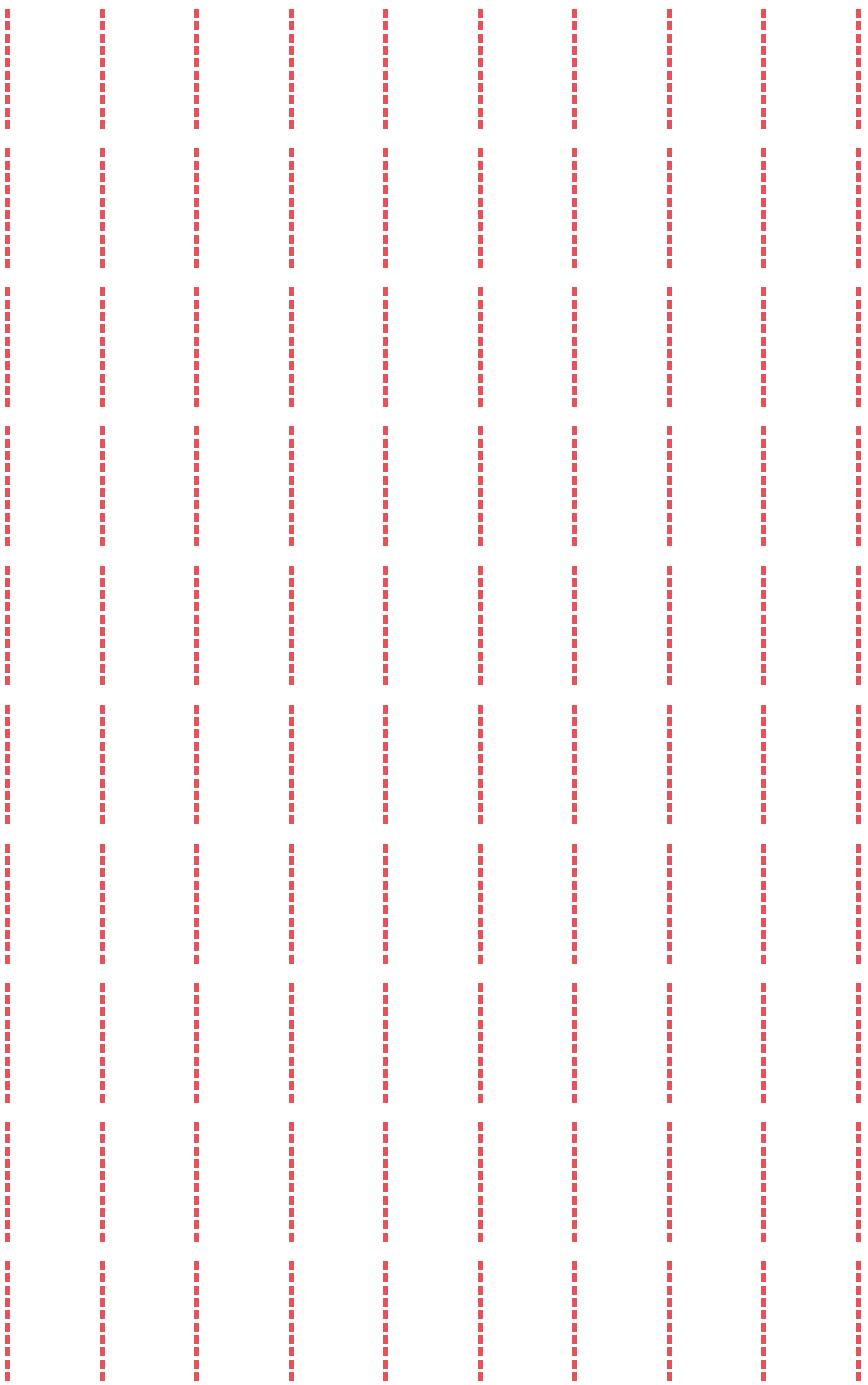
Ten thousands are 10 000.

1. How many tens are shown in Array A on the next page?
2. How many hundreds are shown below?

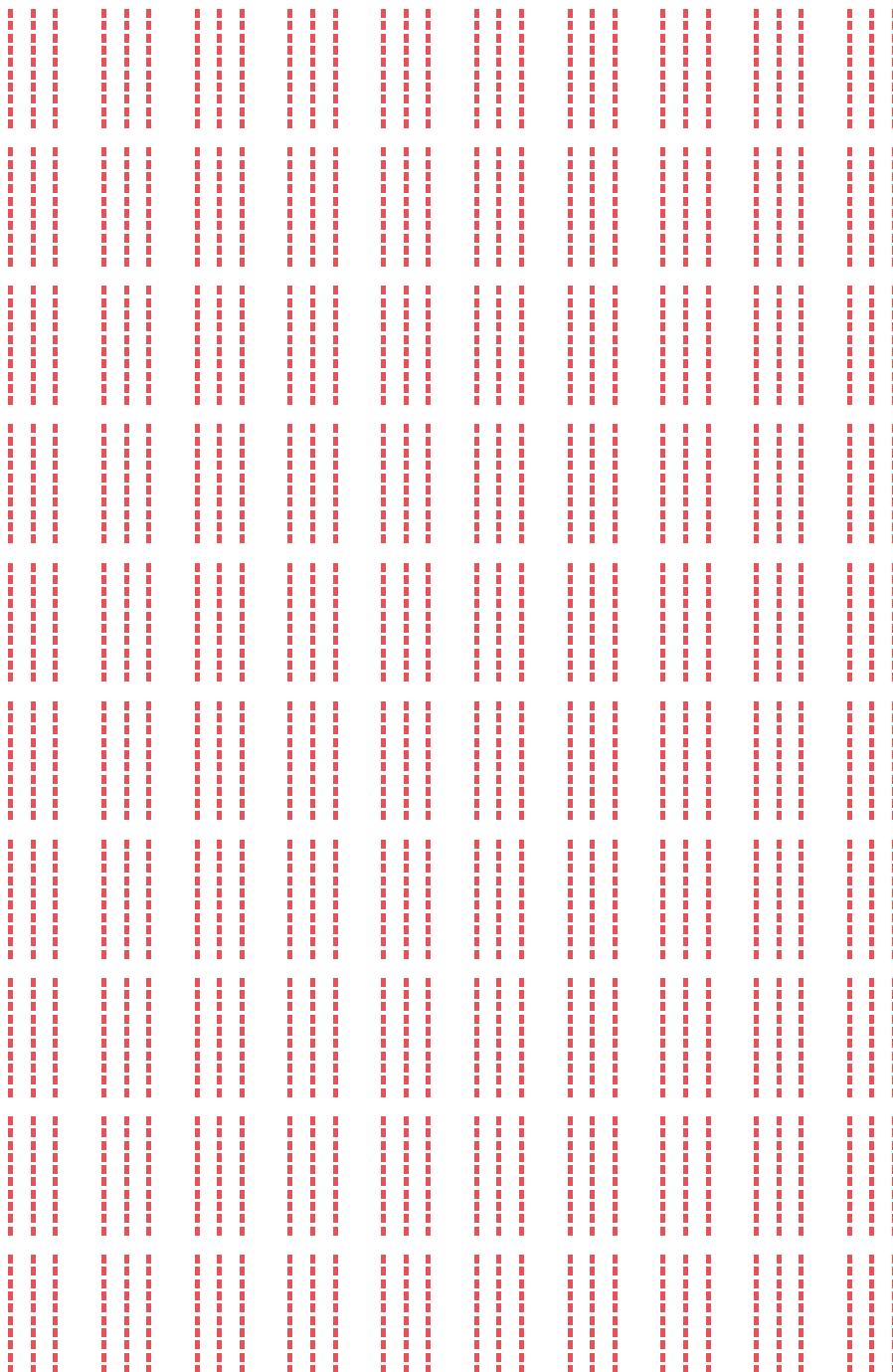


3. (a) Now turn to Array B. How many hundreds are shown in the array?
(b) How many tens are shown in Array B?
(c) How many thirties are shown in Array B?
(d) How many stripes are shown in Array B?
4. Turn to Array C. How many stripes are shown in Array C?
5. (a) Turn to Array D. How many stripes are shown in Array D?
(b) How many hundreds are shown in Array D?
(c) How many tens are shown in Array D?
6. How many stripes are shown in Arrays B and C together?

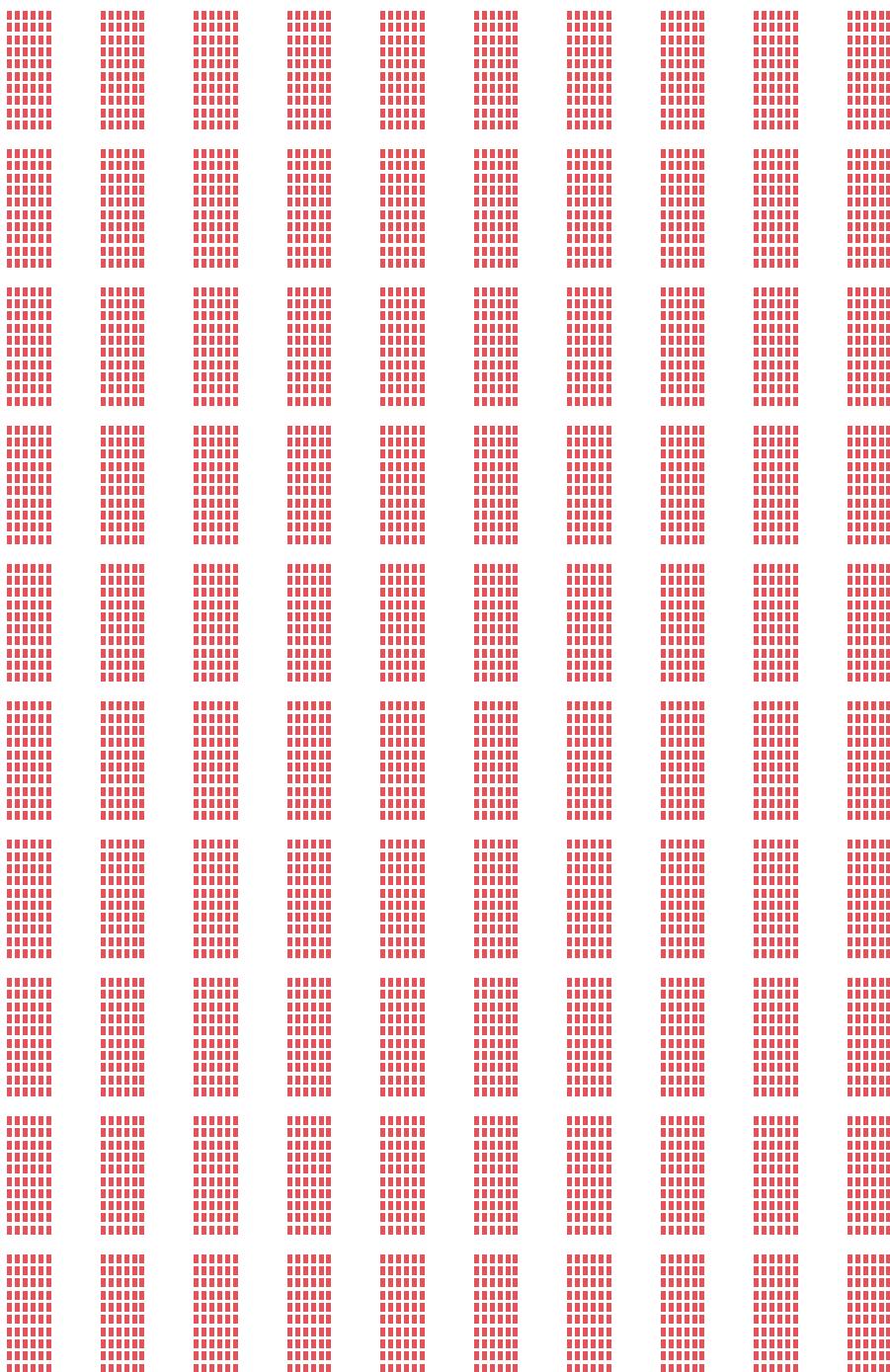
Array of stripes A



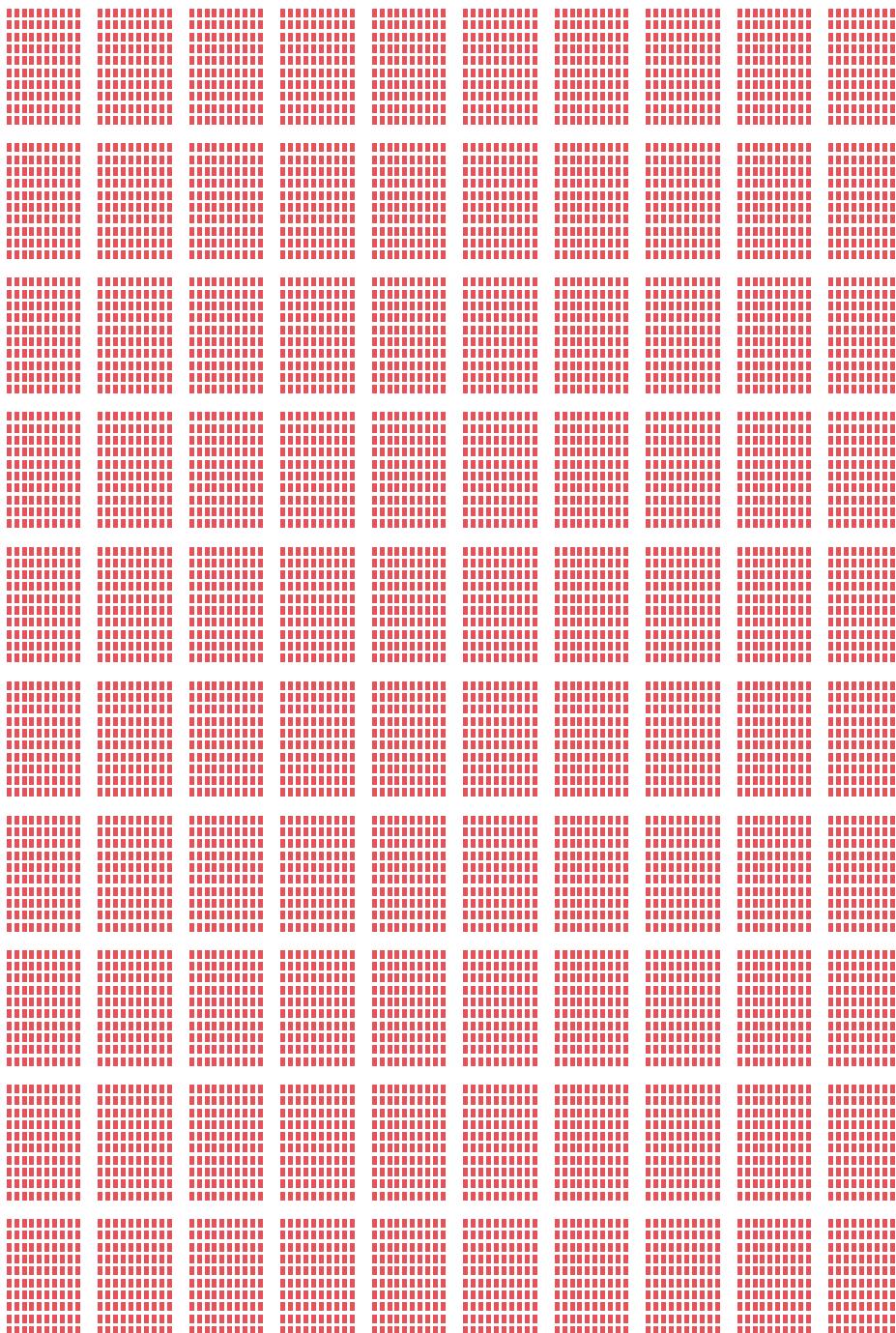
Array of stripes B



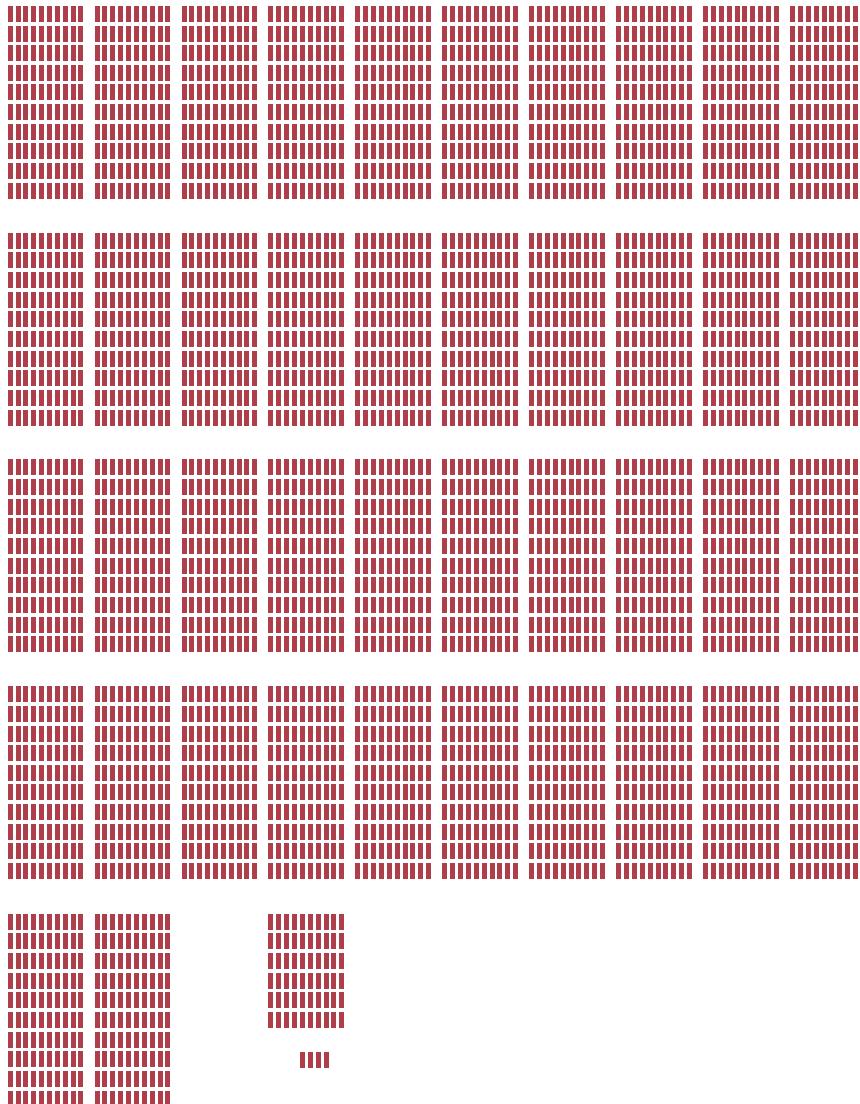
Array of stripes C



Array of stripes D



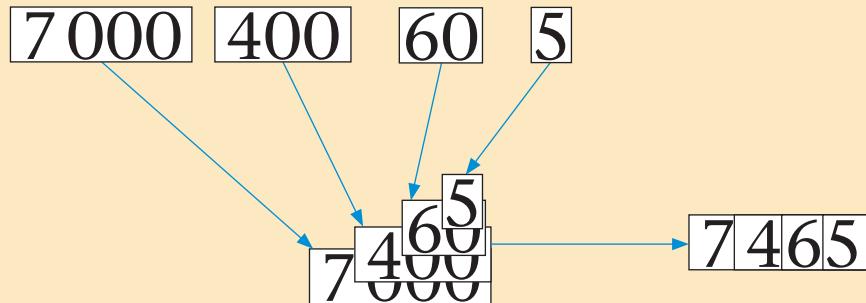
7. (a) How many stripes are shown below?



(b) How many more stripes are needed to fill this up to 5 000?

1.2 Place value

The number symbol for seven thousand four hundred and sixty-five is 7 465. The number symbol can be built up with place value cards:



In the number symbol 7 465 we cannot see the place value parts 7 000, 400 and 60.

The 000 of the 7 000, the 00 of the 400 and the 0 of the 60 are hidden.
Instead of 7 000, only “7” is written in the number symbol.

Instead of 400, only “4” is written in the number symbol.

Instead of 60, only “6” is written in the number symbol.

1. Write the number symbols for these numbers.
 - (a) seven thousand nine hundred and forty-eight
 - (b) six thousand eight hundred and fifty-three
 - (c) one thousand and forty-five
 - (d) three thousand nine hundred and seventy-five
 - (e) four thousand and eight

The **place value parts** of 7 465 are
7 000, 400, 60 and 5.

2. Write the place value parts of each number.

(a) 1 273	(b) 6 525
(c) 3 357	(d) 2 015
(e) 5 042	(f) 1 589

The **expanded notation** for 7 465

is $7\,000 + 400 + 60 + 5$.

3. Write the expanded notation for each of these numbers.

(a) 1 273 (b) 6 525 (c) 2 015

The “7”, the “4”, the “6” and the “5” in the number symbol 7 465 are called **digits**.

The digit “7” in the number symbol 7 465 means 7 000 or 7 thousands because it is in the thousands place.

Any digit in this position indicates thousands.

thousands	hundreds	tens	units
7	4	6	5

$$7\,465 = 7 \text{ thousands} + 4 \text{ hundreds} + 6 \text{ tens} + 5 \text{ units}$$

$$7\,465 = 7\,000 + 400 + 60 + 5$$

The **value** or meaning of a digit in a number symbol depends on the position or **place** of the digit in the number symbol.

4. (a) Which digit is in the tens place in the number symbol 7 465?
(b) Which digit in the symbol 7 465 represents the number 400?

5. The digit in the hundreds place in 8 243 is 2.
(a) Which digit is in the tens place in 8 243?
(b) Which digit is in the tens place in 4 283?

6. The expanded notation for some numbers is given below.
Write the number symbols for these numbers.
(a) $700 + 50 + 3\ 000 + 8$ (b) $70 + 300 + 6 + 1\ 000$
(c) $8\ 000 + 200 + 6$ (d) $8\ 000 + 20 + 6$
(e) $6\ 000 + 40$ (f) $6\ 000 + 4$

1.3 Counting, ordering and comparing numbers

1. Write the number symbols for these numbers and arrange them from smallest to biggest.
 - (a) four thousand eight hundred
 - (b) three thousand and ninety
 - (c) four thousand and eighty-eight
 - (d) four thousand and eight
 - (e) three thousand two hundred
 - (f) three thousand one hundred and fifty
2. (a) Copy the number line.

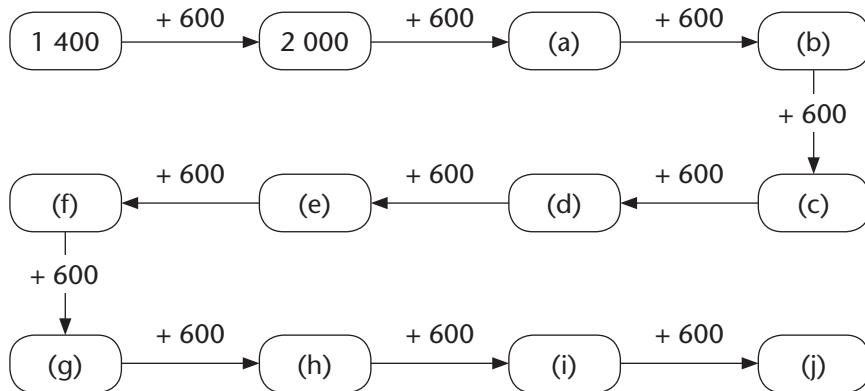


- (b) Write the numbers 6 200, 6 400 and 6 800 at the marks where they belong on your number line.
3. (a) Copy this number line with ten marks.



- (b) Write these numbers at the marks on your number line, from smallest to biggest. Leave marks open for the missing numbers.
6 330 6 390 6 370 6 310 6 350 6 380 6 320
4. Write the numbers down as you go along in each counting task.
 - (a) Count forwards in 5s from 3 250 up to 3 300.
 - (b) Count forwards in 25s from 3 250 up to 3 450.
 - (c) Count forwards in 50s from 3 250 up to 3 450.
 - (d) Count forwards in 5s from 2 158 until you reach 2 188.
 - (e) Count forwards in 50s from 2 133 until you reach 2 333.
 - (f) Count forwards in 25s from 2 127 until you reach 2 327.

5. Write the numbers down as you go along in each counting task.
- Count backwards in tens from 3 250 down to 3 150.
 - Count backwards in tens from 3 254 until you pass 3 150.
 - Count backwards in fives from 3 250 down to 3 200.
 - Count backwards in fives from 3 227 until you pass 3 180.
 - Count backwards in twenty-fives from 3 250 down to 3 100.
 - Count backwards in fifties from 3 250 down to 3 000.
6. Write down the numbers that should be in the blocks in the diagram.
For example, the answer for (a) is 2 600.



The < sign for “smaller than” can be used to state that one number is smaller than another. For example, we can write $23 < 24$ and $1\,999 < 9\,991$.

The > sign for “bigger than” can be used to state that one number is bigger than another. For example, we can write $24 > 23$ and $3\,492 > 1\,274$.

Notice that the open part of the sign is always towards the bigger number.

7. In each case decide which is the bigger of the two numbers. Use the < or > sign to write your answers.
- | | |
|---------------------|---------------------|
| (a) 3 492 and 9 002 | (b) 6 768 and 6 879 |
| (c) 2 901 and 2 899 | (d) 5 536 and 6 355 |

2.1 State addition and subtraction facts

The number 80 can be formed by adding up 8 tens:

$$10 + 10 \rightarrow 20 + 10 \rightarrow 30 + 10 \rightarrow 40 + 10 \rightarrow 50 + 10 \rightarrow 60 + 10 \rightarrow 70 + 10 = 80$$

The number 80 can also be formed by adding up 5 sixteens:

$$16 + 16 \rightarrow 32 + 16 \rightarrow 48 + 16 \rightarrow 64 + 16 = 80$$

We can say: “Adding up 8 tens gives the same result as adding up 5 sixteens”.

A number sentence like this is called a **statement of equivalence**. The number sentence tells us that two *different actions* will produce the *same result*.

This number sentence can also be written in symbols:

$$10 + 10 + 10 + 10 + 10 + 10 + 10 = 16 + 16 + 16 + 16 + 16$$

$8 \times 10 = 5 \times 16$ is a shorter sentence that gives the same information.

1. Write each number sentence in symbols.
 - (a) Adding up 20 fives gives the same result as adding up 10 tens.
 - (b) 25 times 8 gives the same result as 4 times 50.
 - (c) The difference between 930 and 970 is the same as the difference between 430 and 470.
2. Which of these number sentences are false?

“False” means not true.

 - (a) $9 + 9 + 9 + 9 + 9 + 9 + 9 + 9 = 6 + 6 + 6 + 6 + 6 + 6$
 - (b) $9 + 9 + 9 + 9 + 9 + 9 = 6 + 6 + 6 + 6 + 6 + 6 + 6 + 6$
 - (c) $5 + 5 + 5 + 5 + 5 + 5 = 6 + 6 + 6 + 6 + 6$
 - (d) $9 \times 6 = 6 \times 9$
 - (e) $5 \times 6 = 6 \times 5$
 - (f) $9 \times 9 = 6 \times 6$

When numbers are multiplied, any of the numbers can be taken first.

The answer is the same.

Richard and Thandi had to calculate $12 - 3 + 5 - 2$ and $3 \times 10 + 5 \times 2$.
Richard worked like this:

$$12 - 3 = 9$$

$$9 + 5 = 14$$

$$14 - 2 = 12$$

$$3 \times 10 = 30$$

$$30 + 5 = 35$$

$$35 \times 2 = 70$$

Thandi worked like this:

$$3 + 5 = 8$$

$$12 - 8 = 4$$

$$4 - 2 = 2$$

$$3 \times 10 = 30$$

$$5 \times 2 = 10$$

$$30 + 10 = 40$$

Richard and Thandi were very confused when they compared their answers!



To avoid confusion like this, people all over the world follow certain agreements about instructions.

If instructions include only addition and subtraction, the calculations are done from left to right.

Example: $12 - 3 + 5 - 2$ means you have to do this:

$$12 - 3 = 9 \quad 9 + 5 = 14 \quad 14 - 2 = 12$$

If instructions include multiplication, all multiplications are done before additions and subtractions.

Examples: $3 \times 10 + 5 \times 2$ means you have to do this:

$$3 \times 10 = 30 \quad 5 \times 2 = 10 \quad 30 + 10 = 40$$

$3 \times 10 - 5 \times 2$ means you have to do this:

$$3 \times 10 = 30 \quad 5 \times 2 = 10 \quad 30 - 10 = 20$$

Brackets are used to indicate that certain calculations should be done first.

Examples:

In $3 \times (4 + 6)$ the brackets are used to tell you that you must calculate like this:

$4 + 6 = 10$ followed by $3 \times 10 = 30$

The instructions $3 \times 4 + 6$ as well as $6 + 3 \times 4$ tell you that you should calculate like this:

$$3 \times 4 = 12 \text{ followed by } 12 + 6 = 18$$

$12 - (3 + 5) - 2$ means you have to do this:

$$3 + 5 = 8 \quad 12 - 8 = 4 \quad 4 - 2 = 2$$

5. Which of these number sentences are false?

 - (a) $12 - (3 + 5) - 2 = 12 - 3 + 5 - 2$
 - (b) $3 \times 30 + 5 \times 30 = 3 \times (30 + 5) \times 30$
 - (c) $3 \times 30 + 5 \times 30 = (3 \times 30) + (5 \times 30)$
 - (d) $5 \times (20 + 3) = 5 \times 20 + 3$
 - (e) $5 \times (20 + 3) = 5 \times 20 + 5 \times 3$
 - (f) $5 \times (20 + 3) = 5 \times 18 + 5 \times 5$
 - (g) $5 \times (20 - 3) = 5 \times 20 - 5 \times 3$
 - (h) $(20 + 3) \times 5 = 20 \times 5 + 3 \times 5$

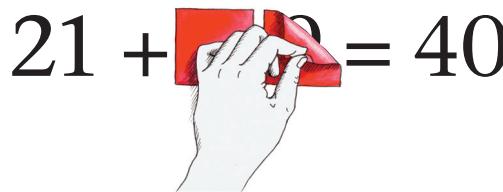
-
6. Which of these number sentences are false?
- $(1 + 3) + (5 + 7) + 9 = 1 + (3 + 5) + (7 + 9)$
 - $(10 + 8) + 6 = (8 + 6) + 10$
 - $(10 + 8) + 6 = (6 + 10) + 8$

When more than two numbers have to be added, you can add any two of them first.

7. Which of these number sentences are false?
- $500 + 300 + 200 = 200 + 500 + 300$
 - $500 + 300 + 200 = 500 + 200 + 300$
 - $500 + 300 - 200 = 500 + 200 - 300$
 - $20 + 10 - 5 = 20 - 5 + 10$
 - $(60 + 3) + (10 + 7) = (60 + 10) + (3 + 7)$
 - $(60 - 7) + (10 - 3) = (60 - 10) + (7 - 3)$
 - $(60 + 7) - (10 + 3) = (60 - 10) + (7 - 3)$
8. Which of the following actions will produce the same result?
Write your answer in the form of number sentences,
for example $3 \times 6 = 2 \times 9$.
- $6 \times 1\,000$ 60×10 60×100 600×10
9. Suppose you want to know how much $20 \times 63 + 20 \times 37$ is.
Which of the following actions will produce the correct answer, and
which will not?
- 20×100
 - $20 \times 60 + 20 \times 3 + 20 \times 30 + 20 \times 7$
 - $20 \times 80 \times 3 + 20 \times 50 \times 7$
 - $20 \times 60 + 20 \times 40$

2.2 Solve and complete number sentences

1. Which number is hidden behind the red stickers?



2. Write down the number that is hidden behind the red stickers in each number sentence.

- | | |
|-------------------------------|-------------------------------|
| (a) $30 + \blacksquare = 50$ | (b) $31 + \blacksquare = 50$ |
| (c) $32 + \blacksquare = 50$ | (d) $35 + \blacksquare = 50$ |
| (e) $30 + \blacksquare = 60$ | (f) $20 + \blacksquare = 60$ |
| (g) $40 + \blacksquare = 60$ | (h) $\blacksquare + 40 = 60$ |
| (i) $\blacksquare + 40 = 100$ | (j) $\blacksquare + 50 = 100$ |
| (k) $\blacksquare + 30 = 100$ | (l) $\blacksquare + 20 = 100$ |
| (m) $25 + \blacksquare = 100$ | (n) $75 + \blacksquare = 100$ |
| (o) $65 + \blacksquare = 100$ | (p) $88 + \blacksquare = 100$ |

3. (a) Choose any two numbers for the blue and yellow stickers.

The two numbers together must make 100.

$$\blacksquare + \blacksquare = 100$$

Write your answer as a number sentence,
for example $90 + 10 = 100$.

- (b) Write a different number sentence that shows two other numbers that add up to 100.
- (c) Write any other ten different number sentences that each show two numbers that add up to 100.
- (d) Write ten different number sentences that each show two numbers that add up to 300.
- (e) Write ten different number sentences that each show two numbers that add up to 700.

4. When you add 3 to the number behind the blue stickers, the answer is 88.

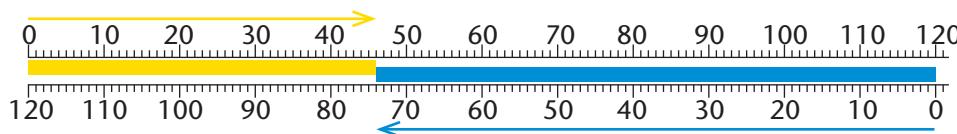
$$\blacksquare \blacksquare + 3 = 88$$

What will the answer be if you add 5 to the number behind the same blue stickers?

$$\blacksquare \blacksquare + 5 = ?$$

5. Simanga worked out that $46 + 74 = 120$.

You can see in the diagram below that his answer is right.

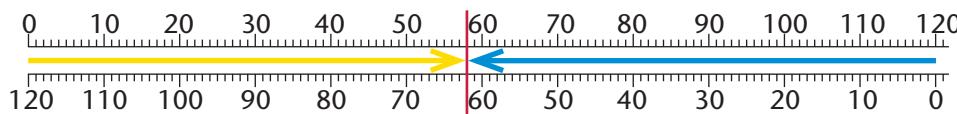


- (a) Is it true that $120 - 74 = 46$?
(b) Is it true that $120 - 46 = 74$?

6. Look at the diagram below. It shows that $58 + 62 = 120$.

Complete these number sentences:

(a) $120 - 62 = \square$ (b) $120 - 58 = \square$

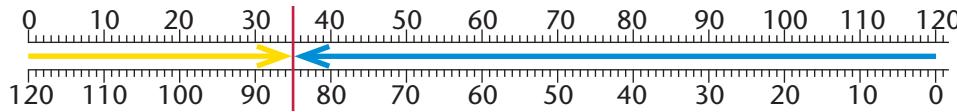


7. Nontobeko knows that $78 - 35 = 43$.

- (a) How much is $43 + 35$?
(b) How much is $78 - 43$?

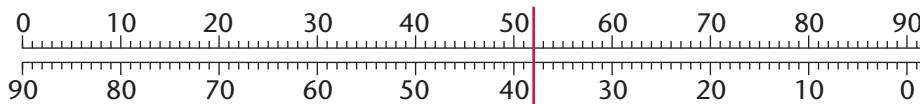
8. In question 5 you can read three number sentences that describe what the diagram shows.

Write three number sentences to describe what the diagram below shows.



9. $52 + 38 = 90$ $90 - 38 = 52$ $90 - 52 = 38$

You can see it in this diagram:



Write ten other addition number sentences that each show two numbers that add up to 90. For each addition number sentence also write two number sentences that state subtraction facts about 90.

10. Write ten addition number sentences that each show two numbers that add up to 1 000. For each addition number sentence also write two number sentences that state subtraction facts about 1 000.
11. The number sentence $100 + 200 + 300 = 600$ shows three numbers that add up to 600.
- Write three other number sentences that each show three numbers that add up to 600.
 - Write three number sentences that each show three numbers that add up to 800.
 - Write three number sentences that each show three numbers that add up to 1 000.
12. The number sentence $20 + 60 - 30 = 50$ shows how adding two numbers and subtracting a number can produce the answer 50.
- Write three other number sentences that each show how adding two numbers and subtracting a number can produce the answer 50.
 - Write three different number sentences that each show how adding two numbers and subtracting a number can produce the answer 200.
 - Write three different number sentences that each show how adding two numbers and subtracting a number can produce the answer 400.

2.3 Equivalence

Choose a number to hide behind the blue stickers in question 1. It must be the same number for each of the blue stickers. Write your blue number down.

Also choose one number to put behind the yellow stickers. It must be same number for each of the yellow stickers. Write your yellow number down.

1. (a) How much is your $\blacksquare + \blacksquare$?
(b) Is it true that $10 \times (\blacksquare + \blacksquare) = 10 \times \blacksquare + 10 \times \blacksquare$?
2. (a) Do you think the other learners in the class chose the same numbers as you to hide behind the blue and yellow stickers in question 1?
(b) Do you think the other learners in the class also found that the number sentence in question 1(b) is true, although they may have chosen different numbers than you did?
3. Choose two other numbers for your blue and yellow stickers.
(a) Is it again true that $10 \times (\blacksquare + \blacksquare) = 10 \times \blacksquare + 10 \times \blacksquare$?
(b) Is $5 \times (\blacksquare + \blacksquare) = 5 \times \blacksquare + 5 \times \blacksquare$?
(c) Choose a number to hide behind the red stickers below.
 $\blacksquare \times (\blacksquare + \blacksquare) = \blacksquare \times \blacksquare + \blacksquare \times \blacksquare$
Is this number sentence true?
(d) Is the number sentence below true?
 $\blacksquare \times (\blacksquare + \blacksquare) = \blacksquare \times \blacksquare + \blacksquare$
4. In each case state whether you think the sentence is true or false.
 - (a) $5 \times (400 + 30 + 7) = 5 \times 400 + 30 + 7$
 - (b) $5 \times (400 + 30 + 7) = 5 \times 400 + 5 \times 30 + 5 \times 7$
 - (c) $5 \times (400 - 30 - 7) = 5 \times 400 - 5 \times 30 - 5 \times 7$
 - (d) $5 \times (400 + 60 + 8) = 10 \times (200 + 30 + 4)$
 - (e) $5 \times (400 + 60 + 8) = 20 \times (100 + 15 + 2)$

3.1 Addition and subtraction facts

The shop

1. The blue flag and the red flag are exactly 100 m from each other, along a straight road. Mac walks along the road and he is now 30 m from the red flag.
 - (a) How far is Mac from the blue flag?

The blue flag is 200 m away from a shop along the road.

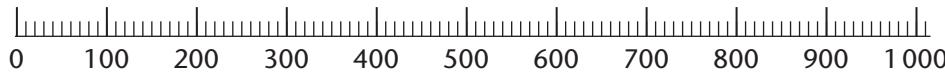
- (b) How far is Mac from the shop?
 - (c) How far is the red flag from the shop?
2. $30 + 70 = 100$

Write number sentences to state how much each of the following is.

- | | |
|----------------|----------------|
| (a) $40 + 60$ | (b) $80 + 20$ |
| (c) $50 + 50$ | (d) $10 + 90$ |
| (e) $100 - 50$ | (f) $100 - 80$ |
| (g) $100 - 60$ | (h) $100 - 70$ |
| (i) $100 - 90$ | (j) $30 + 70$ |
| (k) $100 - 30$ | (l) $100 - 40$ |
| (m) $400 - 30$ | (n) $700 - 40$ |



3. Write the numbers that will make the number sentences true.
 - (a) $40 + \square = 100$
 - (b) $100 - \square = 40$
 - (c) $100 - \square = 60$
 - (d) $440 + \square = 500$
 - (e) $500 - \square = 60$
 - (f) $500 - \square = 440$



6. Write the numbers that will make the number sentences true.

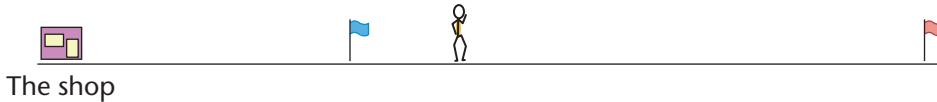
(a) $5\ 700 + \square = 6\ 000$ (b) $6\ 000 - \square = 5\ 700$
(c) $6\ 000 - \square = 300$ (d) $300 + \square = 6\ 000$



7. How much is each of the following?

(a) $2\,000 + 8\,000$	(b) $10\,000 - 8\,000$
(c) $8\,000 + 2\,000$	(d) $10\,000 - 2\,000$
(e) $3\,000 + 7\,000$	(f) $10\,000 - 3\,000$
(g) $4\,000 + 6\,000$	(h) $10\,000 - 6\,000$
(i) $5\,000 + 5\,000$	(j) $10\,000 - 5\,000$
(k) $3\,000 + 4\,000$	(l) $7\,000 - 4\,000$
(m) $5\,000 + 3\,000$	(n) $8\,000 - 5\,000$

8. The blue flag is now 100 m away from the shop, and the red flag is 300 m away from the shop.



The shop

- (a) Approximately how far from the shop is Mac now?
 - (b) Approximately how far from the red flag is Mac?
 - (c) What should you get, if you add up your answers to questions (a) and (b)?
 - (d) How far are the two flags apart in this case?
9. The blue flag is now 1 000 m away from the shop, the green flag is 2 000 m away and the red flag is 3 000 m away.



The shop

Sally, with the yellow dress, is 200 m away from the blue flag.

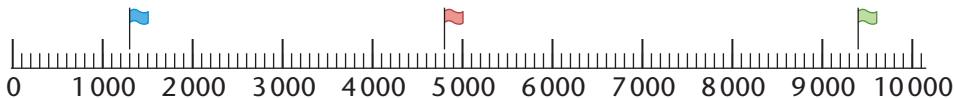
Mac is 400 m away from the red flag.

- (a) How far from Mac is Sally?
- (b) How far from the shop is Mac?

If you think it may help you, you can make your own rough drawing of the situation. If you do, do not spend too much time on making the drawing. A rough drawing is all you need.

- (c) How far is Sally from the red flag?

10. (a) How far is the red flag from the blue flag on the number line?



- (b) How far is the red flag from the green flag?
- (c) How far is the green flag from the blue flag?

3.2 Addition, subtraction and doubling

Suppose you walk 3 200 m in the morning and 4 600 m in the afternoon.

To know how far you walked in total on that day you have to find the **sum** of the two numbers:

$$3\ 200 + 4\ 600 = 7\ 800$$

We can also say you **add** 4 600 to 3 200.

To know how much farther you walked in the afternoon than in the morning, you have to find the **difference** between the two numbers:

$$4\ 600 - 3\ 200 = 1\ 400$$

We can also say you **subtract** 3 200 from 4 600.

1. Bongani is Tebogo's husband. They both work, and save regularly. Bongani has already saved R3 400 and Tebogo has saved R5 700.
 - (a) What is the total of Bongani's and Tebogo's savings?
 - (b) How much more than Bongani has Tebogo saved?

Bongani wants to buy a laptop computer for R6 800 from his savings. Tebogo says she will lend Bongani the money that he is short of.

 - (c) How much is Bongani short of what he needs to pay for the laptop computer?
 - (d) How much will Tebogo have left after she lends Bongani the money he needs?
2. Mr Mudau is a farmer. He has to deliver 2 760 chickens to a big supermarket, but he has only 1 632 chickens ready for delivery. How many chickens is he short?

We often have to add and subtract to find the information that we need. That is why it is very important that you know the addition and subtraction facts for thousands, hundreds, tens and units very well.

3. Here are some addition and subtraction facts:

$$2 + 6 = 8$$

$$8 - 2 = 6$$

$$8 - 6 = 2$$

$$60 + 30 = 90$$

$$90 - 30 = 60$$

$$90 - 60 = 30$$

Write ten other addition facts that you know.

Write two subtraction facts together with each addition fact.

4. Moshanke knows that $432 + 165 = 597$.

Moshanke also knows that 168 is 3 more than 165.

(a) How much is $432 + 168$?

(b) $324 + 239 = 563$

How much is $327 + 239$?

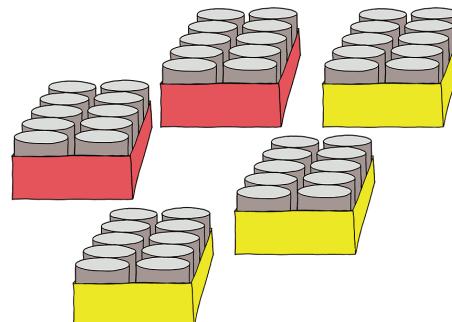
(c) $541 + 165 = 706$

How much is $545 + 165$?

5. Here are two red boxes and three yellow boxes.

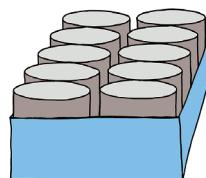
Each box contains 10 tins of Vienna sausages.

(a) How many tins are there in all the boxes together?



There are 10 sausages in each tin.

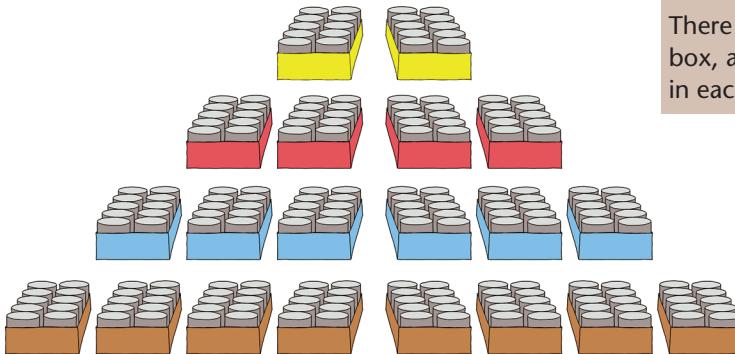
(b) How many sausages are there in all five boxes together?



Each box has 10 tins.



Each tin has 10 Vienna sausages.



6. (a) How many tins are in the yellow boxes shown above?
- (b) How many tins are in the red boxes?
- (c) How many tins are in the blue boxes?
- (d) How many tins are in the brown boxes?

Doubling is an easy way to make addition facts.

For example, it is easy to double 30:

$$30 + 30 = 60$$

We can say: **60 is the double of 30.**

7. Write number sentences to state the doubles of the numbers below.
Example: $3 + 3 = 6$; $30 + 30 = 60$; $300 + 300 = 600$

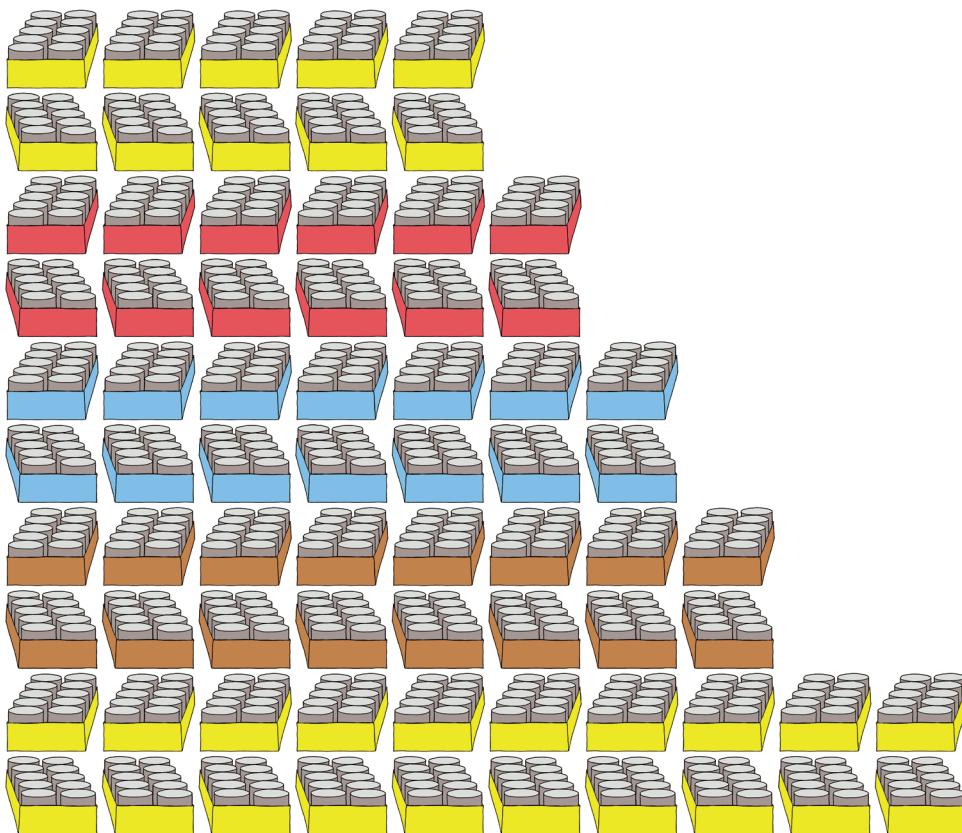
3	4	5	6	7	8	9	10	11
30	40	50	60	70	80	90	100	110
300	400	500	600	700	800	900	1 000	1 100

8. 300 is half of 600. How much is half of each number below?
 - (a) 700
 - (b) 800
 - (c) 1 000
 - (d) 500
 - (e) 250
 - (f) 300
9. (a) How many sausages are in the yellow boxes above?
 (b) How many sausages are in the red boxes?
 (c) How many sausages are in the blue boxes?
 (d) How many sausages are in the brown boxes?

10. (a) How many tins are there altogether in all the boxes in the picture above question 6?

(b) How many sausages are there altogether in all the tins in the picture above question 6?

11. How many sausages are there altogether in the tins below?



12. How much is each of the following?

 - (a) $140 - 70$
 - (b) $140 - 80$
 - (c) $140 - 60$
 - (d) $140 - 50$
 - (e) $140 - 100$
 - (f) $140 - 90$
 - (g) $160 - 80$
 - (h) $160 - 90$
 - (i) $160 - 100$
 - (j) $180 - 90$

3.3 Doubling and other ways to make facts

1. How much is each of the following?

- | | |
|--------------------|--------------------|
| (a) 3 more than 8 | (b) 5 more than 12 |
| (c) 2 more than 16 | (d) 3 more than 18 |
| (e) 4 more than 14 | (f) 1 more than 14 |

2. How much is each of the following?

$300 + 300$	$600 + 600$	$400 + 400$
$500 + 500$	$800 + 800$	$200 + 200$
$700 + 700$	$900 + 900$	$1\,000 + 1\,000$
$25 + 25$	$75 + 75$	$35 + 35$

You have to be able to make a plan when you do not quickly know the answer to a simple addition or subtraction question. One of the things you can do is to use your knowledge of doubles.

For example, you may not know immediately how much $70 + 80$ is. But if you know that $70 + 70 = 140$, you can add 10 and then you know that $70 + 80 = 150$.

If you do not quickly know how much $25 + 28$ is, your knowledge that $25 + 25 = 50$ can help you, for example like this:

28 is 3 more than 25 , so $25 + 28$ is 3 more than $25 + 25$.

So, $25 + 28 = 50 + 3 = 53$.

If you do not know how much $40 + 70$ is, your knowledge that $40 + 40 = 80$ can help you like this:

Because 70 is 30 more than 40 , $40 + 70$ is 30 more than $40 + 40$, so $40 + 70$ is $80 + 30$, which is 110.

3. Explain how doubling 60 can be used to find out how much $60 + 90$ is. Write your explanation clearly, so that someone else can easily understand you.
4. Explain how doubling can be used to find the answer to each of the following.

(a) $75 + 79$	(b) $400 + 700$
(c) $60 + 90$	(d) $50 + 90$

5. Copy the open number sentences for which you *cannot* give the answers quickly. You will work on them later.

$$9 + 6 = \dots$$

$$7 + 6 = \dots$$

$$7 + 8 = \dots$$

$$900 + 600 = \dots$$

$$700 + 600 = \dots$$

$$700 + 800 = \dots$$

$$1\,500 - 600 = \dots$$

$$1\,300 - 700 = \dots$$

$$1\,500 - 800 = \dots$$

$$60 + 60 = \dots$$

$$80 + 50 = \dots$$

$$700 + 700 = \dots$$

$$50 + 80 = \dots$$

$$40 + 90 = \dots$$

$$30 + 100 = \dots$$

$$130 - 50 = \dots$$

$$130 - 40 = \dots$$

$$1\,300 - 300 = \dots$$

$$13 - 8 = \dots$$

$$13 - 9 = \dots$$

$$12 - 3 = \dots$$

$$170 - 60 = \dots$$

$$18 - 6 = \dots$$

$$13 - 6 = \dots$$

$$15 - 8 = \dots$$

$$150 - 70 = \dots$$

$$110 - 60 = \dots$$

$$16 - 8 = \dots$$

$$16 - 7 = \dots$$

$$1\,100 - 500 = \dots$$

$$180 - 90 = \dots$$

$$18 - 8 = \dots$$

$$140 - 60 = \dots$$

$$17 - 8 = \dots$$

$$600 + 900 = \dots$$

$$170 - 90 = \dots$$

$$9 + 8 = \dots$$

$$7 + 9 = \dots$$

$$70 + 40 = \dots$$

$$900 + 800 = \dots$$

$$700 + 900 = \dots$$

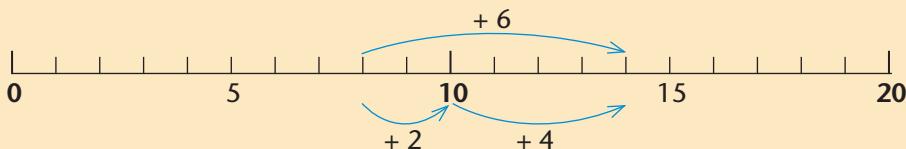
$$700 + 400 = \dots$$

$$1\,700 - 600 = \dots$$

$$1\,600 - 700 = \dots$$

$$1\,100 - 400 = \dots$$

Here is a way to see that $8 + 6 = 14$:



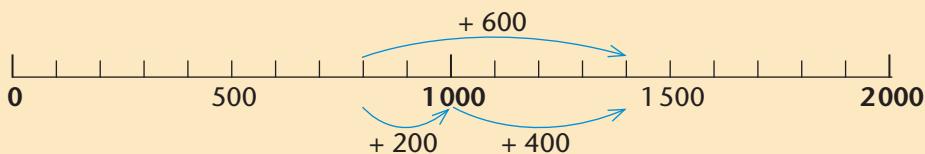
6 can be added to 8 in two steps:

$$8 + 2 = 10 \text{ followed by } 10 + 4 = 14.$$

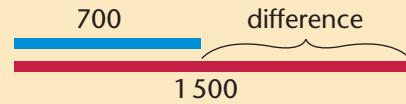
We can write as follows to show this thinking:

$$8 + 2 \rightarrow 10 + 4 = 14.$$

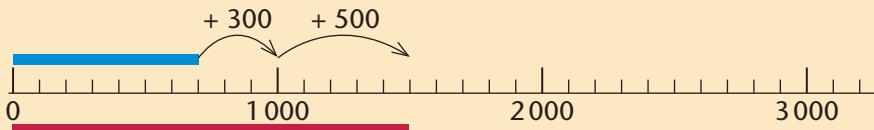
You can also think of a number line to know how much $800 + 600$ is:



To find out how much $1\ 500 - 700$ is, it may help to ask yourself what the **difference** between the two numbers is.



Another way is to ask yourself what you need to add to the smaller number to reach the bigger number.



This thinking can be shown as follows:

$$700 + 300 \rightarrow 1\ 000 + 500 = 1\ 500$$

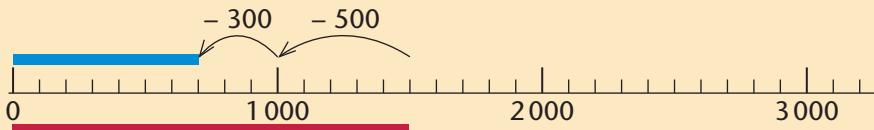
The above number line diagram shows an **addition fact** and **two subtraction facts**:

$$700 + 800 = 1\ 500$$

$$1\ 500 - 700 = 800$$

$$1\ 500 - 800 = 700$$

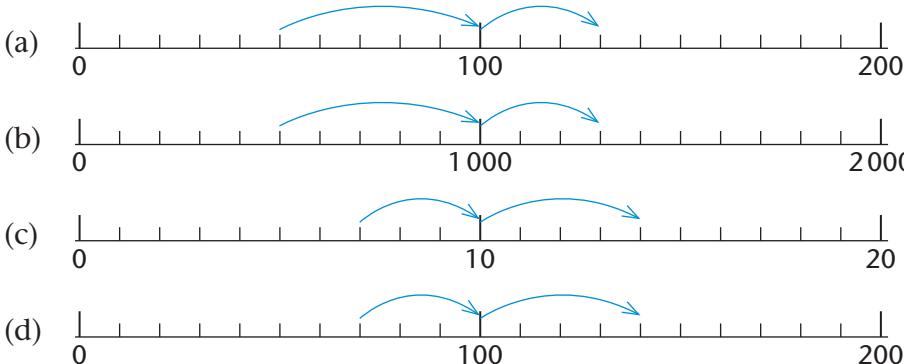
You may also think of moving backwards on the number line:



This thinking can also be shown like this:

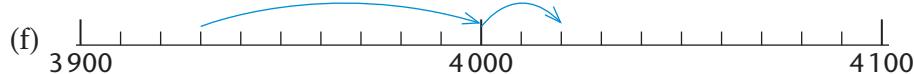
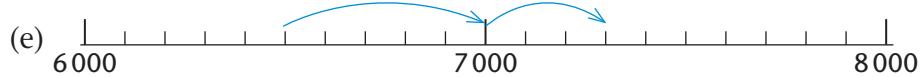
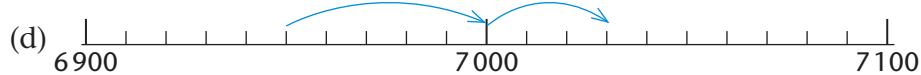
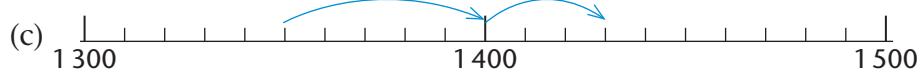
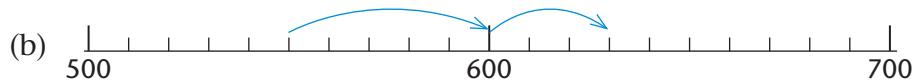
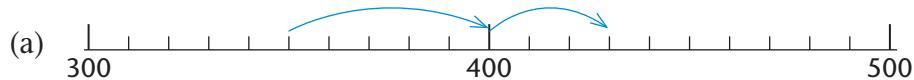
$$1\ 500 - 500 \rightarrow 1\ 000 - 300 = 700$$

6. Write the addition fact and the two subtraction facts that are shown by each number line diagram.



7. Go to the number sentences which you copied in question 5. Try to find answers for them without counting.
 8. How much is each of the following?

(a) $70 + 80$	(b) $700 + 800$
(c) $150 - 80$	(d) $150 - 70$
(e) $1\,500 - 700$	(f) $1\,500 - 800$
(g) $40 + 50$	(h) $400 + 500$
(i) $4\,000 + 5\,000$	(j) $5\,000 + 4\,000$
(k) $70 + 60$	(l) $700 + 600$
(m) $1\,300 - 700$	(n) $900 + 600$
(o) $600 + 800$	(p) $1\,500 - 900$
(q) $1\,400 - 800$	(r) $3\,000 - 800$
 9. Write the addition fact and the two subtraction facts that are shown by each number line diagram.



-
10. Copy the number sentences for which you *cannot* find the answers quickly.

$160 - 100 = \dots$

$160 - 40 = \dots$

$160 - 30 = \dots$

$100 - 80 = \dots$

$180 - 50 = \dots$

$180 - 70 = \dots$

$180 - 90 = \dots$

$180 - 80 = \dots$

$180 - 60 = \dots$

$180 - 100 = \dots$

$80 - 40 = \dots$

$80 - 30 = \dots$

$100 - 30 = \dots$

$130 - 80 = \dots$

$130 - 70 = \dots$

$130 - 90 = \dots$

$130 - 30 = \dots$

$130 - 60 = \dots$

$130 - 100 = \dots$

$130 - 40 = \dots$

$130 - 50 = \dots$

$100 - 20 = \dots$

$120 - 80 = \dots$

$120 - 70 = \dots$

$120 - 90 = \dots$

$120 - 20 = \dots$

$120 - 60 = \dots$

$120 - 100 = \dots$

$120 - 40 = \dots$

$120 - 30 = \dots$

$100 - 50 = \dots$

$150 - 80 = \dots$

$150 - 70 = \dots$

$150 - 90 = \dots$

$150 - 50 = \dots$

$150 - 60 = \dots$

$150 - 100 = \dots$

$150 - 40 = \dots$

$50 - 30 = \dots$

$100 - 70 = \dots$

$170 - 80 = \dots$

$170 - 90 = \dots$

$90 - 70 = \dots$

$170 - 70 = \dots$

$170 - 60 = \dots$

$170 - 100 = \dots$

$70 - 40 = \dots$

$70 - 30 = \dots$

$100 - 40 = \dots$

$140 - 80 = \dots$

$140 - 70 = \dots$

$140 - 90 = \dots$

$140 - 40 = \dots$

$140 - 60 = \dots$

$140 - 100 = \dots$

$140 - 90 = \dots$

$140 - 30 = \dots$

$100 - 90 = \dots$

$190 - 80 = \dots$

$190 - 70 = \dots$

$190 - 90 = \dots$

$190 - 20 = \dots$

$190 - 60 = \dots$

$190 - 100 = \dots$

$190 - 40 = \dots$

$190 - 30 = \dots$

$100 - 60 = \dots$

$160 - 80 = \dots$

$160 - 70 = \dots$

$160 - 90 = \dots$

$160 - 60 = \dots$

$160 - 50 = \dots$

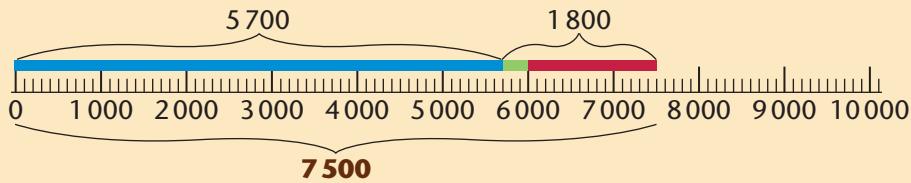
11. Now complete the sentences you have copied in question 10. You may work from the facts that you know or work in any other way you prefer.

3.4 Add and subtract multiples of 100 and 1 000

To calculate $5\ 700 + 1\ 800$ you may fill up to 6 000:

$$\begin{array}{c} 300 + 1\ 500 = 1\ 800 \\ \downarrow \qquad \qquad \searrow \\ \mathbf{5\ 700 + 300 \rightarrow 6\ 000 + 1\ 500 = 7\ 500} \end{array}$$

When you know that $5\ 700 + 1\ 800 = 7\ 500$, you also know that $7\ 500 - 1\ 800 = 5\ 700$ and that $7\ 500 - 5\ 700 = 1\ 800$.



1. Show how filling up to 4 000 can be used to calculate each of the following. In each case write two subtraction facts as well.
 - (a) $3\ 600 + 1\ 700$
 - (b) $3\ 800 + 600$
 - (c) $3\ 500 + 900$
 - (d) $3\ 700 + 1\ 600$

To calculate $8\ 200 - 3\ 700$, you may ask yourself how much should be added to 3 700 to get 8 200:

$$3\ 700 + ? = 8\ 200$$

To make it easier to answer this question, you can start by filling up to 4 000:

$$3\ 700 + ? \rightarrow 4\ 000 + ? = 8\ 200$$

2. Find the missing numbers:
 $3\ 700 + ? \rightarrow 4\ 000 + ? = 8\ 200$,
and use them to find the answer for $8\ 200 - 3\ 700$.
3. Calculate $6\ 500 - 2\ 700$ and $6\ 500 - 3\ 800$.



-
4. How much is each of the following? If it will help you, you may think of movements on the number line.

- (a) $1\ 700 + 900 + 700 + 800 + 900$
(b) $800 + 500 + 900 + 400 + 800 + 700 + 900$
(c) $1\ 900 + 600 + 800 + 800 + 500 + 400$



5. Your answers for questions 4(a), (b) and (c) should be the same. If they are not, you have made mistakes. Find and correct your mistakes.
6. Copy the number sentences for which you *cannot* find the answers quickly.

$$\begin{array}{lll} 360 - 80 = \dots & 360 + 90 = \dots & 760 - 670 = \dots \\ 560 - 480 = \dots & 680 + 70 = \dots & 430 - 270 = \dots \\ 380 - 90 = \dots & 780 + 80 = \dots & 780 - 60 = \dots \\ 720 - 50 = \dots & 770 + 40 = \dots & 940 - 70 = \dots \\ 810 - 730 = \dots & 330 + 80 = \dots & 670 - 90 = \dots \end{array}$$

$$\begin{array}{ll} 3\ 200 - 900 = \dots & 2\ 300 + 900 = \dots \\ 6\ 700 - 500 = \dots & 3\ 500 + 800 = \dots \\ 4\ 500 - 900 = \dots & 3\ 600 + 900 = \dots \\ 8\ 400 + 800 = \dots & 9\ 200 - 800 = \dots \\ 9\ 200 - 8\ 400 = \dots & 5\ 500 + 700 = \dots \\ 6\ 200 - 700 = \dots & 6\ 200 - 5\ 500 = \dots \\ 7\ 200 - 700 = \dots & 7\ 200 - 800 = \dots \\ 7\ 300 - 800 = \dots & 7\ 400 - 900 = \dots \end{array}$$

7. Now complete the number sentences that you have copied in question 6. You may work from the facts that you know or work in any other way you prefer.

3.5 Rounding off and compensating

To calculate $5\ 254 - 3\ 756$, you may ask yourself how much should be added to 3 756 to get 5 254:

$$3\ 756 + ? = 5\ 254$$

To make it easier to answer this question, you can start by filling up to 4 000:

$$3\ 756 + ? \rightarrow 4\ 000 + ? = 5\ 254$$

To make it even easier, you can use more steps:

$$3\ 756 + ? \rightarrow 3\ 800 + ? \rightarrow 4\ 000 + ? = 5\ 254$$

In fact, you can insert another step if you need one:

$$3\ 756 + ? \rightarrow 3\ 760 + ? \rightarrow 3\ 800 + ? \rightarrow 4\ 000 + ? = 5\ 254$$



1. Use any of the above ways to build up the answer for $5\ 254 - 3\ 756$.
2. Work like in the above example to calculate each of the following:

(a) $7\ 178 - 3\ 535$	(b) $6\ 572 - 1\ 944$
(c) $9\ 062 - 5\ 368$	(d) $7\ 869 - 2\ 543$

Here is a different way to subtract 2 543 from 7 869:

7 869 is $7\ 000 + 800 + 60 + 9$ and

2 543 is $2\ 000 + 500 + 40 + 3$.

To calculate $7\ 869 - 2\ 543$,
you can subtract 2 000 from 7 000,
 500 from 800,
 40 from 60,
 3 from 9, and

then put the answers together to build up the answer for $7\ 869 - 2\ 543$.

3. Use the above method to calculate the following:

(a) $8\ 856 - 3\ 243$	(b) $6\ 876 - 1\ 542$
-----------------------	-----------------------

4. What are the missing numbers in these number sentences?

(a) $7\ 000 + \dots = 7\ 543$

(b) $6\ 999 + \dots = 7\ 543$

A difficulty arises when we try to calculate $7\ 543 - 2\ 866$ by breaking down both numbers into place value parts.

7 543 is $7\ 000 + 500 + 40 + 3$ and 2 866 is $2\ 000 + 800 + 60 + 6$.

Now you will have to subtract 2 000 from 7 000,
800 from 500,
60 from 40 and
6 from 3.

Can you do this?

One way to deal with this difficulty is to keep in mind that

$$7\,543 = 544 + 6\,999,$$

and to then first subtract 2 866 from 6 999.

Another way to calculate $7\ 543 - 2\ 866$ is to replace $7\ 000 + 500 + 40 + 3$ with $6\ 000 + 1\ 400 + 130 + 13$.

7. Check whether $7\ 000 + 500 + 40 + 3$ is equal to $6\ 000 + 1\ 400 + 130 + 13$.
 8. Calculate $7\ 543 - 2\ 866$ by subtracting the place value parts of $2\ 866$ from 13 , 130 , $1\ 400$ and $6\ 000$.

To change the expanded notation $8\ 000 + 200 + 30 + 5$ for the number 8 235 to a form that will make it easier to subtract numbers from 8 235, you can **transfer** parts of numbers as shown below:

$$\begin{aligned} 8\ 235 &= 8\ 000 + 200 + 30 + 5 \\ &= 7\ 000 + 1\ 100 + 120 + 15 \end{aligned}$$

9. Write each of these numbers in expanded notation. Then change the expanded notation to a form that will make it easy to subtract 5 898 from the number.
- (a) 8 432 (b) 9 014 (c) 7 566 (d) 8 141

To “transfer” means to move something; to take it from one place to another.

10. How much is each of the following? You can use any method.
- (a) $8\ 432 - 5\ 898$ (b) $9\ 014 - 5\ 898$
(c) $7\ 566 - 5\ 898$ (d) $8\ 141 - 5\ 898$

3.6 Use brackets to describe your thinking

When you want to calculate $8\ 235 - 4\ 789$ by breaking down both numbers into their place value parts, you will have to replace $8\ 000 + 200 + 30 + 5$ by something else to make it easy to subtract the parts from the parts.

Your thinking to do this can be shown in the following ways:

$$\begin{aligned} 8\ 235 &= 8\ 000 + 200 + 30 + 5 \\ &= \underbrace{7\ 000}_{7\ 000} + \underbrace{1\ 000}_{1\ 000} + \underbrace{100}_{100} + \underbrace{100}_{100} + \underbrace{20}_{20} + \underbrace{10}_{10} + \underbrace{5}_{5} \\ &= 7\ 000 + 1\ 100 + 120 + 15 \end{aligned}$$

Another way to show how you are thinking is to use **brackets**:

$$\begin{aligned} 8\ 235 &= 8\ 000 + 200 + 30 + 5 \\ &= (7\ 000 + 1\ 000) + (100 + 100) + (20 + 10) + 5 \\ &= 7\ 000 + (1\ 000 + 100) + (100 + 20) + (10 + 5) \\ &= 7\ 000 + 1\ 100 + 120 + 15 \end{aligned}$$

1. Use brackets to show how you would think to replace $9\ 000 + 200 + 40 + 5$ to make it easier to calculate $9\ 245 - 3\ 678$ by breaking down both numbers into place value parts.
2. Use $\sim\sim\sim$ signs instead of brackets to describe the thinking that is shown below.

$$\begin{aligned} 6\ 425 &= 6\ 000 + 400 + 20 + 5 \\ &= (5\ 000 + 1\ 000) + (300 + 100) + (10 + 10) + 5 \\ &= 5\ 000 + (1\ 000 + 300) + (100 + 10) + 15 \\ &= 5\ 000 + 1\ 300 + 110 + 15 \end{aligned}$$

To add numbers you can break them down into their place value parts. You can then rearrange and recombine the place value parts and build up the answer.

For example, to calculate $5\ 235 + 3\ 352$ you can think as follows:

$$\begin{aligned} &\quad \overbrace{5\ 235}^{} + \overbrace{3\ 352}^{} \\ &= \overbrace{5\ 000 + 200 + 30 + 5}^{} + \overbrace{3\ 000 + 300 + 50 + 2}^{} \\ &= \underbrace{5\ 000}_{} + \underbrace{3\ 000}_{} + \underbrace{200}_{} + \underbrace{300}_{} + \underbrace{30}_{} + \underbrace{50}_{} + \underbrace{5}_{} + \underbrace{2}_{} \\ &= \quad 8\ 000 \quad + \quad 500 \quad + \quad 80 \quad + \quad 7 \\ &= 8\ 587 \end{aligned}$$

3. Use brackets to show how $5\ 235 + 3\ 352$ was calculated in the above example.
4. You can write in any way you prefer to do these calculations.
 - (a) $4\ 253 + 5\ 163$
 - (b) $6\ 134 + 2\ 655$

In some cases there is a slight problem.

For example, when you calculate $2\ 768 + 3\ 547$ in the way shown above, you end up with

$$\begin{aligned} &\quad \overbrace{2\ 000 + 3\ 000 + 700 + 500}^{} + \overbrace{60 + 40 + 8 + 7}^{} \\ &= \quad 5\ 000 \quad + \quad 1\ 200 \quad + \quad 100 \quad + \quad 15 \end{aligned}$$

This must be replaced with the normal expanded notation before the answer can be built up:

$$5\ 000 + \underbrace{1\ 200}_{} + \underbrace{100}_{} + \underbrace{15}_{} = 6\ 000 + 300 + 10 + 5 = 6\ 315$$

-
5. Write the following in the normal expanded notation.
 - (a) $6\ 000 + 1\ 700 + 180 + 16$
 - (b) $3\ 000 + 1\ 100 + 120 + 11$
 - (c) $6\ 000 + 1\ 300 + 340 + 23$
 6. Calculate each of the following by first breaking down both numbers into their place value parts.

(a) $3\ 489 + 4\ 786$	(b) $2\ 784 + 4\ 562$
(c) $5\ 287 + 2\ 496$	(d) $3\ 987 + 2\ 565$

It is quite fortunate that numbers can be added in any order.

For example, to calculate $20 + 30 + 40$ it does not matter whether you do

$$(20 + 30) + 40 = 50 + 40 \text{ or}$$

$$(30 + 40) + 20 = 70 + 20 \text{ or}$$

$$(20 + 40) + 30 = 60 + 30.$$

The answer is 90 in all three cases.

7. Work out each total in the easiest way that you can.
 - (a) $30 + 40 + 50 + 60 + 70 + 80 + 90$
 - (b) $20 + 30 + 40 + 50 + 60 + 70 + 80 + 90$
 - (c) $300 + 400 + 500 + 600 + 700 + 800 + 900$
 - (d) $350 + 450 + 550 + 650 + 750 + 850 + 950$

To calculate $7\ 234 - 3\ 576$

you can replace $7\ 000 + 200 + 30 + 4$ by $6\ 000 + 1\ 100 + 120 + 14$,

or

you can replace $7\ 234$ by $235 + 6\ 999$.

You can use brackets to describe the second method:

$$\begin{aligned}7\ 234 - 3\ 576 &= (235 + 6\ 999) - 3\ 576 \\&= 235 + (6\ 999 - 3\ 576) \\&= 235 + 3\ 423 \\&= 3\ 658\end{aligned}$$

8. Calculate $6\ 154 - 2\ 769$ and show your thinking by using brackets.
You can use any method to do the calculation.

3.7 Add and subtract 4-digit numbers

Addition can be done by taking the following steps:

Step 1: Break both numbers down into their place value parts.

Step 2: Add each kind of place value part separately. This means add thousands to thousands, hundreds to hundreds, tens to tens and units to units.

Step 3: Make transfers if it is necessary.

Step 4: Combine the parts to build up the answer

Example: Calculate $3\ 487 + 2\ 274$.

$$\text{Step 1: } 3\,487 = 3\,000 + 400 + 80 + 7 \text{ and } 2\,274 = 2\,000 + 200 + 70 + 4$$

$$\text{Step 2: } 3\ 000 + 2\ 000 = 5\ 000$$

$$400 + 200 = 600$$

$$80 + 70 = 150$$

$$7 + 4 = 11$$

$$\text{Step 3: } 3\,487 + 2\,274 = 5\,000 + 600 + 150 + 11$$

$$= 5\,000 + 700 + 60 + 1$$

$$\text{Step 4: } = 5\ 761$$

Steps 2 and 3 can also be recorded as follows, to make it easier to keep track of the different place value parts:

$$3\,487 = 3\,000 + 400 + 80 + 7$$

$$2\,274 = 2\,000 + 200 + 70 + 4$$

$$3\,487 + 2\,274 = 5\,000 + 600 + 150 + 11$$

Subtraction can be done by taking the following steps:

Step 1: Break down both numbers into their place value parts.

Step 2: Make changes to the place value parts of the first number if necessary.

Step 3: Subtract each kind of place value part separately. This means subtract thousands from thousands, hundreds from hundreds, tens from tens and units from units.

Step 4: Combine the parts to build up the answer.

Example: Calculate $7\,234 - 3\,876$.

$$\begin{aligned} \text{Step 1: } 7\ 234 &= 7\ 000 + 200 + 30 + 4 \\ &= 6\ 000 + 1\ 100 + 120 + 14 \quad (\text{Step 2}) \end{aligned}$$

$$3\,876 = 3\,000 + 800 + 70 + 6$$

$$\begin{aligned} \text{Step 3: } 7\,234 - 3\,876 &= (6\,000 - 3\,000) + (1\,100 - 800) + (120 - 70) + (14 - 6) \\ &= \quad 3000 \quad + \quad 300 \quad + \quad 50 \quad + \quad 8 \end{aligned}$$

$$\text{Step 4: } = 3\ 358$$

3. Calculate each of the following by using the above method.
 - (a) $7\ 632 - 3\ 876$
 - (b) $5\ 114 - 3\ 566$
 - (c) $6\ 457 - 2\ 874$
 - (d) $8\ 436 - 4\ 787$
 4. (a) Calculate $4\ 787 + 3\ 649$.
(b) Is your answer for question 3(d) correct? If not, do it again.
 5. (a) $7\ 632 - 3\ 876$ can also be calculated by replacing $7\ 632$ by $633 + 6\ 999$. Do this and check whether you get the same answer as when you did question 3(a).
(b) Check your answers for questions 3(b) and (c) in the same way.
 6. Paul earned R8 245 and used R3 878 to buy a bicycle. How much money does he have left?
 7. Mustafizur earns R5 225 per week and Cyril earns R3 886. How much more than Cyril does Mustafizur earn?
 8. Carla has saved R5 678 to buy a leather couch that costs R9 455. How much more must she save before she can buy the couch?

3.8 Round off, estimate and solve problems

It is sometimes useful to estimate approximate answers for addition and subtraction. A good way to do this is to round off the numbers, and to calculate using the rounded-off numbers.

For example, $7\ 258 - 3\ 574$ can be approximated by rounding off to the nearest thousand:

$$7\ 000 - 4\ 000 = 3\ 000, \text{ so } 7\ 258 - 3\ 574 \text{ is approximately } 3\ 000.$$

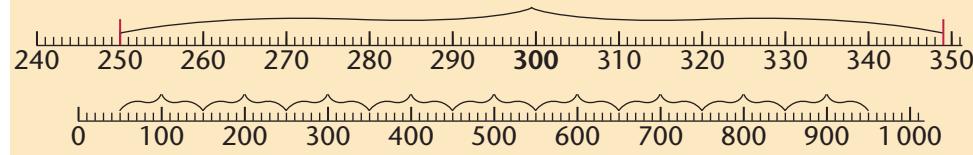
$7\ 258 - 3\ 574$ can also be approximated by rounding off to the nearest hundred:

$$7\ 300 - 3\ 600 = 3\ 700, \text{ so } 7\ 258 - 3\ 574 \text{ is approximately } 3\ 700.$$

The table below shows how rounding off to the nearest 100 is done. For example, all numbers between 150 and 249, including 150 and 249, are rounded off to 200.

Range	Rounded off to nearest 100	Examples
0 to 49	0	14, 34, 48, 49
50 to 149	100	50, 73, 101, 149
150 to 249	200	150, 188, 210, 249
250 to 349	300	250, 277, 325, 349
350 to 449	400	350, 359, 435, 449
.....
750 to 849	800	750, 786, 823, 849
850 to 949	900	850, 866, 899, 949
950 to 1 049	1 000	950, 967, 988, 1 049
1 050 to 1 149	1 100	1 050, 1 079, 1 149
.....
1 450 to 1 549	1 500	1 450, 1 485, 1 549

All the numbers between 250 and 349, including 250 and 349,
are rounded off to 300.

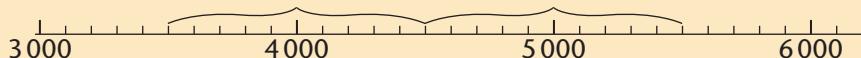


- (a) What is the biggest number that is rounded off to 200?
(b) What is the smallest number that is rounded off to 200?
- (a) What is the biggest number that is rounded off to 600?
(b) What is the smallest number that is rounded off to 600?
- (a) Write five different numbers that are all rounded off to 400.
(b) Write five different numbers that are all rounded off to 1 200.
- (a) What is the biggest number that is rounded off to 1 600?
(b) What is the smallest number that is rounded off to 1 600?
- (a) Write five different numbers that are all rounded off to 800.
(b) Write five different numbers that are all rounded off to 2 300.
(c) Write five different numbers that are all rounded off to 3 700.
- Round off each of the following numbers to the nearest 100:

513 548 550 1 111 3 249 3 250 8 749

Rounding off to the nearest 1 000 works in a similar way.

3 499 rounded off to the nearest 1 000 is 3 000 but
3 500 rounded off to the nearest 1 000 is 4 000.



Range	Rounded off to nearest 1 000	Examples
0 to 499	0	140, 340, 480, 499
500 to 1 499	1 000	500, 730, 1 010, 1 499
1 500 to 2 499	2 000	1 500, 1 880, 2 499
2 500 to 3 499	3 000	2 500, 3 250, 3 499
3 500 to 4 499	4 000	3 500, 4 350, 4 499
.....

- Continue the above table for numbers from 4 500 up to 7 499.
- Round off 2 499 to the nearest 1 000, and to the nearest 100.

-
9. Round off each of the following numbers to the nearest 10, the nearest 100, and the nearest 1 000.
- 2 317 2 344 2 345 2 349 2 499 8 005
10. Estimate in three ways how much $2\ 366 + 4\ 522$ is:
- by first rounding off each number to the nearest 1 000
 - by first rounding off each number to the nearest 100
 - by first rounding off each number to the nearest 10.
11. Estimate the answers to each of the following questions by rounding off the numbers to the nearest 1 000.
- Lennie needs 6 468 bricks to build a small house and 3 236 bricks to build a wall around his plot. How many bricks does Lennie need in total?
 - The bricklayer has already used 3 786 bricks of the 9 030 bricks that were delivered at a building site. How many bricks are still left?
 - A school ordered 9 348 books from a supplier. When the school started in January, 4 859 books had been received. How many books are still outstanding?
 - There are 3 478 learners in School District A and 5 585 learners in School District B. How many learners are there in the two districts together?
12. Make new estimates for questions 11(a) to (d), this time by rounding off the numbers to the nearest 100.
13. Make accurate calculations to find the exact answers for questions 11(a) to (d).

The difference between an estimate and an accurate answer is called the **error**. For example, you can estimate that $3\ 747 + 4\ 874$ is 9 000. The accurate answer is 8 621. The error in this case is 379.

14. (a) Calculate the errors for your estimates in question 11.
(b) Calculate the errors for your estimates in question 12.

What is mathematics?

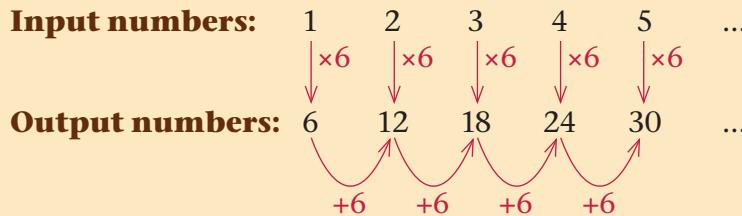
Most mathematicians and scientists say,

“Mathematics is the study of patterns.”

The more patterns you can see in mathematics, the better you are at mathematics!

So, this year, we continue studying patterns ...

You will learn that in **number sequences** such as the one below, there is a **pattern** that does not change although the numbers change: there is a horizontal and a vertical **calculation plan (rule)** that is the same for all the input and output numbers:



We can describe the patterns in such sequences in **words**, in a **table**, in a **flow diagram** and in a **calculation plan**. These help us to solve problems such as the following:

1. Write down the next five numbers in the sequence 6, 12, 18, 24, ...
2. Calculate the 100th number in the sequence 6, 12, 18, 24, ...
3. Is 436 a number in the sequence 6, 12, 18, 24, ... or not?
Explain!

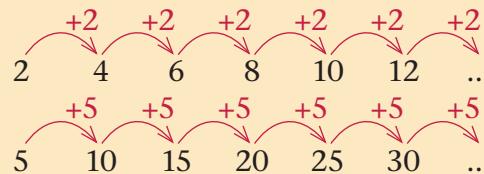
4.1 Patterns in the tables

Here is part of the multiplication table.

\times	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15					
4	4	8	12							
5	5	10	15				35			
6	6	12	18					48		
7	7	14	21							

1. Complete the table.
2. Which method(s) did you use to complete the table? Discuss.
3. Discuss what patterns you see in the table, and how that helps you to “remember” the tables.

Sally completes the tables by using a **horizontal pattern**. The pattern is to add the same number every time, like this:



John completes the tables by using a **vertical pattern**. The pattern is to multiply by the same number every time, like this:

Position no.	1	2	3	4	5	6	...
Sequence	2 ↓ 2	4 ↓ 4	6 ↓ 6	8 ↓ 8	10 ↓ 10	12 ↓ 12	...
Position no.	1 ↓ 5	2 ↓ 10	3 ↓ 15	4 ↓ 20	5 ↓ 25	6 ↓ 30	...
Sequence	5	10	15	20	25	30	...

4. Calculate the next five numbers and the 100th number in each table below. Are you going to use Sally's method, John's method, or a different method altogether?
- 2, 4, 6, 8, 10, 12, 14, 16, ...
 - 3, 6, 9, 12, 15, 18, 21, ...
 - 5, 10, 15, 20, 25, 30, 35, ...
 - 7, 14, 21, 28, 35, 42, 49, ...
 - 9, 18, 27, 36, 45, 54, 63, ...
 - 10, 20, 30, 40, 50, 60, 70, ...

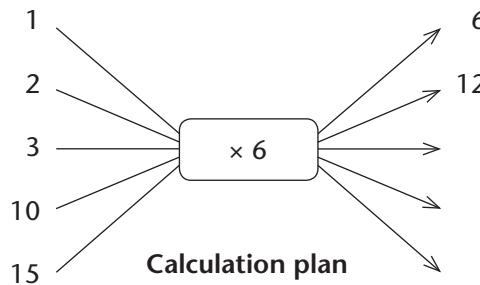
When the tables are written like this we call each row a **sequence**. We also call them **multiples**. 3, 6, 9, ... is the sequence of **multiples of 3**.

We can also describe the sequences with a flow diagram or with a table.

5. Complete this flow diagram and table for multiples of 6. What patterns do you notice?

Input numbers
Position no.

Output numbers
Multiples of 6



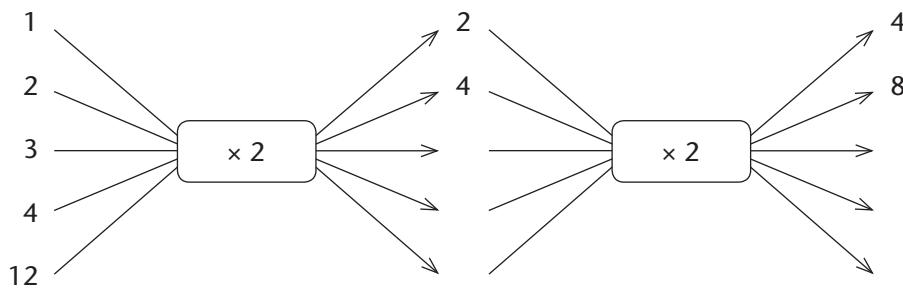
Position no.	1	2	3	10	15	20	40
x 6	6	12					

4.2 Equivalent flow diagrams

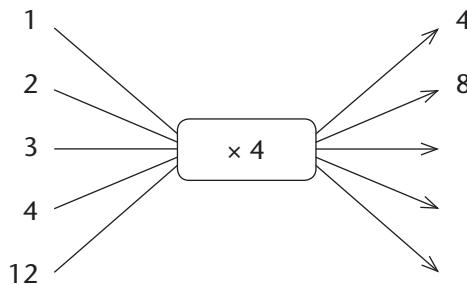
1. (a) Complete Flow diagrams A and B.
- (b) Note that Flow diagram A has two parts of a calculation plan, and the output numbers of the first part are the input numbers for the second part.

Compare Flow Diagrams A and B. How are they different, and how are they the same?

Flow diagram A



Flow diagram B



If two flow diagrams with different operators or order of operators give the same results, we say the flow diagrams are **equivalent**. Because they give the same results, we can choose which one we want to use.

So, because $4 = 2 \times 2$, instead of multiplying by 4, we can get the same answer by doubling, and then doubling the answer again.

- (c) Madeleine says she does not have to learn the four times table, because she can very easily get the answer by doubling and doubling again. For example, for 4×7 she says: “7 doubled is 14 and 14 doubled is 28, so $4 \times 7 = 28$.”

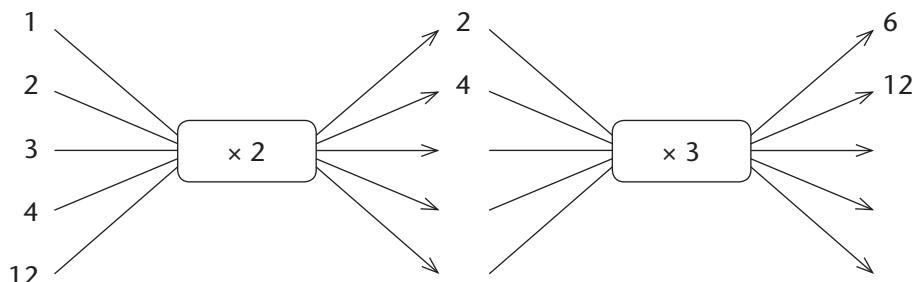
Use a plan like Madeleine’s to easily calculate these:

$$4 \times 8 \quad 4 \times 9 \quad 4 \times 11 \quad 4 \times 14 \quad 4 \times 23 \quad 8 \times 23 \quad 16 \times 14$$

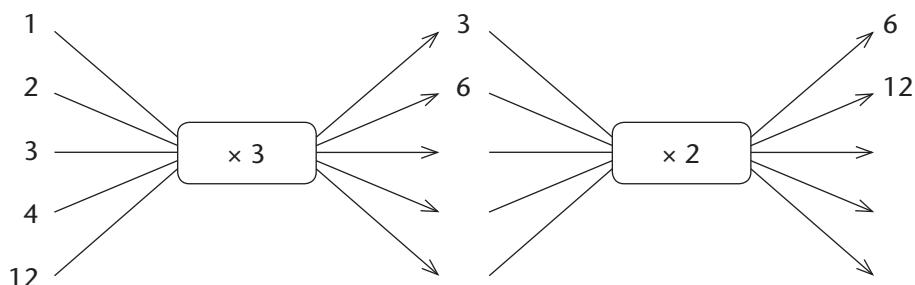
2. (a) Complete Flow diagrams C, D and E.

- (b) Now compare the flow diagrams. How are they different, and how are they the same?

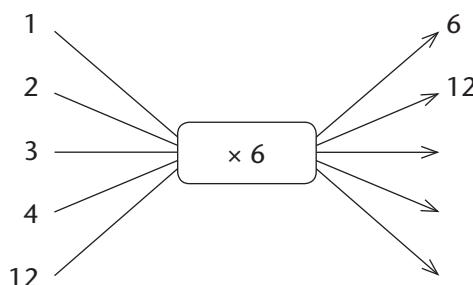
Flow diagram C



Flow diagram D



Flow diagram E



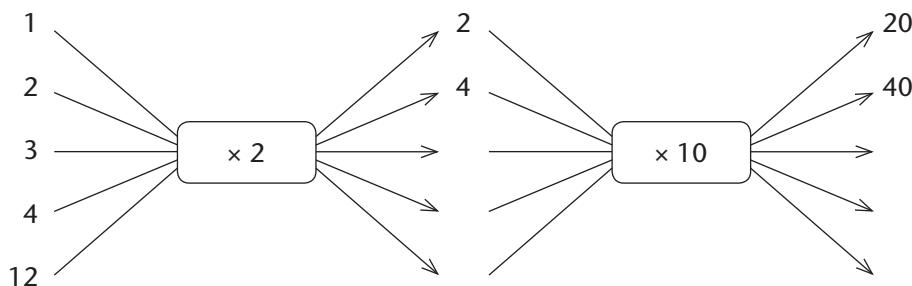
To multiply by 6, we can multiply by 2 and then multiply the answer by 3. Or we can first multiply by 3 and then by 2. The order does not matter.

- (c) Try to split the numbers into smaller factors to make these calculations easier.

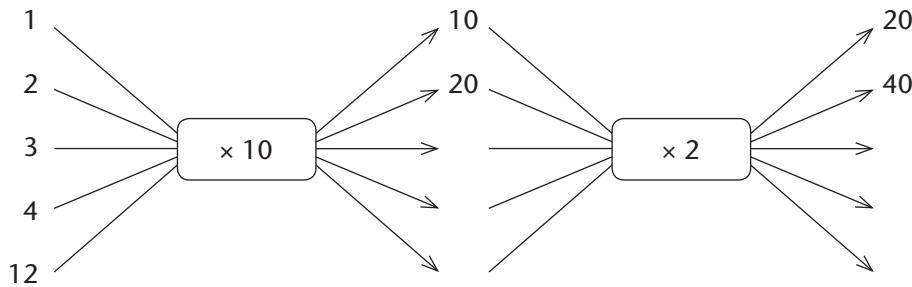
$$9 \times 6 \quad 9 \times 12 \quad 9 \times 24 \quad 8 \times 6 \quad 11 \times 14 \quad 32 \times 12 \quad 14 \times 20$$

3. (a) Complete Flow diagrams F, G and H.
(b) Compare the flow diagrams. How are they different, and how are they the same?

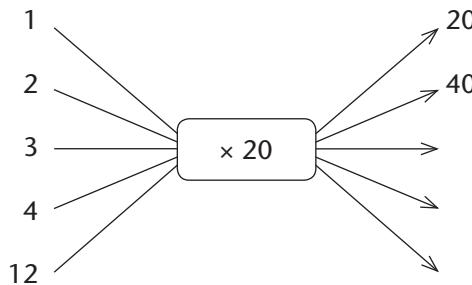
Flow diagram F



Flow diagram G



Flow diagram H



To multiply by 20, we can multiply by 2 and then multiply the answer by 10.
Or we can first multiply by 10 and then multiply the answer by 2.

- (c) Try to split the numbers into smaller factors to make these calculations easier.

$$9 \times 20 \quad 20 \times 12 \quad 20 \times 20 \quad 8 \times 30 \quad 8 \times 60 \quad 9 \times 70 \quad 9 \times 80$$

4.3 Sequences of non-multiples

- For each of the sequences of multiples below, do the following:
 - Continue the sequence for the next five numbers.
 - Find the 100th number in the sequence.
 - Is 436 a number in the sequence? How do you know?

Sequence A: 3, 6, 9, 12, 15, 18, ...

Sequence B: 4, 8, 12, 16, 20, 24, ...

Sequence C: 6, 12, 18, 24, 30, 36, ...

You already know the above sequences of multiples (tables).

But what about sequences of non-multiples? Try question 2 now.

2. (a) What is the same and what is different in Sequences A to D?
- (b) Calculate the next five and the 100th number in each sequence.
- (c) For each sequence: Is 436 a number in the sequence or not?

Sequence A: 4, 8, 12, 16, 20, 24, 28, ...

Sequence B: 5, 9, 13, 17, 21, 25, 29, ...

Sequence C: 6, 10, 14, 18, 22, 26, 30, ...

Sequence D: 7, 11, 15, 19, 23, 27, 31, ...

Sequences A to D have *different* numbers, and they all start with different numbers. But they are all *the same* in the sense that all of them have the same horizontal pattern:

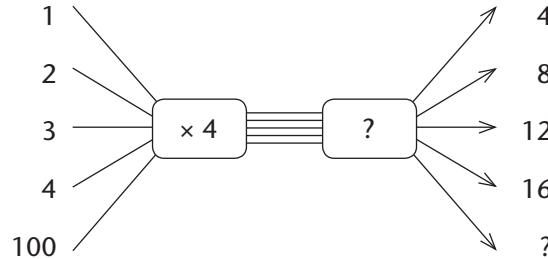
To get the next number you add 4.

So they are family!

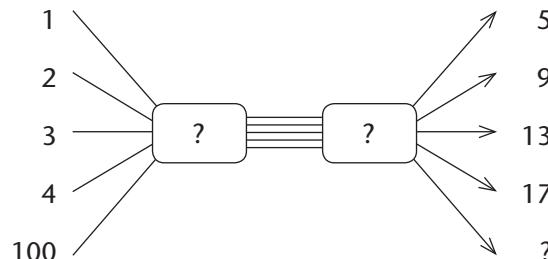
If they are family, how are their flow diagrams and vertical patterns the same and how are they different?

3. (a) Fill in the calculation plan (rule) for each of the sequences in question 2 in these flow diagrams.
- (b) How are the flow diagrams (rules) different, and how are they the same?

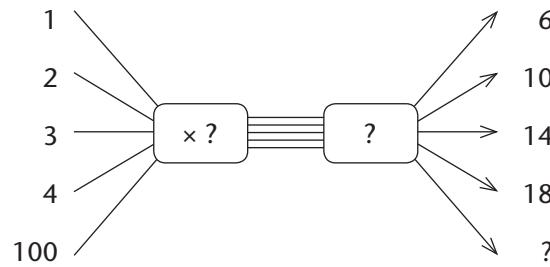
Flow diagram A



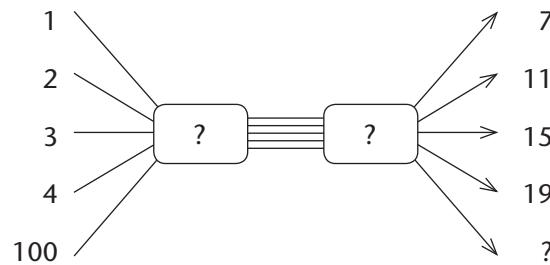
Flow diagram B



Flow diagram C



Flow diagram D



4. (a) Complete this table. Describe and discuss your methods.

Position	1	2	3	4	5	6	30
Position $\times 4$	4	8	12				
Position $\times 4 + 1$	5	9					
Position $\times 4 + 2$	6						
Position $\times 4 + 3$							

- (b) What patterns do you see in the table? What is the same in each sequence, and what is the same in each calculation plan (rule)?
5. (a) What is the same and what is different in the sequences below?
(b) Calculate the 100th number in each sequence.
(c) For each sequence: Is 435 a number in the sequence or not?

Sequence A: 5, 10, 15, 20, 25, 30, 35, ...

Sequence B: 6, 11, 16, 21, 26, 31, 36, ...

Sequence C: 7, 12, 17, 22, 27, 32, 37, ...

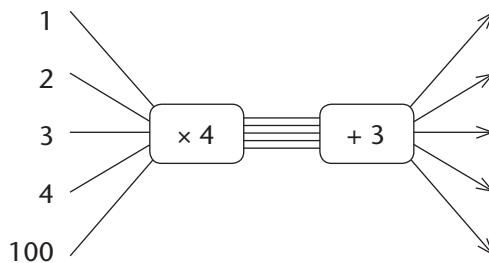
Sequence D: 8, 13, 18, 23, 28, 33, 38, ...

Sequence E: 9, 14, 19, 24, 29, 34, 39, ...

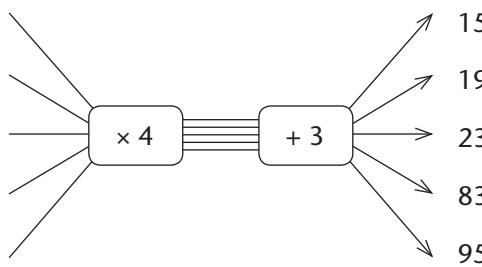
4.4 Flow diagrams and rules

Complete the missing parts in each of these flow diagrams.

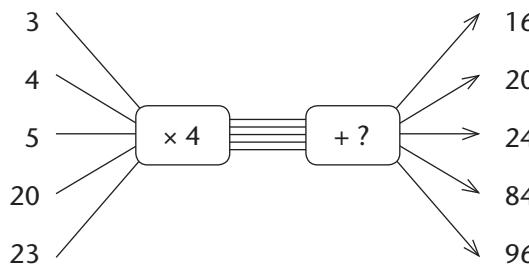
1.



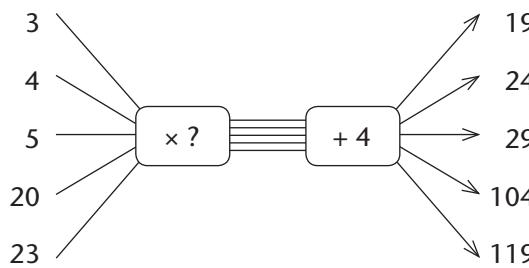
2.



3.



4.



5.1 What is multiplication?

We often know certain things about a situation, but then there may also be things that we do not know. Here are some examples.

- A. You may know that one can of juice costs R8 and that you need 23 cans. You may not know what the total cost of 23 cans is.



- B. You may know that there is 200 g of honey in a jar and that you will get only one eighth of it. You may not know how many grams of honey you will get.

$\frac{1}{8}$ of 200 is $\frac{1}{4}$ of 100 which is ...



- C. You may know that this house is 50 times bigger than the picture shows, and that the picture of the house is 4 cm high. You may want to know how high the actual house is.



What you do to find the information you need in situations like the above, is called **multiplication**.

Multiplication can be done in different ways, for example by repeated addition, by repeated doubling and by breaking down numbers into parts of which you already know the answers.

Here and on the next page you can see four different ways to calculate the total cost of 23 cans of juice if each can costs R8.

By repeated addition

The total cost of 23 cans of juice at R8 each is

$$8 + 8.$$

To find the total you may add 8 repeatedly,
23 times:

$$8 + 8 \rightarrow 16 + 8 \rightarrow 24 + 8 \rightarrow 32 + 8 \rightarrow 40 \dots$$

Fortunately there
are quicker and
easier methods of
multiplication.

By building up from known or easy parts

If you know some **multiplication facts**, for example that $10 \times 8 = 80$ and $3 \times 8 = 24$, you can work out 23×8 much more quickly.

A diagram showing the calculation 23×8 as a sum of three parts. The first part is 10×8 , represented by a group of 10 identical additions of 8. The second part is another 10×8 , also represented by a group of 10 identical additions of 8. The third part is 3×8 , represented by a group of 3 identical additions of 8. Curved arrows point from each part to its respective label below the additions.

Clearly,

$$\begin{aligned} 23 \times 8 &= 10 \times 8 + 10 \times 8 + 3 \times 8 \\ &= 80 + 80 + 24 \\ &= 184 \end{aligned}$$

In this method, the 23 is actually broken down into 10 and 10 and 3, or into 20 and 3. That is why the method is sometimes called the **breaking down and building up method**.

1. Show how 23×8 can be calculated even more quickly if you know that $20 \times 8 = 160$.
2. (a) Suleiman buys 32 loaves of bread at R6 each. Work out how much this will cost in total. You can do it by adding 6 repeatedly, or by breaking the work down into easy parts.
(b) Can the total cost of the loaves of bread be calculated by adding 32 repeatedly? Try it.

Multiplication by repeated doubling

$8 + 8 = 16$, that is 2×8

$16 + 16 = 32$, that is 4×8

$32 + 32 = 64$, that is 8×8

$64 + 64 = 128$, that is 16×8

To “double a number” means to add it to itself. For example, to double 26 you may add it to itself:
 $26 + 26 = 52$

$23 = 16 + 4 + 2 + 1$ so

$$\begin{aligned}23 \times 8 &= 16 \times 8 + 4 \times 8 + 2 \times 8 + 1 \times 8 \\&= 128 + 32 + 16 + 8 \\&= 184\end{aligned}$$

3. Do you think you can calculate 8×28 by doubling 28 repeatedly?
Try it.

Multiplication by rounding off and compensating

To calculate 23×8 you may first round off the 23 to 20:

$$20 \times 8 = 160$$

Of course this is not 23×8 .

We must change the 160 to undo the mistake we made by taking three eights too few.

$$\begin{aligned}\text{So } 23 \times 8 &= 160 + 3 \times 8 \\&= 160 + 24 \\&= 184\end{aligned}$$

Changing an answer to undo a mistake is called **compensation**. In this case we compensate for the rounding off to 20 by adding 24 to 160.

4. Calculate 28×8 by rounding off and compensating.
5. Calculate 32×29 in three different ways:
 - by doubling
 - by rounding off and compensating
 - by breaking down into known or easy parts

5.2 Multiplication facts

To be able to multiply bigger numbers by breaking them down into known parts, you need to know many multiplication facts. The work in this section will help you to form a greater knowledge of multiplication facts.

1. Write the next six numbers in each sequence:

- (a) 25 50 75 100 125 ...
- (b) 15 30 45 60 75 ...
- (c) 8 16 24 32 40 ...
- (d) 9 18 27 36 45 ...
- (e) 7 14 21 28 35 ...

2. How much is each of the following?

- (a) 5×25
- (b) 8×25
- (c) 10×25
- (d) 6×15
- (e) 7×8
- (f) 6×9
- (g) 7×9
- (h) 8×9

When you multiply bigger numbers, for example 73×46 , you often have to do simple calculations like those above and below quickly. It will help you to practise. If you cannot do all the calculations below in the time that the teacher allows, you should complete these exercises in your own time.

Start by answering the questions for which you can give the correct answers *immediately*. You can think about the other questions later.

- 3. (a) 3×6
- (b) 3×40
- (c) 3×7
- (d) 7×6
- (e) 70×6
- (f) 7×4

- 4. (a) 70×4
- (b) 70×40
- (c) 3×15
- (d) 5×12
- (e) 4×8
- (f) 80×4

5. (a) $2\ 800 + 120$ (b) $2\ 800 + 420$
(c) $2\ 920 + 420$ (d) $3\ 220 + 120$
(e) $3\ 340 + 18$ (f) 73×46

6. (a) $1\ 800 + 210$ (b) $1\ 800 + 480$
(c) $2\ 010 + 480$ (d) $2\ 280 + 210$
(e) $2\ 490 + 56$ (f) 38×67

7. (a) $1\ 800 + 360$ (b) $1\ 800 + 120$
(c) $2\ 160 + 120$ (d) $1\ 920 + 360$
(e) $2\ 280 + 24$ (f) 96×24

8. (a) $2\ 000 + 240$ (b) $2\ 000 + 150$
(c) $2\ 240 + 150$ (d) $2\ 150 + 240$
(e) $2\ 390 + 18$ (f) 43×56

5.3 Double, double and double again

You already know that to **double** a number means to add it to itself.

For example, when you double 5, you get 10.

When you double 10, you get 20.

When you double 20, you get 40.

When you double 50, you get 100.

When you double 100, you get 200.

1. What do you get when you double 200?

When you double 50 you get 100 which is $50 + 50$.

We can also say it is “two fifties” or 2×50 .

When you double again you get 200 which is $50 + 50$ and another $50 + 50$.

So when you double 50 and double again, you get 200 which is $50 + 50 + 50 + 50$.

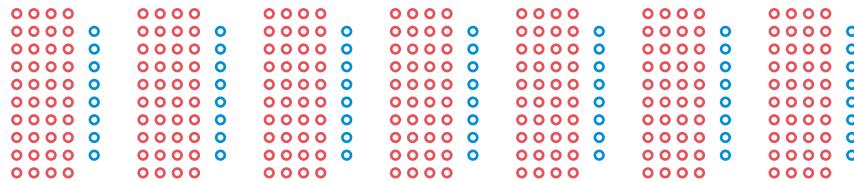
We can also say this is “four fifties” or 4×50 .

By doubling, we have found the multiplication fact $4 \times 50 = 200$.

-
2. (a) How many fifties do you get when you double 50, double again, and double once more?
- (b) Which multiplication fact for 50 have you now found?
3. (a) Double 30, double again, and double once more.
- (b) Which three multiplication facts for 30 have you found?
- (c) Double once more.
- (d) Which three multiplication facts for 60 have you found?
4. In each case, say whether the sequence was formed by doubling repeatedly or by adding repeatedly. Also write the next three numbers in each sequence.
- (a) 3 6 9 12 15 18 ...
- (b) 3 6 12 24 ...
- (c) 25 50 75 100 125 150 ...
- (d) 25 50 100 200 ...
- (e) 6 12 24 ...
- (f) 9 18 36 ...
- (g) 7 14 21 ...
- (h) 7 14 28 ...
- (i) 21 42 84 ...
- (j) 6 12 18 ...
5. (a) How was this sequence formed?
90 180 270 360 450 540 630
- (b) Which number in this sequence is equal to 90×3 ?
- (c) Which number in this sequence is equal to 90×6 ?
- (d) Which number in this sequence is equal to 4×90 ?
6. (a) How was this sequence formed?
70 140 280 560 1 120 2 240 4 480
- (b) Which number in this sequence is equal to 70×8 ?
- (c) Which number in this sequence is equal to 70×4 ?
- (d) Which number in this sequence is equal to 16×70 ?

5.4 Multiply by building up from known parts

1. $4 \times 6 = 24$ and $4 \times 9 = 36$.
 - (a) Combine the above two facts to find out how much 4×15 is.
 - (b) Now you know how much 4×6 is, and 4×9 , and 4×15 .
Note that $9 + 15 = 24$,
and use what you know to find out how much 4×24 is.
2. $7 \times 40 = 280$ and $7 \times 8 = 56$.
 - (a) How much is $7 \times 40 + 7 \times 8$?
 - (b) How much is 7×48 ?



3. Here are two multiplication facts: $8 \times 30 = 240$ and $8 \times 6 = 48$.
How much is 8×36 ?
4. Combine the given facts in each case to form another fact.
 - (a) $6 \times 70 = 420$ and $6 \times 9 = 54$
 - (b) $80 \times 4 = 320$ and $7 \times 4 = 28$
 - (c) $300 \times 6 = 1800$, $60 \times 6 = 360$ and $3 \times 6 = 18$
5. (a) Which multiplication facts will make it easy to find out how much 5×36 is?
(b) Which multiplication facts will make it easy to find out how much 36×5 is?

Here are some multiplication facts that you may use to find the answers for question 6:

$$30 \times 50 = 1500 \quad 4 \times 50 = 200 \quad 30 \times 8 = 240 \quad 4 \times 8 = 32$$

6. How much is each of the following?
 - (a) 34×50
 - (b) 34×8
 - (c) $34 \times 50 + 34 \times 8$
 - (d) 34×58

-
7. Which facts do you need to know to find out how much $53 \times 40 + 53 \times 7$ and 53×47 are?

To find out how much 46×73 is by using the breaking down and building up method, you need to know how much 46×70 is and how much 46×3 is. To know that, you need to know how much 40×70 , 6×70 , 40×3 and 6×3 are.

8. In each case state which facts you need to know so that you can easily find the answer by using the breaking down and building up method. If you know the facts that are needed, give the answer too.
- (a) 57×68 (b) 94×49 (c) 68×68 (d) 73×19
(e) 87×88 (f) 34×98 (g) 57×52 (h) 63×85

Note that 94×49 can be calculated as follows:

$94 \times 100 = 9\ 400$, and half of that is 4 700,
so $94 \times 50 = 4\ 700$.

94×49 is 94 less than 94×50 ,
so $94 \times 49 = 4\ 700 - 94 = 4\ 606$.

9. Show how 73×19 , 34×98 and 57×52 can be calculated in similar ways.

5.5 Strengthen your knowledge of multiplication facts

1. Write only the answers that you know in your book. If you do not know an answer, copy the question into your book, for example (d) $5 \times 7 = \dots$. You will answer those questions later.

- (a) 4×6 (b) 7×5 (c) 4×9
(d) 5×7 (e) 40×9 (f) 5×70
(g) 2×7 (h) 20×70 (i) 3×7
(j) 6×7 (k) 9×2 (l) 4×9
(m) 8×9 (n) 40×90 (o) 20×60
(p) 30×60 (q) 40×60 (r) 50×60

2. Write the next six numbers in each sequence. While you do this you may find the answers for some parts of question 1. Fill those answers in when you find them.

(a) 6 12 18 24 ...

(b) 60 120 180 240 ...

(c) 600 1 200 1 800 2 400 ...

3. Copy and complete this table of multiplication facts. In cases where you do not know the answer, you may look at the sequences that you wrote in question 2, or use any other method.

$3 \times 6 =$	$30 \times 6 =$	$3 \times 60 =$	$30 \times 60 =$
$7 \times 6 =$	$70 \times 6 =$	$7 \times 60 =$	$70 \times 60 =$
$8 \times 6 =$	$80 \times 6 =$	$8 \times 60 =$	$80 \times 60 =$
$5 \times 6 =$	$50 \times 6 =$	$5 \times 60 =$	$50 \times 60 =$
$2 \times 6 =$	$20 \times 6 =$	$2 \times 60 =$	$20 \times 60 =$
$9 \times 6 =$	$90 \times 6 =$	$9 \times 60 =$	$90 \times 60 =$
$6 \times 6 =$	$60 \times 6 =$	$6 \times 60 =$	$60 \times 60 =$
$4 \times 6 =$	$40 \times 6 =$	$4 \times 60 =$	$40 \times 60 =$
$10 \times 6 =$	$100 \times 6 =$	$10 \times 60 =$	$100 \times 60 =$

4.
 - (a) Make a similar table for the multiplication facts for 7 and 70, but do not fill in any answers yet.
 - (b) Now fill in the answers that you know immediately.
 - (c) Try to find more answers. If you need to, you may also write sequences for 7, 70 and 700, like the sequences in question 2.
 5. Do what you have done for 7 and 70 in question 4, for each of the following.
 - (a) 8 and 80
 - (b) 9 and 90
 6. For which of the following can you give the answers straight away?

70 × 90

60 × 90

70 × 80

60 × 70

80 × 90

40 × 70

80 × 80

90 × 90

5.6 Practise multiplication and solve problems

- How much is each of the following?
 - 87×37
 - 29×37
 - 78×32
 - 58×37
 - 26×48
 - 48×52
 - 72×27
 - 54×36
 - 91×13
 - 76×39
 - 78×38
 - 76×41
 - (a) In a new plantation, 32 rows of 78 pine trees in each row were planted. How many trees were planted in this plantation?
(b) In another new plantation, 39 rows of trees were planted. Each row had 32 trees. What is the total number of trees planted in this plantation?
 - For the export market, the apple packers have to wrap and pack the apples in boxes of 36.
 - How many apples are packed in 54 boxes?
 - How many more apples are needed to fill 100 boxes in total?
 - Nandi is buying 36 cups and 48 bowls to serve coffee and soup at a netball tournament. The cups cost R22 each and the bowls cost R34 each. How much will Nandi pay in total for the cups and bowls?
 - A passenger train has 12 carriages with 36 seats per carriage. How many empty seats are there if 338 people boarded the train?
 - The Olive Farm Stall sold 43 ℥ of olive oil at R59 per litre in January. In February the farm stall owner put up the price and received R86 more for 43 ℥. What was the new selling price for 1 ℥ of olive oil?
 - Pam earns R55 for every hour that she babysits. Last month she looked after babies for 43 hours. She spent R346 on a pair of shoes and R129 on a dress. How much money does she have left over?

-
8. A wire artist has used up all his steel wire. He still needs 83 pieces of wire, each 18 cm long, to complete a wire sculpture.
 - (a) What is the total minimum length of wire that he needs?
 - (b) How many centimetres of wire will be left over if he can only buy wire in full metres?
 9. Chairs are arranged in rows next to each other in the school hall for assembly. Each row has 26 chairs.
 - (a) How long is a row of chairs, if the width of each chair is 48 cm?
 - (b) How many rows of 26 chairs each are needed to seat 100 learners?
 10. Last week, Mrs Baker sold 18 pancakes for every 42 muffins that she sold. If she sold 72 pancakes, how many muffins did she sell?

5.7 Multiples, factors and products

The number 48 can be obtained by calculating 6×8 .

We can say:

- 48 is the **product** of 6 and 8.
- 48 is a **multiple** of 6.
- 48 is also a multiple of 8.
- 8 is a **factor** of 48.
- 6 is also a factor of 48.

We can also **express** (write) 48 as the product of two whole numbers in other ways:

$$2 \times 24 = 48 \qquad 3 \times 16 = 48 \qquad 4 \times 12 = 48$$

And then we can also express 48 as the product of 1 and 48 because $1 \times 48 = 48$.

1. Write down three ways in which 36 can be expressed as a product of two numbers. The two factors may be equal.
2. 42 is a multiple of 6, because $6 \times 7 = 42$. 60 is also a multiple of 6, because $6 \times 10 = 60$. Write down five other multiples of 6.

3. Find all the different ways in which each of the following numbers can be expressed as a product of two numbers.

(a) 24 (b) 36 (c) 60 (d) 72
(e) 100 (f) 120 (g) 180 (h) 240

4. Write down 10 multiples of 40.

5. (a) By what number do you have to multiply 40 to get 280?
(b) By what number do you have to multiply 40 to get 480?

6. Express each of the following numbers as a multiple of 40.

(a) 400 (b) 440
(c) 480 (d) 520
(e) 640 (f) 720

7. Express each of the following numbers as a multiple of 30.

(a) 600 (b) 690
(c) 720 (d) 840

8. How much is each of the following?

(a) 6×78 (b) $468 + 4$

Now think about what you worked out in question 8:

- In question (a) you worked out that $6 \times 78 = 468$.
 - In question (b) you worked out that $468 + 4 = 472$.

So, the number 472 can be expressed as $6 \times 78 + 4$.

Note that the number added to the product is smaller than both factors of 468. (4 is smaller than 78 and it is also smaller than 6.)

Also note that one of the two factors of 468 is smaller than 10. (6 is smaller than 10.)

9. Now express 873 in the way 472 is expressed above.
The one factor must be smaller than 10, and the number added
must be smaller than the smaller of the two factors.

-
10. Express each of the following numbers in the same way as above, using 8 as the smaller factor of the product part.
(a) 750 (b) 390 (c) 888 (d) 656
 11. Now express each of the numbers in question 10 as a product of 6 and another number, plus a number smaller than 6.

5.8 Division

We use division to find information about situations like A and B below.

- A. How many ribbons, each 4 cm long, can be cut from a roll of 824 cm ribbon tape?
- B. How long will each piece be if a roll of 824 cm ribbon tape is divided into 8 equal pieces?

In both situations, 824 cm of ribbon tape is divided into equal parts.

In Situation A, the **size of each part is known**, but the number of parts is not known.

In Situation B, it is the other way round: the number of equal parts is known, but the **size of the parts is not known**.

We use division for both these kinds of situations where a given quantity is made up of equal parts:

- A. to work out *how many parts there are*, if we know the size of the parts
- B. to work out *how big each part is*, if we know the number of parts.

To do division, we may use our knowledge of multiplication facts.

For example, $824 \div 4$ can be worked out as follows:

$$200 \times 4 = 800 \text{ and } 6 \times 4 = 24.$$

$$\text{So, } 206 \times 4 = 824 \text{ and this means that } 824 \div 4 = 206.$$

Division is called the **inverse** of multiplication. “To invert” means “to go the opposite way”.

1. How many classrooms can get 6 new chairs each, if 252 new chairs are available?
2. What is the cost of one table if 7 tables cost R420?

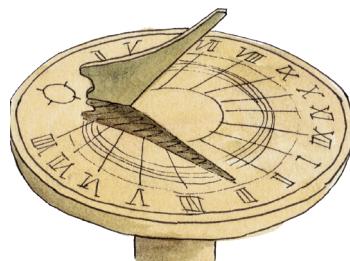
-
3. How many pieces of 4 cm each can be cut from a roll of wire that is 925 cm long?
 4. 720 netball balls are packed in 8 large crates. All the crates have the same number of balls. How many balls are there in each crate?
 5. Calculate.

(a) $846 \div 6$	(b) $904 \div 8$	(c) $452 \div 4$
(d) $774 \div 9$	(e) $625 \div 5$	(f) $729 \div 9$
 6. Fourteen cans of cooldrink costs R126.
 - (a) How much does one can cost?
 - (b) How much do 38 cans cost altogether?
 7. Sixteen loaves of bread cost R128. How much do 43 loaves cost?
 8. (a) How many minibuses are needed to transport 194 learners on an outing if each minibus can only seat 8 learners?
(b) How many minibuses are needed to transport 466 learners if each minibus can only seat 8 learners?
 9. (a) Magda packs 315 muffins into boxes of 4 muffins each. How many boxes does she need?
(b) How many boxes will she need if she packs 6 muffins in each box?
(c) How many boxes will she need if she packs 5 muffins in each box?
(d) If Magda sells all 315 muffins for R945 in total, how much does she get for each muffin?
 10. The Natural Sciences teacher has to mark 126 projects. If she marks 9 projects per day, how long will it take her to finish marking the projects?



6.1 A little history

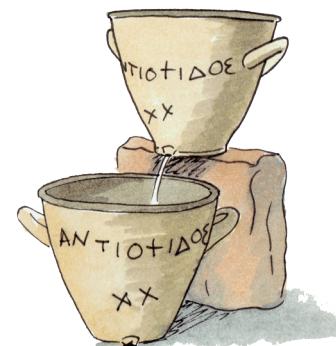
Very, very long ago, the ancient people were more concerned about “calendar time” than the time of day. To till their crops, knowledge of the seasons was important. It was only 5 000 to 6 000 years ago that the civilizations in the Middle East and Egypt found that they also needed ways to organise the time of day.



A sundial



An hourglass



A Greek water clock

In Egypt, at about 3 500 BC, the shadows of tall **obelisks** (tall pointed stone columns) moved like a kind of sundial dividing a day into “before noon” and “after noon”. These shadows also showed the shortest and the longest days of the year.

The Egyptians also developed the **sundial** around 1 500 BC to show the passing of hours. This device could of course only be used during daytime when the sun was shining.

Using a **water clock** was another way to measure time. The amount of water flowing out of or into a container at a steady pace was measured, and indicated the passing of time. Water clocks were used in Babylon (in modern-day Iraq) and Egypt around 1 600 BC. It is said that the Chinese used water clocks long before that.

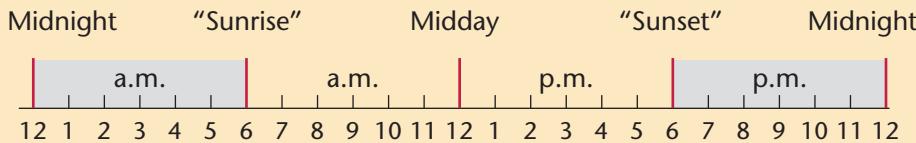
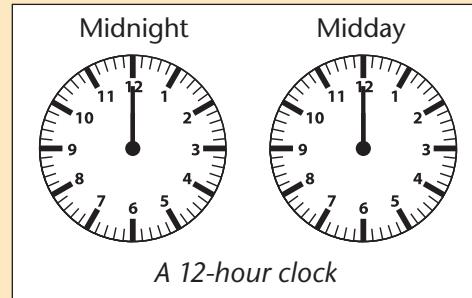
Even today we sometimes use an old instrument in our kitchens to measure time, for example when we boil an egg. This instrument, filled with fine sand, is called an **hourglass**. Do you know how it works? Find out!

6.2 Daytime hours and night-time hours

A **day** is the time it takes for the Earth to spin around on its own axis once. Half of the Earth faces the Sun. This half has light. The other half faces away from the Sun and so this half has darkness.

A day is divided into **24 hours**. We start counting the hours from midnight.

Even though we have 24 hours in one day most clocks show only 12 hours. The hour hand on this 12-hour clock moves around the clock twice in 24 hours.



When your friend says he will phone at 7 o'clock, you need to know whether it is 7 o'clock in the morning or 7 o'clock in the evening. We write 7 **a.m.** for the morning. We write 7 **p.m.** for the evening.

1. Thembu travelled from Soweto to Port Elizabeth. She started her journey at 6 a.m. She arrived at 6 p.m. How many hours did she travel?
2. Mishack worked at the restaurant from midday to midnight. How many hours did he work?
3. Tim starts working at 8:30 a.m. He works for 8 hours. What time does he finish work?
4. Rose works for 8 hours each day. She finishes work at 3:30 p.m. What time does she start working?
5. Navi slept from 10 p.m. to 6 a.m. How many hours did she sleep?

6.3 Read, tell and write time

About 4 000 years ago the Babylonians divided the **day** into 24 shorter parts of equal length, called **hours**. Each hour was then divided into 60 shorter parts of equal length, called **minutes**. Each minute was divided into 60 shorter parts called **seconds**.

How long is a minute?
Count steadily up to 60: "1 and 2 and 3 and 4 and 5 and 6... and 59 and 60."

We also talk about fractions of an hour, for example half an hour or a quarter of an hour.

1. Complete the following:

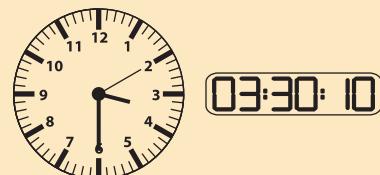
- 1 hour = ____ minutes = ____ seconds
- Half an hour = ____ minutes = ____ seconds
- One quarter of an hour = ____ minutes = ____ seconds
- Three quarters of an hour = ____ minutes = ____ seconds

2. Copy and complete the table. Explain your calculations.

Hours	$\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{2}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	3
Minutes							
Seconds							

These two clocks show the same time:
30 minutes and 10 seconds past three in
the morning.

The **analogue clock** on the left
measures 12-hour time around a circle.



The **digital clock** on the right measures 24-hour time in numbers.
Which clock do you find easier to read?

People catching aeroplanes may get confused between 8 a.m. and 8 p.m., so flight carriers use the 24-hour time notation. 8 p.m. is 20:00.

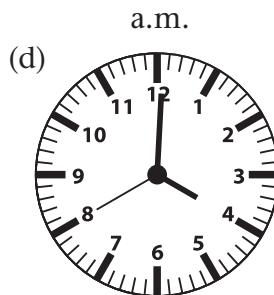
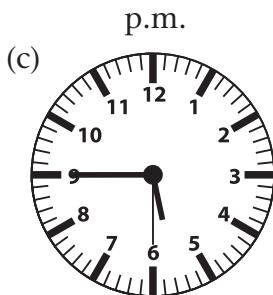
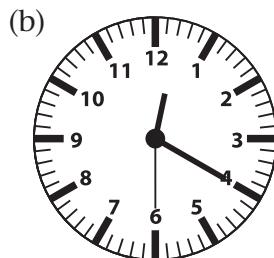
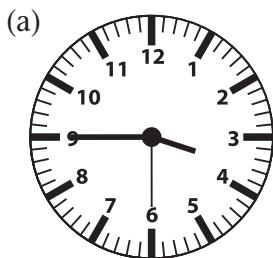
The hours from midnight through to the next midnight start at zero.
In 24-hour time notation, one minute after midnight is written as 00:01.

	12-hour time	24-hour time
12 midnight	12 a.m.	00:00
5 minutes past midnight	12:05 a.m.	00:05
12 noon (midday)	12 p.m.	12:00
12 minutes past noon	12:12 p.m.	12:12
a quarter to 10 at night	9:45 p.m.	21:45

3. Complete the table.

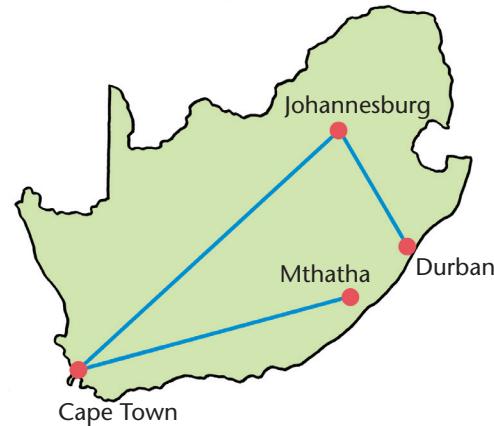
12-hour time	24-hour time	12-hour time	24-hour time
5 a.m.			14:00
	07:30	3:12 p.m.	
9:15 a.m.			17:32
	11:35	11:45 p.m.	

4. Match the 12-hour clocks with the 24-hour clocks. Notice that a.m. or p.m. is written below the 12-hour clocks. Give your answer by writing the letter of the 24-hour clock next to the question number of the 12-hour clock, for example (a) E.



A	17:45:30
B	16:00:40
C	00:20:30
D	15:45:30

-
5. Write these times in 24-hour notation.
- two o'clock in the morning
 - quarter past 10 at night
 - half past 11 in the morning
 - quarter to 12 at night
 - 30 seconds past 4 in the morning
 - 15 seconds past 9 in the evening
 - 20 minutes and 10 seconds to 8 in the evening
6. Draw analogue clocks that show the times in questions 5(a) to (d).
7. Write the times in words. For example:
22:04:55 is 4 minutes and 55 seconds past 10 in the evening
- 09:00:25
 - 08:15:30
 - 21:00:05
 - 12:15:25
 - 23:50:50
 - 00:12:40
 - 19:54:01
 - 15:00:15
8. Draw analogue clocks to show the times in question 7.
9. An aeroplane leaves from OR Tambo International Airport (Johannesburg) for Cape Town International Airport at 18:00. It lands at 20:10. How long was the flight?
10. A flight from King Shaka Airport (Durban) to OR Tambo International Airport took 45 minutes. The flight left at 06:00. At what time did the plane land?
11. A flight from Mthatha was scheduled to arrive at Cape Town International Airport at 16:00. It was 40 minutes late. At what time did the plane land?



6.4 Intervals of time

1. Discuss the meanings of the words printed in *italics*.
 - (a) I visited him *for 20 minutes*.
 - (b) I will speak to her *while* I walk home.
 - (c) *During school time* I don't use my cell phone.
 - (d) The show *starts at* eight and *ends at* eleven.
 - (e) The show *lasted* 4 hours.
 - (f) It happened *between* 10 *and* 11.
 - (g) *It took me* an hour to walk to the train station.
 - (h) *How long* does it take a silkworm to spin a cocoon?
2. Write your own sentences like those in question 1 using the following time words: long; between; lasted; while; during.
3. Estimate the following lengths of time:
 - (a) the time it takes a full kettle to boil
 - (b) the time it takes to write "I am in Grade 5."
 - (c) the time it takes to read "Last year, when I was in Grade 4, I was 9 years old."
 - (d) the time it takes to walk the length of a soccer field
 - (e) the time it takes for a shadow made by the sun to get 5 cm shorter
 - (f) the time it takes a new candle to burn out
4. Order your time estimates in question 3 from short to long lengths of time.
5. Which is longer: 96 hours or 5 days? How do you know?
6. Which is longer: 87 months or 7 years? How do you know?
7. Which is shorter: $2\frac{1}{2}$ minutes or 160 seconds? How do you know?

An experiment

Use a candle that is at least 5 cm long. Measure and mark off the candle in 1 cm increments (parts), starting from the upper end of the candle. Estimate how long it will take the candle to burn down 1 cm, 2 cm and so on, and for it to burn out. Now light the candle and time it. How close were your estimates?

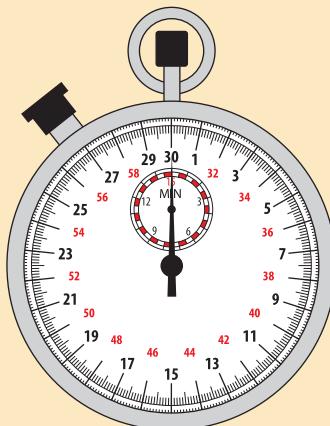
8. Annika is making eight greeting cards as a gift for her sister on her birthday. When she started, her digital watch showed 08:35. Annika wants to finish at 12 o'clock before her sister comes home from the netball game she is playing.
- Is this in the morning or in the evening? How do you know?
 - Write the time she started in words and in 12-hour notation.
 - How many minutes does Annika have before her sister returns?
 - When Annika finishes the first card, the time is 08:50. How long did it take her to make the card?
 - Here you can see at what time the next four cards were finished. How long did she work on each card?

Card 2: 09:06	Card 3: 09:24
Card 4: 09:38	Card 5: 09:55
 - What do you notice about the time she worked on each card?
 - How long did she work on the five cards?
 - How much time is left before her sister comes home?
 - After the fifth card Annika takes a 25 minute break. At what time does she start again?
 - Annika has to make three more cards. What do you think – how long will it take her? Why do you say that? (Look at your answer for question (f) again.) Will she finish before her sister returns?

We use a **stopwatch** to measure how long an activity takes. Look at this picture of an analogue stopwatch.

The numbers on the large dial (circle) indicate seconds and half seconds. The hand moves around once in 30 seconds (half a minute). While this hand turns, the minute hand on the smaller dial (circle) also turns.

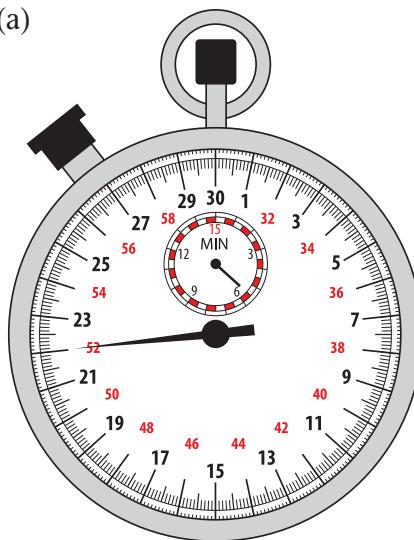
When the second hand has completed two complete full turns, the minute hand on the smaller dial (circle) shows one minute. It takes 15 minutes for the minute hand to make a full turn in the small circle.



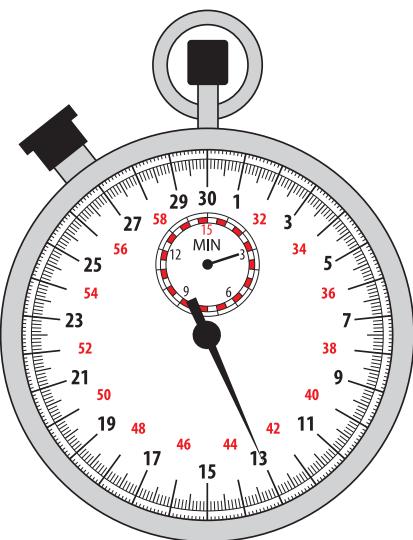
To start measuring how long an activity takes, you press the black button at the top. To stop measuring, when the activity is completed, you press the same button again. You press the button on the side to reset the stopwatch.

9. Four activities were timed with a stopwatch. How long did each activity take?

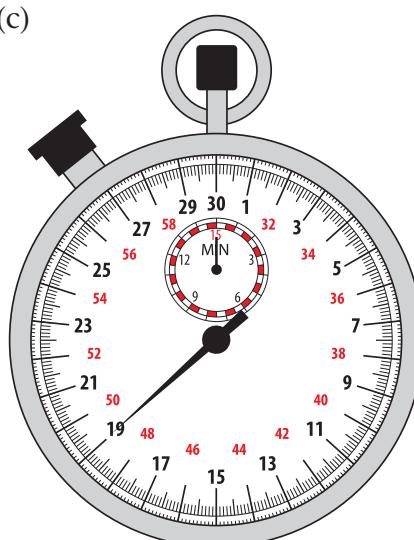
(a)



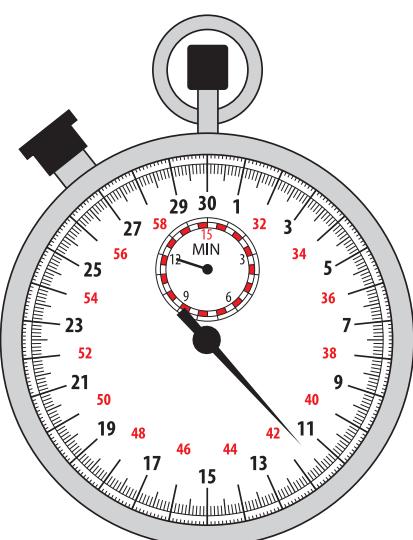
(b)



(c)



(d)



These days we usually use digital stopwatches. Most cell phones have a digital stopwatch. A digital stopwatch is even more accurate than an analogue stopwatch. It accurately counts hundredths of a second, which are also called centiseconds.



10. You need to practise to use a stopwatch accurately.
 - (a) Measure the lengths of time for activities such as those in question 3 as accurately as possible. (Note: some of the activities in question 3 may take too long to measure with a stopwatch.)
 - (b) Compare your estimates to the measured time intervals. Work out how far your estimates were out.

11. In 2014, Bongumusa Mthembu from KwaZulu-Natal won the Comrades Marathon (about 90 km) in 5 hours 28 minutes and 34 seconds (05:28:34). Ludwick Mamabolo came second in a time of 5 hours 33 minutes and 14 seconds (05:33:14).

The times of the five fastest runners are recorded in the table below.

Runner	Country	Measured time	
1. Bongumusa Mthembu	KZN, SA	5h 28min 34s	05:28:34
2. Ludwick Mamabolo	Gauteng, SA	5h 33min 14s	05:33:14
3. Gift Kelehe	Limpopo, SA	5h 34min 39s	05:34:39
4. Stephen Muzhingi	Zimbabwe	5h 35min 18s	05:35:18
5. Rufus Photo	Limpopo, SA	5h 35min 30s	05:35:30

-
- (a) Mthembu started his race at 6 a.m. At what time did he cross the finishing line? Write the time in 24-hour notation.
 - (b) Muzhingi and Photo were very close. How much faster was Muzhingi than Photo?
 - (c) How much faster was Mamabolo than Kelehe?
 - (d) How much slower was Mamabolo than Mthembu?

6.5 Calendar time

Our **calendar year** is based on the time it takes the Earth to move once around the Sun, which is $365\frac{1}{4}$ days.

To make the calendar year a whole number of days, years do not all have the same number of days. Three **normal years** have 365 days each, and then every fourth year is called a **leap year** and has 366 days. The extra day is 29 February. 2012 was a leap year, so 2013, 2014 and 2015 were normal years.

The calendar year is divided into 12 periods called **months**. The months do not all have the same number of **days**: some months have 31 days, some months have 30 days, and February has 28 or 29 days.

A period of seven days is called a **week**, usually taken as starting on Sunday and ending on Saturday.

1. Find a calendar of this year.
 - (a) Mark today's date on the calendar.
 - (b) Mark your teacher's birthday on the calendar.
 - (c) Work out how long before or after your teacher's birthday it is today. Give the answer in months, weeks and days.
 - (d) How old are you today, in years, months, weeks and days? Show in writing how you calculated it.
 - (e) Some months have 31 days and other months have 30 days (except for February). Is there a pattern that you can use to tell quickly which months have 30 days?
 - (f) Which months have four full weeks? Which months have only three full weeks?
 - (g) On what day of the week was 1 January this year? Will it be on the same day of the week next year?

2. The days marked in yellow on this 2016 calendar are public holidays.

JANUARY 2016							FEBRUARY 2016							MARCH 2016							APRIL 2016						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
					1	2		1	2	3	4	5	6		1	2	3	4	5							1	2
3	4	5	6	7	8	9	7	8	9	10	11	12	13	6	7	8	9	10	11	12	3	4	5	6	7	8	9
10	11	12	13	14	15	16	14	15	16	17	18	19	20	13	14	15	16	17	18	19	10	11	12	13	14	15	16
17	18	19	20	21	22	23	21	22	23	24	25	26	27	20	21	22	23	24	25	26	17	18	19	20	21	22	23
24	25	26	27	28	29	30	28	29						27	28	29	30	31			24	25	26	27	28	29	30
31																											
MAY 2016							JUNE 2016							JULY 2016							AUGUST 2016						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
1	2	3	4	5	6	7			1	2	3	4								1	2	1	2	3	4	5	6
8	9	10	11	12	13	14	5	6	7	8	9	10	11	3	4	5	6	7	8	9	7	8	9	10	11	12	13
15	16	17	18	19	20	21	12	13	14	15	16	17	18	10	11	12	13	14	15	16	14	15	16	17	18	19	20
22	23	24	25	26	27	28	19	20	21	22	23	24	25	17	18	19	20	21	22	23	21	22	23	24	25	26	27
29	30	31					26	27	28	29	30			24	25	26	27	28	29	30	28	29	30	31			
														31													
SEPTEMBER 2016							OCTOBER 2016							NOVEMBER 2016							DECEMBER 2016						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
						1	2	3					1		1	2	3	4	5						1	2	3
4	5	6	7	8	9	10	2	3	4	5	6	7	8	6	7	8	9	10	11	12	4	5	6	7	8	9	10
11	12	13	14	15	16	17	9	10	11	12	13	14	15	13	14	15	16	17	18	19	11	12	13	14	15	16	17
18	19	20	21	22	23	24	16	17	18	19	20	21	22	20	21	22	23	24	25	26	18	19	20	21	22	23	24
25	26	27	28	29	30		23	24	25	26	27	28	29	27	28	29	30				25	26	27	28	29	30	31
						30	31																				

- (a) How many days are there in July?
- (b) How many full weeks does October have?
- (c) Is 2016 a leap year? Give a reason for your answer.
- (d) 16 June is Youth Day. On what day of the week does it fall in 2016?
- (e) The second school term starts on 5 April and ends on 24 June. How long is the school term? Give your answer in *days*.
- (f) How many *school days* does the second school term have?
- (g) The third term ends on 30 September. It has 53 *school days*. When does the third term start? And what day of the week is that?
- (h) What is 27 April called? Why is it a public holiday in South Africa?
- (i) Which is longer: 14 weeks or 99 days?
- (j) What is the date, three weeks from 28 July?

6.6 Years and decades

We talk about decades in two ways:

We group the years in tens. We talk, for example, about the decade of the 1990s. The 1990s is the decade when South Africa became a true democracy.

A **decade** is a period of 10 years.

We can also add ten years or subtract ten years from now. Then we say “in the next decade” and “in the previous decade” or “a decade ago”.

Here is a timeline of decades with some important events that took place, some of them from our own history.

1950s	1960s	1970s	1980s
Freedom Charter adopted	Sharpeville Massacre First man on the moon	Student protests Television in South Africa First cell phone	More protests FW de Klerk became President

1990s	2000s	2010s	2020s
South Africa's first democratic election Nelson Mandela became president	Cell phones became widely available	Soccer World Cup in SA Marikana Massacre	Still to come

1. What will the date be a decade from today?
2. How old will you be in a decade's time?
3. How old were you a decade ago?
4. Who is the oldest person you know? In which decade was this person born?
5. Ask older people in your community what they remember from the decades in the timeline. Name more events or incidents that are not mentioned in the timeline.

In this unit we will investigate data about waste and recycling. People who collect waste and deliver it to recycling businesses often work in the informal sector.

People who work to recycle waste help to conserve the environment while they are earning money. They are called “Green Entrepreneurs”.

An entrepreneur is someone who starts a new business.

7.1 Asking questions about a situation

- Suppose you are chosen to represent your town at a conference on recycling. At the conference you have to tell other people about recycling in your town. To be able to do this, you need information. Write down some questions about recycling in your town, for which you would like to have answers.

Since 2011, the Department of Environmental Affairs has been gathering information from municipalities about how they manage the waste that people create. All this information becomes **data** about waste management and recycling.

- (a) Write down what you think “waste” is.
How do things become waste?
- (b) Where does the waste end up where you are living? What do you think will happen if South Africa’s towns and cities run out of landfill space?
- (c) Do you think data about waste in your town or village can be used to plan better? Explain why you say so.

Waste is removed to landfill sites that are managed by the municipalities.

The table on the next page gives information about the waste that was produced by people living in the different provinces of South Africa in 2011. *Municipal waste* is the waste of *households, restaurants and shops*, but not the waste of factories or mines.

The sources of the information in the table are The South African Waste Information Centre and the Department of Environmental Affairs.

Municipal waste contributed by province in South Africa: 2011

Province	Average kilograms of waste per person in 2011
Western Cape	675
Eastern Cape	113
Northern Cape	547
Free State	119
KwaZulu-Natal	158
North West	68
Gauteng	761
Mpumalanga	518
Limpopo	103

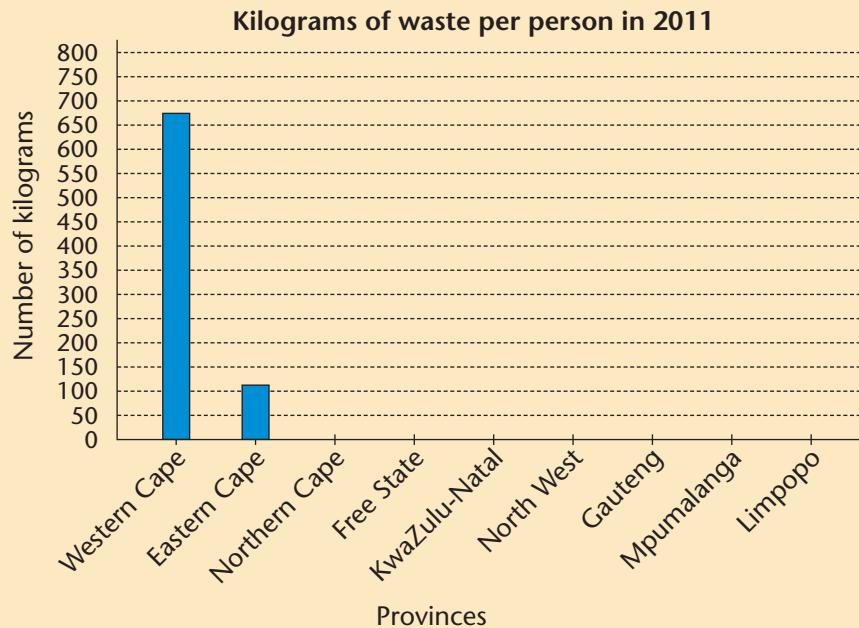
3. Read the information in the table.
What does it tell you?
Answer the questions:
- Which provinces generate high amounts of waste per person?
 - Which provinces generate rather small amounts of waste per person?
 - Write down some reasons why you think the waste contribution per person in the different provinces varies so much.

The waste per person is calculated as follows:
The total mass of waste collected by all the municipalities in the province is calculated (added up). Then the total mass is divided by the number of people that live in the province. The kilogram waste per person in 2011 is the waste of the average person in 2011.

7.2 Drawing and interpreting graphs

1. Copy and label the axes and the heading below, and then complete the graph using the data in the table on the previous page.

Use the number line along the vertical axis to mark the numbers above each province. Then draw each bar from the bottom up to the correct height, in other words up to the marks that you have made.



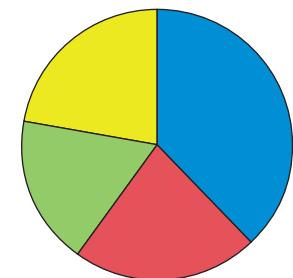
The number line where we can read the number of kilograms of waste per person is called the **frequency axis**.

2. Compare the amount of waste per person in 2011 in the Western Cape and in the Eastern Cape.
 - (a) Use the table to work out how much more waste per person was collected in the Western Cape than in the Eastern Cape.
 - (b) Use your bar graph to say how many times more the waste per person collected in the Western Cape was than the waste per person collected in the Eastern Cape.

3. (a) Choose two other provinces to compare. Answer the same questions as in question 2 about the provinces you chose.
- (b) Work with a classmate. Think critically about the comparisons you made between the provinces. Make corrections if necessary.
4. The pie charts show different kinds of municipal waste collected in the Western Cape and Gauteng in 2011.

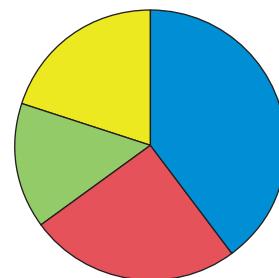
A **key** tells the meaning of the colours used in the pie chart.

Types of municipal waste collected in the Western Cape in 2011



Key: ■ Non-recyclables ■ Recyclable waste
■ Organic waste ■ Builders' rubble

Types of municipal waste collected in Gauteng in 2011



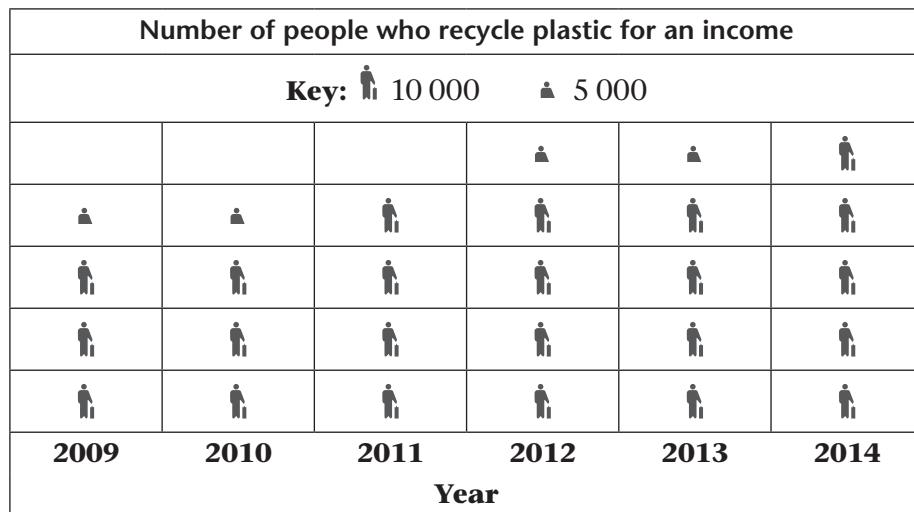
Key: ■ Non-recyclables ■ Recyclable waste
■ Organic waste ■ Builders' rubble

- (a) Estimate the fraction of organic waste in the Western Cape in 2011: Is it less than a quarter or more than a quarter of all the municipal waste in the Western Cape?
- (b) Estimate the fraction of municipal waste in the Western Cape in 2011 that could be recycled.
- (c) Estimate the fraction of municipal waste in Gauteng in 2011 that could not be recycled.
- (d) In which province was the recyclable waste one quarter of the municipal waste in 2011?
- (e) Use the pie charts to decide whether the following statement is true or false. Explain how you made your decision.

Organic waste includes food waste and garden waste.

If we would make compost of all the organic waste and would recycle all the waste that we can recycle, the landfill sites in the Western Cape and Gauteng would have received only about half the waste that they received in 2011.

5. The pictograph below gives a summary of the number of people who earn their income by recycling plastic. These people are informal workers.



- (a) Look at the pictograph. Do you think the number of people who earn their income by recycling plastic is increasing? Explain why you say so.
- (b) Use the key to work out how many people earned their income by recycling plastic in 2011.
- (c) Use the key to work out how many people earned their income by recycling plastic in 2013.
6. The table below gives data about the number of street waste pickers that have worked in Pretoria since 2009.

2009	2010	2011	2012	2013	2014
154	185	215	235	289	301

Read the text on the next page about how to make a pictograph.

Make a pictograph to show the data in the table above.

Make sure your pictograph has a heading and a key.

A street waste picker collects recyclables from waste bins and sells it to buy-back centres.

How to make a pictograph

Step 1: Draw a horizontal line and mark it off in equal lengths. Write the years in the correct order below the line. This is the **category axis**.

Step 2: Decide on an icon (symbol) and on the number of people that your icon will represent. To do this, look at the size of your largest data value. You may choose a number such as 10, 20, or 30.

You may also make an icon that represents half the number you chose; for example, if you decided your icon will represent 30, then half your icon will represent 15.

Step 3: Round off the data values by counting in the number you chose. If you chose 30, count in 30s. As you count, write down the number closest to each data value. For example, if you count in 30s, then 150 is closest to 154.

Calculate the number of icons you need to represent the data for each year. For example, if your icon represents 30 people, you will need 5 icons to represent 150 people.

Step 4: Draw the icons neatly above each year. The icons must be arranged evenly so that you can see at a glance what the data tell.

7.3 Summarising and analysing data

Mrs Mmako works at a buy-back centre. She has to keep track of how much waste they receive and sort. They need the information to plan how much money to have on the site to pay the waste collectors who bring in the recyclable waste, and how many waste sorters they need. They also need to know when to arrange for recycling companies to collect full truckloads of sorted waste.

The buy-back centre is not open on Saturdays and Sundays, because they use those days to complete the sorting of the week's waste.

The table on the next page gives some of the buy-back centre's data. Mrs Mmako says the data are of a typical week.

If data are typical it means we can accept that they tell the story of what you can expect (more or less) when you look at any other week.

Mass of recyclable waste received in Week 12

Day	Time	Mass of unsorted waste	Mass of sorted waste		
			Paper	Glass	Plastic
Monday	10:00	106 kg	21 kg	56 kg	29 kg
	12:00	100 kg	23 kg	52 kg	25 kg
	14:00	116 kg	41 kg	54 kg	21 kg
	16:00	78 kg	25 kg	41 kg	12 kg
Tuesday	10:00	114 kg	25 kg	49 kg	40 kg
	12:00	81 kg	24 kg	33 kg	24 kg
	14:00	94 kg	35 kg	40 kg	19 kg
	16:00	84 kg	34 kg	49 kg	1 kg
Wednesday	10:00	82 kg	25 kg	34 kg	23 kg
	12:00	91 kg	46 kg	40 kg	5 kg
	14:00	100 kg	31 kg	47 kg	22 kg
	16:00	115 kg	24 kg	58 kg	33 kg
Thursday	10:00	113 kg	23 kg	48 kg	42 kg
	12:00	101 kg	50 kg	41 kg	10 kg
	14:00	112 kg	30 kg	56 kg	26 kg
	16:00	92 kg	47 kg	45 kg	0 kg
Friday	10:00	101 kg	36 kg	38 kg	27 kg
	12:00	102 kg	50 kg	30 kg	22 kg
	14:00	117 kg	44 kg	60 kg	13 kg
	16:00	113 kg	32 kg	43 kg	38 kg

-
- (a) Work with a classmate. Study the data in the table and think about waste collection. Write down some questions that start with “I wonder if ...”
 - (b) Which of your questions can you answer with the data in the table? Explain how you will work with the data to answer the questions.

Mrs Mmako also asked “I wonder if ...” questions about her data.

She said: “I wonder if we tend to receive more glass than plastic. I will add up the mass of the sorted glass we got in the week and compare it with the total mass of the sorted plastic we got in the week. Then I will have an idea.”

When we say “tend to...” we mean there may be a pattern for all the data together, although not every single data value will follow the pattern exactly.

- (a) What is the mode of the amount of paper that was delivered in Week 12?
- (b) What is the mode of the amount of glass that was delivered in Week 12?

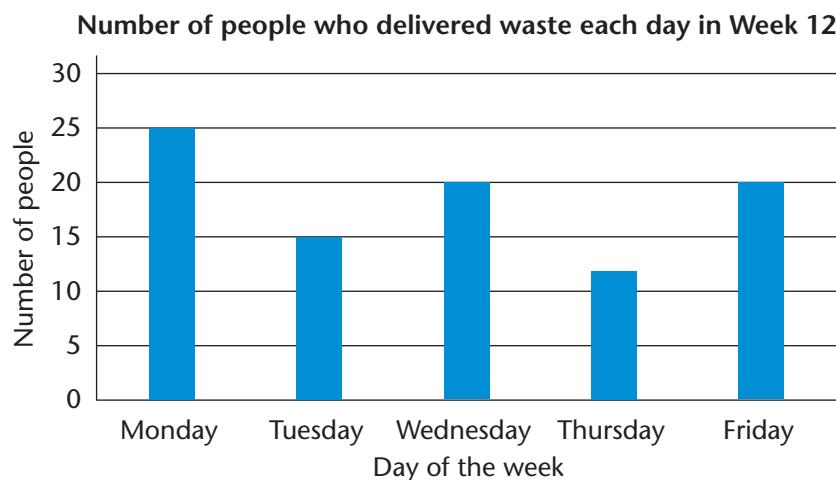
The **mode** is the value that occurs the *most*.

- Work with the data to complete the table, and answer the questions.

Day	Total mass of unsorted waste	Total mass of paper	Total mass of glass	Total mass of plastic
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				

- (a) On what day of the week does the buy-back centre typically receive the biggest mass of unsorted waste? Can you think of a reason why this is so?
- (b) On what day of the week does the centre typically receive lots of glass? Can you think of a reason why?

-
- (c) Why do you think the mass of the plastic that waste pickers bring in to the centre is generally lower than the mass of the glass?
4. Mrs Mmako also gathers data of the number of waste pickers that visit the buy-back centre every day to deliver recyclable waste. She made this bar graph with the data for Week 12.



Write a short paragraph to interpret the information in the graph.

5. (a) The buy-back centre pays R10 per kilogram for unsorted waste (if the waste consists only of paper, glass and plastic). How much money must Mrs Mmako plan to have on the site every day of the week?
- (b) Do you think the amounts of waste will be exactly the same every week? Explain why you say so.
- (c) Work with the total amount that the buy-back centre paid for unsorted waste on Monday. Share the money evenly between the number of people who delivered the waste. How much money did they typically get for the waste they delivered on Monday?

7.4 Project

Gather data about the amount of recyclable waste on your school grounds or at your house. You must gather *at least* one week's data.

Step 1: Set up the project

Label different containers for recyclable waste, organic waste and non-recyclable waste. Ask your Natural Sciences teacher to help you understand what kinds of waste should go where.

Inform the other learners in the school (or your people at home) about your project and ask them to dispose of their waste in the correct bins.

Step 2: Gather data

Decide whether you want daily data or weekly data. Weigh the bags with waste at the same time of day, for example after the last period or after sports practice.

Decide whether you want to gather data about specific kinds of recyclable waste. If so, sort the waste so that you can weigh the different kinds of waste (for example paper, glass, tins, and plastic) separately.

Step 3: Represent and analyse the data

Use your knowledge of data handling to draw pictographs or bar graphs of the data.

Step 4: Interpret and report the data

Write a report of your findings. Make recommendations to the school or to your family about working together to recycle waste. If you can, use the internet to find out about waste recycling projects in your area.

8.1 Curved and straight lines



You can join dots such as these with **straight lines**:



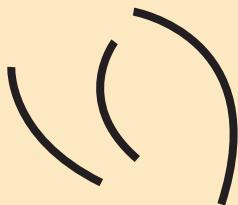
You can also draw a **curved line** that passes through the dots:



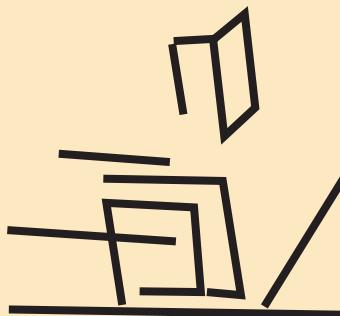
Rock artists used both curves and straight lines in their art.

A South African artist used straight lines and curves to make this painting.

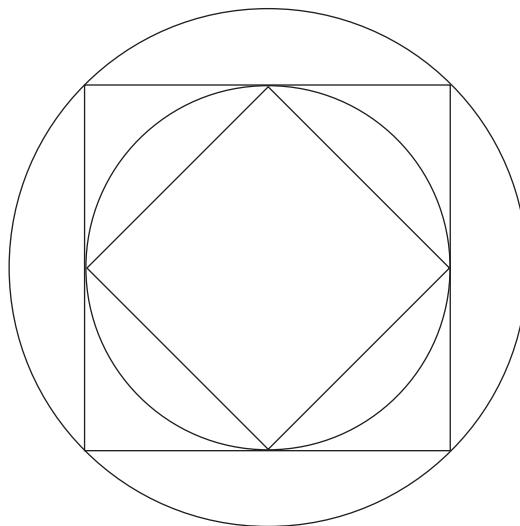
These are some of the curves she used:



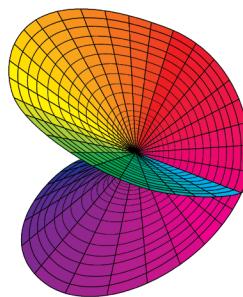
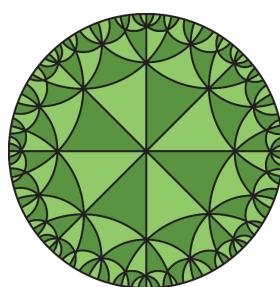
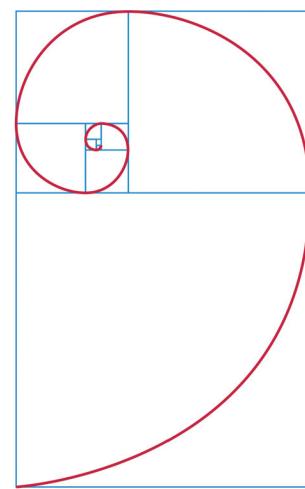
These are some of the straight lines she used:



1. (a) Make a rough drawing of the curved parts of the diagram on the right.
- (b) Make a rough drawing of the straight line parts of the diagram on the right.



2. The red curve in the drawing on the right is called a spiral.
- Make a drawing of a spiral, without any straight lines on your drawing.
 - Make a drawing of all the straight lines in the drawing, without the spiral.



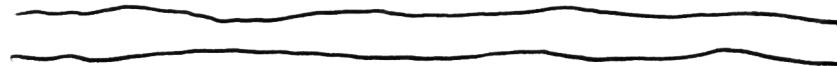
Two more examples of drawings with curves and straight lines

Make some freehand drawings

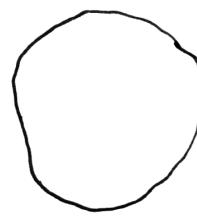
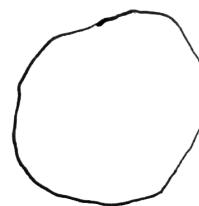
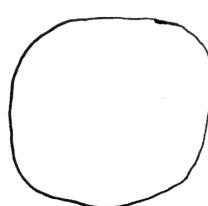
3. Try to draw a straight line without using a ruler. Try to do it better than the line below has been drawn.



If you draw two lines close to each other, you can see which one is a better attempt to draw a straight line.

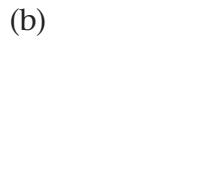
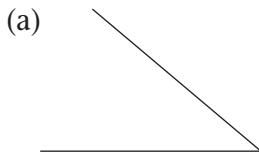


4. Try to draw a circle without using a cup or glass or saucer or other guide. Some attempts are shown below.



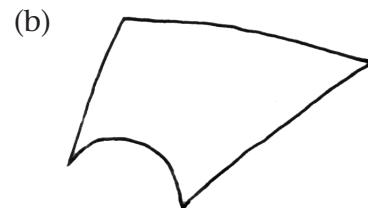
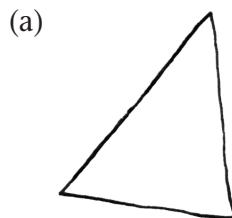
8.2 Figures with different shapes

1. Draw figures with shapes like these. Do not use a ruler but try to make the lines as straight as you can. Do not lift your pencil at the corners.



In each of the figures that you have drawn above, two straight lines meet. When two straight lines meet, we say an **angle** is formed.

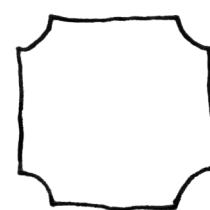
2. Draw figures like these. Do not lift the pencil before the drawing is finished.



The figures that you have drawn in question 2 are called **closed figures**.

The figures that you have drawn in question 1 are called **open figures**.

3. Which figures below are closed, and which are open?



Closed figures with *five* straight sides are called **pentagons**.

“Penta” means five.

Closed figures with *six* straight sides are called **hexagons**.

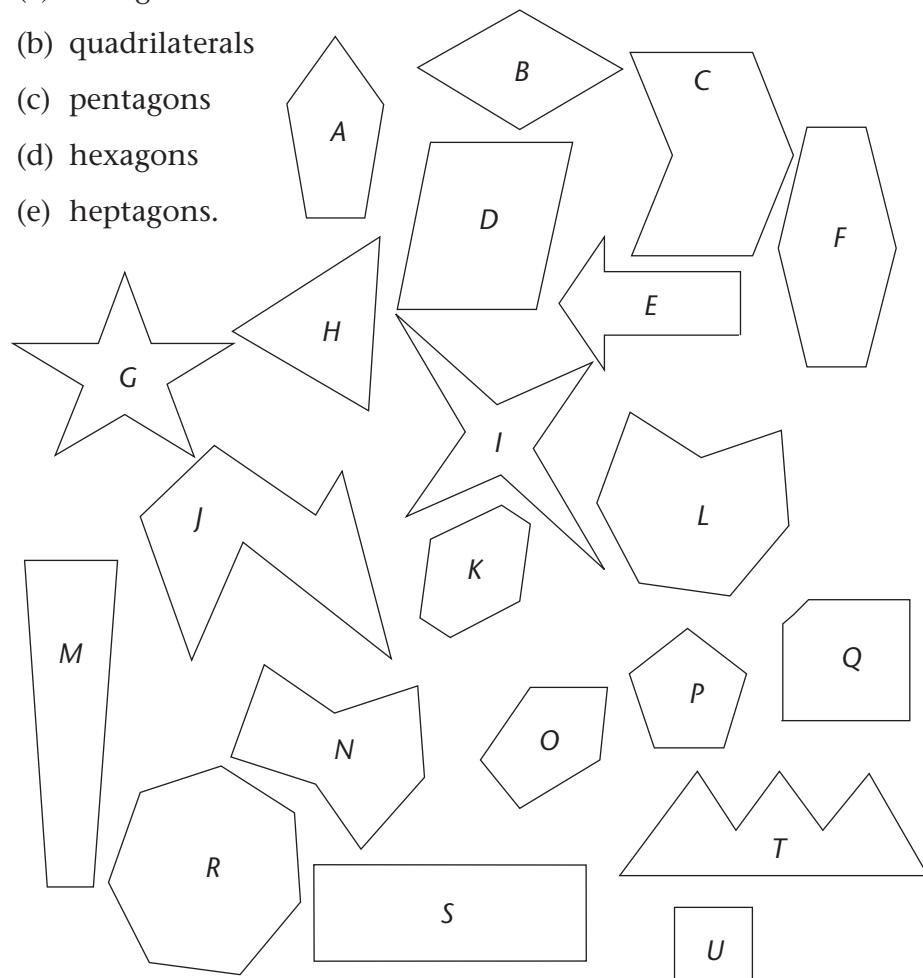
“Hexa” means six.

Closed figures with *seven* straight sides are called **heptagons**.

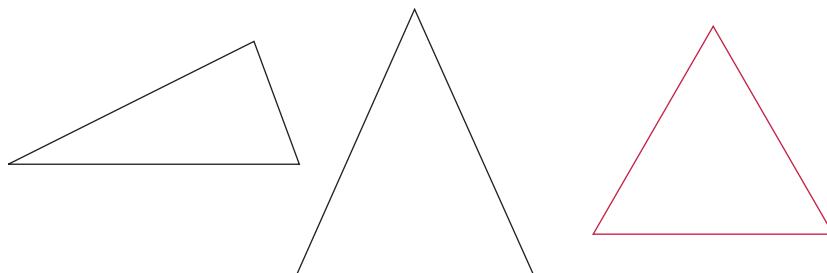
“Hepta” means seven.

4. Write down the letters of all the figures that have the shapes of:

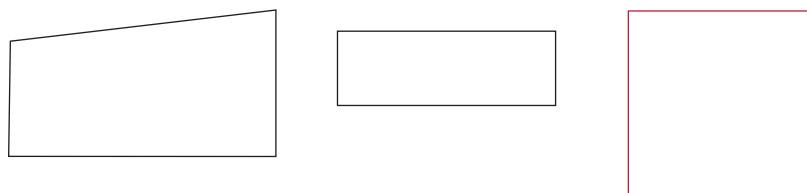
- (a) triangles
- (b) quadrilaterals
- (c) pentagons
- (d) hexagons
- (e) heptagons.



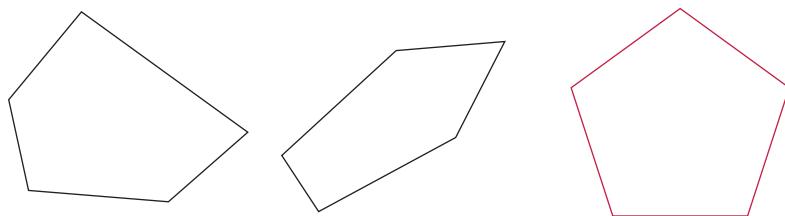
-
5. These figures are all triangles. How are they different?



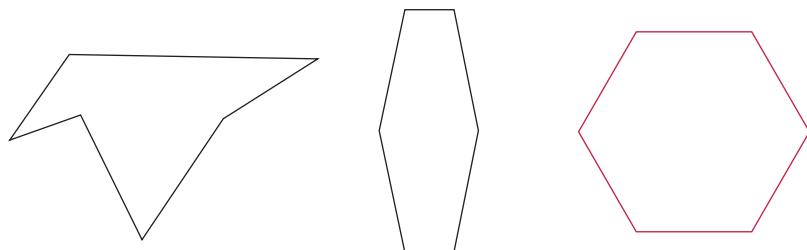
6. These figures are all quadrilaterals. How are they different?



7. These figures are all pentagons. How are they different?



8. These figures are all hexagons. How are they different?

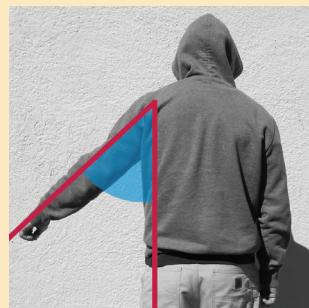
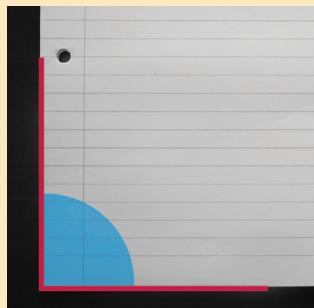


The red figures above are called **regular polygons**. All their sides have the **same length** and all their angles have the **same size**.

8.3 Angles

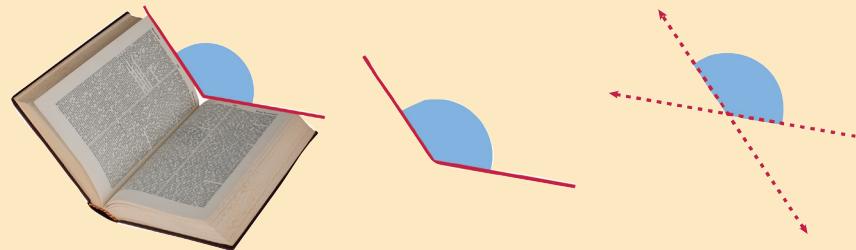
You can see many angles in your environment, for example:

- The edges of a page form right angles.
- An open door is at an angle to the door frame.
- Two walls form an angle where they meet.
- A broom against a wall forms an angle with the floor and with the wall.
- If you lift your arm there is an angle between your body and your arm.

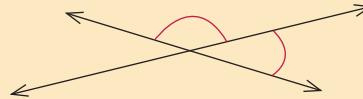


1. Describe other angles in your surroundings.

When you open a book, the two opposite pages form an angle with each other.



When two lines meet to form an angle, you can imagine the lines going on so that four angles are formed. The red **arcs** below show two of the four angles:



The arrowheads mean the lines can be as long as you want them to be, the angles stay the same.

2. There are angles in the pictures below. Make simple but neat drawings of the lines that cross to form the angles. Draw arcs to show the angles.

(a)



(b)



(c)



(d)



(e)

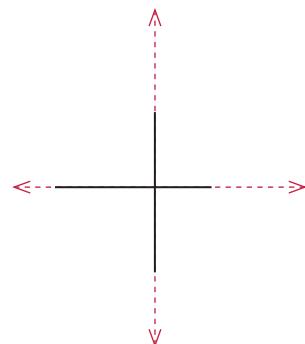


(f)

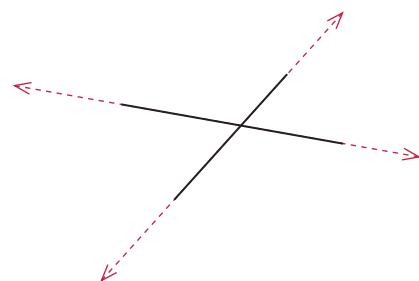


8.4 Right angles around us

These two lines form four **right angles** where they cross. We call the angles right angles because all four angles are the same size. We say the lines are **perpendicular to each other**.



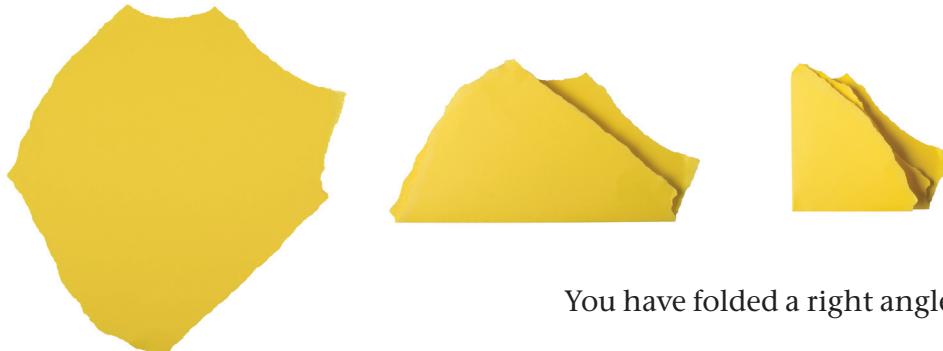
These two lines do not form right angles where they cross. All four angles are not equal.



1. Draw two lines that cross at right angles.
2. Draw two lines that do not cross at right angles.
 - (a) Mark the angles that are smaller than a right angle.
 - (b) Use a different way to mark the angles that are bigger than a right angle.

Make your own right-angle template

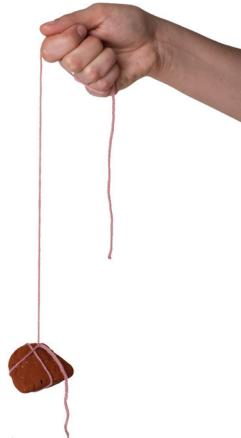
Take a piece of paper. Fold it once. Make sure you fold a sharp edge. Fold it again so that the first fold line folds onto itself.



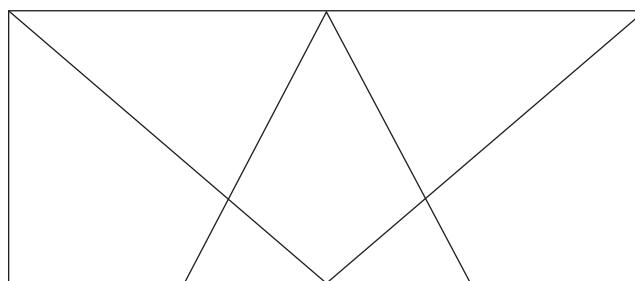
You have folded a right angle.

Make your own plumb line

Tie a small, heavy object such as a washer (or a small flat stone) to the end of a piece of string. Hold the string so that the object (called a plumb bob) hangs free. When the plumb bob stops swinging the string hangs vertically. A line that is perpendicular to the plumb line is a horizontal line.



3. Use your plumb line to test if the top of your desk is horizontal.
Explain and make a drawing to show how you judge.
4. Use your right-angle template to test if two walls in your class meet at a right angle.
5. Use your plumb line to determine if the door frame in your class is vertical.
6. Draw this diagram in your book. Use your right-angle template to test if the angles are smaller than a right angle, or bigger than a right angle, or the size of a right angle.

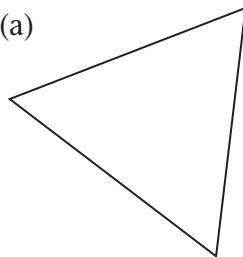


- (a) Mark all the right angles in the diagram with a box, like this:
- (b) Mark all the angles that are smaller than a right angle with the letter A.
- (c) Mark all the angles that are bigger than a right angle with the letter O.

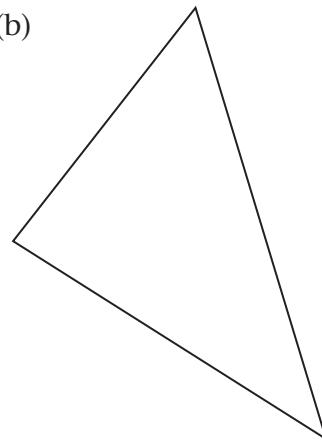
8.5 Angles and sides in two-dimensional figures

1. Draw each figure in your book. Name the figure, then compare the sizes of the angles. Mark the angle with a \square if you decide it is a right angle. Write A in the angle if the angle is smaller than a right angle. Write O in the angle if the angle is bigger than a right angle.

(a)



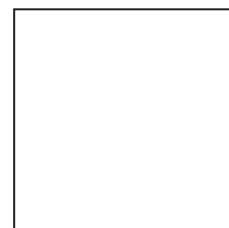
(b)

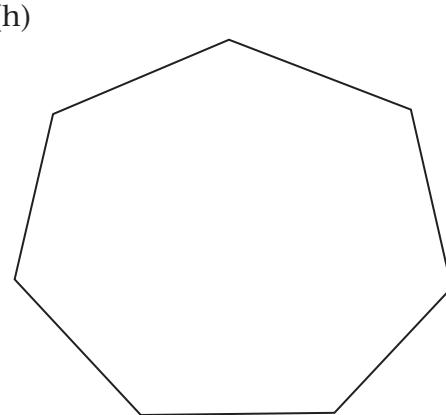
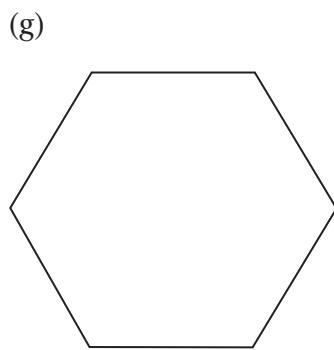
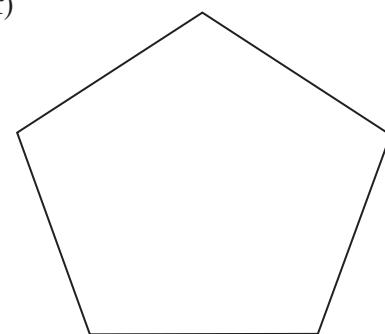
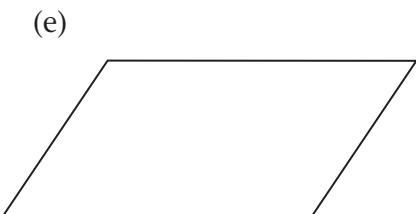


(c)



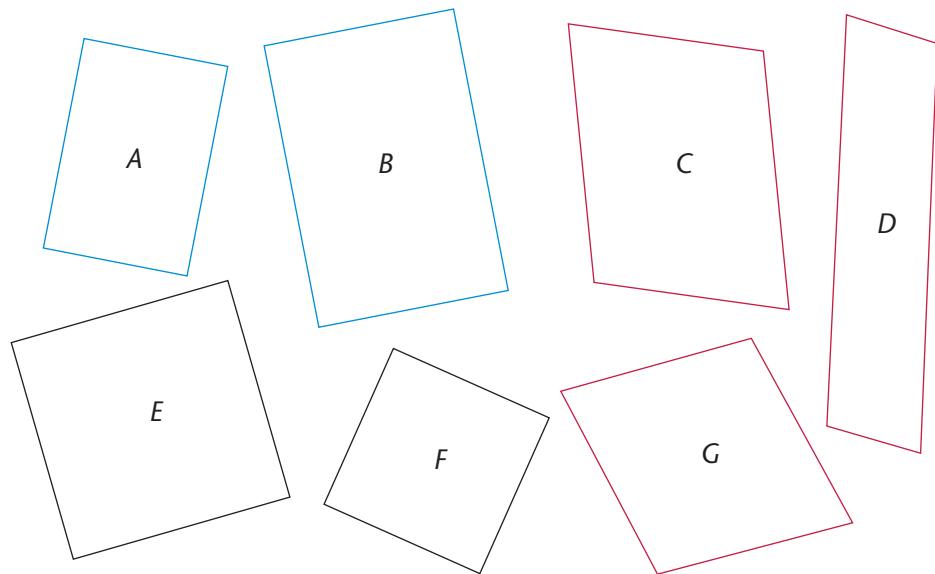
(d)





2. Compare the figures in question 1.
 - (a) Which of the figures have sides that are all the same length?
 - (b) Which of the figures have angles that are all the same size?
Make angle templates to help you decide.
3. (a) Draw a triangle with an angle that is bigger than a right angle.
Look at the other two angles of your triangle. Are they smaller or bigger than a right angle?
(b) Try to draw a triangle with two angles that are bigger than right angles. Explain what happens.

4. (a) How do the blue and black figures on the left differ from the red figures on the right?



- (b) In what way are the two black figures similar to the two blue figures?
(c) In what way are the two black figures different from the two blue figures?

If all the angles of a quadrilateral are right angles, it is called a **rectangle**.

If the four sides of a rectangle have the same length, it is called a **square**.

5. (a) Which figures in question 1 are squares?
(b) Which figures in question 1 are rectangles?
6. (a) Are all rectangles also squares?
(b) Are all squares also rectangles?

9.1 Capacity and volume

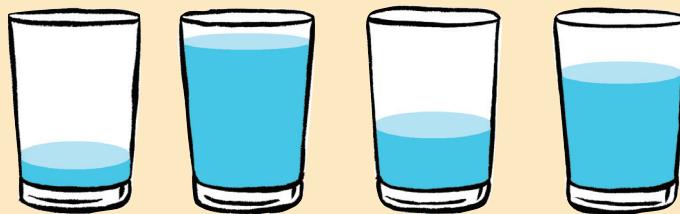
The two glasses on the right have the same **capacity** but they contain different **volumes** of water.

If you just want to drink a little water, you do not fill your glass to the top. There is then only a small **volume** of water in your glass. But it can hold more water! You can increase or decrease the volume of water in a glass.

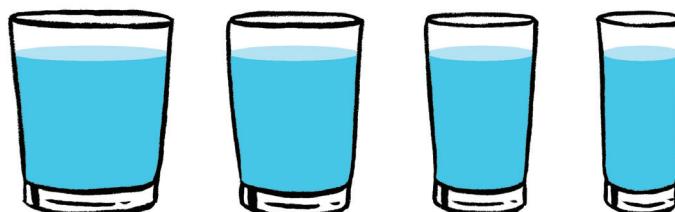
The volume of water that the glass *can hold* when it is filled to the brim is called the **capacity** of the glass. You cannot increase or decrease the capacity of a glass.



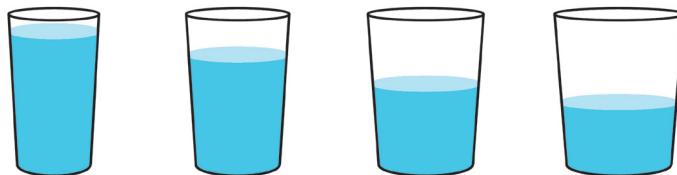
These four glasses all have the **same capacity**, but they contain **different volumes** of water.



1. (a) Do the glasses below contain the same volume of water, or do they contain different volumes of water?
(b) Give reasons for your answer.



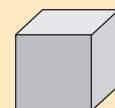
2. Is it possible that these four glasses contain the same volume of water? Explain your answer.



An ordinary cup or glass can hold about **250 millilitres** of liquid. 250 ml is the same as a quarter of a litre.



You can take some clay and make a cube with each edge about 1 cm long. Your cube will be approximately as big as shown here.



If you do this, you will have used about **1 millilitre** of clay for your cube.

3. (a) What is the capacity of an ordinary cup or glass?
- (b) Approximately how much water is there in the glass shown above?
- (c) What is the volume of juice in a tin like the one shown here, if it is only half full?
- (d) Approximately how much water do you think you can hold in your mouth?

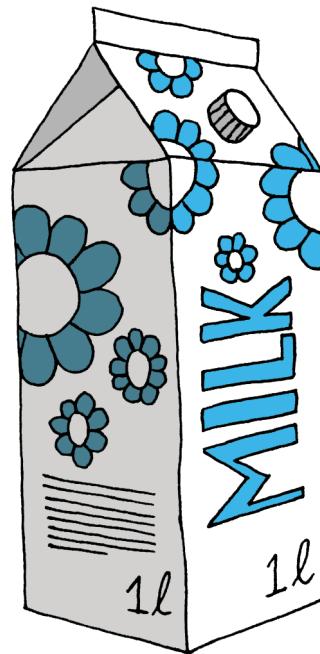
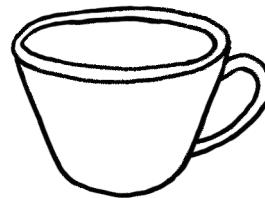


-
4. How many ordinary cups can you fill from 1 ℓ of milk?

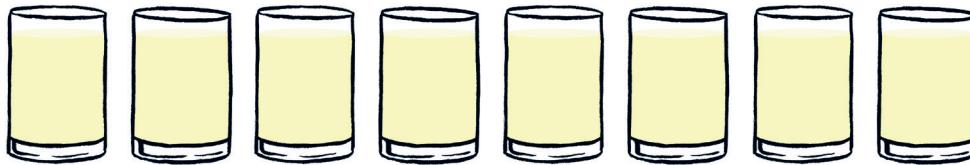
1 litre is 1 000 millilitres.

Instead of millilitre you can write ml.

Instead of litre you can write ℓ.



5. (a) How many small glasses, each with a capacity of 100 ml, can you fill from 1 ℓ of milk?
- (b) If you share 1 ℓ of milk equally between eight glasses, what will be the volume of milk in each glass?



- (c) How many millilitres is one eighth of a litre?
6. How many millilitres are each of the following?
- | | |
|-------------------------|--------------------------|
| (a) 2 ℓ | (b) one fifth of a litre |
| (c) 3 fifths of a litre | (d) 7 tenths of a litre |
| (e) $2\frac{3}{5}$ ℓ | (f) $1\frac{3}{4}$ ℓ |

9.2 Make a measuring jug

You can make a measuring jug from a 1 ℓ or a 750 ml or a 500 ml plastic bottle. You can do this by yourself or in a team.

To do this you need water, a bottle and five similar glasses or five similar jars (for example five jam jars).

Fill the bottle with water up to its shoulder.

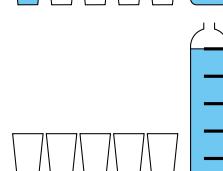
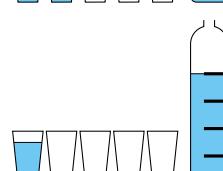
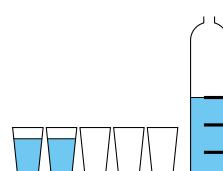
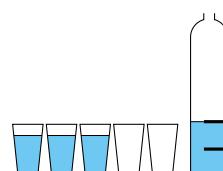
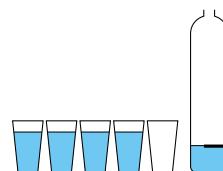
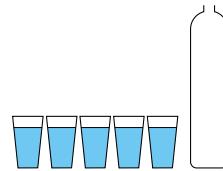
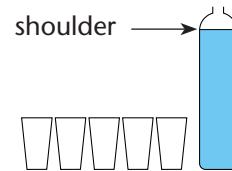
Empty the bottle into the five glasses or jars so that there is the same volume of water in each of them.

Pour the contents of one glass back into the bottle, and mark the water level clearly on the bottle with a pen or a strip of paper or a scratch mark.

Pour the contents of another glass back into the bottle, and mark the water level clearly on the bottle.

Continue like this until you have poured all the water back into the bottle.

1. What is the capacity of your bottle?
2. Approximately how much water was in each of your five glasses?
3. How many millilitres does each of the marks you have made on the bottle indicate?
4. Make marks halfway between the marks you have already made on the bottle.
5. Write the number of millilitres next to each of the marks on your bottle, from smallest to biggest.



9.3 Litre and millilitre

- To fill a 250 ml cup with caster sugar, Rita filled a measuring spoon 10 times.
What is the capacity of the measuring spoon that Rita used?
 - A certain measuring spoon has a capacity of 50 ml.
 - How many times do you have to fill the measuring spoon if you want to fill a 2 l container with sugar?
 - How much sugar do you need to fill 30 measuring spoons like this one?
 - In each case, state what the capacity of the container is and what the volume of juice in the container is. Give your answers in litres as well as in millilitres.



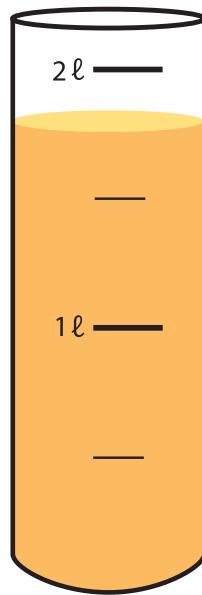
What is the capacity of the measuring spoon that Rita used?

A certain measuring spoon has a capacity of 50 ml.

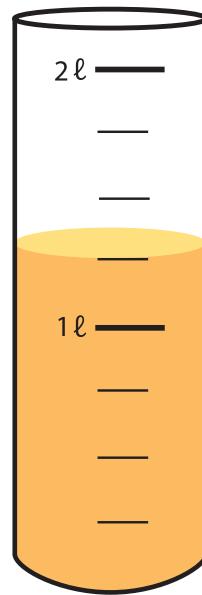
- (a) How many times do you have to fill the measuring spoon if you want to fill a 2 l container with sugar?
 - (b) How much sugar do you need to fill 30 measuring spoons like this one?

3. In each case, state what the capacity of the container is and what the volume of juice in the container is. Give your answers in litres as well as in millilitres.

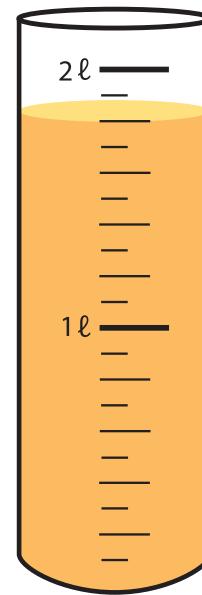
(a)



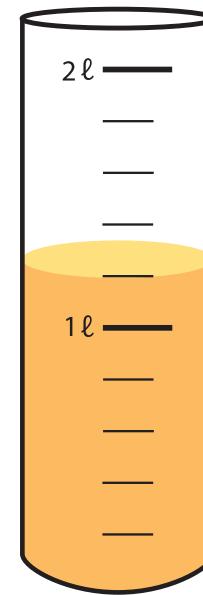
(b)



(c)

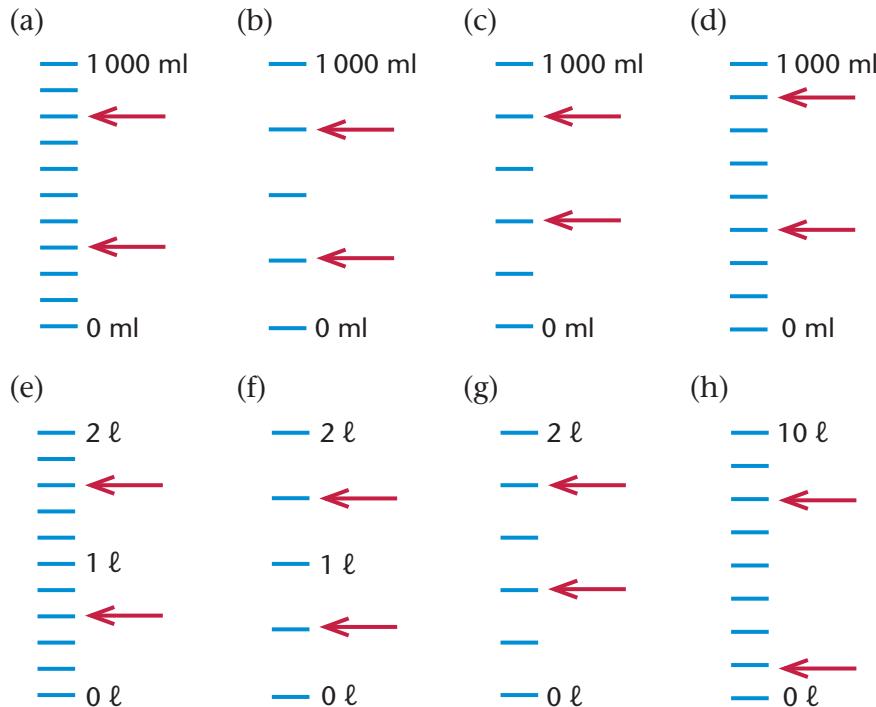


(d)



4. Different scales are given below. For each scale, write the numbers and units (ml or ℓ) that should appear at the marks that the arrows are pointing at. Do this from top to bottom. Write your answers in millilitres as well as in fractions of a litre, for example: 50 ml; $\frac{1}{20}$ ℓ.

The marks and numbers on a measuring jug are called the **scale**.



1 litre is 1 000 ml.

You can write 1 500 ml as $1 \ell + 500 \text{ ml}$ or as $1\frac{1}{2} \ell$.

Other ways to write this are $1,500 \ell$ and $1,5 \ell$. The 1 tells you that you have 1 full litre and the 0,500 or 0,5 tells you that you have another $\frac{1}{2} \ell$.

5. Express each of the following in millilitres.

(a) $3 \ell + 500 \text{ ml}$	(b) $1 \ell + 250 \text{ ml}$	(c) $\frac{1}{8} \ell$
(d) $2,5 \ell$	(e) $2\frac{3}{4} \ell$	(f) $1 \ell + \frac{1}{4} \ell$
(g) $4\frac{7}{10} \ell$	(h) 6ℓ	(i) $\frac{3}{5} \ell$

-
6. Write these volumes in ascending order (from the smallest to the largest):

(a) $1\frac{1}{2}\text{ l}$; $1\text{ l} + 50\text{ ml}$; $1\ 250\text{ ml}$

(b) $5\ 750\text{ ml}$; $5\frac{1}{2}\text{ l}$; $5\text{ l} + 75\text{ ml}$

(c) $4\frac{3}{4}\text{ l}$; $4\text{ l} + 34\text{ ml}$; $4\ 734\text{ ml}$

7. Write these volumes in descending order (from the largest to the smallest):

(a) $19\text{ l} + 250\text{ ml}$; $19\frac{1}{2}\text{ l}$; $9\ 250\text{ ml}$

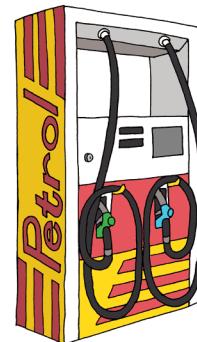
(b) 650 ml ; $6\text{ l} + 5\text{ ml}$; $6\frac{1}{5}\text{ l}$

(c) $8\ 750\text{ ml}$; $87\text{ l} + 50\text{ ml}$; $8\frac{3}{4}\text{ l}$; $8,5\text{ l}$

9.4 Calculations and problem solving

1. Winnie invited 17 friends to her party. The paper cups they will use have a capacity of 250 ml, but her mom usually only pours about 235 ml into each cup, so they don't spill.
- (a) How much cooldrink should she buy if each guest will have 3 cups of cooldrink? Write your answer in millilitres and litres.
- (b) Winnie's mom buys the cooldrink in $1\frac{1}{2}\text{ l}$ bottles. How many bottles must she buy?
2. A big supermarket group sells many large crates of cooldrink every month. One crate holds eighteen $2,5\text{ l}$ bottles.
- (a) How many litres of cooldrink are in 18 bottles?
- (b) How many millilitres of cooldrink is that?
- (c) At one stage there were only 632 crates left in the warehouse. They were distributed equally to 8 stores. How many crates did each store get?
- (d) How many bottles did each store get?

-
3. A 2ℓ carton of milk costs R21 at a supermarket. A shop at a filling station sells the same 2ℓ carton of milk for R26.
- Annette pays R105 for the milk that she buys at the supermarket. How much would she have paid for the same number of cartons at the shop at the filling station?
 - What costs less: 6 cartons of milk at R26 per carton or 9 cartons of milk at R21 per carton?
4. Each milkshake at *The Sweet Tooth* is made with 3 scoops of ice cream and $\frac{1}{4}\ell$ milk.
- How much milk is used with 15 scoops of ice cream?
 - How much ice cream is added to $1\frac{3}{4}\ell$ milk?
 - How much ice cream and how much milk are needed for 25 milkshakes?
 - How many milkshakes can be made with 2 ℓ milk, and how much ice cream will be needed?
5. (a) If petrol costs R9,50 per litre, how much does 78 ℓ petrol cost?
(b) If 9 ℓ of petrol cost R94,50, what is the price of 1 ℓ ?
(c) If petrol costs R8,00 per litre and you paid R872 to fill your tank, how many litres did you buy?



Term Two

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1.1 Counting and representing bigger numbers

Look at the next page.

There are ten thousand stripes on the next page.

Ten thousand is written like this in number symbols: 10 000

On *two* pages like the next page, there will be twenty thousand stripes altogether.

Twenty thousand is written like this in number symbols: 20 000

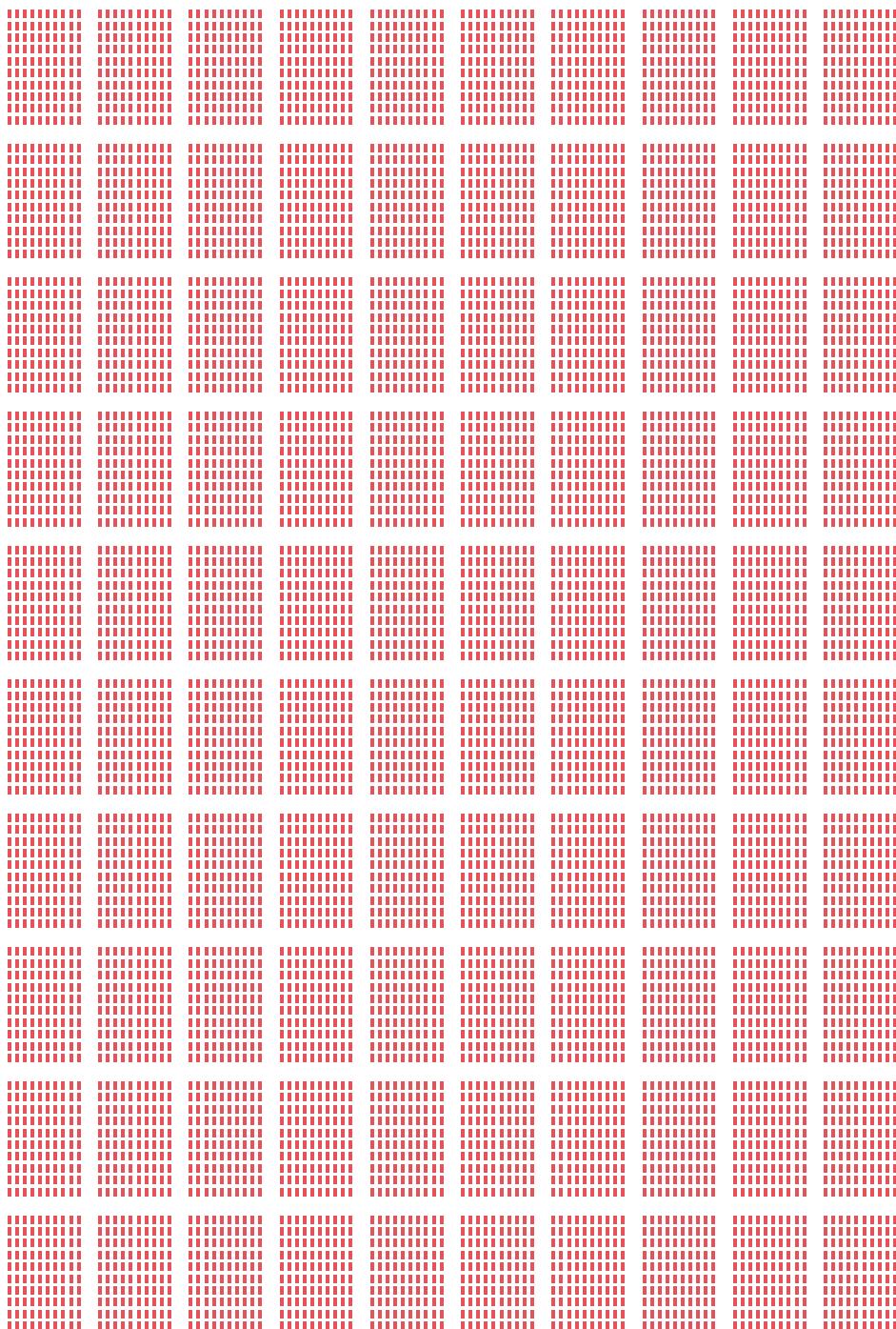
On *nine* pages like the next page, there will be ninety thousand stripes altogether.

Ninety thousand is written like this in number symbols: 90 000

On *ten* pages like the next page, there will be a hundred thousand stripes altogether.

Hundred thousand is written like this in number symbols: 100 000

1. Write the number symbols for each of the following numbers.
 - (a) forty thousand
 - (b) seventy thousand
 - (c) one hundred and twenty thousand
 - (d) two hundred thousand
 - (e) two hundred and sixty thousand
 - (f) four hundred thousand
2. Count and write the number symbols as you go along.
 - (a) Count in ten thousands from 20 000 up to 180 000.
 - (b) Count in ten thousands from 200 000 up to 400 000.



3. One metre is 1 000 millimetres.

Write your answers to the questions in words and in symbols. This means you must write the number names and the number symbols.

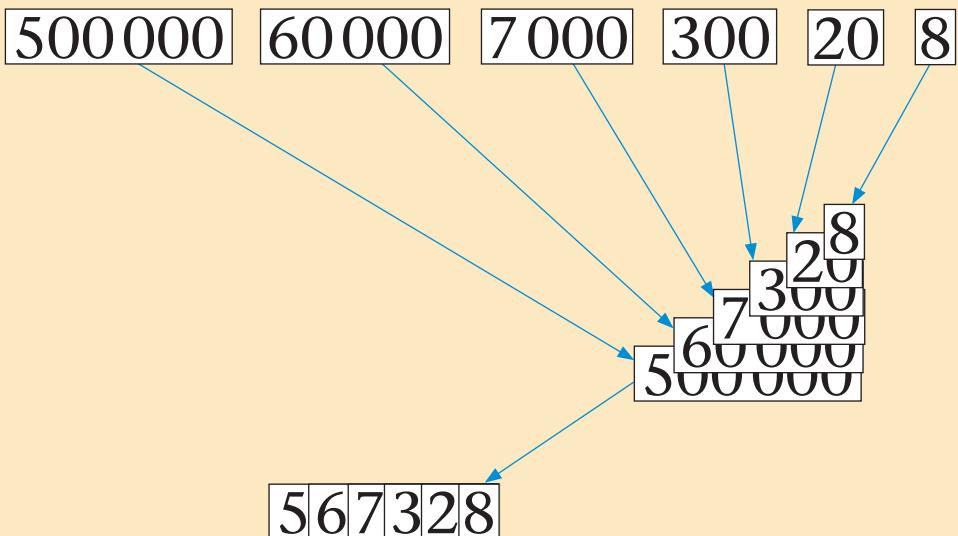
- How many millimetres are equal to 3 metres?
- How many millimetres are equal to 30 metres?
- How many millimetres are equal to 300 metres?
- How many millimetres are equal to 280 metres?
- How many millimetres are equal to 720 metres?

The number *five hundred and sixty-seven thousand three hundred and twenty-eight* can be broken down into the following place value parts:

500 000 60 000 7 000 300 20 8

Imagine that the place value parts are written on strips of cardboard or paper.

The strips can then be put on top of each other to show what the number symbol looks like. The zeros of the bigger place value parts are hidden in the number symbol.



When we write 4-digit, 5-digit and 6-digit numbers, we can leave a space before the *last* group of three digits. For example, we can write:

7 622 instead of 7622
54 382 instead of 54382
136 961 instead of 136961.

This way of grouping the digits makes it easier to read and say a number.

Also notice how we use the word “and” before the tens and ones in each group of three digits when we say and write the number names of large numbers:

2 004	two thousand <i>and</i> four
2 714	two thousand seven hundred <i>and</i> fourteen
2 734	two thousand seven hundred <i>and</i> thirty-four
22 714	twenty-two thousand seven hundred <i>and</i> fourteen
272 609	two hundred <i>and</i> seventy-two thousand six hundred <i>and</i> nine

4. Write the number symbol and expanded notation for each number.
- two hundred and ninety-five thousand one hundred and eighty-five
 - nine hundred thousand seven hundred and five
 - five hundred and four thousand and thirty-eight
 - four hundred and twenty-four thousand one hundred and forty-three
 - two hundred and fifteen thousand six hundred and eighty-two
 - nine hundred and eighty-nine thousand eight hundred and ninety-eight
 - two hundred and thirty-one thousand seven hundred and eleven
 - eight hundred and fifty-seven thousand two hundred and sixty-eight

-
5. Write the number name and expanded notation for each number.
 - (a) 789 324
 - (b) 528 738
 - (c) 501 103
 - (d) 441 160
 - (e) 287 564
 - (f) 487 923
 6. Round off each of the numbers in question 5 to the nearest:
 - (a) ten
 - (b) hundred
 - (c) thousand.

1.2 Order and compare numbers

1. Count in four hundreds from 40 800 until you reach 45 200. Write down the number symbols as you go along.
2. Copy this number grid and complete it. You have to count in 2 250s to do this.

9 000	11 250	13 500	15 750	
20 250				
	33 750			40 500
42 750				
	56 250		60 750	

3. Arrange these numbers in **ascending order** (from smallest to biggest).

66 152 98 987 95 923 98 899 21 965 47 677

4. Arrange these numbers in **descending order** (from biggest to smallest).

27 180 65 153 20 122 20 121 31 999 31 001

-
5. Count in thirty thousands from 10 000 up to 310 000. Write down the number symbols as you go along.
 6. Start at 800 000 and count backwards in six thousands until you reach 740 000. Write the number symbols as you go along.
 7. The seven numbers below are all bigger than 600 000 but smaller than 700 000. Arrange these numbers in ascending order.

641 245 662 786 680 901 646 091

656 488 673 168 637 173

8. The seven numbers below are all bigger than 900 000 but smaller than 1 000 000. Arrange these numbers in descending order.

928 028 953 156 999 820 941 783

927 891 945 678 996 788

9. In each case, decide whether the first number is bigger than, smaller than or equal to the second number. Then write the two numbers with the $<$ or $>$ or $=$ sign between the numbers.

Examples: $63\ 372 < 64\ 372$; $45\ 871 > 20\ 200$; $17\ 081 = 17081$

- | | |
|------------------------|-------------------------|
| (a) 63 372 and 63 002 | (b) 86 762 and 68 872 |
| (c) 27 901 and 28 817 | (d) 35 530 and 53 305 |
| (e) 390 860 and 390860 | (f) 701 847 and 710 874 |

2.1 Facts and skills for addition and subtraction

Up to now you have added and subtracted with numbers up to 10 000. This term, you will work with bigger numbers, up to 100 000.

To do this well, you need to know facts such as $40\ 000 + 30\ 000 = 70\ 000$ and $90\ 000 - 40\ 000 = 50\ 000$.

1. (a) Approximately how many millilitres is a mouthful of water?
(b) Approximately how many mouthfuls of water can you drink from a full 500 ml bottle?
(c) Approximately how many millilitres of water do you drink in a month?
2. (a) How many millilitres are equal to 3 litres of milk?
(b) How many millilitres are equal to 40 litres of milk?
3. (a) How many bottles are shown here?



- (b) And how many bottles are shown here?

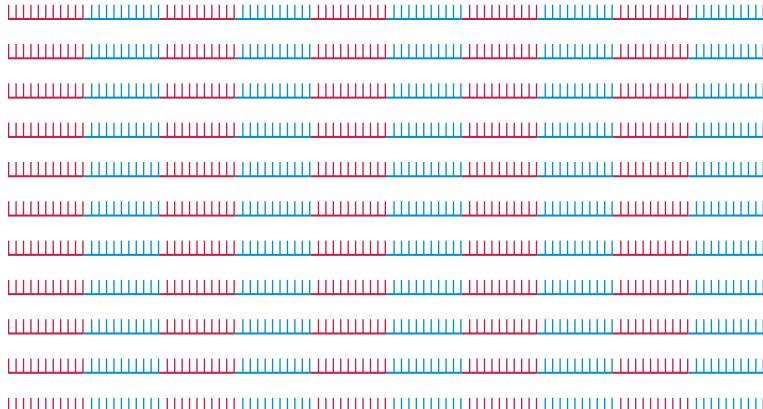


- (c) If each bottle contains 1 000 ml of juice, how many millilitres of juice are there altogether in all the bottles in (a) and (b)?



- (a) How many lines like this do you have to put next to each other to get 1 m?
 - (b) How many millimetres are there in 1 m?
 - (c) How many millimetres are there in 5 m?
 - (d) How many millimetres are there in 10 m?
 - (e) How many millimetres are there in 15 m?
 - (f) How many millimetres are there in 63 m?

7. How many mm long are all these lines together?



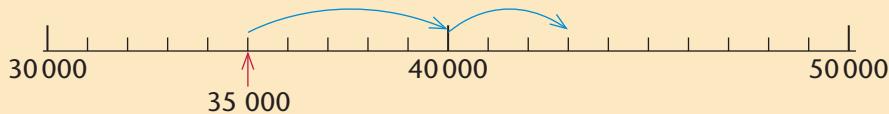
- $$8. \quad 34 \text{ m} = 34\,000 \text{ mm}$$

How many millimetres are each of the following?

- (a) $20 \text{ m} + 30 \text{ m}$ (b) $4 \text{ m} + 5 \text{ m}$
(c) $24 \text{ m} + 35 \text{ m}$ (d) $25 \text{ m} + 34 \text{ m}$
(e) $42 \text{ m} + 43 \text{ m}$ (f) $37 \text{ m} + 56 \text{ m}$

9. There is 80 000 ml of milk in a container.
- How many litres of milk is this?
 - How many millilitres of milk are left in the container if 30 000 ml of milk is taken out to fill bottles?
10. Calculate each of the following.
- $3\ 000 + 5\ 000 + 8\ 000 + 4\ 000$
 - $13\ 000 + 5\ 000 + 4\ 000 + 6\ 000 + 7\ 000$

You can have a picture like this in your mind to work out how much $35\ 000 + 8\ 000$ is:

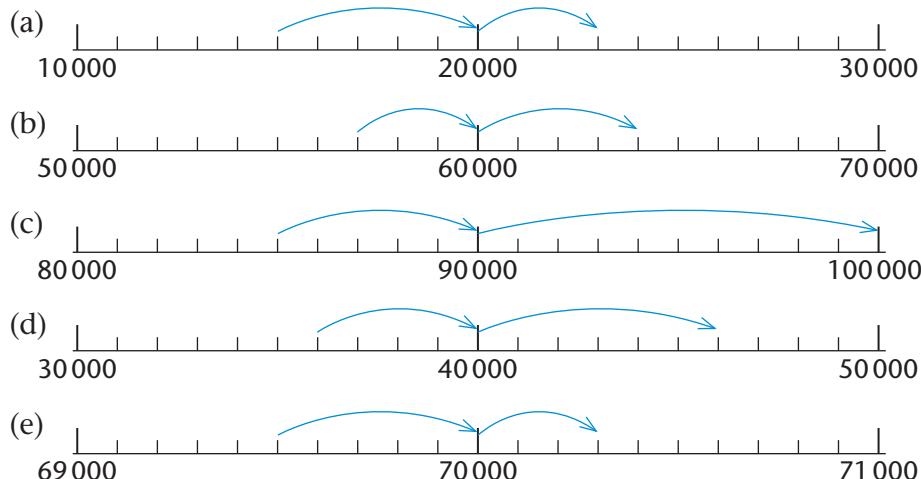


You do not have to draw a number line when you think about it. You may describe your thinking like this:

$$35\ 000 + ? \rightarrow 40\ 000 + ? = ?$$

↑ ↑
8 000 in total

11. Use question marks and arrows as it is done in the example above, to describe the thinking shown in each of these number line diagrams. Then solve your number sentences.



From any addition fact you can easily form two subtraction facts. For example, if you know that $60\ 000 + 20\ 000 = 80\ 000$, you also know that $80\ 000 - 20\ 000 = 60\ 000$ and $80\ 000 - 60\ 000 = 20\ 000$.

12. Use each of the number line diagrams in question 11 to form two subtraction facts.
13. Copy the number sentences for which you *cannot* find the answers quickly.

$$10\ 000 + 5\ 000 = \dots$$

$$5\ 000 + 8\ 000 = \dots$$

$$5\ 000 + 9\ 000 = \dots$$

$$5\ 000 + 5\ 000 = \dots$$

$$5\ 000 + 12\ 000 = \dots$$

$$5\ 000 + 14\ 000 = \dots$$

$$19\ 000 - 7\ 000 = \dots$$

$$7\ 000 + 8\ 000 = \dots$$

$$17\ 000 + 8\ 000 = \dots$$

$$27\ 000 - 8\ 000 = \dots$$

$$57\ 000 + 8\ 000 = \dots$$

$$27\ 000 + 18\ 000 = \dots$$

$$21\ 000 + 4\ 000 = \dots$$

$$40\ 000 + 30\ 000 = \dots$$

$$4\ 000 + 39\ 000 = \dots$$

$$37\ 000 + 4\ 000 = \dots$$

$$34\ 000 + 10\ 000 = \dots$$

$$34\ 000 - 20\ 000 = \dots$$

$$31\ 000 + 9\ 000 = \dots$$

$$79\ 000 + 8\ 000 = \dots$$

$$29\ 000 + 8\ 000 = \dots$$

$$9\ 000 + 25\ 000 = \dots$$

$$27\ 000 + 18\ 000 = \dots$$

$$6\ 000 + 64\ 000 = \dots$$

14. Use any method to complete the number sentences you wrote down in question 13.

15. Write each of the following as a single number.

(a) $50\ 000 + 18\ 000 + 700 + 60 + 28$

(b) $40\ 000 + 4\ 000 + 1\ 300 + 80 + 7$

(c) $60\ 000 + 3\ 000 + 2\ 700 + 60 + 14$

(d) $4\ 000 + 300 + 30\ 000 + 40 + 3 + 40\ 000 + 3\ 000 + 5 + 30 + 400$

(e) $80\ 000 - 300 + 7\ 000 + 50 - 5 + 600 - 30 - 2\ 000 + 9 - 20\ 000$

(f) $30\ 000 + 4\ 000 + 200 + 30 + 2 + 50\ 000 + 3\ 000 + 500 + 30 + 6$

(g) $50\ 000 + 30\ 000 + 4\ 000 + 3\ 000 + 500 + 200 + 30 + 30 + 6 + 2$

(h) $4\ 000 + 30 + 500 + 30\ 000 + 3\ 000 + 200 + 2 + 50\ 000 + 6 + 30$

2.2 Add and subtract 5-digit numbers

34 687 + 23 365 + 18 435 can be calculated like this:

$$\begin{aligned}34\ 687 &= 30\ 000 + 4\ 000 + 600 + 80 + 7 \\23\ 365 &= 20\ 000 + 3\ 000 + 300 + 60 + 5 \\18\ 435 &= 10\ 000 + 8\ 000 + 400 + 30 + 5 \\\text{Total} &= 60\ 000 + 15\ 000 + 1\ 300 + 170 + 17 \\&= 70\ 000 + 6\ 000 + 400 + 80 + 7 \\&= 76\ 487\end{aligned}$$

1. Calculate.
 - (a) $34\ 362 + 52\ 653$
 - (b) $28\ 638 + 47\ 287$
2. Mr Marota has to pay the following amounts to the workers in his shop. What is the total amount?
R12 765 R8 392 R34 297 R19 237
3. Do the calculations in brackets first, then add the answers.
 - (a) $(24\ 764 + 32\ 828) + (16\ 274 + 37\ 648)$
 - (b) $(37\ 648 + 24\ 764) + (32\ 828 + 16\ 274)$
 - (c) $(24\ 764 + 16\ 274) + (37\ 648 + 32\ 828)$
4. If your answers for questions 3(a), (b) and (c) are not the same, you have made a mistake. If that is the case, correct your mistake.

73 856 – 21 334 can be calculated like this:

$$\begin{aligned}73\ 856 &= 70\ 000 + 3\ 000 + 800 + 50 + 6 \\21\ 334 &= 20\ 000 + 1\ 000 + 300 + 30 + 4 \\73\ 856 - 21\ 334 &= 50\ 000 + 2\ 000 + 500 + 20 + 2 \\&= 52\ 522\end{aligned}$$

5. Do the calculations in brackets first, then work out the answers.
 - (a) $(54\ 764 - 23\ 324) + (36\ 869 - 32\ 153)$
 - (b) $(54\ 764 - 32\ 153) + (36\ 869 - 23\ 324)$
 - (c) $(54\ 764 + 36\ 869) - (32\ 153 + 23\ 324)$
6. If your answers for 5(a), (b) and (c) are not the same, you have made a mistake. If that is the case, correct your mistake.

73 456 – 26 879 cannot be calculated so easily:

$$73\ 456 = 70\ 000 + 3\ 000 + 400 + 50 + 6$$

$$26\ 879 = 20\ 000 + 6\ 000 + 800 + 70 + 9$$

$$73\ 456 - 26\ 879 = 50\ 000 + \text{?} + \text{?} + \text{?} + \text{?}$$

A plan needs to be made when there is not enough to subtract from, as in the above case.

One plan is to think of 73 456 as 70 000 + 3 456 and to transfer 1 from the 70 000 to the 3 456.

In this way 73 456 is replaced by 69 999 + 3 457.

You can then subtract 26 879 from 69 999, and add the 3 457 back afterwards:

$$69\ 999 = 60\ 000 + 9\ 000 + 900 + 90 + 9$$

$$26\ 879 = 20\ 000 + 6\ 000 + 800 + 70 + 9$$

$$\begin{aligned} 69\ 999 - 26\ 879 &= 40\ 000 + 3\ 000 + 100 + 20 + 0 \\ &= 43\ 120 \end{aligned}$$

So, $73\ 456 - 26\ 879 = 43\ 120 + 3\ 457$ which is 46 577.

In this method you thus first change to an easier number to subtract from, then you add to the answer to compensate for the change you made.

A different plan is to replace $70\ 000 + 3\ 000 + 400 + 50 + 6$ by $60\ 000 + 12\ 000 + 1\ 300 + 140 + 16$:

$$\begin{aligned} 73\ 456 &= 70\ 000 + \underbrace{3\ 000}_{\text{blue arrow}} + \underbrace{400}_{\text{blue arrow}} + \underbrace{50}_{\text{blue arrow}} + 6 \\ &= 60\ 000 + 12\ 000 + 1\ 300 + 140 + 16 \end{aligned}$$

$$26\ 879 = 20\ 000 + 6\ 000 + 800 + 70 + 9$$

$$\begin{aligned} 73\ 456 - 26\ 879 &= 40\ 000 + 6\ 000 + 500 + 70 + 7 \\ &= 46\ 577 \end{aligned}$$

This is called the **transfer method** of subtraction. In the past it was called the borrowing method.

7. Do the calculations in brackets first, then add the answers.

- $(54\ 764 - 23\ 764) + (36\ 153 - 32\ 869)$
- $(54\ 764 - 32\ 869) + (36\ 153 - 23\ 764)$
- $(54\ 764 + 36\ 153) - (32\ 869 + 23\ 764)$

-
8. If your answers for 7(a), (b) and (c) are not the same, you have made a mistake. If that is the case, correct your mistake.
9. Calculate:
- (a) $89\ 324 - 58\ 732$ (b) $50\ 130 + 44\ 016$
(c) $91\ 265 - 19\ 562$ (d) $23\ 481 + 29\ 340$
(e) $98\ 765 + 12\ 345$ (f) $54\ 321 + 67\ 890$
(g) $75\ 849 + 30\ 213$ (h) $65\ 748 + 39\ 201$
(i) $60\ 073 - 28\ 028$ (j) $30\ 314 - 12\ 242$
(k) $62\ 891 - 37\ 108$ (l) $59\ 832 - 32\ 895$
10. You will do the following calculations later. You will do the calculations from left to right. Which of these do you *expect* to have the same answers?
- (a) $49\ 678 + 33\ 547 - 23\ 749$
(b) $49\ 678 - 33\ 547 + 23\ 749$
(c) $49\ 678 - 23\ 749 + 33\ 547$
(d) $33\ 547 - 23\ 749 + 49\ 678$
11. Do the calculations in question 10.
12. You will do the following calculations later. You will do the calculations from left to right. Which of these do you *expect* to have the same answers?
- (a) $69\ 346 + 23\ 458 - 45\ 735 - 18\ 576$
(b) $69\ 346 - 45\ 735 + 23\ 458 - 18\ 576$
(c) $69\ 346 - 18\ 576 + 23\ 458 - 45\ 735$
13. Do the calculations in question 12.
14. (a) What is the difference between 37 526 and 22 809?
(b) Work out the sum of 36 127, 1 786 and 978.
(c) What number is 43 606 more than 78 065?
(d) Add 37 349 to 53 782 and subtract 41 131 from the answer.
(e) What number must be added to 35 409 to make 88 375?

2.3 Apply your knowledge

1. Mr van Staden has to pay these bills for his furniture shop:

Electricity	R7 469
Rental	R14 298
Security services	R12 356
Insurance	R8 362

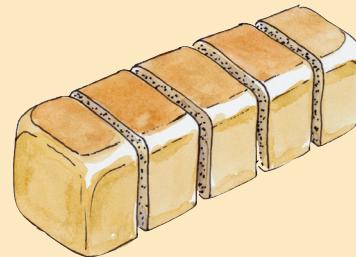
- (a) Approximately how much is this in total, to the nearest R10 000?
(b) Calculate the exact total.
2. A road athlete has already run 12 754 m of a 20 000 m race. How far does he still have to run?
3. 10 476 new houses were built by a municipality during the year. Now there are 71 658 houses. How many houses were there at the beginning of the year?
4. A church congregation has already spent R21 559 of its budget of R54 436. How much money is still available?
5. 43 452 of the 90 388 voters in a district are male. How many of the voters are female?
6. If 21 358 people live in Hari City and 32 135 people live in Ra Rangi, how many more people live in Ra Rangi than in Hari City?
7. In 2005, The Kruger Park's elephant population was found to be 12 467. There were 10 698 elephants in herds and the others were lone bulls. How many lone bulls were there?
8. Mr Cotton earns R57 912 per year and Mr Rice earns R10 272 more per year. Work out how much Mr Rice earns per year.

3.1 Dividing into fraction parts

This loaf is cut into five equal parts.

Each part is **one fifth** of the loaf.

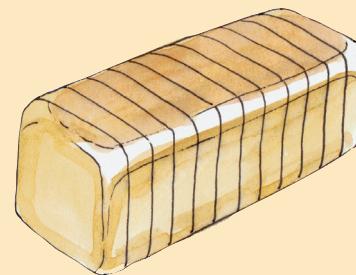
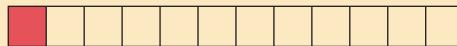
We can write one fifth in fraction notation as $\frac{1}{5}$.



This loaf is cut into twelve equal parts.

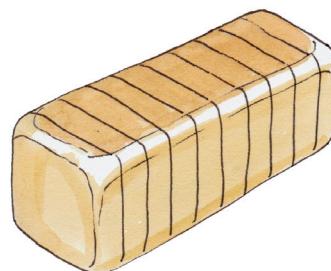
Each part is **one twelfth** of the loaf.

We can write one twelfth as $\frac{1}{12}$.

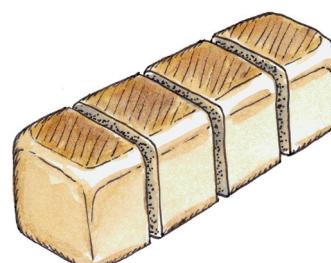


- These loaves are cut in different ways.

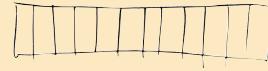
- What do we call each part of the loaf, and how do we write this in fraction notation?



- What do we call each part of this loaf, and how do we write this in fraction notation?



Diagrams like these are called **fraction strips**.



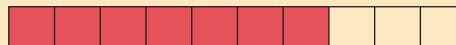
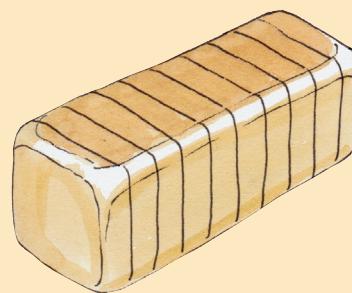
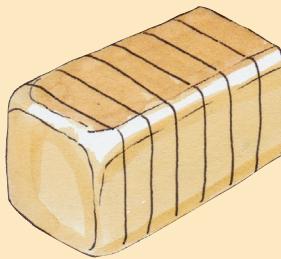
The strip on the left shows what we mean by sixths.

The strip on the right shows what we mean by twelfths.

2. In each case below, draw a fraction strip. Write down what we call each part, and also write this in fraction notation.
 - (a) A loaf of bread, or some other object, is cut into eight equal pieces.
 - (b) An object is cut into seven equal pieces.
 - (c) An object is cut into nine equal pieces.
 - (d) An object is cut into eleven equal pieces.

This loaf of bread is cut into ten equal slices.

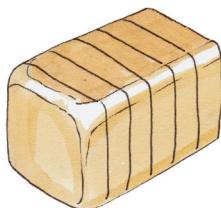
The picture below shows 7 tenths of the loaf.



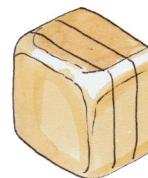
We can write 7 tenths as $\frac{7}{10}$.

3. What part of the loaf of bread above is shown in each of the pictures below? Give your answer in words and in fraction notation, and also draw a rough fraction strip in each case.

(a)



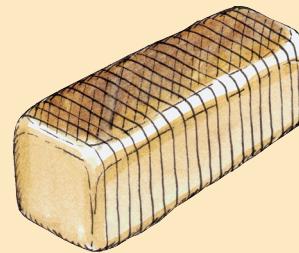
(b)



This loaf of bread is cut into 20 equal slices.

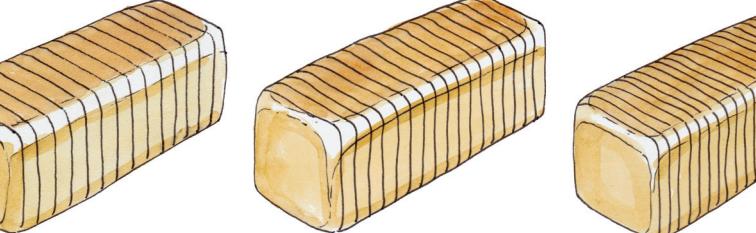
Each slice is **one twentieth** of the loaf.

The symbol for one twentieth is $\frac{1}{20}$.



4. Into how many slices are each of these loaves of bread cut? Write down what part of the whole loaf each slice is.

(a) (b) (c)



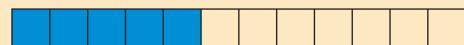
5. (a) What part of the whole loaf is each slice, if a loaf is cut into 25 equal slices?
(b) What part of the whole loaf is each slice, if a loaf is cut into 14 equal slices?
(c) What part of a cake is each slice, if the cake is cut into 7 equal slices?

6. (a) A litre of milk is shared equally between 5 children. What part of a litre does each child get?
(b) 3 loaves of bread are shared equally between 12 people. What part of a loaf does each person get?

7. (a) A cake is shared equally between all the children at a birthday party. Each child gets one eighth of the cake. How many children are at the party?
(b) 3 litres of milk were shared equally between a number of people. Each person got one fifth of a litre. How many people shared the milk?

3.2 Work with fraction parts

Part of this strip is coloured.



We say: **5 twelfths** of the strip is coloured.

We write: $\frac{5}{12}$ of the strip is coloured.

This strip is divided into nine

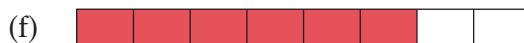


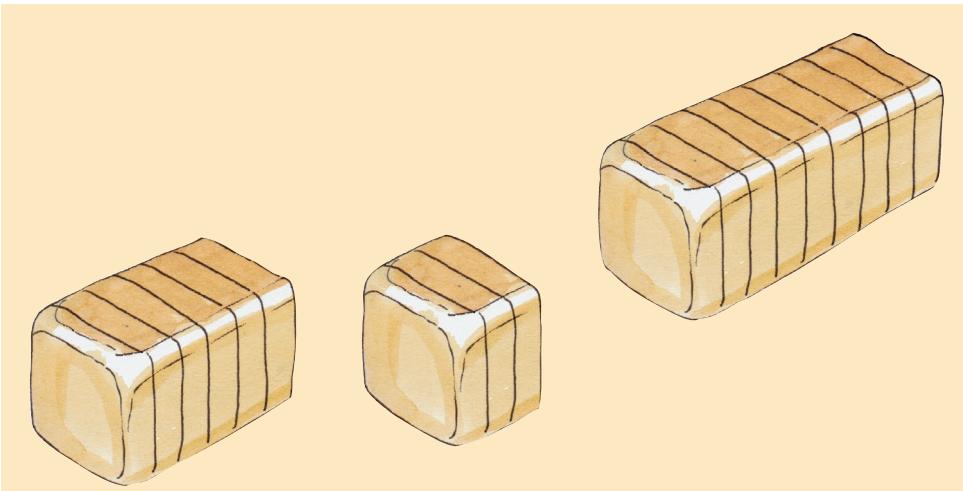
equal parts. Five of the parts are coloured.

We say: **5 ninths** of the strip is coloured.

We write: $\frac{5}{9}$ of the strip is coloured.

1. What part of each strip is coloured?

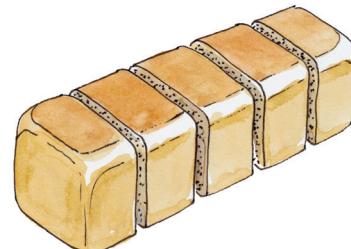




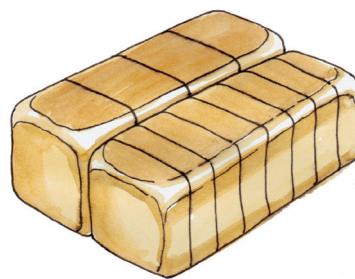
6 tenths of a loaf and 3 tenths of a loaf together is 9 tenths of a loaf.

We can write $\frac{6}{10} + \frac{3}{10} = \frac{9}{10}$

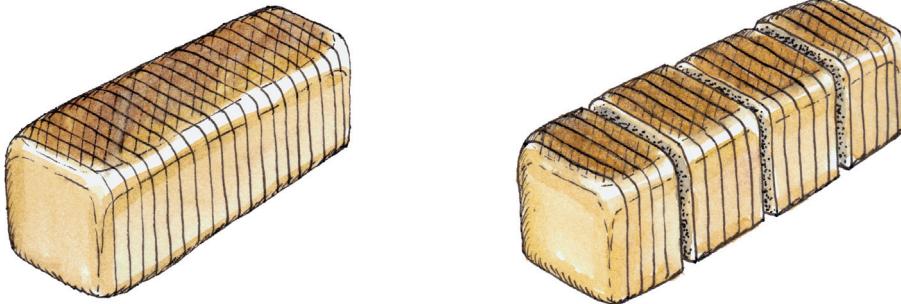
2. Write your answers as number sentences and use fraction notation as in the example above.
 - (a) If you put $\frac{5}{10}$ and $\frac{3}{10}$ of a loaf together, what part of a whole loaf do you get?
 - (b) If you put $\frac{2}{10}$ and $\frac{4}{10}$ of a loaf together, what part of a whole loaf do you get?
3. How much bread is this?
 - (a) $\frac{3}{8}$ of a loaf + $\frac{2}{8}$ of a loaf
 - (b) $\frac{2}{5}$ of a loaf + $\frac{3}{5}$ of a loaf
4. (a) 20 people must each get one fifth of a loaf. How many loaves do you need, to provide this?
(b) How many loaves do you need to provide 50 people with one fifth of a loaf each?
(c) How many loaves do you need to provide 20 people with one tenth of a loaf each?



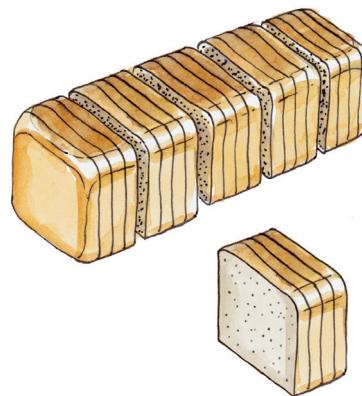
5. (a) How many eighths of a loaf is the same as one quarter of a loaf?
- (b) How many eighths of a loaf is the same as half of a loaf?
- (c) How many eighths of a loaf is the same as $\frac{3}{4}$ of a loaf?



6. This loaf is cut into 20 slices.



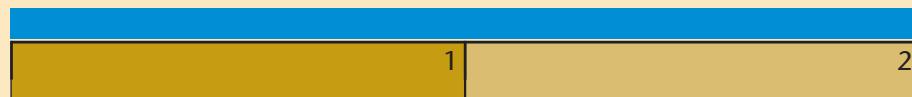
- (a) What fraction of the loaf is each slice?
- (b) The picture on the right shows the loaf divided into quarters. How many slices are there in each quarter?
- (c) How many twentieths make up each quarter?
- (d) How many twentieths are half of the loaf?
- (e) How many twentieths are equal to $\frac{3}{4}$ of the loaf?
7. The picture on the right shows a loaf of 20 slices, divided into 5 equal portions.
- (a) What part of the whole loaf is each portion?
- (b) Is each portion $\frac{1}{5}$ of the loaf, or is it $\frac{4}{20}$ of the loaf?



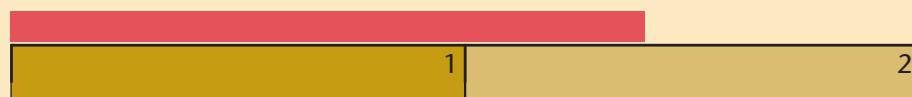
3.3 Measure with fractions of a unit

Janice uses this measuring stick to measure the length of strips of metal and lace. She calls it her Brownstick.

This blue strip is exactly 2 Brownsticks long:



The red strip below is longer than 1 Brownstick, but it is shorter than 2 Brownsticks.



We need smaller units to measure the red strip accurately.

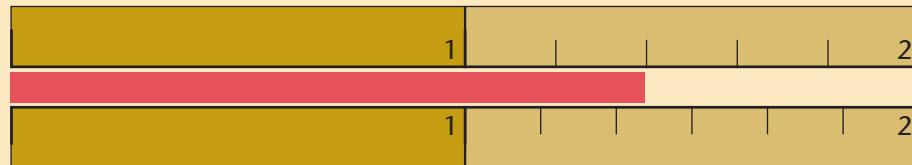
1. Part of this Brownstick ruler is divided into smaller units.



- (a) What part of a Brownstick is each of these smaller units?
- (b) What part of a Brownstick is each of the smaller units on the ruler below?



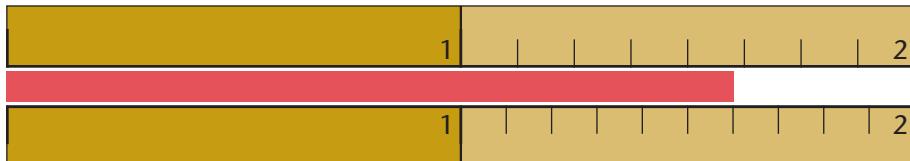
On the diagram below you can see that the red strip is **one and two fifths** of a Brownstick long, or $1\frac{2}{5}$ Brownsticks.



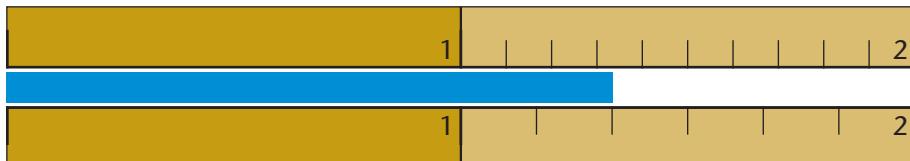
The ruler with sixths is not useful to measure the red strip.

Write your answers to questions 2 to 7 in words and in symbols. In some of the questions you may be able to state the length in two different ways.

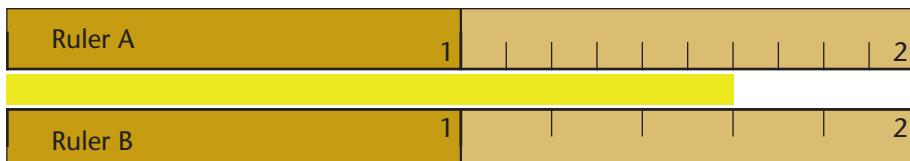
2. How long is this red strip?



3. How long is this blue strip?



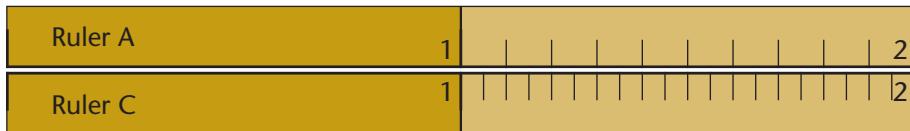
4. How long is this yellow strip?



Ruler A above is called a **tenths-ruler** because it is marked in tenths of a Brownstick.

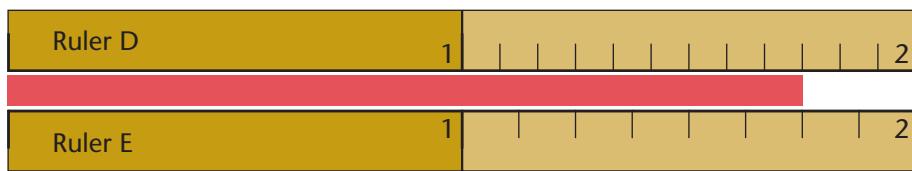
Ruler B is called a **fifths-ruler** because it is marked in fifths of a Brownstick.

5. (a) What can we call Ruler C below?

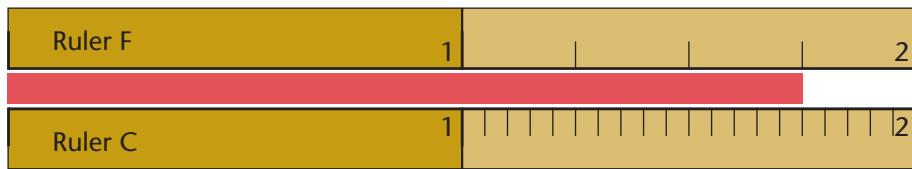


- (b) How many twentieths of a Brownstick is the same length as 6 tenths of a Brownstick?
- (c) How many twentieths of a Brownstick is the same length as 3 fifths of a Brownstick?

6. How long is this red strip?



7. This is the same red strip as in question 6. How long is it?



$\frac{3}{4}$ of a Brownstick, $\frac{9}{12}$ of a Brownstick, $\frac{6}{8}$ of a Brownstick and $\frac{15}{20}$ of a Brownstick are different ways of describing the same length.

$\frac{3}{4}$ of a metre, $\frac{9}{12}$ of a metre, $\frac{6}{8}$ of a metre and $\frac{15}{20}$ of a metre are also different ways of describing the same length.

Fractions that describe the same length or quantity are called **equivalent fractions**.

"Equi-" means equal.
Equivalent means equal value.

We can use the equal sign to indicate that fractions are equivalent.

For example, we can write $\frac{3}{4} = \frac{9}{12} = \frac{6}{8} = \frac{15}{20}$.

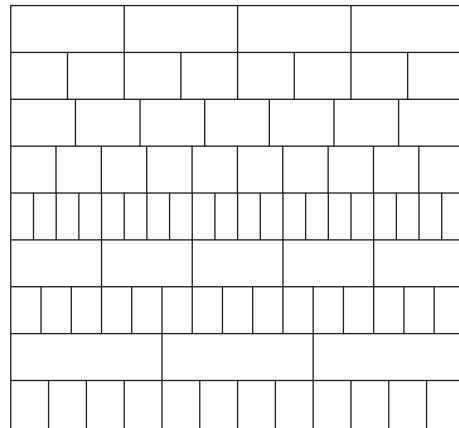
8. Which is more milk, or are the two volumes the same?
(In some cases it may help you to look at Rulers A to F in questions 4 to 7.) Write your answers using the $>$, $<$ and $=$ signs.
- (a) $\frac{1}{4} \ell$ milk or $\frac{1}{5} \ell$ milk (b) $\frac{1}{4} \ell$ milk or $\frac{2}{8} \ell$ milk
(c) $\frac{3}{10} \ell$ milk or $\frac{3}{8} \ell$ milk (d) $\frac{4}{5} \ell$ milk or $\frac{8}{10} \ell$ milk
9. Express each of the volumes in question 8 in millilitres and then check your answers for question 8.

3.4 Compare and order fractions

1. Which weighs more, or is the mass the same?

You may find the diagrams useful.

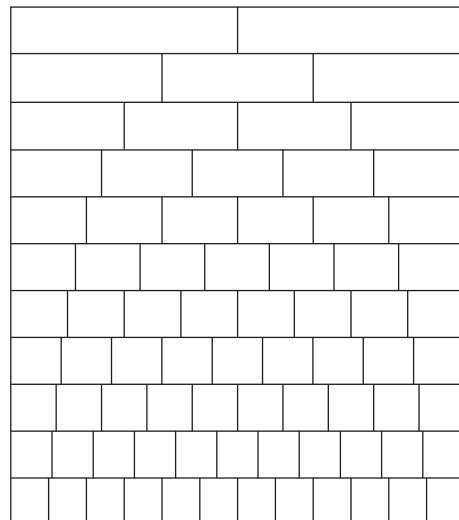
- (a) $\frac{6}{8}$ kg copper or $\frac{5}{7}$ kg copper
- (b) $\frac{2}{7}$ kg copper or $\frac{3}{8}$ kg copper
- (c) $\frac{5}{7}$ kg copper or $\frac{7}{10}$ kg copper
- (d) $\frac{9}{15}$ kg copper or $\frac{3}{5}$ kg copper
- (e) $\frac{8}{12}$ kg copper or $\frac{2}{3}$ kg copper
- (f) $\frac{13}{15}$ kg copper or $\frac{17}{20}$ kg copper
- (g) $\frac{8}{10}$ kg copper or $\frac{12}{15}$ kg copper



2. Arrange the following 11 numbers from smallest to largest:

$$\frac{1}{8} \quad \frac{1}{6} \quad \frac{1}{12} \quad \frac{1}{9} \quad \frac{1}{3} \quad \frac{1}{4}$$

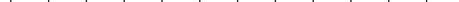
$$\frac{1}{5} \quad \frac{1}{2} \quad \frac{1}{10} \quad \frac{1}{7} \quad \frac{1}{11}$$



3. Arrange the following 11 numbers from smallest to largest:

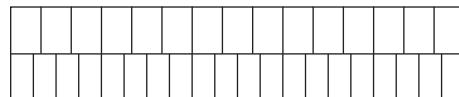
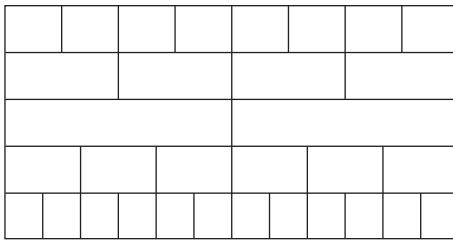
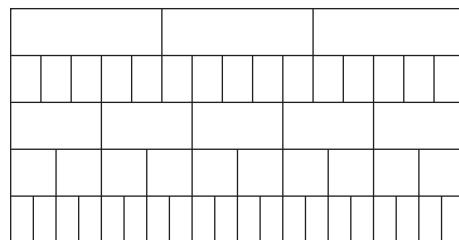
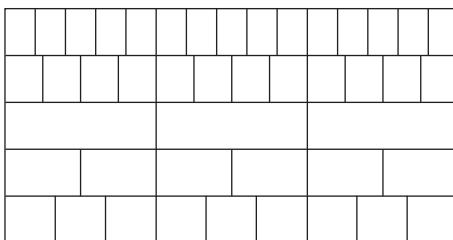
$$\frac{7}{8} \quad \frac{5}{6} \quad \frac{11}{12} \quad \frac{8}{9} \quad \frac{2}{3} \quad \frac{3}{4}$$

$$\frac{4}{5} \quad \frac{1}{2} \quad \frac{9}{10} \quad \frac{6}{7} \quad \frac{10}{11}$$



4. Which is more milk, or is it the same volume of milk?

- (a) $\frac{2}{5}$ of 1 ℓ of milk or $\frac{2}{5}$ of 500 ml of milk
- (b) $\frac{2}{5}$ of 1 ℓ of milk or $\frac{1}{5}$ of 500 ml of milk
- (c) $\frac{1}{3}$ of 750 ml of milk or $\frac{1}{2}$ of 500 ml of milk



$\frac{6}{8}$, $\frac{9}{12}$ and $\frac{15}{20}$ are all equivalent to $\frac{3}{4}$.

5. Name at least two fractions that are equivalent to each of the following. (You may use the above diagrams.)
 - (a) $\frac{1}{2}$
 - (b) $\frac{1}{3}$
 - (c) $\frac{1}{4}$
 - (d) $\frac{1}{5}$

6. Name two fractions that are equivalent to each of the following.
 - (a) $\frac{4}{5}$
 - (b) $\frac{2}{3}$
 - (c) $\frac{6}{10}$
 - (d) $\frac{8}{12}$

7. Name three fractions that are bigger than each of the following.
 - (a) $\frac{3}{5}$
 - (b) $\frac{2}{3}$
 - (c) $\frac{3}{4}$
 - (d) $\frac{7}{8}$

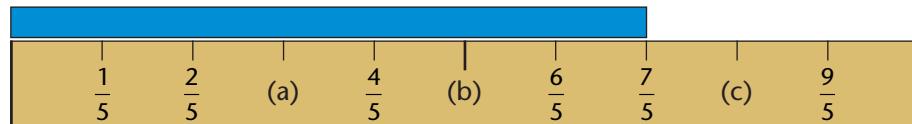
8. Name three fractions that are smaller than each of the following.
 - (a) $\frac{1}{5}$
 - (b) $\frac{3}{8}$
 - (c) $\frac{3}{4}$
 - (d) $\frac{1}{3}$

The name of a fraction, for example third, fifth or eighth, tells us into how many equal parts the whole or the measuring unit is divided. The name indicates the size of the part and therefore the unit in which we measure. It is called the **denominator** of the fraction.

The number of parts, for example the “three” in three ninths, is called the **numerator**. It indicates how many of the parts are counted.

3.5 Count in fractions on the number line

A ruler can be marked in more detail, as shown below.

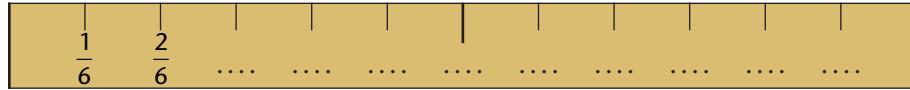


This ruler is 2 Brownsticks long.

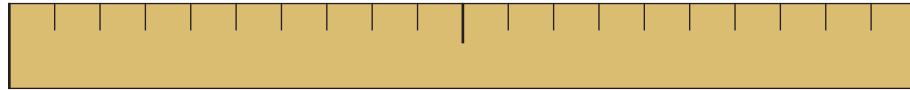
1. How long is the blue strip above the ruler?
2. What numbers should be written at (a), (b) and (c) on the above ruler?
3. Write the numbers $\frac{6}{5}$, $\frac{7}{5}$, $\frac{8}{5}$ and $\frac{9}{5}$ in another way.
4. Write down the numbers that are missing from the ruler below, from left to right.



5. Write down the numbers that are missing from the ruler below, from left to right.



6. Write down the numbers that should be at the marks on the tenths-ruler below, from left to right.

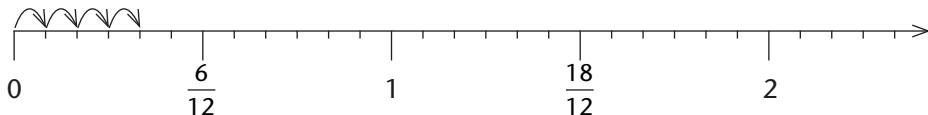


To answer the last question, you actually counted in tenths up to 19 tenths:

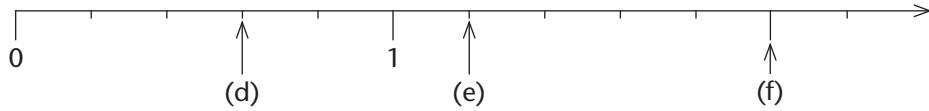
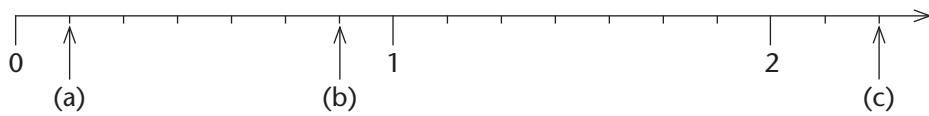
One tenth, two tenths, three tenths, four tenths 19 tenths.

You may have written it as $\frac{1}{10}, \frac{2}{10}, \frac{3}{10}, \frac{4}{10}, \frac{5}{10}, \dots \dots \dots$ up to $\frac{19}{10}$.

7. Count in twelfths up to 2. Write the numbers in symbols as you go along. While you count you may think of moving in steps of one twelfth on the number line.



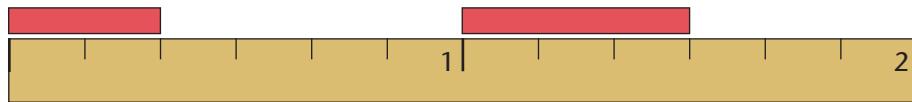
8. Count in eighths up to 3. Write the numbers in symbols as you go along.
9. Write the numbers that should be at the arrows on the number lines below.



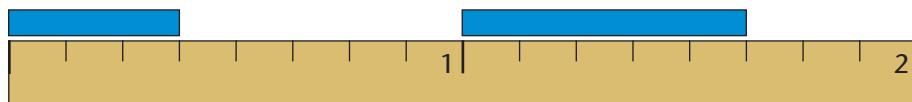
3.6 Solve problems

1. Mrs Faku has two sons. When she gives them cookies to eat, she gives two cookies to the older son for every one cookie that she gives to the younger son.
 - (a) What fraction of all the cookies that she gives them does each of the sons get?
 - (b) If she gives them 36 cookies in total, how many cookies does each son get?
2. There are 15 people at a party and 5 milk tarts. Thulisile eats $\frac{1}{4}$ of a milk tart. Is that more or less than her fair share? Explain your answer.

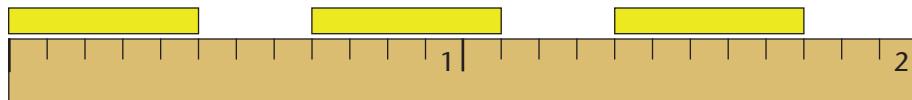
-
3. 72 learners are divided equally into three classes. Each class has its own classroom. What fraction of all the learners are in each of the classrooms?
 4. A mother shares the peaches that she bought equally among her four children. What fraction of all the peaches does each of the children get?
 5. Pienie uses about $\frac{2}{5}$ of one small block of butter to bake one batch of rusks. How much butter does she need for four batches of rusks?
 6. Each ruler below is 2 Brownsticks long.
 - (a) How long are the two red strips together?



- (b) How long are the two blue strips together?



- (c) How long are the three yellow strips together?



7. How much is each of the following?
 - (a) $\frac{1}{8} \text{ kg} + \frac{1}{8} \text{ kg} + \frac{1}{8} \text{ kg}$ of meat
 - (b) $\frac{3}{10} \text{ kg} + \frac{4}{10} \text{ kg}$ of meat
8. (a) How many twelfths of a kilogram is $\frac{1}{4} \text{ kg}$?
(b) How much is $\frac{1}{4} \text{ kg}$ sugar + $\frac{5}{12} \text{ kg}$ sugar?

4.1 Know the measuring units

1. Measure the length of your book using your pencil.
 - (a) What problem do you experience with this measurement?
 - (b) Find out if your classmates have the same problem. Discuss this with one or two of your classmates.
 - (c) Is it useful to know what the length of an object is if the measurement was done with a pencil?
 - (d) Discuss the reasons for your answer to question (c) with one or two of your classmates.

You have just used your pencil to measure the length of your book. Your pencil was the **unit of measurement**. However, a pencil is not a standard unit of measurement because all pencils are not all the same length.

2. Discuss the following with a few classmates:
 - (a) Why do we measure things?
 - (b) Why is it necessary to have standard units of measurement?

In South Africa, we use the **metric (decimal) system**, which is a standard system of measurement. Each unit is always the same size. This system is easy to use. To change from one unit to another, we divide by 10 (or multiples of 10), or multiply by 10 (or multiples of 10).

Below is a table of standard units. This year, we will use the units km, m, cm and mm only.

Kilometre (km)	Hectometre	Decametre	Metre (m)	Decimetre	Centimetre (cm)	Millimetre (mm)
1	10	100	1 000	10 000	100 000	1 000 000

The **standard unit** of measuring length in the International System of Units (the SI) is the **metre** (m). All the other units are named according to their relationship with the 1 m unit.

A **centimetre** (cm) is the length of each of the parts if 1 m is divided into 100 equal parts.

Centi- in **centimetre** means **hundredth**.

A **millimetre** is one of the parts that is formed when 1 m is divided into 1 000 equal parts.

Milli- in **millimetre** means **thousandth**.

A **kilometre** (km) is **1 000 times** as long as 1 m.

Kilo- in **kilometre** means **thousand**.

$$100 \text{ cm} = 1 \text{ m}$$

$$1\ 000 \text{ mm} = 1 \text{ m}$$

$$1\ 000 \text{ m} = 1 \text{ km}$$

The rulers and tape measures that you already know are marked in centimetres and millimetres. Your teacher can show you another commonly used ruler. It is 1 m long and is called a **metre stick**.

3. Which unit will you use if you have to measure the length of each of the objects below: millimetre, centimetre, metre or kilometre?
 - (a) the height of one of your classmates
 - (b) the length of your pencil
 - (c) the distance between two towns
 - (d) the height of a wall of a building
 - (e) the width of your fingernail

$$10 \text{ mm} = 1 \text{ cm}$$

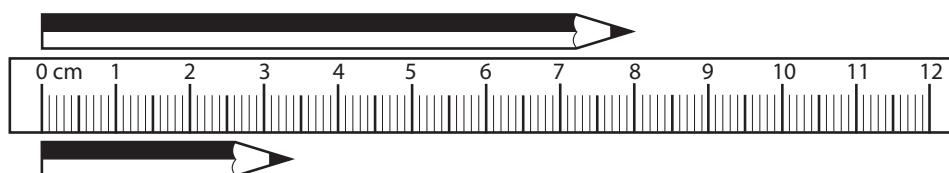
4. Name three objects that are about the length of a centimetre.
(Hint: look at your hands or look around in the classroom.)
5. Name three objects that are about 10 cm long or wide.
6. Name three objects that are about 30 cm long or wide.
7. Name three objects that are about 1 m long or wide.
8. Now use some of the objects that you named in questions 4 to 7 to help you estimate the following:
 - (a) the length of your eraser
 - (b) the length of your teacher's table
 - (c) the height of your classroom wall

4.2 Estimate and measure

When you measure the length (or width or height) of an object with your ruler, remember the following:

- Make sure that the one end of the object that you measure is on the 0 mark of the ruler.
- Read the measurement where the other end of the object is.
- Make sure that your line of sight is perpendicular to the ruler. Your eyes should be exactly above the point where you are reading on the ruler.

1. (a) Estimate and then measure the length of your pencil.
(b) What problems did you have with this task? Write them down.
2. Measure the pencils:



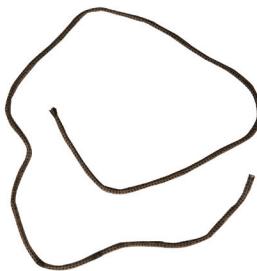
-
3. First estimate the lengths in centimetres of each of the bars below. Then measure each length with your ruler.

Copy this table and fill in the estimated lengths and the measured lengths. Write your measured lengths as centimetres and millimetres.

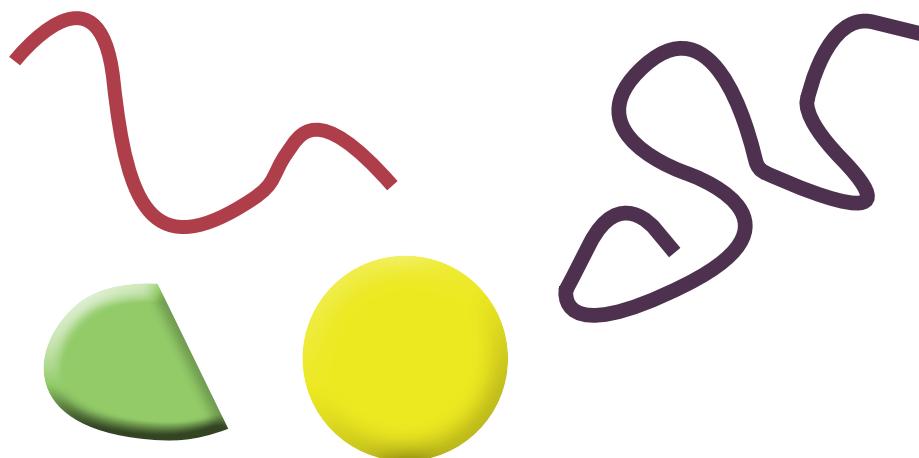
Bar	Estimated length	Measured length
Red		
Purple		
Yellow		
Green		
Grey		



4. (a) Discuss with a classmate how you can use a piece of string to find the lengths and distances described in the table below.
- (b) For each of the objects, first estimate and then measure the length. Copy this table and fill in the estimated and measured lengths.



Object	Estimated length	Measured length
The length of the red wire		
The length of the purple wire		
The distance around the yellow disc		
The distance around the green object		



5. Use a folded sheet of paper as a straight edge and draw lines that you think have approximately the following lengths: 2 cm; 8 cm; 120 mm; 15 cm.

Now use your ruler to measure your lines, and to see how accurate your estimates were.

-
6. Estimate the following lengths and write down the answers, one below the other:
- (a) the height of your school desk or table
 - (b) the width of the classroom door
 - (c) the width of the classroom
 - (d) the thickness of your eraser
 - (e) the length of a wall in your classroom
 - (f) the thickness of your pencil
 - (g) the length of your foot

Estimating does not give you the exact length, width, height or thickness, but it helps you to get an idea of the size of these measurements and the units in which they are measured.

7. The following measuring instruments are available:
a ruler, a measuring tape or metre stick, a builder's tape measure longer than 5 m, a trundle wheel.
- Which of these instruments will you use to measure the following?
- (a) the height of the classroom wall
 - (b) the distance around the playground at school
 - (c) the length of a curtain
 - (d) the length of material for making a dress
 - (e) the length of your pencil
 - (f) the thickness of this textbook
8. Now, measure the objects and distances in question 6.
- (a) Write down the measured lengths next to the estimated lengths.
 - (b) How close are your estimates to the actual measurements?
Discuss this with a classmate.

-
9. Estimate the following and write down the estimates. Afterwards, take exact measurements and write them next to the estimates.
 - (a) the height of your chair
 - (b) the width of this textbook
 - (c) the distance from your elbow to the tip of your middle finger
 - (d) the width of your thumbnail
 10. (a) Do you know how far a kilometre is? Go to a safe, familiar place and measure the distance of 1 km using a trundle wheel.
(b) Estimate the distance that you live from school.

4.3 Converting units

When we write a measurement in another unit, we say we **convert** from one unit to the other. Our system of units is a decimal system. That makes it easy to convert from one unit to another, because each unit is 10, 100 or 1 000 times as large or as small as another unit in the system. Look again at the table on page 143.

$$\begin{array}{ll} \mathbf{1 \text{ m} = 1 000 \text{ mm}} & \mathbf{1 \text{ km} = 1 000 \text{ m}} \\ \mathbf{1 \text{ cm} = 10 \text{ mm}} & \mathbf{1 \text{ m} = 100 \text{ cm}} \end{array}$$

1. (a) How would you convert centimetres to metres?
(b) How would you convert millimetres to centimetres?
(c) How would you convert millimetres to metres?
(d) How many centimetres are there in 5 m?
(e) How many millimetres are there in 6 cm?
(f) How many millimetres are there in 9 m?
2. Complete by writing the length in the given unit.
 - (a) $10 \text{ cm} = \underline{\hspace{2cm}}$ mm (b) $300 \text{ mm} = \underline{\hspace{2cm}}$ cm
 - (c) $100 \text{ cm} = \underline{\hspace{2cm}}$ mm (d) $20 \text{ mm} = \underline{\hspace{2cm}}$ cm
 - (e) $180 \text{ cm} = \underline{\hspace{2cm}}$ mm (f) $600 \text{ mm} = \underline{\hspace{2cm}}$ cm

3. Copy and complete the table.

mm	20		30		90		100		130	540		
cm		5		18		4		100			43	430

4. Complete by writing the length in the given unit.

- | | |
|--|--|
| (a) $480 \text{ cm} = \underline{\hspace{2cm}}$ m | (b) $560 \text{ mm} = \underline{\hspace{2cm}}$ cm |
| (c) $30 \text{ m} = \underline{\hspace{2cm}}$ cm | (d) $20 \text{ m} = \underline{\hspace{2cm}}$ mm |
| (e) $300 \text{ mm} = \underline{\hspace{2cm}}$ cm | (f) $750 \text{ mm} = \underline{\hspace{2cm}}$ m |

5. Copy and complete the tables.

(a)	mm	4 000			2 000		1 000
	cm	400	800				
	m	4		6		9	

(b)	mm			5 000			75 000
	cm		300		600		
	m	12				9	

6. Complete:

- | | |
|---|---|
| (a) $1 \text{ km} = \underline{\hspace{2cm}}$ m | (b) $1 000 \text{ m} = \underline{\hspace{2cm}}$ km |
| (c) $20 \text{ km} = \underline{\hspace{2cm}}$ m | (d) $3 500 \text{ m} = \underline{\hspace{2cm}}$ km |
| (e) $450 \text{ km} = \underline{\hspace{2cm}}$ m | (f) $300 \text{ m} = \underline{\hspace{2cm}}$ km |

You know that $1 000 \text{ m} = 1 \text{ km}$. You can write $1 500 \text{ m}$ as $1 \text{ km} + 500 \text{ m}$ or as $1\frac{1}{2} \text{ km}$.

Other ways to write this are $1,500 \text{ km}$ and $1,5 \text{ km}$. The 1 tells you that you have 1 full kilometre and the 0,5 or 0,500 tells you that you have another $\frac{1}{2} \text{ km}$.

7. Copy and complete the table.

m	2 000	8 500			28 000		176 000		5 500
km			18	134		$\frac{1}{2}$		4,5	

-
8. Write the following distances as kilometres and metres.
Example: $2\ 345\text{ m} = 2\text{ km and }345\text{ m}$
- (a) 5 892 m (b) 17 056 m (c) 8 331 m
(d) 23 451 m (e) 2 003 m (f) 100 400 cm
9. (a) We know that $1\text{ m} = 100\text{ cm}$. Write 50 cm in metres.
(b) What is half of 50 cm? Give your answer in metres.
(c) What is half of 50 cm? Give your answer in centimetres.
10. Write the following in cm:
(a) $1\frac{1}{4}\text{ m}$ (b) $2\frac{1}{2}\text{ m}$ (c) $1\frac{3}{4}\text{ m}$
11. We can write 6 257 mm as 6 m and 25 cm and 7 mm. Write the following as m, cm and mm:
(a) 7 035 m (b) 8 004 mm (c) $308\frac{1}{4}\text{ cm}$
(d) 10 400 mm (e) 3 671 cm (f) $4\frac{1}{4}\text{ km}$
12. Is it possible to add lengths that are expressed in different units?
Explain your answer.
13. Add the following distances or lengths:
(a) $15\text{ km} + 67\ 894\text{ m}$ (b) $9\ 555\text{ m} + 9\frac{1}{2}\text{ km}$
(c) $674\text{ m} + 538\text{ cm}$ (d) $304\text{ cm} + 567\text{ mm}$
(e) $70\ 025\text{ cm} + 88\ 040\text{ mm}$ (f) $73\ 257\text{ m} + 7\frac{1}{2}\text{ km}$
14. Now, for each of the lengths (or distances) in question 13, subtract the shorter one from the longer one.
15. Write the following lengths in descending order (from longest to shortest) and write down how you decided on this order.
- (a) $643\text{ cm}; 12\frac{1}{2}\text{ m}; 870\text{ mm}; \frac{3}{4}\text{ m}$
(b) $1,5\text{ km}; 1\ 230\text{ m}; 21\ 877\text{ cm}$
(c) $556\text{ cm}; 1\frac{1}{2}\text{ km}; 861\ 490\text{ cm}; 91\ 499\text{ mm}; 521\ 027\text{ m}; 0,5\text{ km}$
(d) $20\ 000\text{ m}; 25\text{ km}; 150\ 000\text{ cm}$

4.4 Rounding off with units of measurement

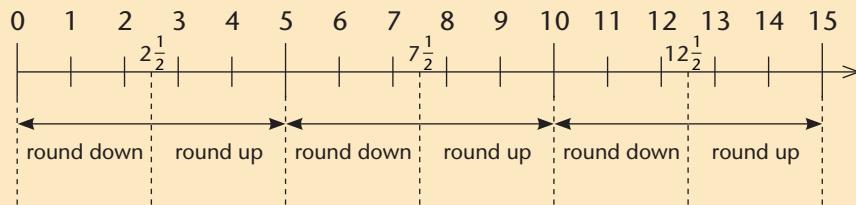
When a length is given in a smaller unit, we often round it off to a bigger unit.

If you round off to the nearest 100 cm, it is the same as rounding off to the nearest metre. Rounding off to the nearest 10 mm is the same as rounding off to the nearest centimetre, rounding off to the nearest 1 000 m is the same as rounding to the nearest kilometre and so on.

So, 46 mm rounded off to the nearest centimetre is 5 cm. This is because there are 10 mm in 1 cm, and 46 mm is closer to 50 mm than to 40 mm.

2 592 m rounded to the nearest kilometre is 3 km. There are 1 000 m in 1 km, and 2 592 m is closer to 3 000 m than 2 000 m.

We can also round off to other numbers, for example to the number 5. The number 5 and its multiples then become your base:



Rounded off to the nearest 5:

- | | |
|---------------------|---------------------|
| 8 becomes 10 | 22 becomes 20 |
| 84 becomes 85 | 87 becomes 85 |
| 6 becomes 5 | 7 becomes 5 |
| 999 becomes 1 000 | 997 becomes 995 |
| 1 844 becomes 1 845 | 2 702 becomes 2 700 |
| 2 708 becomes 2 710 | 2 073 becomes 2 075 |

-
1. Round the following lengths up or down as required.
 - (a) 16 cm to the nearest 10 cm
 - (b) 983 mm to the nearest cm
 - (c) 7 665 km to the nearest 100 km
 - (d) 2 519 cm to the nearest m
 - (e) 1 500 m to the nearest km
 - (f) 28 mm to the nearest cm
 - (g) 9 km to the nearest 10 km
 - (h) 999 cm to the nearest m
 - (i) 5 569 cm to the nearest m
 - (j) 2 099 mm to the nearest m
 2. Round off to the nearest 5 of the given unit.

(a) 16 km	(b) 44 cm
(c) 57 cm	(d) 302 km
(e) 25 mm	(f) 89 cm
(g) 599 mm	(h) 14 m
(i) 509 m	(j) 19 km
 3. (a) The distance between Cape Town and Durban is given as 1 753 km. Round it off to the nearest 10 km.
(b) The distance between Cape Town and East London is given as 1 079 km. Round it off to the nearest 100 km.
(c) The distance from the Earth to the moon is not the same everywhere. This is because of the shape of the orbit of the Earth around the Sun. The shortest distance is given as 363 104 km. The longest distance is given as 405 696 km. Round off both of these distances to the nearest 100 km.

4.5 Problem solving

1. Researchers fitted a tracking collar around a leopard's neck to find out how big his hunting ground is. In the first week, the leopard covered a distance of 42 km and 499 m. In the second week, his distance was 59 km and 504 m, and in the third week, 82 km.
 - (a) How far did the leopard walk in these three weeks? Give your answer in km and m.
 - (b) What is the difference between the longest and shortest distance that the leopard walked?
 - (c) Round off all the distances to the nearest kilometre and add them together. What is the difference between this answer and the answer you gave in (a)?
 - (d) If the leopard walked 931 km altogether in 14 days, how many kilometres does he walk on average per day? Give your answer in km and m.
2. The yard animals are holding an endurance competition to see who can cover the biggest distance in one hour. Snail starts and covers 746 cm. Sparrow (he is not allowed to fly) has the shortest legs and moves five times further than Snail. Hen does double the distance of Sparrow and Scottish Terrier travels 36 times farther than Snail.
 - (a) Write down the distance that each of the animals travelled. Write your answer in cm, and in m and cm.
 - (b) Arrange the distances in ascending order (from shortest to longest).
 - (c) Write the distance that Snail moved in mm.
 - (d) How far will Snail go in three weeks if he moves one hour a day?
 - (e) What distance did all the animals together travel in one hour? Answer in cm, and in m and cm.



-
- (f) Round off the distance each animal travelled in the one hour to the nearest 5 cm.
- (g) How far must Sparrow go if he wants to double Snail's distance?
3. For each 1 500 m that Mrs Cat runs, Mr Dog runs 2 000 m.
- How far does Mr Dog run if Mrs Cat runs 4 500 m?
 - How far does Mrs Cat run if Mr Dog runs 10 km?
4. Adam wants to put up an electric fence consisting of five wires around his yard. He needs 5 lengths of 120 m wire. He decides to round off the length of the wire to the nearest 100 to make it easier to work out how much wire he will need.
- How many metres of wire does he need if he works it out like this?
 - How many metres too many or too few is this?
5. Nandi plants vegetables in her vegetable patch. Each row is 3 m long. There are several rows.
- Draw two rows each 12 cm long and divide each row into 3 equal parts. Each of the parts represents 1 m.
 - In the first row, Nandi plants her tomatoes 50 cm apart. Make marks on your drawing to show where the tomato plants will go. How many can she plant in this row?
 - In the next row, she plants mealies 30 cm apart. Make marks on your drawing to show where the mealie seeds will go. How many mealie seeds will she plant in this row?
 - She plants more rows of tomatoes, also 50 cm apart. If she has 28 tomato plants, how many rows of tomatoes can she plant?
 - For every 7 tomato plants that she plants, she plants 11 mealie seeds. How many mealie seeds will she plant if she plants 56 tomato plants?
 - How many tomato plants does she need if she plants 110 mealie seeds?

-
- (g) In one row she plants only 3 tomato plants. Which fraction/part of the 3 m long row is still open?
- (h) What fraction of the row did she plant if she planted 5 tomato plants?
6. Fill in the sign of operation (+ or -) and the missing length to get the given length.

Example: $26 \text{ m } \square 24 \text{ m} = 50 \text{ m}$

- (a) $37 \text{ mm } \square \underline{\quad} = 70 \text{ mm}$ (b) $87 \text{ cm } \square \underline{\quad} = 1 \text{ m}$
(c) $155 \text{ m } \square \underline{\quad} = 120 \text{ m}$ (d) $880 \text{ mm } \square \underline{\quad} = 90 \text{ cm}$
(e) $7500 \text{ m } \square \underline{\quad} = 8 \text{ km}$ (f) $6402 \text{ m } \square \underline{\quad} = 10 \text{ km}$
(g) $11\frac{1}{2} \text{ km } \square \underline{\quad} = 9000 \text{ m}$ (h) $1554 \text{ cm } \square \underline{\quad} = 16 \text{ m}$

5.1 Refresh your multiplication memory

- For which of these do you know the answer? Copy the questions that you *do not* quickly know the answers to into your book, so that you can work on them later.

30×8	30×10	30×2	30×5	
70×7	70×8	70×10	70×2	
80×6	80×7	80×8	80×10	
50×4	50×6	50×7	50×8	
20×9	20×4	20×6	20×7	
90×3	90×9	90×4	90×6	
60×5	60×3	60×9	60×4	
40×2	40×5	40×3	40×9	
10×10	10×2	10×5	10×3	
30×3	30×9	30×4	30×6	30×7
70×5	70×3	70×9	70×4	70×6
80×2	80×5	80×3	80×9	80×4
50×10	50×2	50×5	50×3	50×9
20×8	20×10	20×2	20×5	20×3
90×7	90×8	90×10	90×2	90×5
60×6	60×7	60×8	60×10	60×2
40×4	40×6	40×7	40×8	40×10
10×9	10×4	10×6	10×7	10×8

Jeminah does not immediately know how much 60×7 is.

She asks herself: “Is there some other multiplication fact for 60 that I do know?”

She can only remember that $2 \times 60 = 120$.

Now she thinks: “If $2 \times 60 = 120$,
then 4×60 is 120 doubled... and that is 240.

And $6 \times 60 = 4 \times 60 + 2 \times 60 = 240 + 120 = 360$.

So 7×60 is one 60 more than 360, and that is 420.”

2. (a) Choose any of the items you could not immediately answer when you did question 1. Try to work it out using any method you prefer.
(b) Do the same for another item you could not answer. Continue in this way until you have answered all those items.
3. Copy the table below, and fill in the answers that you did *not* know when you did question 1.

\times	2	4	8	3	6	5	10	9	7
10									
50									
90									
80									
40									
20									
30									
60									
70									

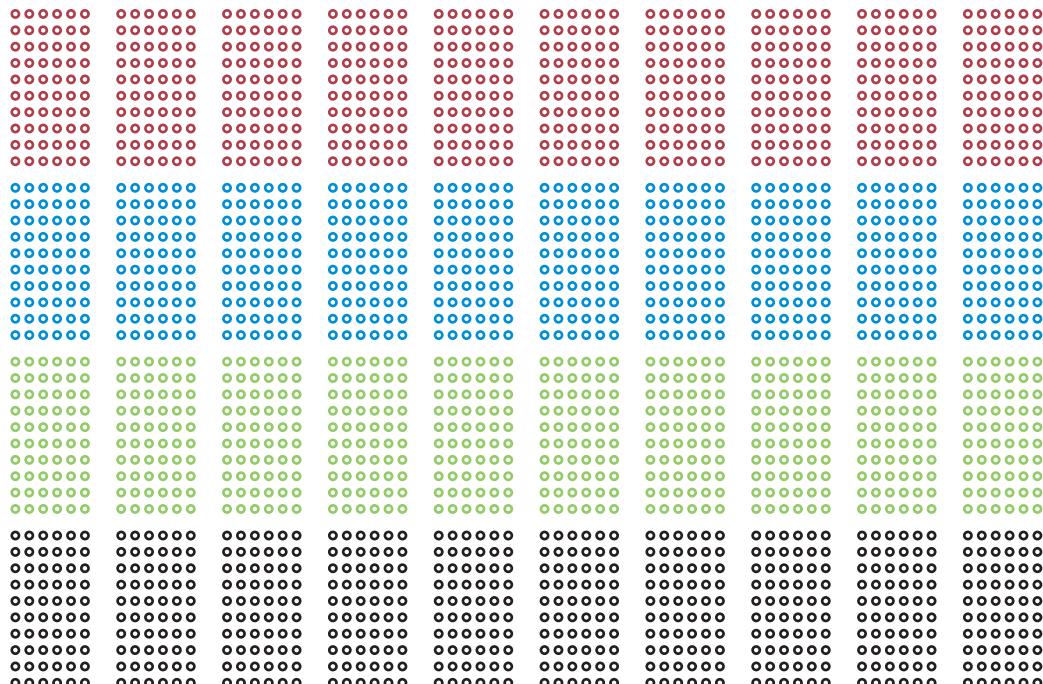
5.2 Working with hundreds

1. How much is each of the following?
(a) 4×6 (b) 4×60

Mlungisi says when he looks at his answers for question 1, he can see that he just needs to write another 0 after 240 to get the answer for 4×600 .

So Mlungisi believes that $4 \times 600 = 2\,400$.

2. Double 600, and double again, to check whether Mlungisi is right.
3. How many beads are shown below?



4. (a) How many beads of each colour are there?
(b) How many groups of 60 beads each are there?
5. Are there 4×600 beads or 40×60 beads?
6. How many beads will there be on 10 pages like this?

-
7. (a) How many people are ten groups of 10 people each?
(b) How many people are ten groups of 100 people each?
(c) How many people are ten groups of 1 000 people each?
(d) How many people are ten groups of 30 people each?
(e) How many people are ten groups of 70 people each?
(f) How many people are ten groups of 700 people each?
 8. In each case, indicate whether the statement is true or false.
 - (a) Ten hundreds are one thousand.
 - (b) Hundred tens are ten thousand.
 - (c) Hundred hundreds are ten thousand.
 - (d) Hundred tens are one thousand.
 - (e) Two hundred fives are one thousand.
 - (f) Two hundred fifties are ten thousand.

Now look at this:

$$\begin{aligned}367 &= 300 + 60 + 7 \\10 \times 367 &= 10 \times 300 + 10 \times 60 + 10 \times 7 \\&= 3 000 + 600 + 70\end{aligned}$$

When 367 is multiplied by 10 the 300 becomes 3 000, the 60 becomes 600 and the 7 becomes 70.

9. Investigate how the 500, 80 and 3 that make up 583 are affected if 583 is multiplied by 100.
10. How much is each of the following?

100×6	100×60	200×60
400×60	60×300	30×600
50×700	400×80	900×4
40×900	70×900	8×700
600×70	30×900	700×40

5.3 Multiply 3-digit numbers by 1-digit numbers

347×8 can be calculated as follows:

$$347 = 300 + 40 + 7$$

$$\begin{aligned} \text{So, } 347 \times 8 &= 300 \times 8 + 40 \times 8 + 7 \times 8 \\ &= 2400 + 320 + 56 \\ &= 2000 + 400 + 300 + 20 + 50 + 6 \\ &= 2776 \end{aligned}$$

1. Calculate each of the following.

(a) 563×7	(b) 6×378
(c) 362×9	(d) 8×623
(e) 6×407	(f) 785×6
(g) 9×284	(h) 7×493
(i) 587×8	(j) 698×4
(k) 478×7	(l) 908×8
2. One hotel has 238 rooms. How many rooms are there in 7 such hotels?
3. At a large wedding reception, 8 guests sit at one table. How many guests are at the wedding reception if 156 tables are fully occupied?
4. During a cross-country marathon there should be at least nine water sachets for each athlete. How many sachets of water are needed if there are 577 runners?
5. Jane needs to feed eight two-week-old baby goats 375 ml of milk each, four times a day. How much milk does she need every day? Give your answer in litres.
6. The price of four soccer balls is R556. How much do nine balls cost?
7. A bag of onions has a mass of 875 g. Calculate the total mass of eight bags of onions. Give your answer in kilograms.

5.4 Multiply 3-digit numbers by 2-digit numbers

347×84 can be calculated as follows:

$$347 = 300 + 40 + 7$$

$$\text{So, } 347 \times 84 = 300 \times 84 + 40 \times 84 + 7 \times 84$$

$$= 300 \times 80 + 40 \times 80 + 7 \times 80 + 300 \times 4 + 40 \times 4 + 7 \times 4$$

Each of the three parts have to be calculated separately.

1. Calculate each of the parts of 347×84 shown above, and then find out how much 347×84 is.
2. Calculate 347×84 in a different way, by first breaking down 84 into 80 and 4.
3. Calculate each of the following.

(a) 384×76	(b) 64×328
(c) 374×42	(d) 419×56
(e) 83×387	(f) 276×77
(g) 658×69	(h) 709×26
(i) 52×354	(j) 542×63
(k) 288×58	(l) 46×496
4. See if you can use your answer for question 3(i) to calculate the mass of 177 bags of river sand if the mass of one bag is 52 kg.
5. The entrance fee for a concert is R32 for school children and R48 for adults. Tickets are sold at the door. How much money is taken at the door if 215 children and 467 adults attend the concert?
6. Twenty-four schools each receive a large box with 254 light bulbs. How many light bulbs is this in total?
7. (a) On a strawberry farm, there are 546 strawberry plants in each bed. How many plants are there altogether in 34 strawberry beds?
(b) Strawberry jam is also produced on the farm and packed in boxes of 48 jars each. How many jars are there in 465 boxes?

8. A container with three tennis balls costs R39. The tennis coach needs at least twelve new tennis balls per match. This season, 48 matches will be played.
- How many tennis balls does the coach need this season?
 - How much money will he need to buy the tennis balls?

5.5 Rate

Salmon and Rashid both play drum in an orchestra.

Salmon plays a big drum and Rashid plays a small drum.

For a certain item that lasts more than four minutes, Salmon has to beat the big drum at 10-second intervals.

Rashid has to start slowly but play faster and faster while they perform the item.



- How many beats should Salmon make in 3 minutes while they perform the item?

This table shows how many beats each player made during each minute while they played the item.

	First minute	Second minute	Third minute	Fourth minute
Salmon	• • • •	• • • •	• • • •	• • • •
Rashid	• • • • •	• • • • •	• • • • •	• • • • •

-
2. Copy the table below. Count the dots in each cell of the table on page 163 and enter the numbers in your table.

	First minute	Second minute	Third minute	Fourth minute
Salmon				
Rashid				

Salmon beat his drum at a rate of 6 beats per minute during the whole item.

We can say Salmon played at a **constant rate** of 6 beats **per** minute, for 4 minutes.

When we say something is **constant**, we mean it remains the same, it does not change.

3. Did Rashid also play at a *constant* rate during the 4 minutes?
4. (a) In another item, Rashid plays at a constant rate of 8 beats per minute and he plays for 5 minutes. How many beats does he make in total?
(b) In this item Salmon also plays at a constant rate, but he only plays for 3 minutes. He makes 36 beats in total. At what rate does Salmon play?
(c) There is a third drummer in this item. Maria plays at a constant rate of 8 beats per minute, and she makes 32 beats in total. For how many minutes does she play?
(d) If Salmon continues to play as fast as he does in question (b), how many beats will he make in 5 minutes?
5. Eric, Sally and Katie are working on a tomato farm.
(a) Eric picks tomatoes at an almost constant rate of 74 tomatoes per hour. Approximately how many tomatoes will he pick in 3 hours?
(b) Sally also picks tomatoes at an almost constant rate. She picks 240 tomatoes in 3 hours. How many tomatoes will she pick in 5 hours?

-
- (c) Katie picks tomatoes at a rate of approximately 46 tomatoes per hour. On a certain day she picked 276 tomatoes in total. How many hours did she work?

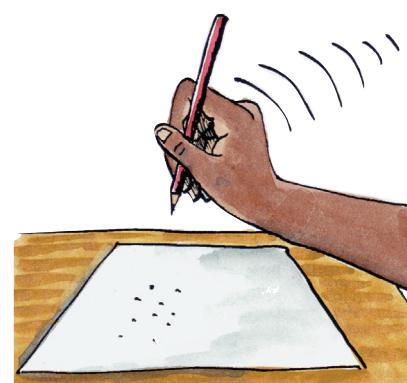
5.6 Ratio

Salmon and Rashid are practising a new item. Salmon has to beat the big drum 6 times during each minute at regular intervals. Rashid has to make 30 beats on the small drum during each minute.

1. Tap with your fingers on your desk for a while, approximately as fast as Salmon has to play his drum. Now use your pencil to tap and make a mark on a sheet of paper each time you tap. Your teacher will let you do this for 4 minutes.



2. Now tap your desk for a while, approximately as fast as Rashid has to play his drum. Then use your pencil again and make a mark on another sheet of paper each time you tap. Your teacher will let you do this for 4 minutes.



We can say Salmon has to play at a **rate** of 6 beats **per** minute.

3. At what rate does Rashid have to play?
4. (a) How many beats should Rashid make in 5 minutes?
(b) How many beats should Salmon make in 5 minutes?

In order to answer question 4, you multiplied the rate by the period of time.

-
5. (a) How many times should Rashid beat the small drum if Salmon beats the big drum 18 times?
(b) How many times should Salmon beat the big drum if Rashid beats the small drum 120 times?
 6. (a) Copy this table, and enter your answers for question 5 in it.

Number of beats on the small drum								
Number of beats on the big drum	6	12	18	24	30	36	42	48

- (b) Complete the table.
7. (a) How many beats should be made on the small drum, for every 12 beats on the big drum?
(b) How many beats should be made on the small drum, for every 30 beats on the big drum?
(c) How many beats should be made on the small drum, for every 9 beats on the big drum?
(d) How many beats should be made on the small drum, for every 1 beat on the big drum?

To compare how often the two players must beat their drums, we can say that the **ratio** of beats on the small drum to beats on the big drum is 30 to 6. We can also say the ratio is 5 to 1.

- The **ratio** is a comparison between two quantities of the same kind.
8. When he walks, Isaac takes 12 steps each minute while Benjamin takes 20 steps.
 - (a) What is the ratio between the numbers of steps they take in one minute?
 - (b) How many steps will Benjamin take while Isaac takes 6 steps?
 - (c) How many steps will Isaac take while Benjamin takes 30 steps?

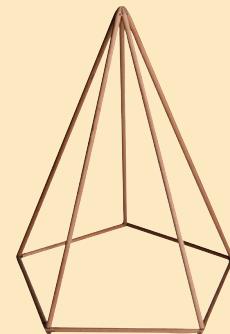
6.1 Flat and curved surfaces on 3-D objects

Different kinds of 3-D objects have surfaces with different shapes.

Prisms and **pyramids** have **flat surfaces** only.

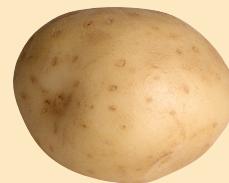
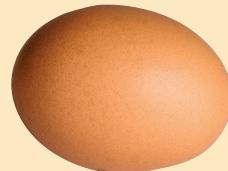


Wooden prisms



A frame for a pyramid

Spheres and egg-shaped objects have **curved surfaces** only.



Cylinders and **cones** have flat and curved surfaces.



A paper cone seen from different positions



A tin of beans has the shape of a cylinder.

Flat surfaces of 3-D objects are also called **faces**.

-
1. Describe all the cones, cylinders and pyramids you can see in these pictures.



2. Describe any object with a curved surface in your classroom.
3. Describe three prism-shaped objects in your classroom.
4. Does your classroom have the shape of a prism?

6.2 Make cylinders and cones

1. You can easily make a cylinder from a sheet of paper.



Do it.



An open cylinder like this can also be called a **tube**.

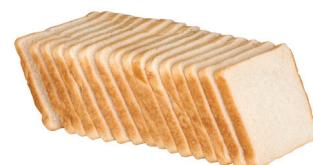
You can put sticky tape at two or three places to hold it together.

2. The two ends of your cylinder are open.
 - (a) Make a rough drawing to show the shape of the two open ends.
 - (b) Are the two ends the same?

If you fill the cylinder with clay and close the two ends, and let the clay dry, you will have a **solid cylinder**.

If you slice a loaf of bread, you can make all the slices almost the same.

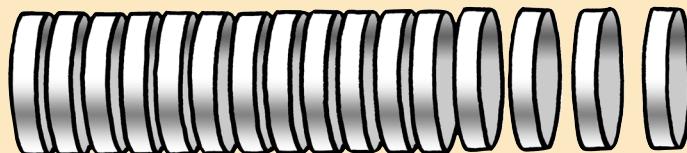
3. If a cylinder is cut in the way you will slice a loaf of bread, what shape will the cylinder slices be? Make a drawing.



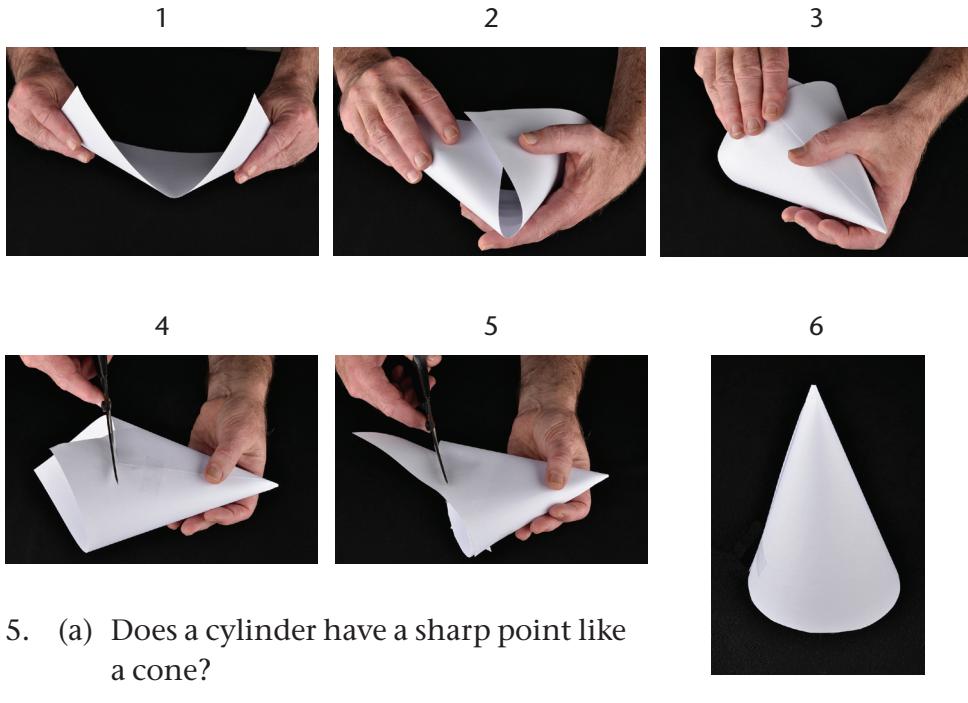
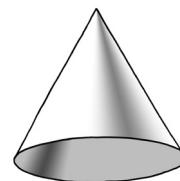
You can think of a cylinder as many slices pressed together.

Each of the slices is also a cylinder.

A thin cylinder like this is also called a **circular disk**.

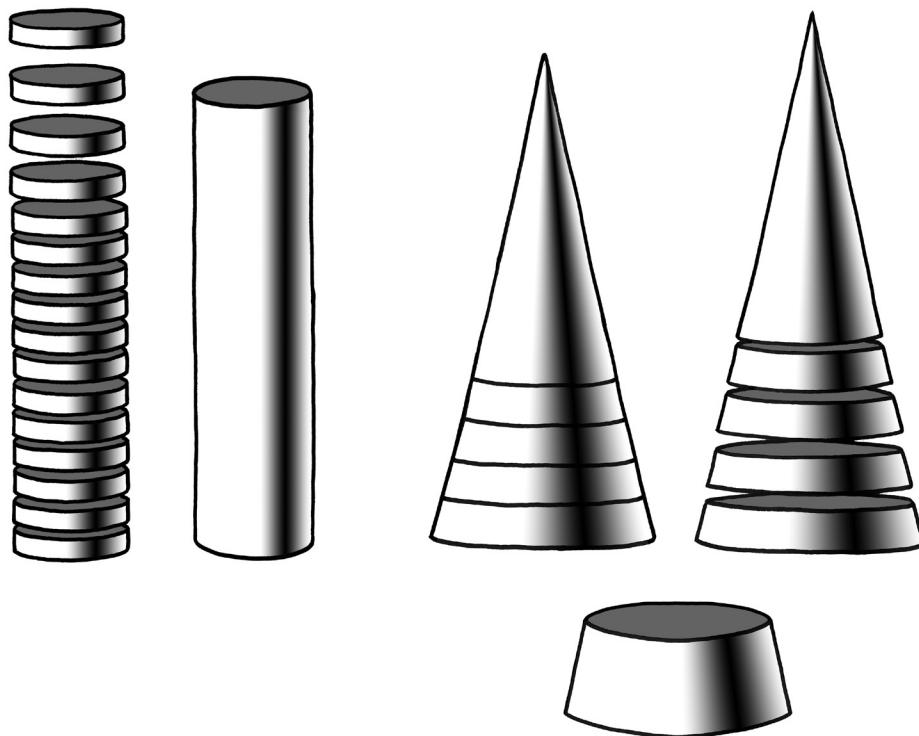


4. You can also make a cone by rolling a sheet of paper. Look at the pictures below and try to do the same. Use sticky tape to hold it together.

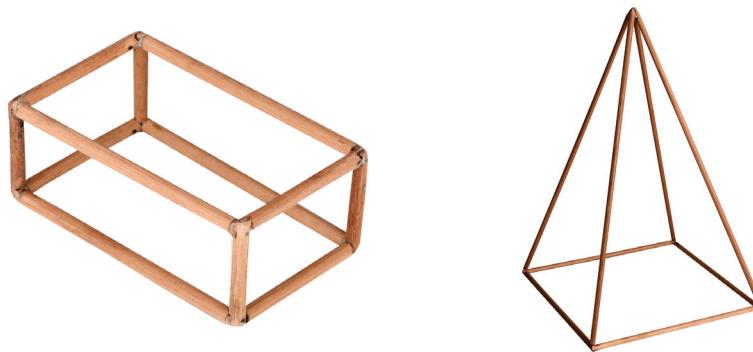


5. (a) Does a cylinder have a sharp point like a cone?
(b) Can a cone be cut into slices that are all the same, like you can do with a cylinder?
(c) Think of other differences between a cylinder and a cone and describe them.

-
6. Look at the pictures below. Can you describe another difference between a cylinder and a cone?



7. A prism and a pyramid are shown below.



- (a) How do prisms and cylinders differ from cones and pyramids?
(b) How do prisms and pyramids differ from cones and cylinders?

6.3 Make prisms and pyramids

The pictures show how you can fold a sheet of paper to make a prism.

1



2



3



4



5



6



Picture 6 shows a **square prism**. It is open at the two ends.

Picture 7 shows a **hexagonal prism** and Picture 8 shows a **rectangular prism**.

7



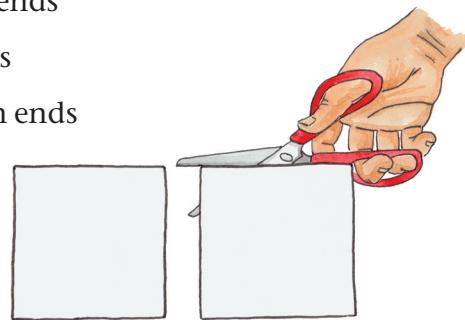
8



-
1. Make the following:

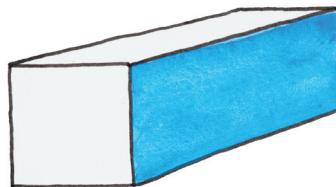
- a triangular prism with open ends
- a square prism with open ends
- a pentagonal prism with open ends

You can cut two square-shaped pieces of paper to close the open ends of your square prism.



2. Make rough drawings to show the shapes of the endpieces that can be used to close your triangular and pentagonal prisms.

If you have a coloured rectangular piece of paper like the one shown on the right, you can paste it onto your square prism to make it look like this:

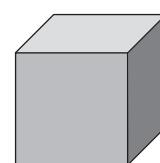


3. How many more rectangular pieces of coloured paper do you need, and how many square pieces of coloured paper do you need, so that all the outer parts of your square prism are coloured?

Each outer part of a prism for which you need a piece of coloured paper is called a **face** of the prism.

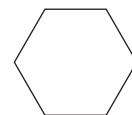
4. (a) How many faces does a triangular prism have?
(b) What are the shapes of the faces, and how many faces of each kind of shape does a triangular prism have?

A prism with six square faces is called a **cube**.



-
5. (a) How many faces does a pentagonal prism have?
(b) What are the shapes of the faces, and how many faces of each kind of shape does a pentagonal prism have?

A prism with ends like this is called a **hexagonal prism**.



6. What are the shapes of the faces, and how many faces of each kind of shape does a hexagonal prism have?
7. Make a square-based pyramid by working as shown in the pictures.

1



2



3



4



5

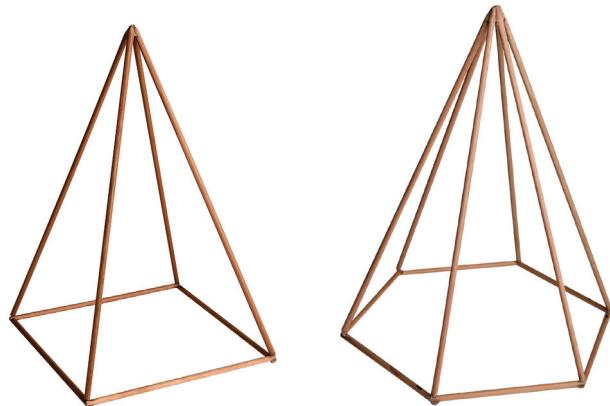


6



-
8. Make rough drawings of the shapes of all the faces of your square-based pyramid.

*These are pictures of the frames of a **square-based** pyramid and a **hexagonal** pyramid.*



9. In each row below the shapes of all the faces of a 3-D object are shown. In each case name the object that has such faces.



7.1 Making patterns



This is a Size 9 by 7 border pattern. It means that the pattern is 9 blue triangles high and 7 blue triangles wide.

1. How many blue triangles, how many black triangles, and how many triangles are there in total in the border pattern above? Describe and discuss your method.

It takes too long to count in ones!

Mary first writes down her **calculation plan** before actually calculating it:

$$\text{No. of blue triangles} = 2 \times 9 + 2 \times 7 = 18 + 14 = 32$$

$$\text{No. of black triangles} = 2 \times 8 + 2 \times 6 = 16 + 12 = 28$$

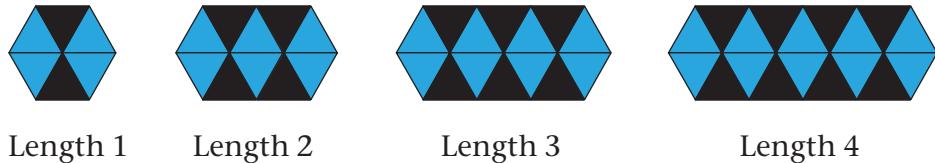
Total no. of triangles = $32 + 28 = 60$

2. Calculate the number of blue, the number of black and the total number of triangles in these border patterns of different sizes:

(a) 12 by 10 (b) 15 by 10 (c) 20 by 15

7.2 From pictures to tables

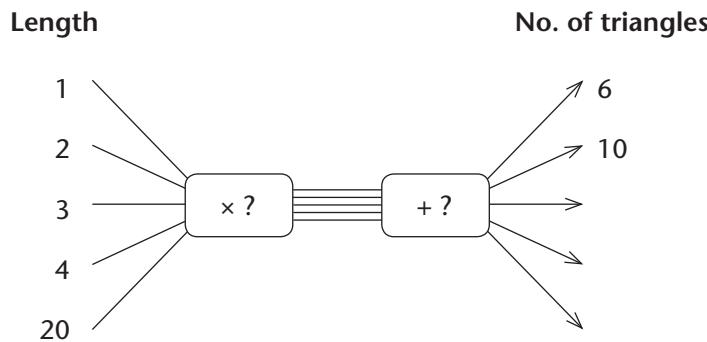
Zubeida uses this growing pattern of triangles of different lengths as a border pattern to decorate different lengths of walls.



1. (a) Describe Length 5 in words.
(b) Now draw Length 5.
(c) How many triangles are there in Length 5?
2. (a) Describe Length 50 in words.
Do not draw it! Imagine it; “see” it in your head!
(b) Write down a calculation plan to calculate the number of triangles in Length 50, and then calculate it.
3. Complete this table. Describe and discuss your methods.
Describe and discuss patterns in the table.

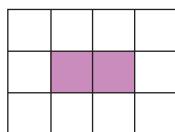
Length	1	2	3	4	5	6	7	$\left\{ \begin{array}{l} 60 \\ \dots \end{array} \right.$
No. of black triangles	2	4	6					
No. of blue triangles	4	6						
Total no. of triangles	6	10						

4. Complete this flow diagram:

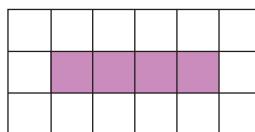


7.3 Extending patterns

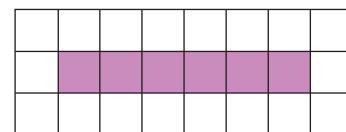
1. Purple tiles and white tiles are arranged to make this growing geometric pattern:



Size 1



Size 2



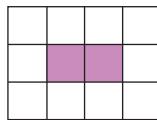
Size 3

- (a) Complete the table. Describe and discuss your method.

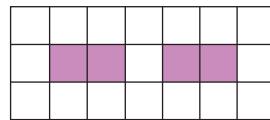
Size	1	2	3	4	5	6	30
No. of purple tiles	2	4	6				
No. of white tiles	10						
Total no. of tiles	12						

- (b) Describe and discuss *horizontal* and *vertical* numeric patterns for the purple tiles and for the white tiles and for the total number of tiles in the table.

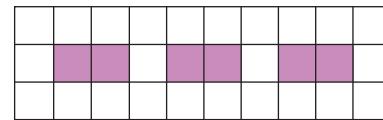
2. Answer the same questions as in question 1 for this tile pattern.



Size 1

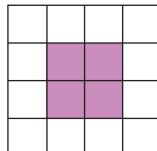


Size 2

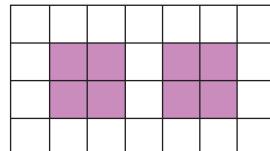


Size 3

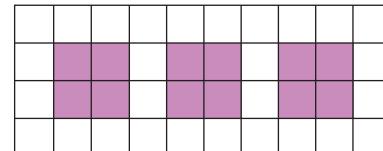
3. Answer the same questions as in question 1 for this tile pattern.



Size 1



Size 2



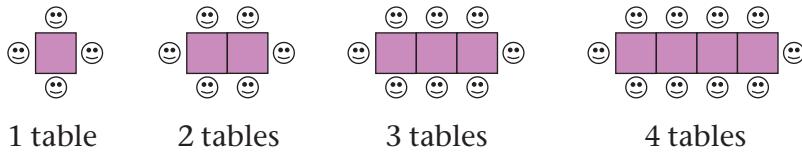
Size 3

7.4 Using patterns to solve problems

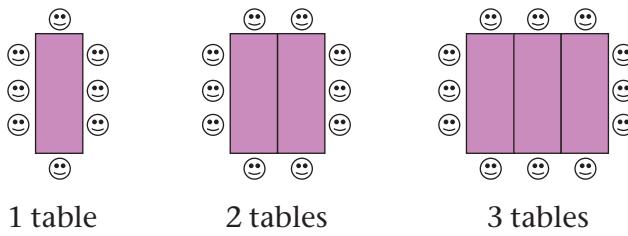
Anand plans to invite many friends to his birthday party. He must decide how he will seat all his friends.

He wants to make one long table by pushing a number of smaller tables together. The sketches below show different plans for seating the guests around the tables. Anand wonders which plan will be the best. Can you help him decide?

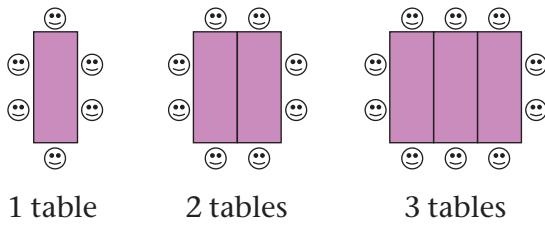
Plan 1



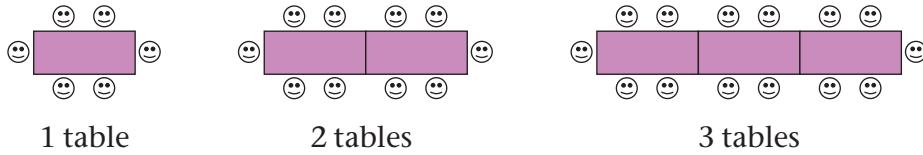
Plan 2



Plan 3

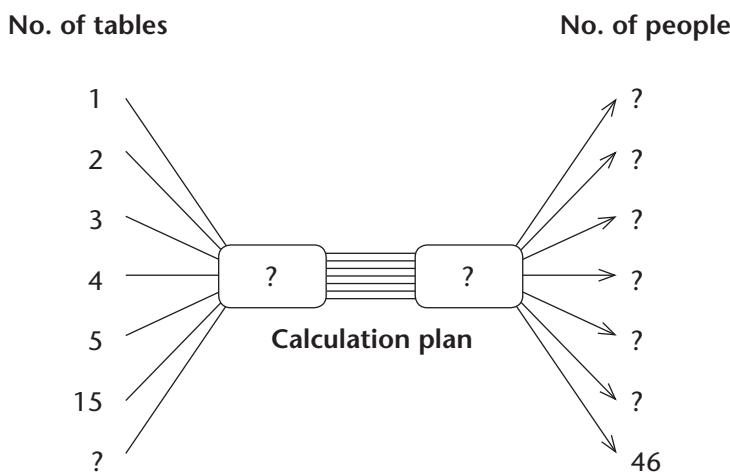


Plan 4



-
1. For Plan 1:

- (a) Describe in words how the seating works. (For example: “Each small table can seat two people, plus one person at each end of the long table.”)
- (b) Complete this flow diagram. (You must fill in the missing input and output numbers and the calculation plan.)



- (c) Complete this table showing the relationship between the number of tables and the number of people.

No. of tables	1	2	3	4	5	15	
No. of people							46

2. For Plan 2, answer the same questions as for Plan 1.
3. For Plan 3, answer the same questions as for Plan 1.
4. For Plan 4, answer the same questions as for Plan 1.
5. If there will be 46 people at the party (including Anand), which plan needs the fewest number of tables?

8.1 Drawing symmetrical figures

Ma Esther Mahlangu is famous all over the world for her Ndebele art. She says she draws **symmetrical figures** like this: whatever she draws on the right, she also draws on the left.

1. Trace over the black lines of Ma Esther's symmetrical painting below using your two forefingers at the same time. Start in the middle at the top of the painting and trace the lines so that you do the same movements on the left and on the right.

If you can fold a diagram in half so that the two parts match exactly, the fold line is called a **line of symmetry**.



2. Which pictures show a fold line that is a line of symmetry?

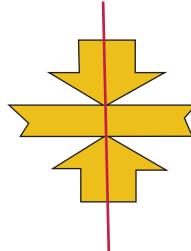
(a)



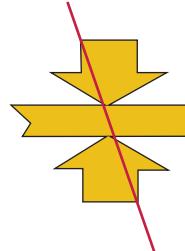
(b)



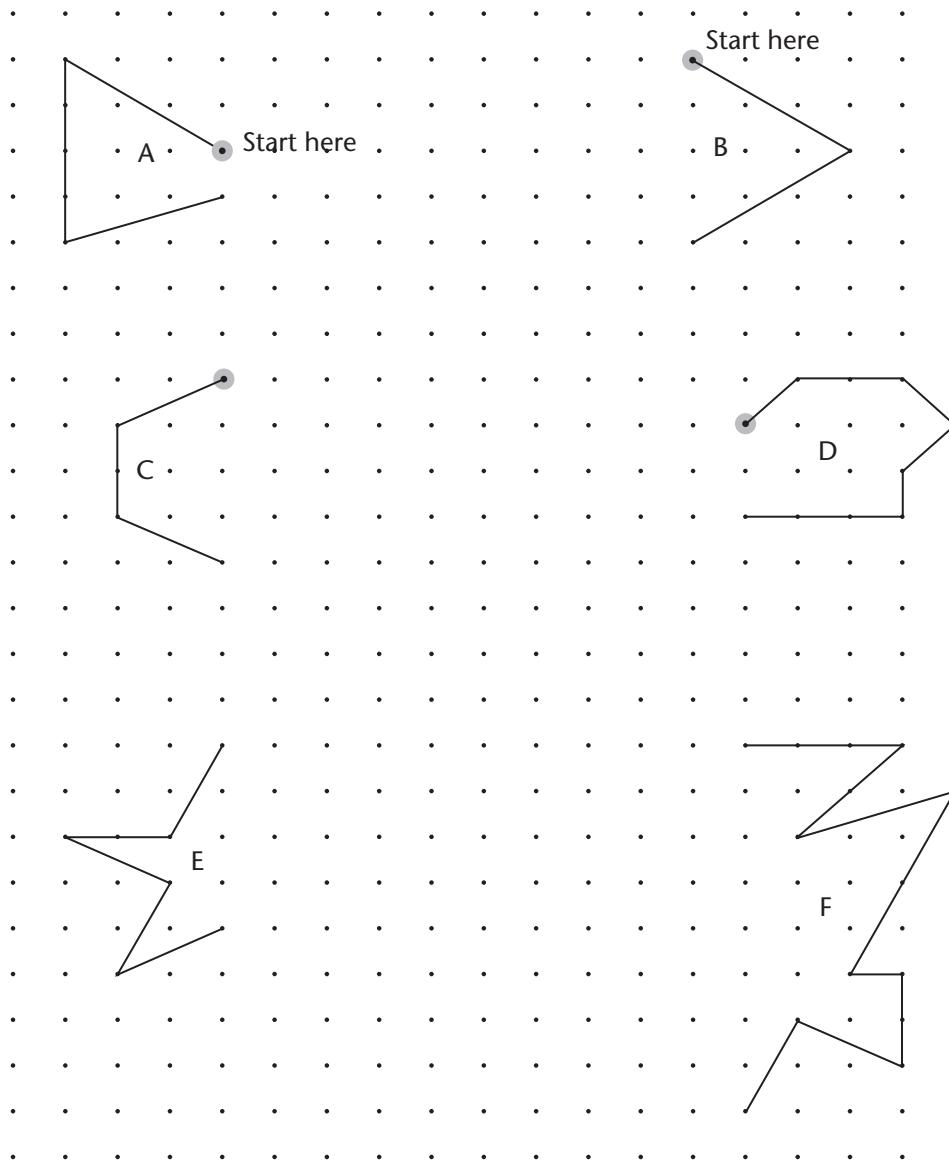
(c)



(d)

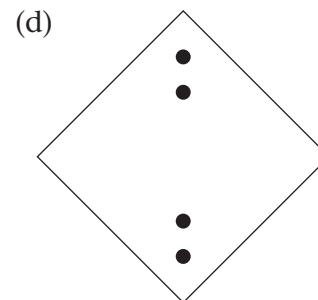
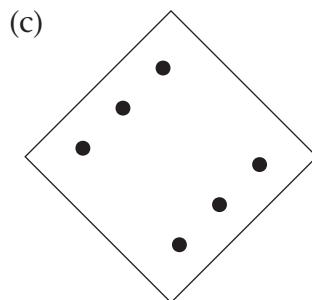
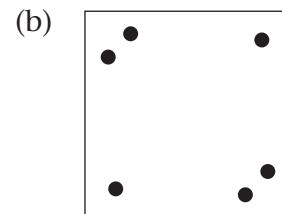
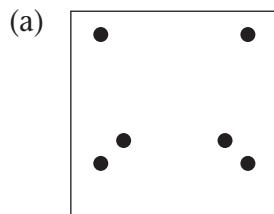


3. The figures show what one hand drew.
- Redraw the figures on dotted paper.
 - Complete the figures to show what the other hand must draw to make a symmetrical figure.

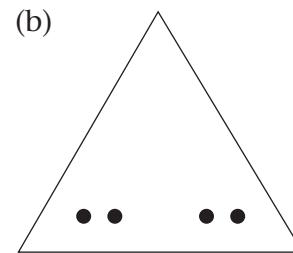
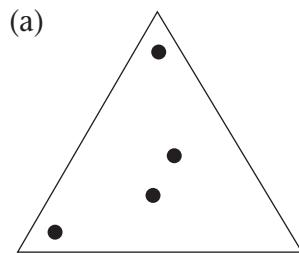


8.2 Finding lines of symmetry

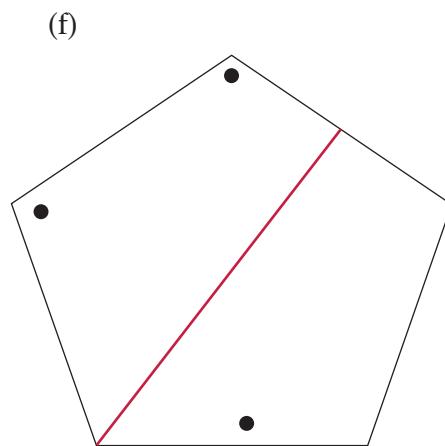
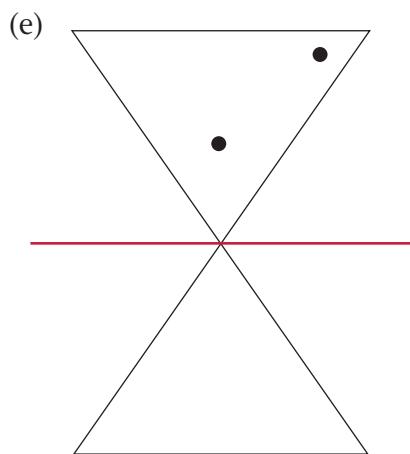
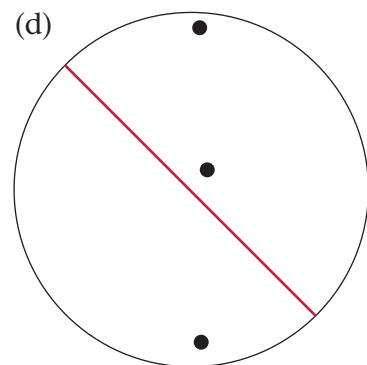
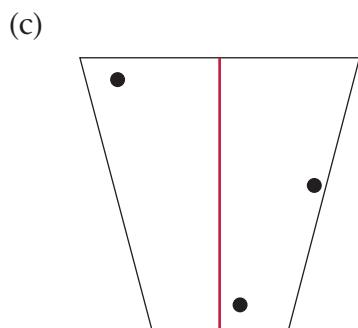
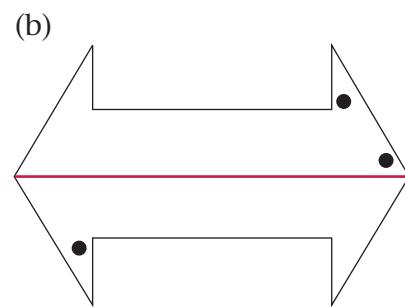
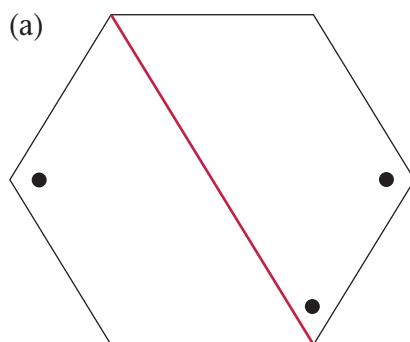
1. Where must you fold the square to make the dots fall onto each other? Trace each figure onto a clean page and draw a line of symmetry. Try to be accurate.



2. Where must you fold the triangle to make the dots fall onto each other? Trace each figure onto a clean page and draw a line of symmetry. Try to be accurate.

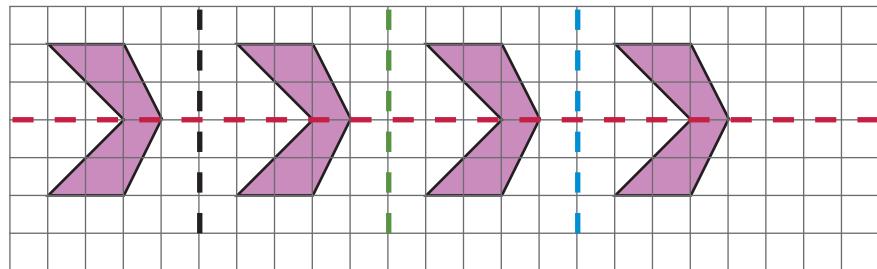


3. Lines of symmetry have been drawn in red on the figures. Trace each figure onto a clean page and draw the missing dots. Try to be accurate.

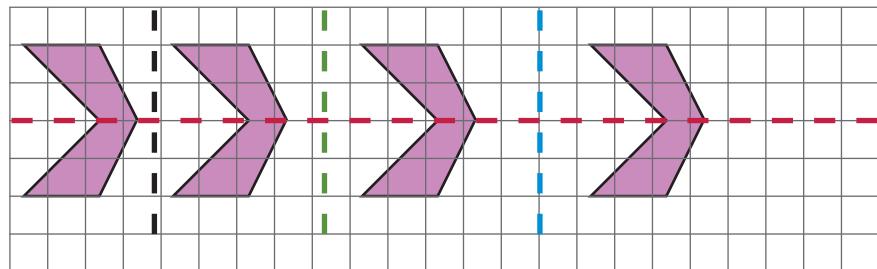


8.3 Moving figures to make symmetries

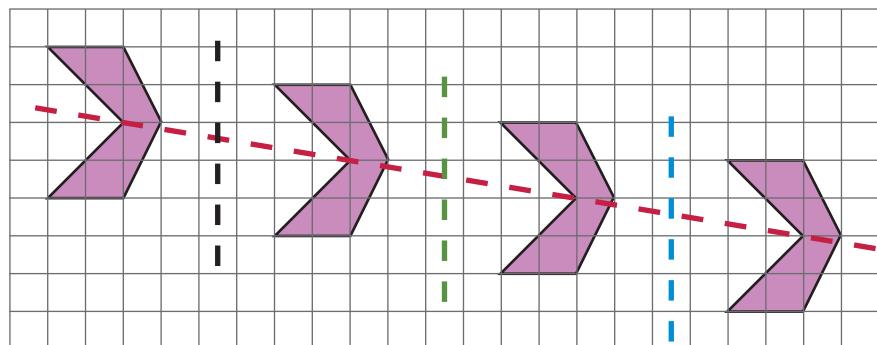
1. (a) How was the first hexagon moved to form the pattern?



- (b) Which of the broken lines are lines of symmetry of the pattern?
2. (a) How was the hexagon now moved to form this pattern?

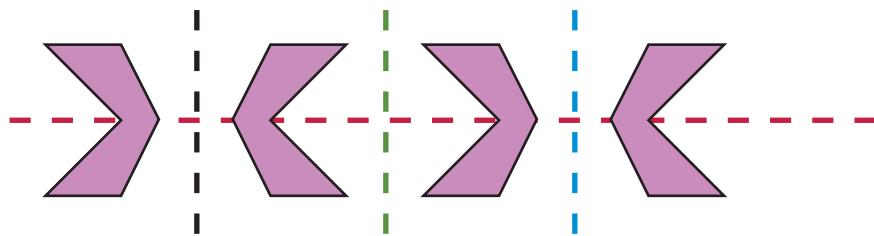


- (b) Which of the broken lines are lines of symmetry of this pattern?
(c) Do you think you will always get a symmetrical pattern when you shift a symmetrical figure along a straight line?
3. (a) How was the hexagon now moved to form a pattern?



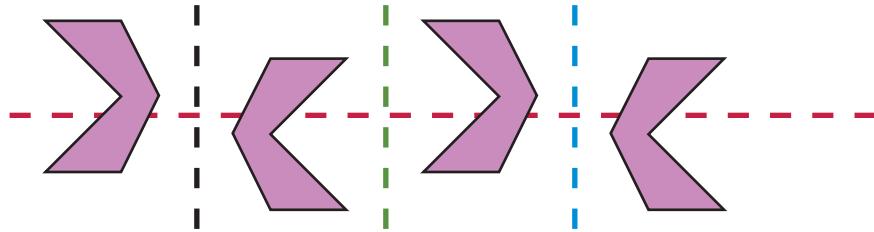
- (b) Which of the broken lines are lines of symmetry of this pattern?

4. (a) How was the hexagon now moved to form a pattern?



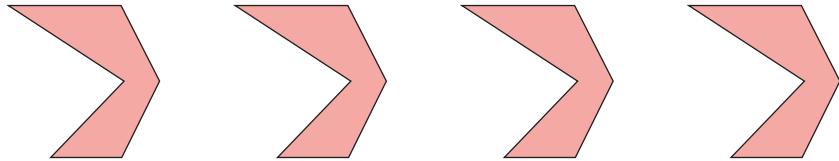
- (b) Which of the broken lines are lines of symmetry of this pattern?
(c) Which of the broken lines are lines of symmetry of parts of the pattern, but not of the whole pattern? For which parts?

5. (a) How was the hexagon now moved to form a pattern?

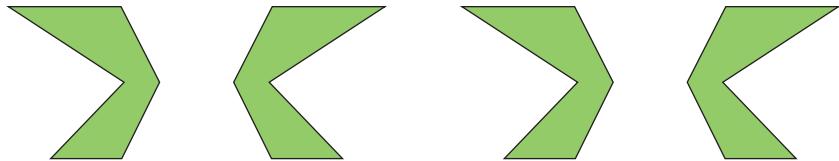


- (b) Which of the broken lines are lines of symmetry of this pattern?
6. Draw these three patterns on grid paper.
Also draw any lines of symmetry that you see in any of the patterns.

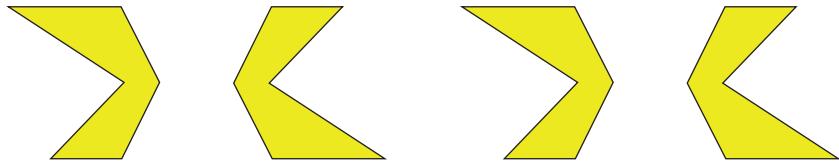
(a)



(b)



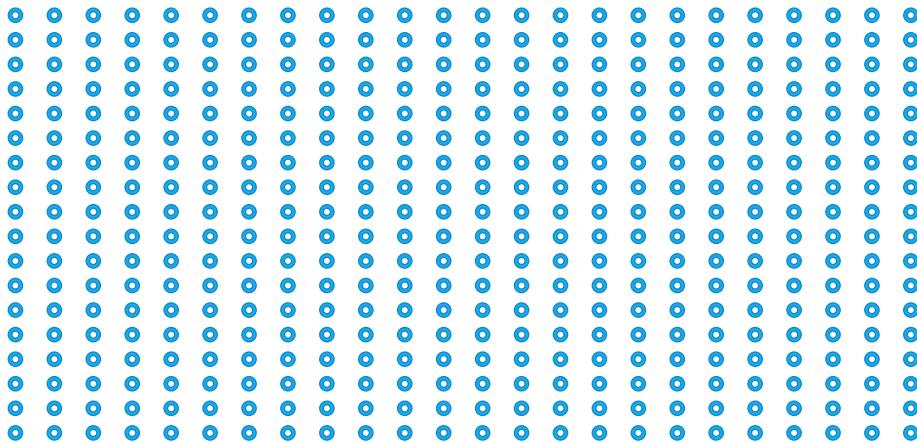
(c)



9.1 Build multiplication knowledge for division

1. Find the missing number in each case. You may estimate, check and correct.
 - (a) $2 \times \dots$ is at least 950, but less than 960.
 - (b) $3 \times \dots$ is at least 950, but less than 960.
 - (c) $4 \times \dots$ is at least 950, but less than 960.
 - (d) $5 \times \dots$ is at least 950, but less than 960.
 - (e) $6 \times \dots$ is at least 950, but less than 960.
 - (f) $7 \times \dots$ is at least 950, but less than 960.
 - (g) $8 \times \dots$ is at least 950, but less than 960.
 - (h) $9 \times \dots$ is at least 950, but less than 960.
2. Find the missing number in each case.
 - (a) $10 \times \dots$ is at least 950, but less than 970.
 - (b) $11 \times \dots$ is at least 950, but less than 970.
 - (c) $12 \times \dots$ is at least 950, but less than 970.
 - (d) $13 \times \dots$ is at least 950, but less than 970.
 - (e) $14 \times \dots$ is at least 950, but less than 970.
 - (f) $15 \times \dots$ is at least 950, but less than 970.
 - (g) $16 \times \dots$ is at least 950, but less than 970.
 - (h) $17 \times \dots$ is at least 950, but less than 970.
 - (i) $18 \times \dots$ is at least 950, but less than 970.
 - (j) $19 \times \dots$ is at least 950, but less than 970.
3. How much is each of the following?

(a) 23×20	(b) 43×20
(c) 17×40	(d) 37×30



- (b) Nathi wants to rearrange these rings into rows with 12 rings each. How many rows will that be?

(c) How many rings will there be in each row if the rings are arranged into 8 equal rows?

(d) How many rings will there be in each row if the rings are arranged into 9 equal rows?

7. 720 rings are arranged in rows of 24 rings each. How many rows are there?

8. 720 rings are arranged in 36 equal rows. How many rings are there in each row?

9.2 Use multiplication facts to do division

Read questions A and B below. Think about them but do not work out the answers.

- A. 774 apples must be packed in boxes, with 24 apples in each box.
How many boxes are needed?
- B. 774 apples must be equally shared between 24 households.
How many apples can each household get?

You may know that

$$24 \times 2 = 48 \text{ and}$$

$$24 \times 10 = 240.$$

Using this, you can work out that

$$24 \times 20 = 480, \text{ and that}$$

$$24 \times 30 = 24 \times 10 + 24 \times 20,$$

and that is $240 + 480$ which is 720.

$$\text{So } 24 \times 30 = 720.$$

1. Can you use the multiplication facts $24 \times 2 = 48$ and $24 \times 30 = 720$ to help you to find the answers to questions A and B above? Answer the questions now.

To answer questions A and B you worked out what 24 must be multiplied by in order to get 774 or close to 774.

This is the same as working out how many parts of 24 each there are in 774. We call this **division** and write this as $774 \div 24$.

Now think about questions C and D below. Do not work out the answers.

- C. 768 apples must be packed in boxes, with 27 apples in each box.
How many boxes are needed?
- D. 768 apples must be equally shared between 27 households.
How many apples should each household get?

To answer questions C and D we have to work out how much $768 \div 27$ is. This is the same as working out by what 27 must be multiplied to get 768 or close to it.

Read the next page to see how we can find this out.

A good way to start to develop an answer to this question is to ask yourself what **multiplication facts** about 27 you already know, or can easily make up.

For example, you may know that $27 \times 10 = 270$.

Half of that is $27 \times 5 = 135$.

27×20 is 270 doubled, so it is 540.

We now use this knowledge to find out by what 27 must be multiplied to get 768:

$$27 \times 20 = 540 \text{ and } 27 \times 5 = 135,$$

so $27 \times 25 = 540 + 135$ which is 675.

So 25 is not the answer yet. We need some more 27s.

$$675 + 27 \rightarrow 702 + 27 \rightarrow 729 + 27 \rightarrow 756$$

So now we know that $27 \times 25 + 27 \times 3 = 756$, which means that $27 \times 28 = 756$.

12 more is needed to get to 768. The shortfall of 12 is the **remainder**. This means that 27 must be multiplied by 28, and 12 must be added in order to get 768.

We write this in symbols as $768 = 27 \times 28 + 12$.

The answer can also be written like this:

$$768 \div 27 = 28 \text{ remainder } 12.$$

The mathematical statement

$$768 \div 27 = 28 \text{ remainder } 12$$

tells us that $768 = 27 \times 28 + 12$.

You do not have to write so much when you do division yourself!

Just write what you really need to when you do questions 2 and 3.

2. Calculate $870 \div 33$.

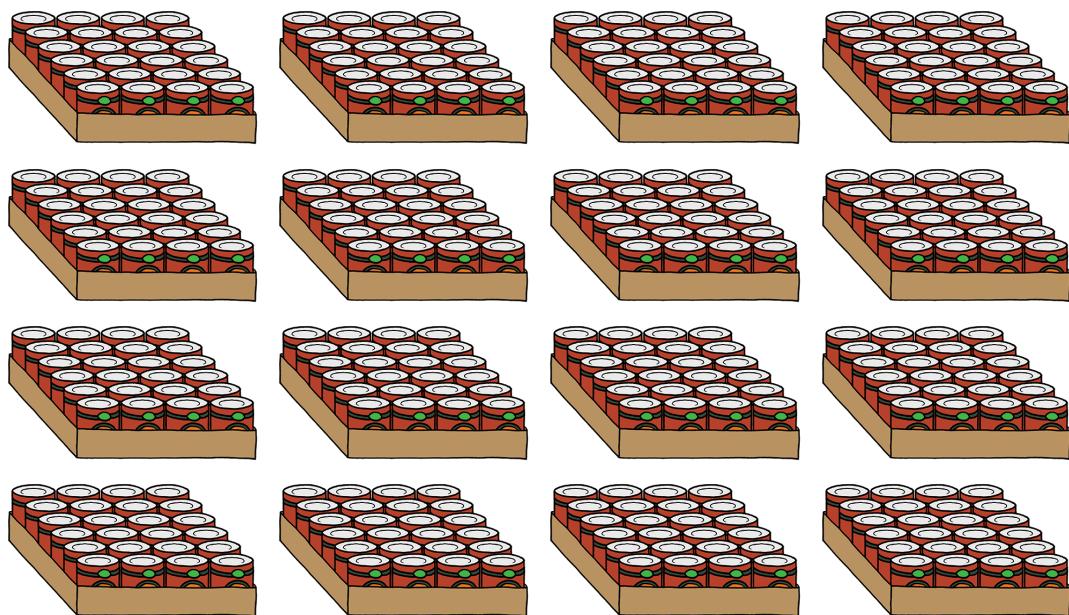
You may start by writing down some multiplication facts about 33, for example 10×33 and then you can double it.

- ### 3. Calculate.

- (a) $625 \div 28$ (b) $625 \div 78$
 (c) $876 \div 27$ (d) $548 \div 78$

9.3 Find answers for practical questions

- Some boxes with cans of beans are shown below. How many more boxes must be added so that there will be 1 000 cans altogether?



- A certain truck can carry 43 bags of cement.
 - How many truckloads must be delivered if 1 000 bags of cement are needed on a construction site?
 - How many truckloads must be delivered if 500 bags of cement are needed on a construction site?
- (a) How many chickens at R57 each can be bought with R1 000?
(b) How many chickens at R57 each can be bought with R500?
(c) How many chickens at R57 each can be bought with R570?
(d) How many chickens at R57 each can be bought with R1 070?
- 851 trees are planted in 23 equal rows. How many trees are there in each row?

-
5. All the learners of a primary school are going on a school outing. They are travelling on five buses:

There are 76 learners on Bus A.

There are 68 learners each on Buses B and C.

There are 59 learners on Bus D.

There are 74 learners on Bus E.

When they travel back to school, the buses will all carry an equal number of learners. How many learners will there be on each bus?

6. 634 learners have to be transported in 9 buses which are all the same size.
- Describe *three* different possibilities of how many learners can go in each bus. The numbers need not be the same for each bus.
 - How many learners should go in each bus, if the number must be the same for eight of the nine buses? Again describe *three* different possibilities.
 - Five of the nine buses must each carry the same number of learners. Three of the nine buses must also each carry the same number of learners but that number must be different than the number for the five buses. Describe *one* possibility of how many learners should go in each of the nine buses.
7. Transport for 832 learners must be arranged. Two possibilities are available:

Option A:

Small buses that can carry 23 passengers each, at R210 for each bus.

Option B:

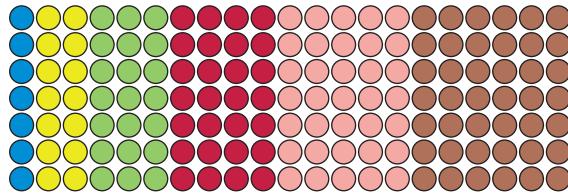
Large buses that can carry 92 passengers each, at R828 for each bus.

Which option is cheaper?

9.4 Multiply and divide

Thandi makes beaded mats and sells them at the craft market.

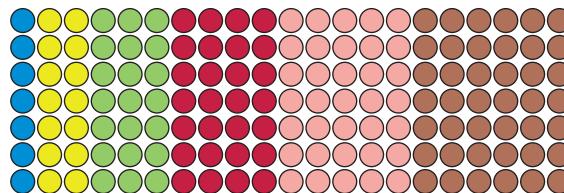
All her mats have the same pattern.



Look at Thandi's mat. Then answer questions 1 to 6.

1. How many beads are there in one of Thandi's mats?
2. How many red beads does Thandi need to make 45 mats?
 - (a) How many mats can she make, and how many pink beads will be left over?
 - (b) How many blue beads will Thandi need for the mats she can make with 750 pink beads?
 - (c) How many red beads will Thandi need for the mats she can make with 750 pink beads?
4. At one time Thandi has only 800 brown beads available.
 - (a) How many mats can she make, and how many brown beads will be left over?
 - (b) How many green beads will Thandi need for the mats she can make with 800 brown beads?
 - (c) How many pink beads will Thandi need for the mats she can make with 800 brown beads?
5. At one time Thandi has only 650 red beads available.
 - (a) How many yellow beads will Thandi need for the mats she can make with 650 red beads?
 - (b) How many pink beads will Thandi need now?
6. During a certain week, Thandi used a total of 882 beads to make mats like the above. How many beads of each colour did she use?

Here you can again see the drawing of Thandi's mat.



7. Look carefully at Thandi's mat. Then decide which of the following statements are true, and which are false.
- (a) For every 4 red beads Thandi uses, she uses 6 brown beads.
 - (b) For every 14 yellow beads Thandi uses, she uses 21 green beads.
 - (c) For every 7 pink beads Thandi uses, she uses 8 brown beads.
 - (d) For every 2 yellow beads Thandi uses, she uses 5 red beads.
 - (e) For every blue bead Thandi uses, she uses 21 green beads.
 - (f) For every green bead Thandi uses, she uses 2 brown beads.
 - (g) For every 3 green beads Thandi uses, she uses 5 pink beads.

The word **ratio** can also be used to compare the numbers of beads of different colours in situations like the above. For example, instead of saying:

“For every 3 green beads Thandi uses, she uses 5 pink beads.”
we can say:

“**The ratio** of green beads to pink beads **is** 3 to 5.” or
“The green beads and the pink beads **are in the ratio** 3 to 5.”

8. Now take another look at Thandi's mat. In what ratio is each of the following?
- (a) the number of yellow beads and the number of pink beads
 - (b) the number of pink beads and the number of yellow beads
 - (c) the number of red beads and the number of brown beads
 - (d) the number of blue beads and the number of red beads
 - (e) the number of red beads and the number of blue beads

Cindy also makes beaded mats. In each of Cindy's mats

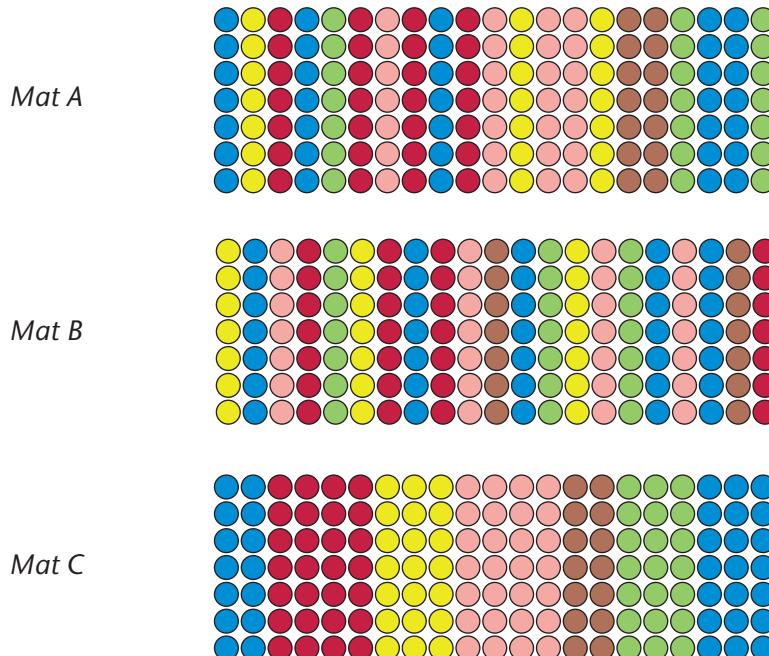
- yellow and red beads are in the ratio 3 to 4,
- blue and brown beads are in the ratio 2 to 5, and
- yellow and blue beads are in the ratio 1 to 3.

9. There are 180 blue beads in one of Cindy's mats.

- (a) How many yellow beads are there in this mat?
- (b) How many brown beads are there in this mat?
- (c) How many red beads are there in this mat?

10. One day, Cindy has no beads left. She buys 900 brown beads and decides to use all 900 brown beads in one large mat. How many blue, yellow and red beads will she have to buy for this mat?

Here you can see three mats that Belinda made. Look at them carefully and then answer question 11.



11. Describe Belinda's three mats by stating all the ratios between the numbers of beads of different colours.

Term Three

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1.1 Parts of wholes and parts of collections

This yellow strip is divided into seven equal parts.



Each part is one seventh of the whole strip.

The symbol for one seventh is $\frac{1}{7}$.

1. This strip is also divided into equal parts.

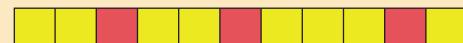


(a) What part of this strip is red?

(b) Describe in words what you did to decide on your answer for (a).

This strip is divided into 11 equal parts.

$\frac{3}{11}$ of the strip is red.



2. What part of each strip is red?

- (a)
- (b)
- (c)
- (d)
- (e)
- (f)
- (g)

3. Which is bigger in each case?

(a) $\frac{4}{12}$ or $\frac{4}{10}$

(b) $\frac{1}{6}$ or $\frac{1}{5}$

(c) $\frac{5}{6}$ or $\frac{4}{5}$

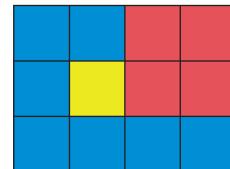
(d) $\frac{7}{8}$ or $\frac{6}{7}$

4. Jenny eats $\frac{1}{6}$ of a loaf of bread, and Jill eats $\frac{1}{8}$ of the same loaf.

- (a) Who eats more bread?
(b) Explain how you know that.

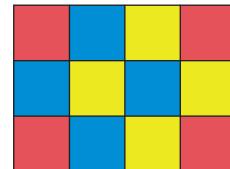
5. (a) What part of this rectangle is yellow?

- (b) Do you agree or disagree that $\frac{1}{3}$ of this rectangle is red?
(c) Explain your answer.



6. (a) Do you agree or disagree that $\frac{1}{3}$ of this rectangle is red?

- (b) Explain your answer.



7. (a) Do you agree or disagree that $\frac{4}{12}$ of this rectangle is red?

- (b) Explain your answer.

- (c) Do you still agree with your answers to question 5?



- (d) Is it true that $\frac{2}{6}$ of the rectangle is red?

Different fractions can be used to describe the same part of a whole.

For example, the fractions $\frac{4}{12}$, $\frac{1}{3}$ and $\frac{2}{6}$ can all be used to state what part of the rectangle in question 7 is red.

Different fractions that describe the same quantity are called **equivalent fractions**.

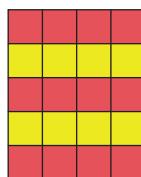
8. (a) Do you agree or disagree that $\frac{3}{9}$ of this rectangle is red?

- (b) Explain your answer.

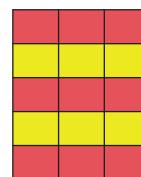


9. What part of each rectangle below is yellow?

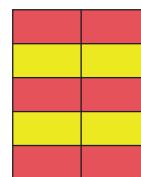
(a)



(b)



(c)

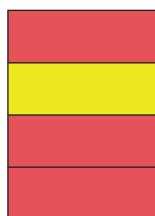


(d)

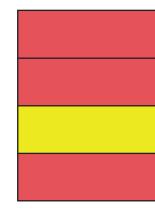


10. What part of each rectangle below is red?

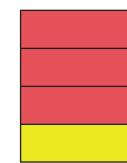
(a)



(b)



(c)



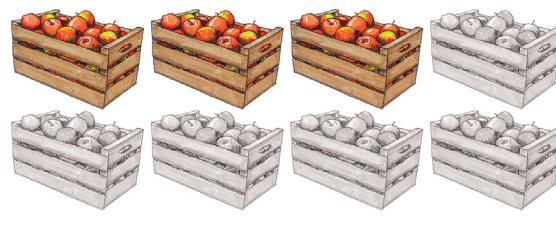
11. (a) Is $\frac{1}{4}$ of the rectangle in 10(a) equal to $\frac{1}{4}$ of the rectangle in 10(c)?

(b) Explain your answer.

A fraction is a part of a whole. The “4” in $\frac{3}{4}$ is called the **denominator** of the fraction. It tells us what the size of the parts is and therefore how many parts it takes to make a whole. The “3” in $\frac{3}{4}$ is called the **numerator** of the fraction. It tells us how many parts there are in this fraction.

12. Mr Daniels packs apples in boxes. He wants to put the same number of apples in each of the boxes. He has enough apples to fill 8 boxes.

(a) What fraction of all of the apples is in each box?



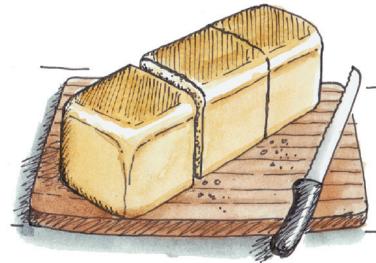
(b) What fraction of all of the apples is in three of the boxes?

Each box contains one eighth of all the apples. The **denominator** is 8 in this case. There is $\frac{3}{8}$ of all of the apples in 3 of the boxes. The **numerator** is 3 – that is the number of the parts in the fraction.

1.2 Equivalent fractions

1. A loaf of bread is cut into 3 equal parts.
 - (a) What fraction of the whole loaf is each of these parts?
 - (b) If you cut each of these smaller parts into two equal parts, what fraction of the loaf is each of these smaller parts?
 - (c) Dora cuts another loaf of bread into three equal parts. She wants smaller parts. So she cuts each of the parts into three equal parts. What fraction of the whole is each of these smaller parts?
 - (d) In words, write three fractions that are equivalent to one third.

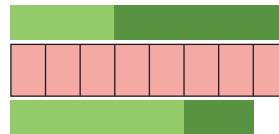
2. This cake is cut into four equal parts.
 - (a) You cut each of the four parts into two equal parts. What fraction of the whole cake is each of these smaller parts?
 - (b) Rosie has another cake. She cuts that cake also into four equal parts. She wants smaller parts. So she cuts each of the four parts into three equal parts. What fraction of the whole cake is each of these smaller parts?
 - (c) In words, write three more fractions that are equivalent to one quarter.



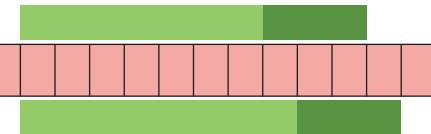
The three fractions that you named as equivalent all describe the same quantity, namely one third in question 1 and one quarter in question 2. However, their denominators differ because in each case the fraction was cut up into smaller parts.

3. $\frac{3}{8}$ of Strip (a) on the diagram below is light green. Use the divisions on the pink strip as a guide to find out what part of each green strip is light green.

(a)



(b)



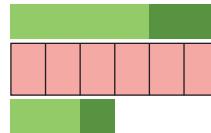
(c)



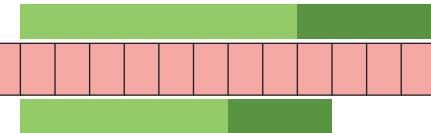
(d)



(e)



(f)



(g)



(h)

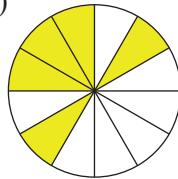


4. Which statements about the above strips are true and which are false?

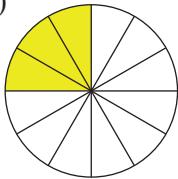
- (a) $\frac{2}{3}$ of Strip (f) is light green. (b) $\frac{6}{8}$ of Strip (h) is light green.
(c) $\frac{2}{3}$ of Strip (e) is light green. (d) $\frac{4}{6}$ of Strip (e) is light green.
(e) $\frac{4}{6}$ of Strip (g) is light green. (f) $\frac{6}{9}$ of Strip (h) is light green.
(g) $\frac{6}{9}$ of Strip (e) is light green.

5. What fraction parts of the circles are shaded? Write each answer in as many different ways as you can.

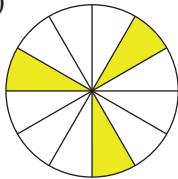
(a)



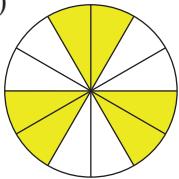
(b)



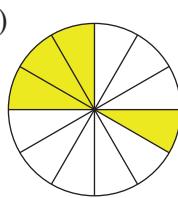
(c)



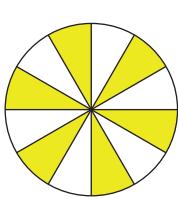
(d)



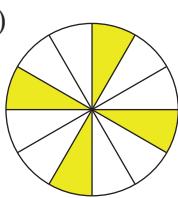
(e)



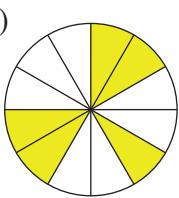
(f)



(g)

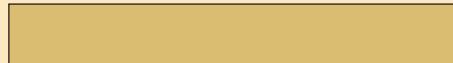


(h)

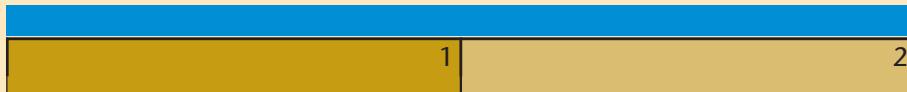


1.3 Parts of a measuring unit

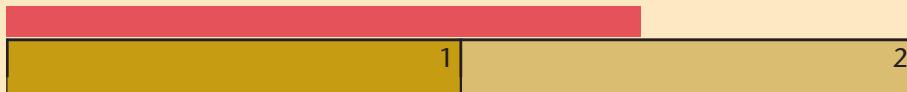
You will now measure the length of coloured strips.
The Brownstick below will be your unit of measurement:



This blue strip is exactly 2 Brownsticks long:



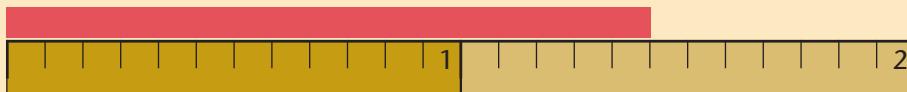
The red strip below is longer than 1 Brownstick, but it is shorter than 2 Brownsticks.



You will use rulers that are divided into fraction parts of a Brownstick.
For example, the ruler below is divided into **tenths** of a Brownstick.

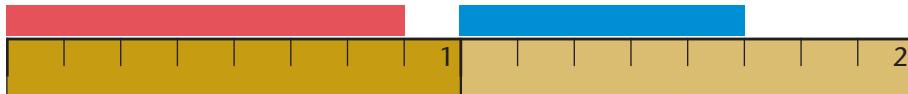


On the ruler below you can see that the red strip is
one and 5 twelfths of a Brownstick long.



We can write the length in symbols as $1\frac{5}{12}$ of a Brownstick.

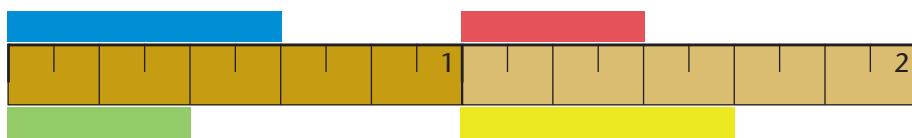
- (a) How long is each coloured strip below?



- How long are these two strips together?

- Are the two strips together longer or shorter than $1\frac{1}{2}$ Brownsticks?

2. (a) How long is each of the coloured strips below?



- (b) How long are the blue and red strips together?
(c) How long are the green and yellow strips together?

3. Calculate:

(a) $\frac{6}{10} + \frac{4}{10}$

(b) $\frac{3}{5} + \frac{2}{5}$

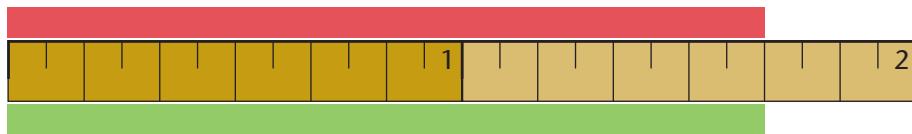
(c) $\frac{3}{10} + \frac{4}{10}$

(d) $\frac{2}{5} + \frac{2}{5}$

(e) $\frac{7}{10} + \frac{4}{10}$

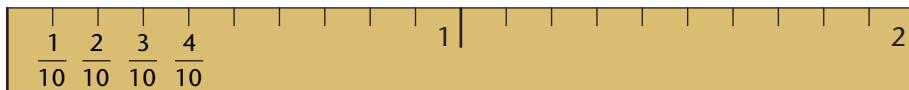
(f) $\frac{4}{5} + \frac{3}{5}$

4. (a) How long is each coloured strip below?



- (b) How long will each piece be, if the red strip is divided into 5 equal pieces?
(c) Imagine that part of the green strip is painted red. The painted part is $\frac{5}{12}$ of a Brownstick long. How long is the piece that remains green?
5. (a) How many twelfths of a Brownstick is the same length as one sixth of a Brownstick?
(b) How many twelfths of a Brownstick is the same length as one third of a Brownstick?
(c) How many tenths of a Brownstick is the same length as one fifth of a Brownstick?
(d) How many eighths of a Brownstick is the same length as three quarters of a Brownstick?

1.4 Combining, comparing and ordering fractions



1. Numbers are shown at the first four marks on the above ruler. Write the numbers that can be written at the other marks from left to right in your book. Start at $\frac{5}{10}$ and write the numbers until you reach 2.

When you write the numbers $\frac{1}{10}; \frac{2}{10}; \frac{3}{10}; \frac{4}{10}; \frac{5}{10} \dots$ we may say you **count in tenths**.

2. Start at $\frac{1}{8}$ and count in eighths until you reach 2. Write the numbers down as you would write them on an eighths-ruler.



3. Write the numbers.
 - (a) Count in fifths from $\frac{1}{5}$ until you reach 3.
 - (b) Count in eighths from $\frac{1}{8}$ until you reach 2.You can count backwards in fractions too, for example $1; \frac{8}{9}; \frac{7}{9}; \frac{6}{9}; \frac{5}{9}; \frac{4}{9} \dots$
4. Write the numbers in each case.
 - (a) Count backwards in fifths from 2, until you reach 0.
 - (b) Count backwards in eighths from 3, until you reach $1\frac{1}{2}$.
5. Write these numbers from the smallest to the biggest:
 - (a) $\frac{1}{2}; \frac{5}{6}; \frac{2}{3}; \frac{1}{3}; \frac{1}{6}$
 - (b) $\frac{10}{11}; \frac{4}{5}; \frac{7}{8}; \frac{2}{3}; \frac{8}{9}; \frac{5}{6}$
6. Say whether these fractions are bigger than, smaller than or equal to a half.
 - (a) $\frac{5}{9}$
 - (b) $\frac{3}{7}$
 - (c) $\frac{6}{12}$
 - (d) $\frac{5}{11}$

7. Draw four vertical number lines like these in your book. Use the lines in your book as the horizontal lines. Draw the short marks on the lines as they are indicated below. Fill in the missing numbers at the marks.

(a)



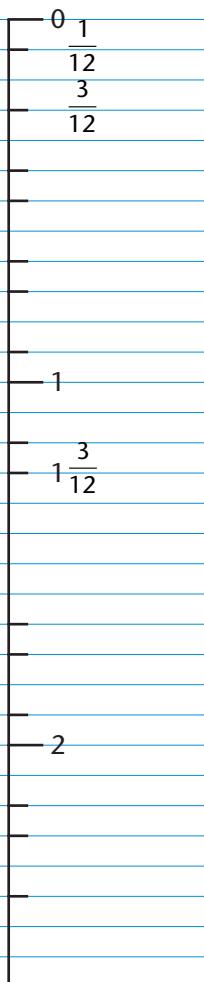
(b)



(c)



(d)



8. Did you notice equivalent fractions as you counted? Make a list of all the equivalent fractions that you see. Compare your list with the lists of your classmates.

1.5 Calculating a fraction of a quantity

1. Copy the tables and complete them.

(a)

Number	50	55	60	65	80	110	190
$\frac{1}{10}$ of the number							

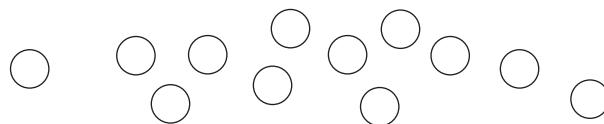
(b)

Number	50	55	60	65	80	110	190
$\frac{2}{10}$ of the number							

(c)

Number	50	55	60	65	80	110	190
$\frac{1}{5}$ of the number							

2. (a) What did you notice about $\frac{2}{10}$ and $\frac{1}{5}$ when you did question 1?
(b) Can you explain that?
3. There are 35 learners in Mr Nkebe's class. $\frac{4}{5}$ of the class takes part in sport. How many learners is that?
4. Mrs Dube complains that one fifth of her class is absent with flu. There are 8 learners in her class with flu. How many learners are in her class?
5. If this is two fifths of all the circles, how many circles are there altogether?



1.6 Addition and subtraction of fractions

1. Discuss with a classmate what you will do if you have to subtract $1\frac{5}{11}$ from $3\frac{1}{11}$.
2. Do you agree that it is easy to subtract $1\frac{1}{11}$ from $2\frac{5}{11}$? Discuss this with a classmate.

You can subtract 1 from 2 and $\frac{1}{11}$ from $\frac{5}{11}$, so

$$2\frac{5}{11} - 1\frac{1}{11} = (2 - 1) + \left(\frac{5}{11} - \frac{1}{11}\right) = 1\frac{4}{11}$$

Remember that $3\frac{1}{11} = 2 + 1\frac{1}{11} = 2 + \frac{12}{11}$... and that makes it easier to do calculations such as the one in question 1!

$$\text{So, } 3\frac{1}{11} - 1\frac{5}{11} \rightarrow 3 - 1 \rightarrow 2 + \frac{1}{11} - \frac{5}{11} \rightarrow 1 + \frac{11}{11} + \frac{1}{11} - \frac{5}{11} \rightarrow 1 + \frac{12}{11} - \frac{5}{11} = 1 + \frac{7}{11} = 1\frac{7}{11}$$

3. Now, calculate these:

(a) $\frac{3}{7} + \frac{3}{7} + \frac{3}{7} + \frac{3}{7} + \frac{3}{7}$

(b) $\frac{7}{8} + \frac{7}{8} + \frac{7}{8} + \frac{7}{8} + \frac{7}{8}$

(c) $\frac{7}{12} + \frac{7}{12} + \frac{7}{12} - \frac{5}{12} - \frac{1}{12}$

(d) $2\frac{7}{8} + \frac{5}{8} + \frac{3}{8} + \frac{1}{8}$

(e) $3\frac{5}{11} - 2\frac{7}{11}$

(f) $4\frac{1}{6} + 2\frac{5}{6} - \frac{7}{6}$

(g) $\frac{5}{9} + \frac{5}{9} - \frac{1}{9}$

(h) $2\frac{1}{3} - 1\frac{2}{3}$

4. Calculate:

(a) $\frac{5}{12} + \frac{5}{12} + \frac{5}{12} + \frac{5}{12}$

(b) $2 - \frac{1}{9}$

(c) $3\frac{1}{7} + \frac{6}{7} - \frac{4}{7}$

(d) How will you subtract $3\frac{7}{12}$ from $5\frac{1}{12}$?

Lindi does it like this: $5\frac{1}{12} - 3 \rightarrow 2\frac{1}{12} - \frac{7}{12} \rightarrow 1\frac{13}{12} - \frac{7}{12} = 1\frac{6}{12}$

(e) Now do this one: $7\frac{2}{5} - 5\frac{4}{5}$.

-
5. Look at the strips below. What fraction of each strip is blue, what fraction is red and what fraction is white?

Name each of the fractions in more than one way.



6. Calculate the following:

(a) $\frac{2}{11} + \frac{6}{11} + \frac{3}{11}$

(b) $1 - \frac{3}{11}$

7. What number is missing in each of these number sentences?

(a) $\dots + \frac{2}{7} = \frac{3}{7}$

(b) $\frac{2}{7} + \frac{2}{7} = \dots$

(c) $\frac{3}{7} + \frac{2}{7} = \dots$

(d) $\frac{5}{7} + \frac{2}{7} = \dots$

(e) $\frac{6}{7} + \frac{2}{7} = \dots$

(f) $1 + \frac{2}{7} = \dots$

(g) $\dots + \frac{2}{7} = 2\frac{1}{7}$

(h) $\dots + \frac{2}{7} = 3$

8. Leon uses 3 quarters of a metre of material to make one flag. How many flags can he make if he has 10 m of material available?

9. Mary has $2\frac{3}{4}$ m of lace. Her friend, Sethu needs $\frac{5}{8}$ m of that lace.

How many metres will Mary have left if she agrees to give $\frac{5}{8}$ m to Sethu?

2.1 Models of kilograms and grams

The **mass** of an object tells you how *heavy* or *light* the object is.

Everything we can touch has mass, even the tiniest thing. Sometimes our instruments cannot measure mass accurately enough and the scale may show a reading of zero. A reading of zero mass on one scale just means we need a better instrument to measure with.

The **standard unit** of measurement for mass is the **kilogram (kg)**.
1 ℥ of water has a mass of about 1 kg.

Very light objects are measured in **grams (g)** or fractions of grams.
20 drops of water have a mass of 1 g.

1. Make your own 1 kg mass and 1 g mass.

- (a) Fill a clear plastic bag with 1 ℥ of water.
- (b) Fill another small plastic bag with 20 drops of water.



If you ignore the mass of the plastic, you can use these bags to estimate the mass of other objects.

2. Make a balance scale to measure the mass of light objects.

- (a) Use your pencil, ruler and two identical pieces of cardboard or little boxes. Put the ruler over the pencil at the middle of the ruler. Put the cardboard pieces or boxes on the ruler on either side of the pencil. They must be the same distance away from the pencil. But even more important, the scale must balance, and one side must not dip down and the other dip up before you start using it.

- (b) Put your little bag with a mass of 1 g (20 drops of water) on one side of your balance scale. You can now use your scale to estimate different masses. How are you going to do this? Discuss this with the class.



3. Use the balance scale you made to estimate the mass of the following objects. Work with a classmate to combine your 1 g bags.
- How many paper clips balance the mass of 1 g?
 - Estimate the mass of a paper clip.
 - Estimate the mass of a ballpoint pen.
 - Estimate the mass of an eraser.
 - Estimate the mass of a bottle top.
 - Find other objects that you think have a mass of about 1 g. Test your estimates using your balance scale.
 - Find objects that you think have a mass of about 5 g. Test your estimates using your balance scale.

You can make more gram models. For example, fill another small plastic bag with 5×20 drops of water to make a model of about 5 g. Make one for 10 g also. Remember to adjust your estimates, since the plastic bags also have mass!

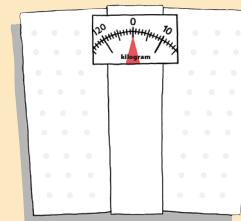
2.2 Estimating and measuring mass

A bathroom scale measures in kilograms. It is not accurate enough to measure differences in mass that are less than half a kilogram.

A bathroom scale usually measures objects that vary between a mass of about 1 kg and 120 kg.

Cooks and bakers use kitchen scales to measure small quantities in grams and kilograms.

A kitchen scale usually weighs amounts from a few grams to between 2 and 5 kg. 1 kg is the same mass as 1 000 g.



1. Would you use grams or kilograms to talk about the mass of the following?
 - (a) an adult goat
 - (b) a mouse
 - (c) a pencil
 - (d) the butter used for baking a cake
2. Would you use a kitchen scale or a bathroom scale to measure the following?
 - (a) sugar for baking a cake
 - (b) a thick letter
 - (c) your own mass
3. If you have an electronic kitchen scale, use it to check some of your estimates in question 3 on the previous page.
4. (a) Estimate the mass of each of the following objects. Use your 1 ℥ bag of water to help you to estimate.
 - a stack of books
 - a schoolbag
 - a pair of shoes
 - a brick
 - a potted plant
(b) Use a bathroom scale to check your estimates.
(c) Make a graph of the measurements.
5. Say what you think.
 - (a) Is sugar heavier than rice?
 - (b) Is sand heavier than sugar?
 - (c) Is peanut butter heavier than butter?
 - (d) Is liquid soap heavier than water?
 - (e) Is oil heavier than liquid soap?

How could you test your ideas? Discuss this with the class.

If we work with estimates in measurements, our answers must always say "about so much". We say that this is the **approximate measurement**.

If we want to compare the mass of different things, we have to make sure we compare equal amounts of the things.

6. (a) Estimate the mass, in grams, of a cupful of each of the following things. Use the same cup each time.

- water
- sand
- liquid soap
- flour
- clay or play dough

- (b) Use a kitchen scale to check your estimates.
(c) Write your mass measurements as fractions of kilograms.
7. Which of the objects in question 4 were too light to measure accurately on the bathroom scale? Measure them again on a kitchen scale and write down their measurements.

A cupful of water (about 250 ml) without the cup has a mass of about 250 g. This is the same as $\frac{250}{1000}$ or one quarter of a kilogram.

2.3 The relationship between grams and kilograms

$$1\,000 \text{ g} = 1 \text{ kg} = 1\,000 \text{ g}$$

$$500 \text{ g} + 500 \text{ g} = 1\,000 \text{ g}, \text{ so } 500 \text{ g} = \frac{1}{2} \text{ kg}$$

$$250 \text{ g} + 250 \text{ g} + 250 \text{ g} + 250 \text{ g} = 1\,000 \text{ g}, \text{ so } 250 \text{ g} = \frac{1}{4} \text{ kg}$$

1. Read the mass of each grocery item and complete the table on the next page.



Mass	Grocery items
Less than $\frac{1}{4}$ kg	
$\frac{1}{4}$ kg	
Between $\frac{1}{4}$ kg and $\frac{1}{2}$ kg	
$\frac{1}{2}$ kg	
Between $\frac{1}{2}$ kg and 1 kg	
1 kg	
Between 1 kg and 2 kg	
More than 2 kg	

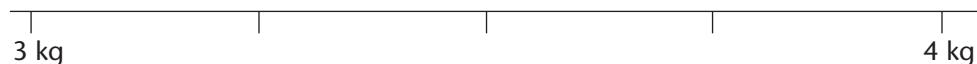
2.4 Counting in grams and kilograms, and reading scales

1. Count in kilograms and grams.

(a) 3 kg and 500 g + 250 g → 3 kg and ___ g + 250 g →
___ kg and ___ g + 250 g → ___ kg and ___ g + 250 g →
___ kg and ___ g + 250 g → ___ kg and ___ g

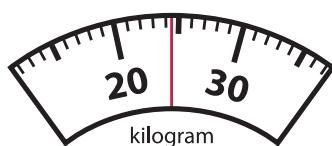
(b) 1 kg and 800 g + 200 g → ___ kg and ___ g + 200 g →
___ kg and ___ g + 200 g → ___ kg and ___ g + 200 g →
___ kg and ___ g + 200 g → ___ kg and ___ g

2. Copy the number lines below. Count the number of spaces between each kilogram. Calculate the value of each space in grams. Fill in the kilograms and grams at each mark on your number lines.



3. Write the mass on each scale in kilograms and grams.

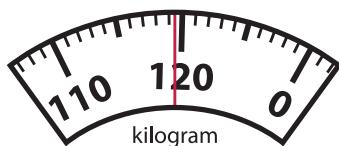
(a)



(b)



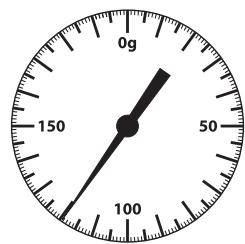
(c)



(d)



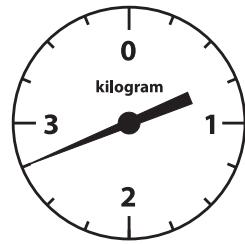
(e)



(f)



(g)



2.5 Solving problems about mass and quantity

1. A citrus farm exports oranges to America. They pack about 80 oranges in a box. Then they pack 60 boxes in a crate. Then they pack 12 crates in a shipping container. A single orange has a mass of about 200 g. Work out the following and give each answer in kilograms:
 - (a) the mass of a box of oranges
 - (b) the mass of a crate of oranges
 - (c) the mass of the oranges in one shipping container
 - (d) the total mass of the oranges they export if they export 30 containers in a season
2. A hardware store sells bags of nails that weigh 100 g, 500 g and 1 kg. There are about 60 nails in a 100 g bag. Estimate the following:
 - (a) the mass of 30 nails
 - (b) the mass of 15 nails
 - (c) the mass of 3 nails
 - (d) the mass of 300 nails
 - (e) the number of nails in a 500 g bag
 - (f) the number of nails in two 1 kg bags
 - (g) which bags to buy if you need about 1 000 nails
3. The table shows the mass of a cupful of different ingredients.

Ingredient (1 cupful or 250 ml)	water	sugar	flour	salt	butter
Mass in grams	250	200	125	300	225

The baker's scale is broken and he will have to use a cup to measure. How many cupfuls are each of these?

- (a) $1\frac{1}{2}$ kg of sugar
 - (b) 3 kg of flour
 - (c) 1 kg of butter
 - (d) 60 g of salt
4. A turkey has a mass of about 5 kg. The mass of the food it eats per day is about one twentieth of its own mass.
 - (a) What is the mass of a turkey's daily food?
 - (b) What mass of food will a rafter of 12 turkeys eat per day?

A group of turkeys is called a rafter of turkeys.

3.1 Compare and order numbers

1. (a) Which of the following numbers is closest to three hundred thousand?

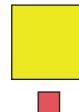
278 545 312 215 209 778 309 778 288 103

- (b) Arrange the above numbers from smallest to biggest.

2. Imagine that the back cover of this textbook is covered

with yellow stickers like the one shown here

or with red stickers like the one shown here.



Imagine that the stickers are pasted neatly next to each other.

- (a) Which of the following numbers do you think is closest to the number of yellow stickers needed to cover the back cover?

100 500 1 000 5 000

10 000 50 000 100 000 500 000

- (b) Which of the above numbers do you think is closest to the number of red stickers needed to cover the back cover?

3. Imagine that your classroom floor is covered with tiles of this size.

Will the number of tiles be

- between 100 and 1 000 or
- between 1 000 and 100 000 or
- between 100 000 and 999 999?

4. Count in six thousands from 120 000 until you reach 180 000.
Write down the number symbols as you go along.

5. Arrange the following seven numbers in ascending order (from smallest to biggest).

366 152

398 987

395 923

398 899

321 965

347 677

339 365

6. Arrange the following seven numbers in descending order (from biggest to smallest).

427 180

493 586

465 153

420 122

420 121

431 999

431 001

7. Round each of the numbers in question 6 off to the nearest:

(a) five

(b) ten

(c) hundred

(d) thousand.

8. Which number should be written at the question mark in each of the number lines? Write the number name and number symbol.



9. Which numbers should be written at the question marks in each of the number lines? Write the numbers from smallest to biggest.

(a)



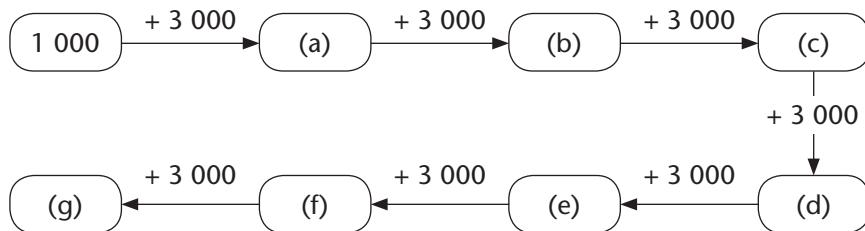
(b)



(c)



- Count in 1 500s from 120 000 until you reach 132 000. Write down the number symbols as you go along.
 - Write the numbers that should be in the blocks in the diagram.



12. In each case decide which is the bigger of the two numbers. Show what you have decided in *two* ways, using the $<$ sign for “smaller than” *and* using the $>$ sign for “bigger than”. Look at the example.

Example: 243 708 and 452 001

$243\ 708 < 452\ 001$ and $452\ 001 > 243\ 708$

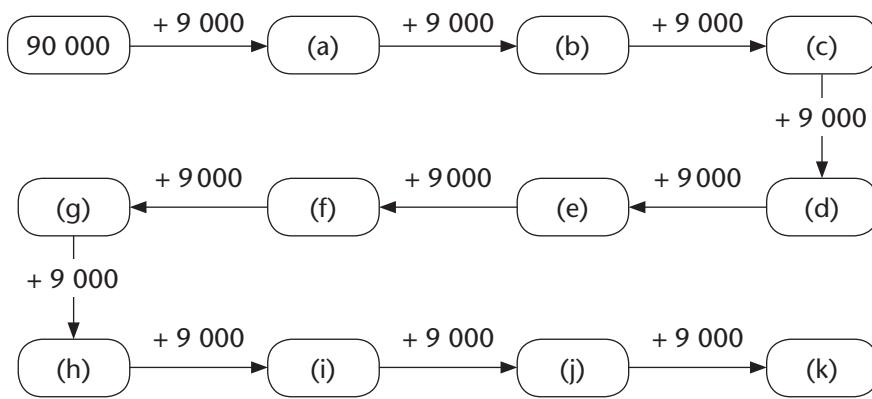
- (a) 160 054 and 123 654 (b) 987 121 and 789 121
(c) 404 872 and 440 782 (d) 144 544 and 414 454

3.2 Represent and compare numbers

1. Copy the table and complete it.

Number symbol	Number name	Expanded notation
	four hundred and twenty-three thousand seven hundred and seventy-two	
611 954		
		$500\,000 + 40\,000 + 5\,000 + 700 + 50 + 6$
	seven hundred and one thousand two hundred and five	
801 630		
		$300\,000 + 6\,000 + 300 + 1$
	two hundred thousand and thirty-six	
870 102		
		$900\,000 + 9\,000 + 9$
	eight hundred and fifty-nine thousand five hundred and sixty	
102 040		
		$100\,000 + 10\,000 + 300$
	six hundred and six thousand one hundred and nine	
800 001		
		$200\,000 + 900 + 9$

2. (a) What is the biggest number in the table in question 1? Write it down.
- (b) What is the smallest number? Write it down.
3. Count in 40 000s from 120 000 until you pass 500 000. Write down the number symbols as you go along.
4. Write the numbers that should be in the blocks in the diagram.



5. In each case decide which is the bigger of the two numbers. Each time show this in two ways, using the $<$ sign for “smaller than” and the $>$ sign for “bigger than”.

Example: $13\ 678 < 13\ 768$ and $13\ 768 > 13\ 687$

- | | |
|-----------------------|-----------------------|
| (a) 16 154 and 16 654 | (b) 23 121 and 23 322 |
| (c) 44 872 and 44 782 | (d) 14 544 and 41 454 |

3.3 An investigation

Approximately how many bricks are needed to build a house with two bedrooms, a bathroom, a kitchen and a lounge/dining room? Give good reasons for your approximation.

An **approximation** is a rough estimate and therefore not exact.

In this unit you will learn how to write less when you add and subtract. This will make it easier for you to write up your work when you work with large numbers. To start, you need to make sure that you understand how to do addition and subtraction, and get some practice.

4.1 Revision, and adding in columns

You can write like this to show what you are thinking when you calculate $765 + 857$:

$$765 = 700 + 60 + 5$$

Step 1: Break down the numbers into place value parts.

$$857 = 800 + 50 + 7$$

Step 2: Add corresponding parts.

$$765 + 857 = 1\,500 + 110 + 12$$

$$= 1\,600 + 20 + 2$$

Step 3: Make transfers to obtain the place value parts of the answer.

= 1622

Step 4: Build up the answer

2. Steve did the work below. Find the mistakes in Steve's work. Write a short note to Steve, in which you tell him what he did wrong.

$$5\,687 \equiv 5\,000 + 400 + 80 + 7$$

$$2736 = 2000 + 700 + 30 + 6$$

$$5\,687 + 2\,736 = 8\,000 + 1\,100 + 110 + 13$$

$$= 9\,000 + 200 + 10 + 3$$

- 9213

3. Calculate and write your work as shown in the example above question 2.

(a) $859 + 478$

(b) $537 + 764$

(c) $4\ 736 + 7\ 658$

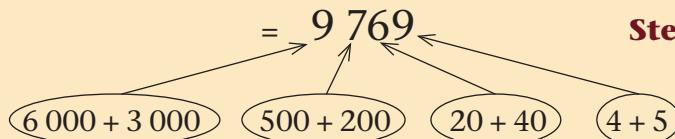
(d) $48\ 673 + 33\ 948$

In a case such as $6\ 524 + 3\ 245$ you do not need to make any transfers, so you need only three steps.

$$6\ 524 = 6\ 000 + 500 + 20 + 4$$

$$3\ 245 = 3\ 000 + 200 + 40 + 5$$

$$6\ 524 + 3\ 245 = 9\ 000 + 700 + 60 + 9$$



Step 1: Break down.

Step 2: Add the parts.

Step 3: Build up.

When you want to explain to someone else how you thought, it is good to write down the separate place value parts in Step 2. But if you are just interested in getting to the answer, you can combine the place value parts in your mind and write the answer directly as shown below.

$$\mathbf{6\ 524 = 6\ 000 + 500 + 20 + 4}$$

$$\mathbf{3\ 245 = 3\ 000 + 200 + 40 + 5}$$

$$\mathbf{6\ 524 + 3\ 245 = 9\ 769}$$

4. Do these calculations by writing as in the example printed in colour above.

(a) $7\ 435 + 3\ 532$

(b) $43\ 364 + 34\ 523$

When you are not explaining but just trying to find the answer, you can write even less if no transfers are needed.

Look at this example for the calculation of $4\ 345 + 3\ 253$:

$$\begin{array}{r} 4\ 345 \\ + 3\ 253 \\ \hline 7\ 598 \end{array}$$

Think of $4\ 345$ as $4\ 000 + 300 + 40 + 5$ but do not write it.

Think of $3\ 253$ as $3\ 000 + 200 + 50 + 3$ but do not write it.

Think of $5 + 3 = 8$, $40 + 50 = 90$,
 $300 + 200 = 500$ and $4\ 000 + 3\ 000 = 7\ 000$ and
 $7\ 000 + 500 + 90 + 8$, but only write $7\ 598$.

When you write like this to do addition, we say you **add in columns**.

5. Think and write like in the above example to calculate the following:

(a) $5\ 436 + 3\ 352$

(b) $23\ 572 + 53\ 215$

(c) $35\ 254 + 42\ 623$

(d) $23\ 234 + 32\ 123 + 11\ 442$

6. Try to calculate $859 + 478$ by adding in columns. You may find that it does not work.

When you try to calculate $3\ 658 + 5\ 736$ by writing in columns, you will experience a problem.

$$\begin{array}{r} 3\ 658 \\ + 5\ 736 \\ \hline \end{array}$$

You can calculate $8 + 6 = 14$ and write the 14.

If you now calculate $50 + 30 = 80$, you will find that the "1" of the 14 sits in the place where you want to write the "8" of the 80.

$$\begin{array}{r} 14 \\ \swarrow \quad \nearrow \\ ?? \end{array}$$

80

Fortunately there is a simple solution for this problem. You can write the 80 in the next line, and continue to write the total for each kind of place value part in a new line, as shown in red below.

It is now easy to form the answer from the **part answers** for the different kinds of place value parts.

$$\begin{array}{r} 3\ 658 \\ + 5\ 736 \\ \hline \end{array}$$

14 ... $(8 + 6)$

80 ... $(50 + 30)$

1 300 ... $(600 + 700)$

8 000 ... $(3\ 000 + 5\ 000)$

9 394

7. Calculate each of the following. Record your thinking in columns as shown above. Write the reasons for the part answers.

(a) $26\ 987 + 54\ 654$ (b) $44\ 887 + 47\ 596$

8. Thuli calculated $676 + 895$ as

shown here. She made mistakes.

$$676$$

$$\underline{895}$$

Find the mistakes. Write a short note to Thuli, in which you tell her what she did wrong.

11 $(6 + 5)$

16 $(7 + 9)$

140 $(6 + 8)$

1 670

9. Calculate the following by writing in columns. You do not have to show the reasons for the part answers.

(a) $36\ 876 + 45\ 658$ (b) $23\ 568 + 8\ 679 + 27\ 876$

(c) $25\ 886 + 38\ 758$ (d) $44\ 362 + 54\ 525$

(e) $578 + 649 + 735 + 847 + 547 + 2\ 376 + 876$

(f) $8\ 564 + 12\ 568 + 4\ 658 + 13\ 276$

4.2 Subtracting in columns

1. Calculate:

(a) $876 - 254$
(c) $8254 - 3876$

(b) $7967 - 4653$
(d) $78668 - 23534$

When you calculate $876 - 254$ by breaking down the numbers into place value parts and building up the answer, you can write this to show how you are thinking:

$$\begin{aligned}876 &= \boxed{800} + \boxed{70} + \boxed{6} \\254 &= \boxed{200} + \boxed{50} + \boxed{4} \\876 - 254 &= \boxed{600} + \boxed{20} + \boxed{2} \\&= 622\end{aligned}$$

Step 1: Break down the numbers into place value parts.

Step 2: Subtract corresponding parts.

Step 3: Build up the answer.

This way of writing is sometimes called “the expanded column notation”, because the numbers are written in expanded notation.

You can also record your thinking in the “vertical” way shown below.

$$\begin{array}{r} \boxed{8}\boxed{7}\boxed{6} = 800 + 70 + 6 \\ - \boxed{2}\boxed{5}\boxed{4} = 200 + 50 + 4 \\ \hline 622 \end{array}$$

Step 1: Break down.

Step 2: Subtract corresponding parts.

Step 3: Build up the answer.

The parts in red show the expanded notation of the numbers that are to be subtracted. The parts in black show the parts of the answer. The parts in blue show how the part answers were obtained.

This way of writing subtraction is called **subtracting in columns**.

2. Describe what you did in questions 1(b) and (d) by writing in columns as in the above example. Include the expanded notation (red in the example), the part answers (black in the example) and the reasons for the part answers (blue in the example).
3. Calculate the following and record your thinking in the vertical way. Write the expanded notation and the explanations for the part answers (the parts in blue in the example).
(a) $8985 - 6342$ (b) $48684 - 23424$

4. Calculate each of the following. Record your thinking by writing in columns (the vertical way). Write the reasons for the part answers, but do not write the numbers in expanded notation.
- (a) $8\ 856 - 3\ 444$ (b) $18\ 768 - 9\ 265$
(c) $76\ 496 - 24\ 174$ (d) $78\ 768 - 37\ 244$

In a case such as $8\ 985 - 6\ 342$, you can build the answer up directly and write it while you do the calculations
 $5 - 2$, $80 - 40$, $900 - 300$ and $8\ 000 - 6\ 000$ in your mind.

8 985
$\underline{- 6\ 342}$
2 643

5. Calculate each of the following. Write as little as possible.
- (a) $6\ 756 - 2\ 354$ (b) $12\ 785 - 6\ 432$
(c) $56\ 896 - 21\ 635$ (d) $67\ 657 - 23\ 434$
6. Find the missing numbers in these number sentences:
- (a) $45\ 436 = 5\ 436 + \dots \dots$
(b) $45\ 436 = \dots \dots + 39\ 999$
7. Replace $63\ 352$ by *some number* $+ 59\ 999$ and then calculate $63\ 352 - 27\ 685$ by first calculating $59\ 999 - 27\ 685$.
You do not have to write your work in the vertical way now.

When you calculate $63\ 254 - 27\ 786$ by replacing $63\ 254$ by $3\ 255 + 59\ 999$, you can write in columns as shown here.

59 999
$\underline{- 27\ 786}$
32 213
$\underline{+ 3\ 255}$
35 468

8. Do these calculations by writing in columns.
- (a) $9\ 542 - 3\ 878$ (b) $53\ 345 - 26\ 789$
(c) $76\ 768 - 34\ 453$ (d) $68\ 374 - 25\ 824$
9. 97 373 new vehicles were registered last year in a certain province. Of those, 58 408 were sedans. How many other kinds of vehicles were registered?

4.3 Less writing when adding in columns

The calculations for $2\ 257 + 3\ 432$ and $4\ 697 + 8\ 956$ are shown on the right.

For $2\ 257 + 3\ 432$ the answer is built up and written without writing the part answers first.

For $4\ 697 + 8\ 956$ the part answers are written down first, and then added up to form the answer.

It would be nice to write the work for $4\ 697 + 8\ 956$ in a shorter way. You will now explore some possibilities for doing that.

The part answers for $4\ 697 + 8\ 956$ can be written down in a different way. When you add 6 to 7 you can write the 13 in two parts as shown on the right.

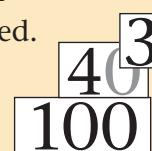
By doing this, the space under the 90 and 50 is left open.

$$\begin{array}{r} 2\ 257 \\ + 3\ 432 \\ \hline 5\ 689 \end{array}$$
$$\begin{array}{r} 4\ 697 \\ + 8\ 956 \\ \hline 13\ 653 \end{array}$$

$$\begin{array}{r} 4\ 697 \\ + 8\ 956 \\ \hline \square 3 \end{array}$$

10

When $50 + 90 = 140$ is calculated in the next step, the 140 can also be written in two parts as shown on the right. This leaves the space to the left of the “4” open for the next step, when $600 + 900$ is calculated.

$$\begin{array}{r} 4\ 697 \\ + 8\ 956 \\ \hline \square 43 \\ 10 \\ 100 \end{array}$$


By continuing in this way, the calculation can be written up as shown on the right.

$$\begin{array}{r} 4\ 697 \\ + 8\ 956 \\ \hline 12\ 543 \\ 10 \\ 100 \\ \hline 1\ 000 \\ \hline 13\ 653 \end{array}$$

1. Do these calculations by writing as shown in the example on the right.

(a) $7\ 688 + 8\ 567$

(b) $45\ 847 + 37\ 586$

(c) $38\ 586 + 26\ 795$

$$\begin{array}{r} 4\ 697 \\ + 8\ 956 \\ \hline 12\ 543 \end{array}$$
$$\begin{array}{r} 10 \\ 100 \\ \hline 1\ 000 \end{array}$$
$$\begin{array}{r} 13\ 653 \end{array}$$

Instead of adding only the 90 and 50 in the second step of the calculation shown in the above example, you can calculate $90 + 50 + 10 = 150$, and write it as shown on the right.

We say you “carry” the 10 from the $7 + 6 = 13$ to the $90 + 50 = 140$, to make it 150. You can also say you **transfer** the 10.

Similarly, you can transfer (carry) the 100 of 150 to 600 + 900 in the next step.

You then have $600 + 900 + 100$ and the written work will look like this.

In the next step you carry 1 000.

On the right you can see what you will have written when you have finished.

You will soon try to do addition without actually writing the 10, 100 and 1 000 down.

2. Do these calculations by working in the above way.
 - (a) $8\ 867 + 7\ 968$
 - (b) $45\ 886 + 38\ 657$
 - (c) $26\ 783 + 48\ 894$
 - (d) $55\ 378 + 28\ 257$
 3. Try to calculate $7\ 668 + 8\ 897$ by writing in the above way but without writing the 10, 100 and 1 000.

4. Show how your work for question 2(b) can be written in the way you wrote in Terms 1 and 2 (the “expanded column notation”), before you learnt to write in the vertical way.

Here are four different ways to write the work vertically when you calculate $34\ 697 + 48\ 956$:

A	B	C	D
34 697	34 697	10 000	11 11
+ 48 956	+ 48 956	1 000	34 697
13	83 653	100	+ 48 956
140	10	10	83 653
1 500	100	34 697	
12 000	1 000	+ 48 956	
70 000	10 000	83 653	
83 653			

The symbols “1”, “1”, “1” and “1” at the top of D actually mean 10, 100, 1 000 and 10 000, as shown in C.

You can use any of the above ways of writing, but you should try to get used to making transfers and writing like in B, C or D.

In fact, it would be good if you can learn to make the transfers without any writing to remind you of the 10, 100, 1 000 or 10 000, as shown on the right.

$$\begin{array}{r} 34\ 697 \\ + 48\ 956 \\ \hline 83\ 653 \end{array}$$

5. Calculate.
- | | |
|-------------------------|-----------------------------------|
| (a) $57\ 658 + 36\ 867$ | (b) $27\ 858 + 36\ 765$ |
| (c) $65\ 483 + 23\ 564$ | (d) $13\ 537 + 33\ 148 + 21\ 209$ |
| (e) $27\ 334 + 58\ 428$ | (f) $43\ 569 + 22\ 387$ |
6. Ben earns R14 786 each month, Sally earns R16 787 and Zweli earns R15 456. How much do they earn together?
7. There are 57 866 houses in a large township. How many houses will there be if 18 477 more houses are built?

4.4 Another way of subtracting in columns

63 543 – 27 688 can be calculated by **adding on** to 27 688 until you reach 63 543:

$$\begin{array}{r} 12 \\ 2300 \\ + 33543 \\ \hline 35855 \end{array}$$

A different way to calculate 63 543 – 27 688 is to break down both numbers into place value parts as shown below.

$$\begin{aligned} 63\ 543 &= 60\ 000 + 3\ 000 + 500 + 40 + 3 \\ 27\ 688 &= 20\ 000 + 7\ 000 + 600 + 80 + 8 \end{aligned}$$

There is not enough to subtract from in the thousands, hundreds, tens and units columns.

One way to get around this difficulty is to replace 63 543 by 3 543 + 60 000 and then by 3 544 + 59 999.

$$\begin{array}{r} 59\ 999 \\ - 27\ 688 \\ \hline 32\ 311 \end{array}$$

You can then calculate 59 999 – 27 688 and add 3 544. This is called the **change-and-compensate method**.

$$\begin{array}{r} + 3\ 544 \\ \hline 35\ 855 \end{array}$$

You can write this in columns as shown on the right.

Another way is to make transfers in the expanded notation of 63 543, so that the parts of 27 688 can be easily subtracted from it:

$$\begin{aligned} 63\ 543 &= 60\ 000 + 3\ 000 + 500 + 40 + 3 \\ &= 50\ 000 + 12\ 000 + 1\ 400 + 130 + 13 \\ 27\ 688 &= 20\ 000 + 7\ 000 + 600 + 80 + 8 \\ 63\ 543 - 27\ 688 &= 30\ 000 + 5\ 000 + 800 + 50 + 5 \\ &= 35\ 855 \end{aligned}$$

This is called the **transfer method** or the **borrowing method**.

Different ways of writing this work in columns are shown on the right.

If you can keep track of the transfers in your mind without writing, you can just write as shown below.

$$\begin{array}{r} 63\ 543 \\ - 27\ 688 \\ \hline 35\ 855 \end{array}$$

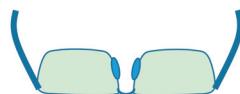
$$\begin{array}{r} 50\ 000 \quad 50\ 000 \ 12\ 000 \ 1\ 400 \ 130 \ 13 \\ 12\ 000 \quad 6 \quad 3 \quad 5 \quad 4 \quad 3 \\ 1\ 400 \quad -2 \quad 7 \quad 6 \quad 8 \quad 8 \\ \hline 130 \quad 3 \quad 5 \quad 8 \quad 5 \quad 5 \\ 13 \\ 63\ 543 \quad 50 \ 12 \ 14 \ 13 \ 13 \\ - 27\ 688 \quad 6 \ 3 \ 5 \ 4 \ 3 \\ \hline 35\ 855 \quad -2 \ 7 \ 6 \ 8 \ 8 \\ \hline 3 \ 5 \ 8 \ 5 \ 5 \end{array}$$

4.5 Solve problems

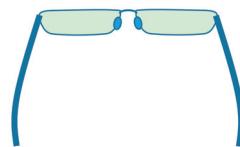
1. Pipes were laid so that 35 255 more hectares of land could be irrigated. That brought the total of irrigated land to 89 034 hectares. How many hectares were already under irrigation?
 2. An agreement was reached to import 45 880 frozen chickens. A food chain has already received 35 794 frozen chickens. How many must still be imported?
 3. There were too many impalas in the national parks, so 10 550 had to be culled. Afterwards, there were 79 600. How many impalas were there in the parks originally?
 4. Practising for a marathon, a long distance runner tries to put in extra distance over the weekends. Last week Saturday he ran 21 876 m and Sunday he ran 35 889 m. How many metres did he run over the weekend?
 5. The owner of a small block of flats earned R18 564 each month by renting out the flats. After he increased the rent, he earned R19 655 per month. How much more did he earn?
 6. The odometer of a car showed 79 093. After a long trip, it read 85 084. How many kilometres did the driver travel?

5.1 Different views of the same object

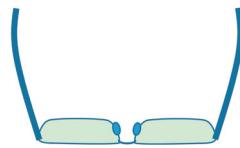
1. Thandi is holding the mug on the right. Write a short paragraph to describe what you see in the pictures of the mugs on the right.
2. This is what you will see if Thandi holds her glasses like she is holding the mug in Picture C:



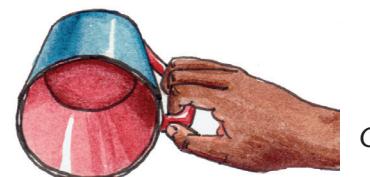
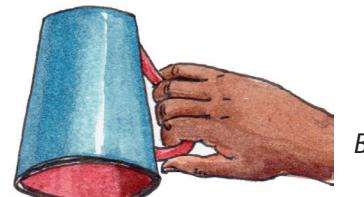
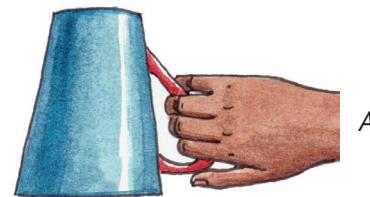
This is what you will see if Thandi holds her glasses like she is holding the mug in Picture E:



How is Thandi holding her glasses if you see them like this?

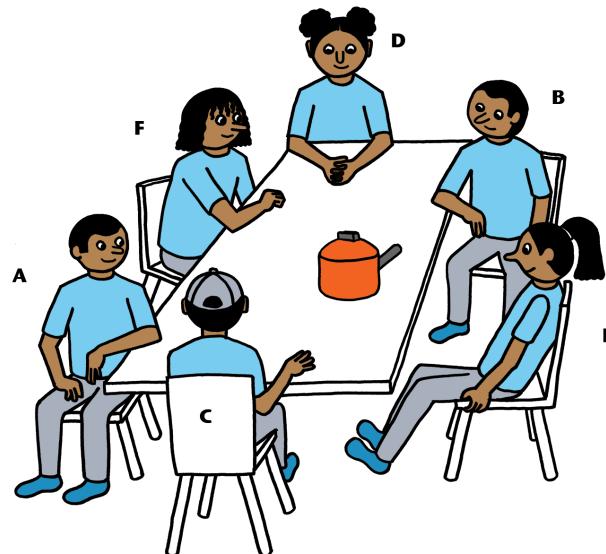


3. Make a drawing to show how you will see the glasses if Thandi holds them like she is holding the mug in Picture A.

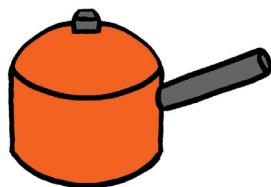


5.2 What you see from different places

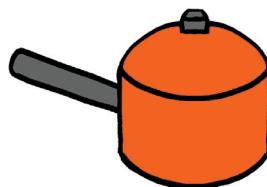
1. Six people are sitting at positions A, B, C, D, E and F around a table.



- (a) Which picture shows how the person at A sees the pot?
- (b) Which pictures show how the people at B, E and F see the pot?



Picture 1



Picture 2



Picture 3



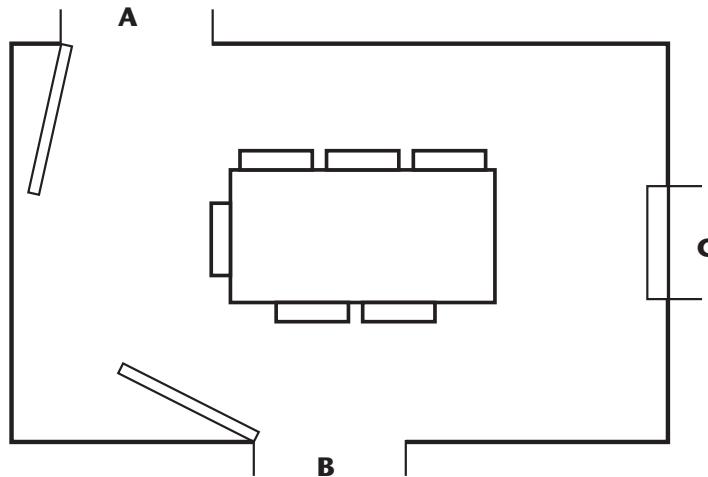
Picture 4

- (c) Make drawings of how the people at C and D see the pot.

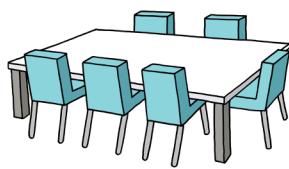
This is a **plan** of the dining room in the house of Mr Phosa.

A plan shows how something looks from above, like a bird that flies and looks down would see it.

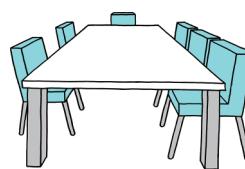
There are doors at A and B, and a window at C.



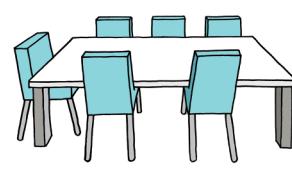
2. Tebogo, Piet and Jaamiah are standing at the doors and the window.
 - (a) Picture 1 shows what Piet sees. Where is he standing?
 - (b) Picture 2 shows what Jaamiah sees. Where is she standing?
 - (c) Picture 3 shows what Tebogo sees. Where is she standing?



Picture 1

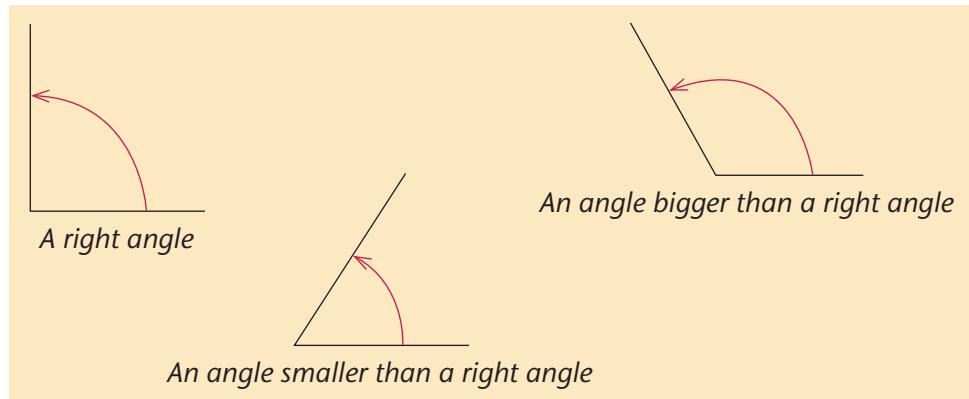


Picture 2



Picture 3

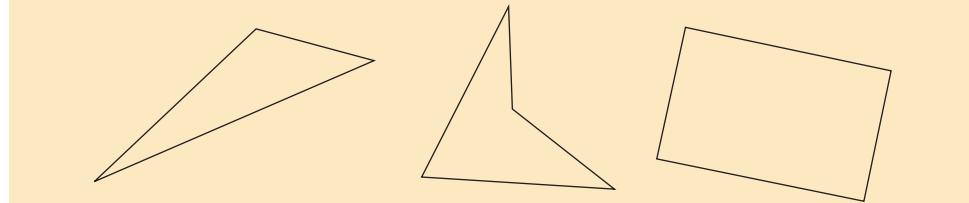
6.1 Draw figures on grid paper



1. Use a ruler or any other object with a straight edge to draw each of the following figures on blank paper:
 - (a) a triangle with one angle bigger than a right angle
 - (b) a triangle with all three angles smaller than a right angle
 - (c) a quadrilateral with no right angles
 - (d) a quadrilateral with four right angles
 - (e) a pentagon with all angles bigger than right angles

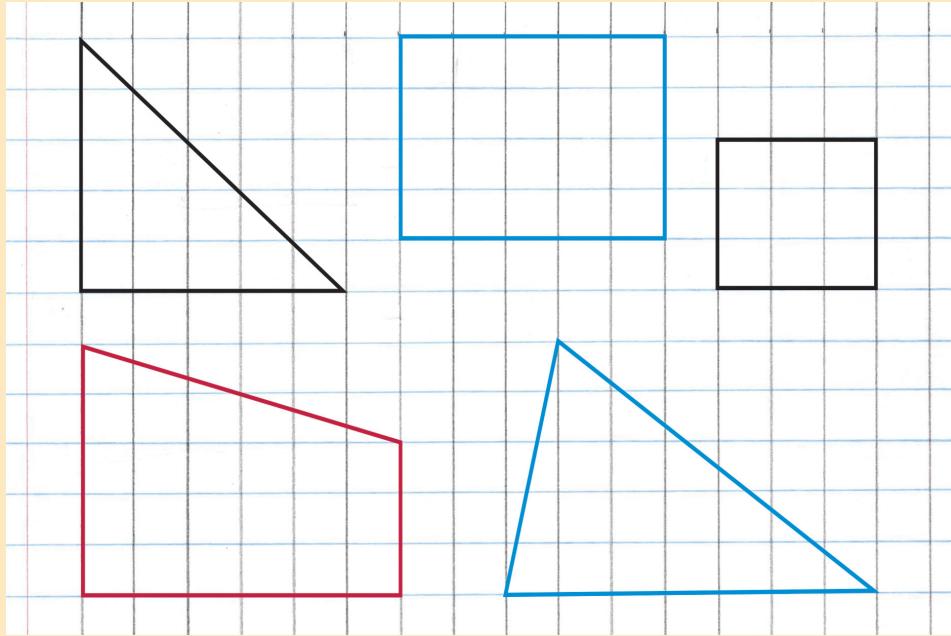
It is easy to draw a neat triangle or quadrilateral on blank paper with a ruler, if the angles are different.

It is not so easy to draw a figure with equal angles.



It is easier to draw figures with right angles on grid paper than on blank paper.

You can make your own grid paper by drawing vertical lines on ruled paper. Your vertical lines must be the same distance from each other as the lines on the ruled paper are.

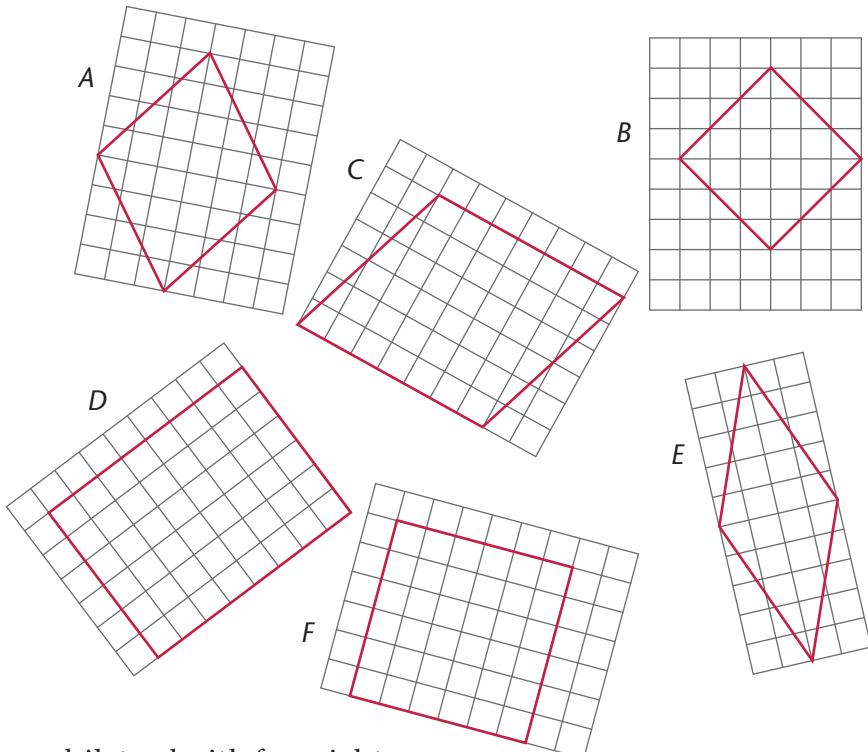


The black triangle above has only one right angle. It has two angles that are smaller than right angles.

2. (a) Which quadrilateral above has only two right angles?
(b) Which quadrilateral has four equal sides?
3. Try to draw the figures described below. Use grid paper.
If you find that it is impossible, state it in writing.
 - (a) a triangle with two right angles
 - (b) a quadrilateral with only one right angle
 - (c) a quadrilateral with only three right angles
 - (d) a triangle with three angles all smaller than a right angle
 - (e) a quadrilateral with four angles all smaller than a right angle
 - (f) a quadrilateral with four angles all bigger than a right angle

6.2 Figures with equal sides and right angles

1. In this question, use your ruler only when it is really necessary.
 - (a) Which figures below have four equal sides?
 - (b) Which figures have four right angles?
 - (c) Which figures have four right angles and four equal sides?



A quadrilateral with four right angles is called a **rectangle**.

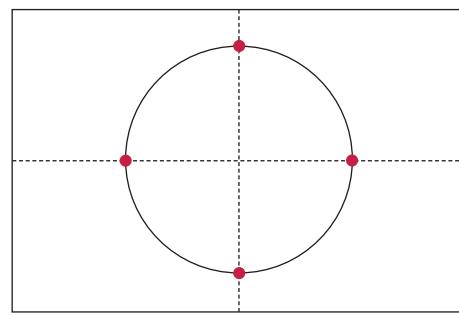
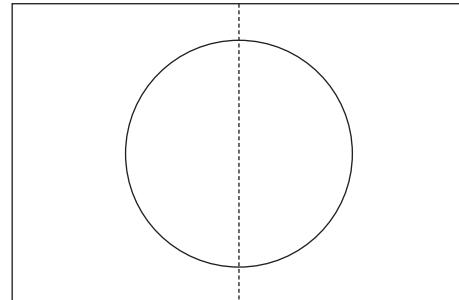
A rectangle with four equal sides is called a **square**.

2. (a) Which of the above figures are rectangles?
(b) Which of the above figures are squares?
(c) Which of the above figures are rectangles but not squares?
(d) Which of the above figures have four equal sides, but are not squares?

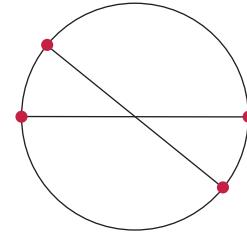
-
3. Make drawings of the following figures on grid paper:
- (a) a rectangle with two sides longer than the other two sides
 - (b) a quadrilateral with no right angles and four equal sides
 - (c) a rectangle with four equal sides
 - (d) a pentagon with two right angles, and three angles bigger than right angles
 - (e) a pentagon with two right angles, and one angle smaller than a right angle
4. Make drawings of the following figures on grid paper:
- (a) a quadrilateral with three right angles
 - (b) a quadrilateral with only two right angles
 - (c) a quadrilateral with only one right angle
 - (d) a quadrilateral with no right angles and no equal sides
5. Which of the statements below are false, and which statements could be true?
- It may help you to think about what you did in question 4. In some cases you may need to make new drawings.
- (a) If a quadrilateral has only two right angles, the other two angles are both smaller than right angles.
 - (b) If a quadrilateral has only two right angles, the other two angles are both bigger than right angles.
 - (c) If a quadrilateral has only two right angles, one of the other angles is smaller than a right angle.
 - (d) If a quadrilateral has only one right angle, one or two of the other angles are smaller than right angles.
 - (e) If all the angles of a figure with straight sides are right angles, it is definitely a quadrilateral.
 - (f) If one angle of a quadrilateral is smaller than a right angle, then one or more of the other angles are bigger than right angles.
 - (g) If one angle of a triangle is smaller than a right angle, then one of the other angles is definitely bigger than a right angle.

6.3 Figures inside circles

1. (a) Use a glass or a tin or some other round object to draw a circle in the middle of a loose sheet of paper.
- (b) Fold the sheet so that the fold divides the circle into two equal halves.
- (c) Fold the sheet again so that the circle is divided into four equal quarters.
- (d) Draw lines between the four points where the fold lines pass through the circle.
- (e) What kind of figure is formed?



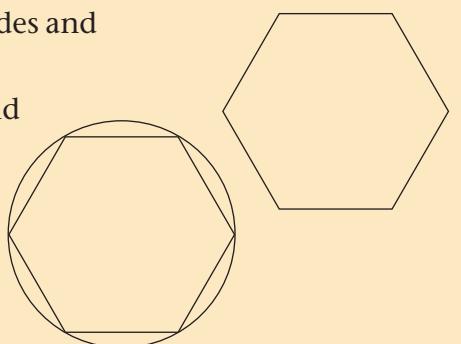
2. (a) Draw another circle, and draw two lines through its centre (middle) as shown on the right.
- (b) Draw lines between the points where your lines meet the circle.
- (c) What kind of figure is formed?



A **regular hexagon** has six equal sides and six equal angles.

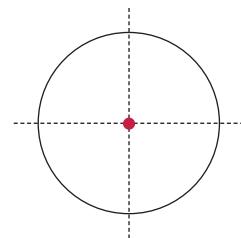
A circle can be drawn tightly around a regular hexagon.

You can follow the instructions on the next page to draw a regular hexagon accurately.

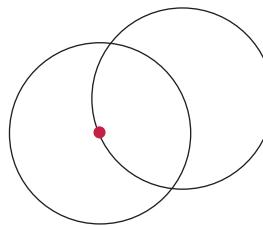


3. Follow the instructions to draw a regular hexagon accurately.

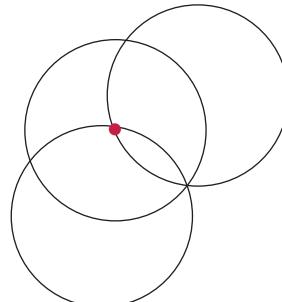
(a) Use a round object to draw a circle in the middle of a clean sheet of paper.



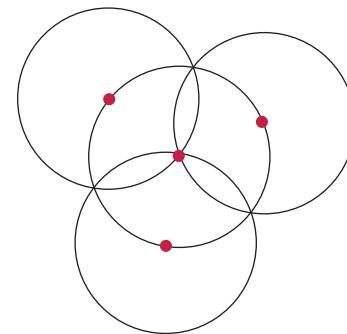
(b) Fold the sheet twice to find the centre of the circle.



(c) Draw another circle that passes through the centre of the first circle.

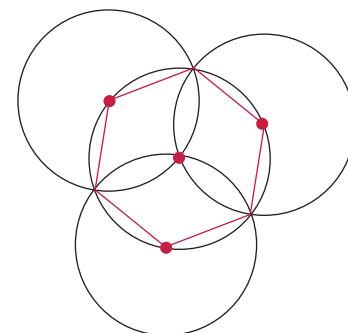


(d) Your two circles meet in two points. Draw a third circle that passes through one of these points, and the centre of your first circle.



(e) Draw another circle in this way so that your drawing looks like this.

Mark the midpoints of the three outer circles as accurately as you can.



(f) Draw lines between points on your first circle to form the regular hexagon.

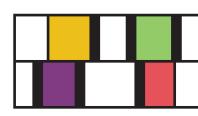
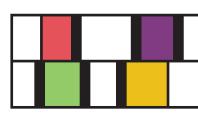
7.1 Making patterns by moving a shape

Each of the three patterns below was made by moving this colourful glass tile in a certain way.

You will soon learn to see how the tile was moved to make each of the patterns.



Pattern A



Pattern B

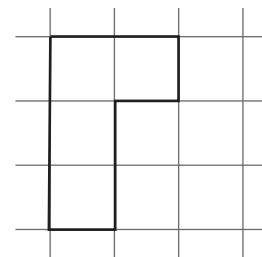
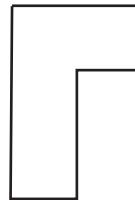


Pattern C

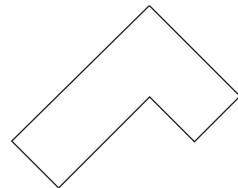
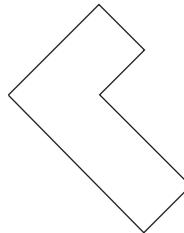
1. (a) Describe how Patterns A and B differ from each other.
(b) Describe how Patterns A and C differ from each other.

-
2. Draw a copy of this shape, and cut it out. Do not spend much time; your copy need not look exactly like this.

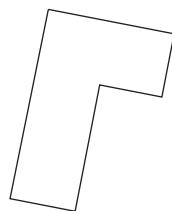
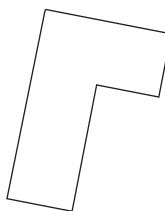
The piece of paper that you have cut out is called a **template**.



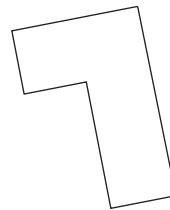
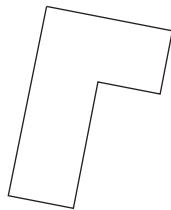
3. (a) Put your template on the figure on the left, so that it fits.



4. (a) Put your template on the figure on the left, so that it fits.



5. (a) Put your template on the figure on the left below, so that it fits.

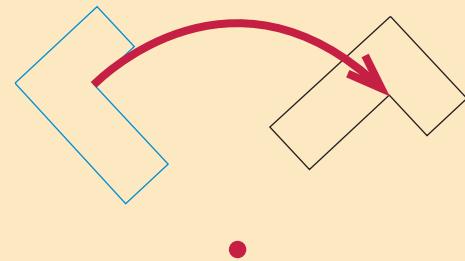


- (b) Move your template to the figure on the right so that it fits.

6. Describe the different ways in which you moved your template when you did questions 3(b), 4(b) and 5(b).

To move the template from the position on the left to the position on the right you can swing or **rotate** the template.

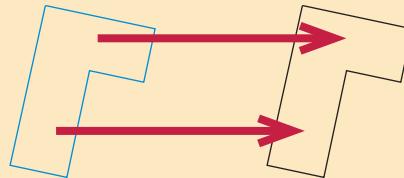
The black figure is called a **rotation** of the blue figure.



To move the template from the position on the left to the position on the right you can slide the template without turning it.

We say we **translate** the template.

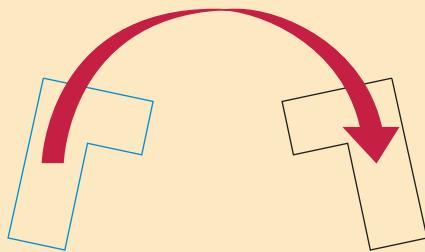
This black figure is called a **translation** of the blue figure.



To move the template from the position on the left to the position on the right you can pick the template up and flip it over.

We say we **reflect** the template.

This black figure is called a **reflection** of the blue figure.



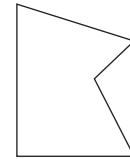
7. Look again at your answers for question 1.

- Which of the three patterns can be made by repeatedly rotating the glass tile?
- Which of the three patterns can be made by repeatedly reflecting the glass tile?
- Which of the three patterns can be made by repeatedly translating the glass tile?

7.2 Rotations

- Follow the steps below to make a **rotation tool** that you can use to draw rotations of a pentagon like this.

Trace a copy of the diagram below onto a piece of cardboard or thick paper.



Cut it out.

Make a small hole at the one end of the strip as shown in the diagram.

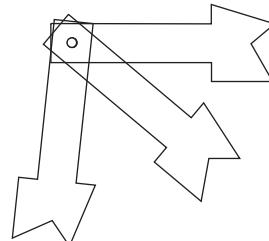
If you press your pencil tip through the small hole onto a blank sheet of paper, you can swing the pentagon around the pencil.

- Do this activity with a classmate.

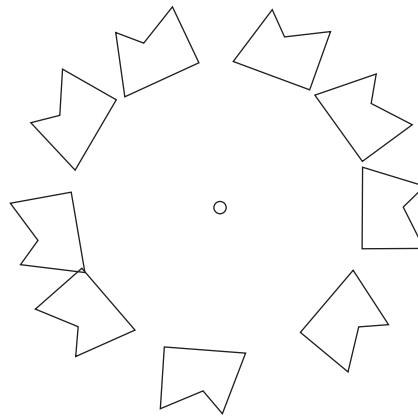
You need two pencils and a blank sheet of paper.

- Pin the rotation tool to the middle of the paper with one of the pencils. Trace around the pentagon using the other pencil.

Swing the pentagon to a different position. Trace around the pentagon to show the new position.



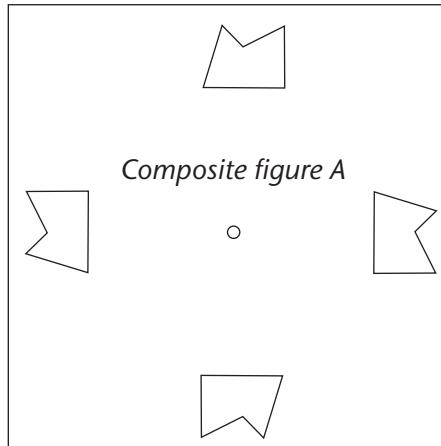
Repeat as many times as you can fit in the pentagon.



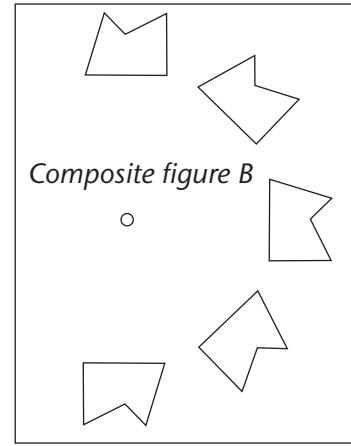
- What shape can be formed by rotating the pentagon many times?

A 2-D figure that consists of more than one figure is called a **composite figure**.

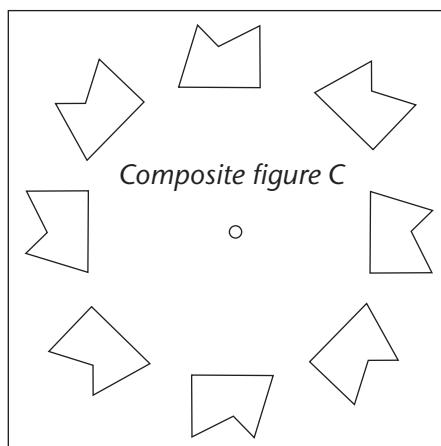
3. How many times do you have to rotate the pentagon to make the composite figures A, B, C and D below?



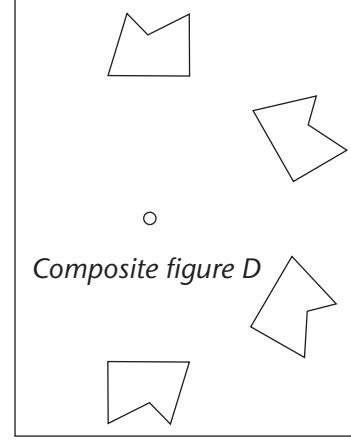
Composite figure A



Composite figure B

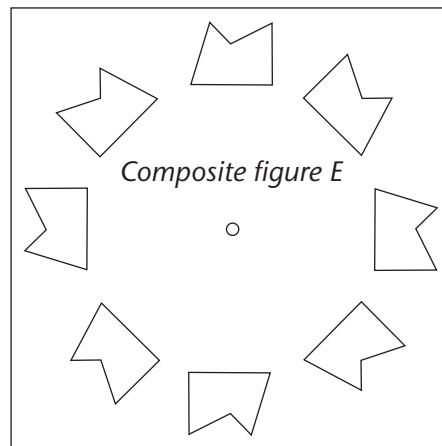


Composite figure C



Composite figure D

4. (a) How do the composite figures C (above) and E (on the right) differ?
(b) Describe how you will use your rotation tool to draw a composite figure like E.
(c) Draw the figure.

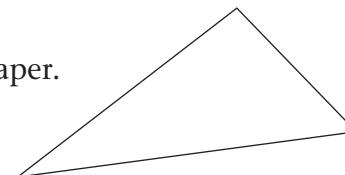


Composite figure E

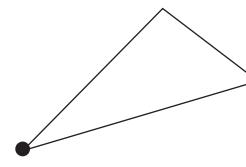
5. You will now draw rotations of a triangle without a rotation tool.

Cut a triangle from paper or cardboard.

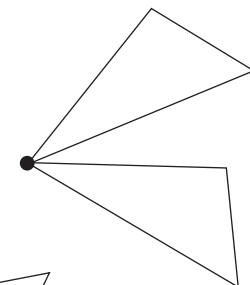
Make a dot in the middle of a sheet of paper.



Put one corner of your triangle next to the dot and trace the triangle.

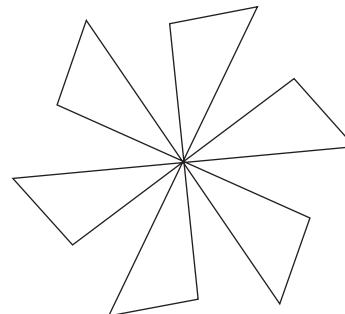


Put your triangle in a different position, with the same corner next to the dot.

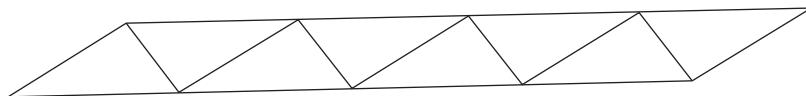


Trace the triangle again.

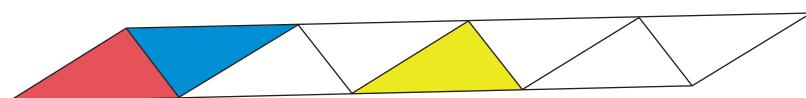
Repeat the above actions to draw a composite figure with several rotations of the triangle, like this.



6. (a) Use the triangle you have cut out to draw a composite figure like the one below.



(b) Is the yellow triangle below a rotation of the red triangle? If not, is it a translation or is it a reflection?



(c) Is the yellow triangle a rotation of the blue triangle?

(d) Is the blue triangle a rotation of the red triangle?

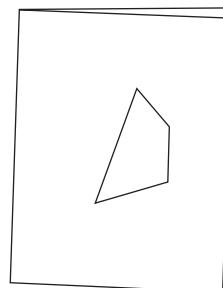
7.3 Reflections and translations

- Follow these instructions to draw a reflection of a quadrilateral.

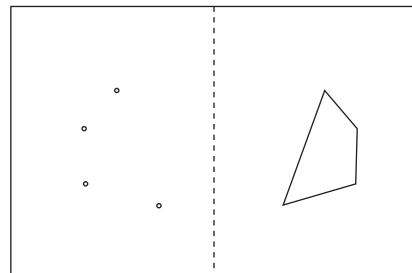
You need a pencil with a sharp tip.



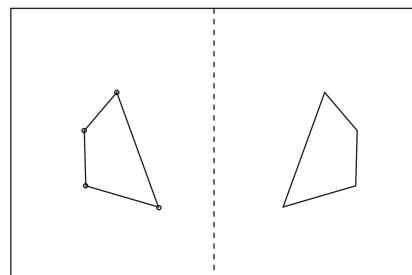
- Fold a sheet of paper in half, and draw a quadrilateral on one side.
- Use the tip of your pencil to punch four small holes at the corners of your quadrilateral. The holes must go through both layers of paper.



- When you open up the sheet you can see your drawing on the one half of the sheet, and the four holes on the other half. You can also see the fold line.

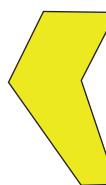


- Draw lines from one hole to the next. In doing so, you are drawing a reflection of the first quadrilateral that you drew.



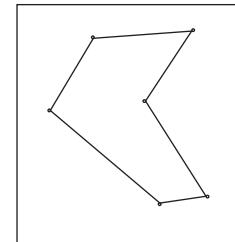
- The yellow hexagon below is a translation of the black hexagon.

- Which hexagon is a reflection of the black hexagon?
- Which hexagon is a rotation of the red hexagon?

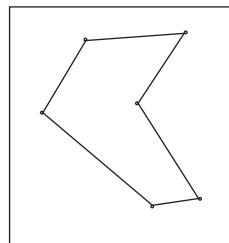


-
3. Draw a hexagon on a rectangular piece of paper about this size, and punch small holes at the six corners of the hexagon.

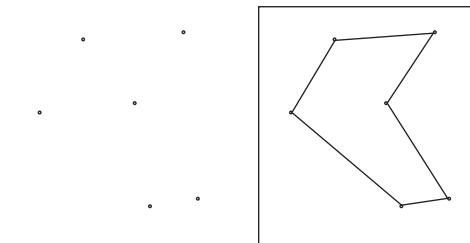
You will use this template to draw translations, reflections and rotations.



4. Follow these instructions to draw translations of the hexagon on your template.
- Draw a straight line across the width of a blank sheet of paper.
 - Put the bottom edge of your template against the line as shown below.



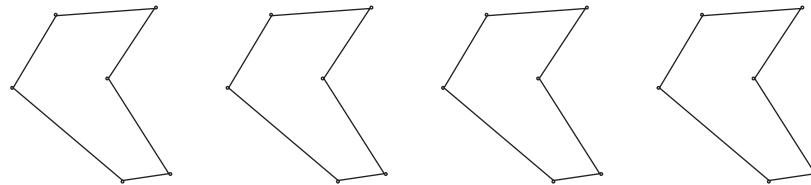
- Make marks through the six holes, so that you can later draw a copy of the hexagon by joining the marks with lines.
- Slide your template to a new position, but keep the bottom edge against the line that you have drawn.



- Make marks through the six holes again, for another copy of the hexagon.

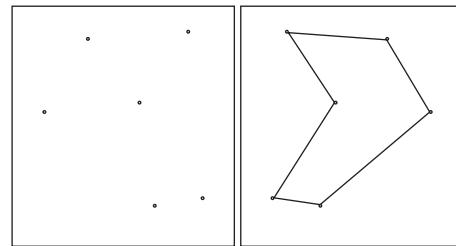
- (f) Continue to slide the template and make marks through the holes, until you have reached the end of your line.

Join the six marks you made in each position of the template, to draw translations of the hexagon.

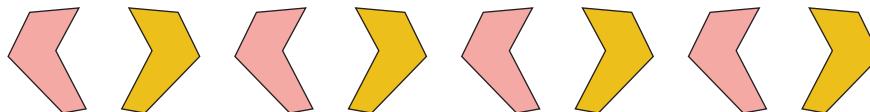


5. Use your hexagon template to draw a reflection of the hexagon.

It will be helpful to trace all around the edges of the template too.



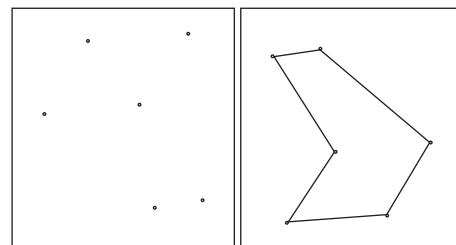
The pattern below can be made by reflecting a hexagon many times:



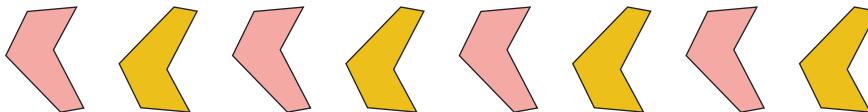
6. Can this pattern also be made by translating hexagons? Describe how this can be done.

7. Use your hexagon template to draw a rotation of the hexagon.

It will again be helpful to trace around the template too.

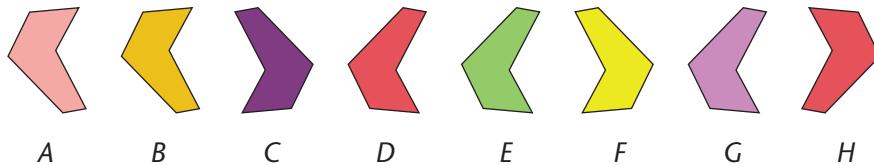


8. How can this pattern be made?



Translations, rotations and reflections are three different types of **transformations**.

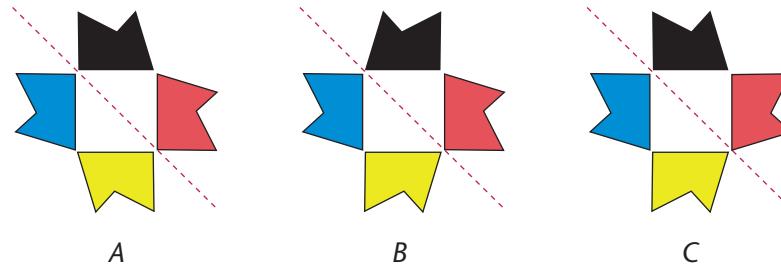
9. To make the pattern below, the hexagon template was first translated, then rotated, and then reflected.



Which transformation was used to move the template from D to E?

10. Which transformation can be used for each of the following movements of the hexagon in the above pattern?

- | | |
|-----------------|-----------------|
| (a) from E to F | (b) from F to G |
| (c) from G to H | (d) from A to H |
| (e) from F to B | (f) from B to H |
11. Three figures are shown below.
- (a) In which of the figures is the red pentagon a reflection of the black pentagon?
 - (b) In which figures is the yellow pentagon a rotation of the black pentagon?
 - (c) In which figures is the blue pentagon a rotation of the red pentagon?



- (d) In which figures is the red broken line a line of symmetry?

8.1 Estimating and measuring temperature

When we say “it is cold” or “it is hot” we talk about **temperature**. We are comfortable when the weather is not too hot and not too cold.

When we say “it is cold today”, it is because our bodies are warmer than the environment. When we complain that it is too hot, it is because our bodies are colder than the environment.

When water gets very cold, it freezes to become ice. When water gets very hot, it boils.

1. Rub the palm of your one hand with a finger from your other hand. Rub hard until you feel your skin burn slightly. The rubbing makes your skin warmer.
2. Take a book from your bag. Is it colder or warmer than your hand?
3. When does ice melt faster outside, on a warm day or on a cold day?
4. When does boiled water cool down faster, on a warm day or on a cool day?

In South Africa we usually measure temperature in units called **degrees Celsius** (we write °C).

Water boils when its temperature is close to 100 °C.

When you are healthy, your body temperature is about 37 °C.

The temperature in a home refrigerator is about 5 °C.

Water freezes when its temperature is about 0 °C.

Except when it gets colder than when water freezes, the temperature of the environment varies between 0 °C and 50 °C. The environmental temperature is pleasant when it is between 20 °C and 30 °C.

We use a **thermometer** to measure temperature accurately. There are many different thermometers.

“Thermo” means heat.

One type of thermometer consists of a sealed glass tube that contains a liquid, such as mercury, that rises (expands) or falls (contracts) with temperature changes.

Each thermometer has a scale which is marked in equal intervals, from the lowest temperature to the highest temperature that it can measure.



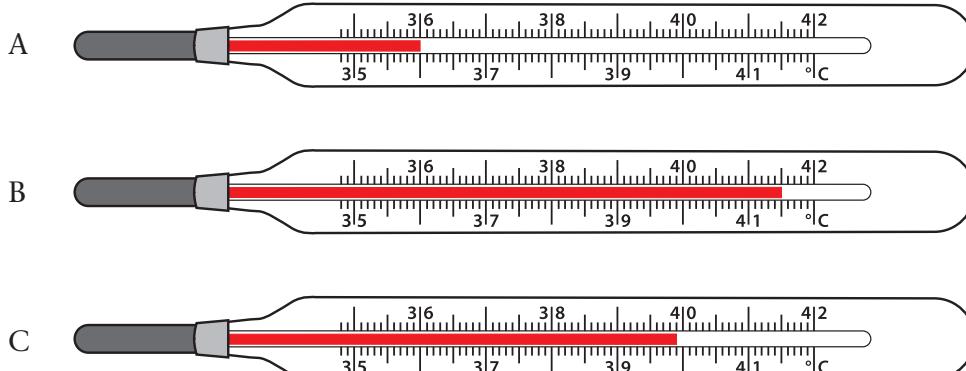
This is an example of a medical thermometer

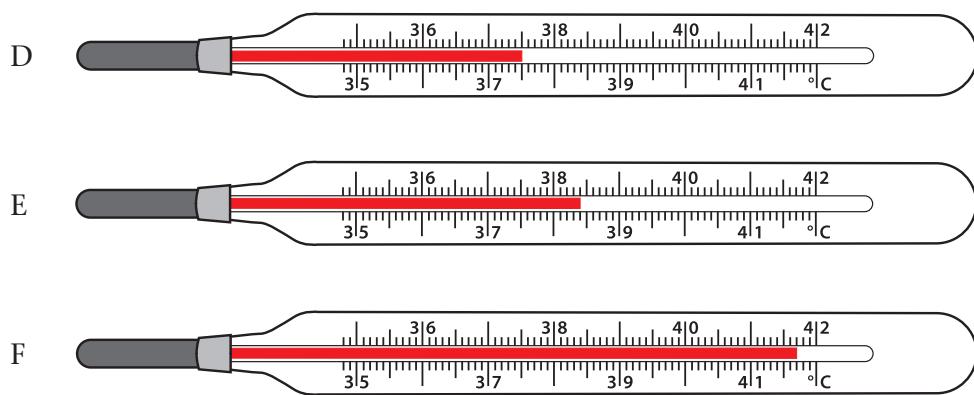
This thermometer shows a temperature of 37°C . If a patient has a temperature of, for example, $37\frac{1}{2}^{\circ}\text{C}$ we can round off the temperature to the nearest degree and then say that the patient has a temperature of about 38°C .

5. (a) The minimum mark on the medical thermometer above is 35°C . What is the maximum mark on this thermometer?
(b) Why does a medical thermometer measure temperature only between these numbers?
6. (a) Read the temperatures in degrees Celsius on these thermometers.
Write the temperatures in fraction notation where necessary.
(b) Round the temperatures that you wrote in fraction notation up or down to the nearest degree Celsius.

Examples

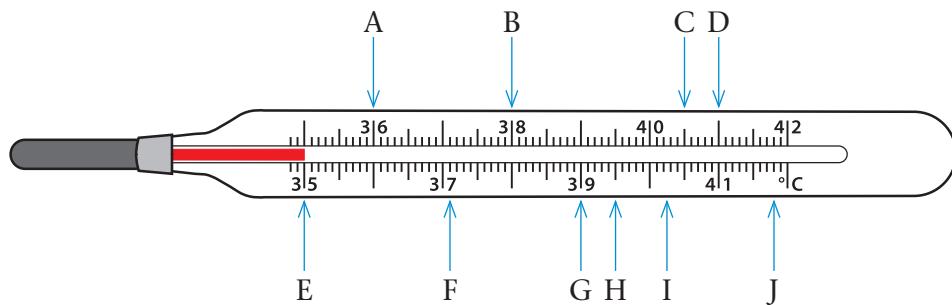
$$37\frac{1}{2}^{\circ}\text{C} \quad 38\frac{6}{10}^{\circ}\text{C}$$





7. Where will the fluid in the tube (the red line) be at each of the following temperatures? Match each temperature with one of the letters shown in the drawing below (A to J).

- (a) 36°C
- (b) 35°C
- (c) $39\frac{1}{2}^{\circ}\text{C}$
- (d) $37\frac{1}{10}^{\circ}\text{C}$
- (e) $41\frac{8}{10}^{\circ}\text{C}$
- (f) $40\frac{1}{2}^{\circ}\text{C}$
- (g) two degrees below 40°C
- (h) three and a half degrees higher than $35\frac{1}{2}^{\circ}\text{C}$
- (i) $40\frac{1}{4}^{\circ}\text{C}$
- (j) half a degree lower than $41\frac{1}{2}^{\circ}\text{C}$



8.2 Weather temperatures

1. The expected maximum and minimum temperatures for towns in South Africa are given every day on television and on the radio.
 - (a) What do you think is the reason for giving the expected minimum and maximum temperatures?
 - (b) What do you estimate the temperature to be on a very hot day where you live?
 - (c) What do you estimate the temperature to be on a very cold day where you live?
 - (d) What do you estimate the temperature was this morning when your school started? What do you think it is now?
 - (e) Is it always the warmest at midday and the coldest at midnight?
 - (f) Is it always the warmest in summer and the coldest in winter?

The table below shows the actual maximum and minimum temperatures on a day in January for a few towns.

	Upington	Bloemfontein	Pretoria	Durban	East London
Minimum	20 °C	19 °C	15 °C	20 °C	17 °C
Maximum	38 °C	32 °C	29 °C	27 °C	22 °C

2. (a) Compare the minimum temperatures of Durban and East London given in the table. How much colder was it in East London than in Durban on this day?
(b) Compare the maximum temperatures of Durban and East London. How much warmer was it in Durban than in East London on this day?
(c) Calculate the difference in temperature between the minimum and maximum for each town.
(d) In which town was the difference between the minimum and maximum temperatures the smallest?
(e) In which town did the temperature change the most between the minimum and maximum measurements?

This table shows the recorded maximum and minimum temperatures on a day in July for a few towns.

	Upington	Bloemfontein	Pretoria	Durban	East London
Maximum	21 °C	14 °C	20 °C	22 °C	20 °C
Minimum	4 °C	-3 °C	1 °C	11 °C	11 °C

3. (a) The minimum temperature in Bloemfontein on this day was minus three degrees Celsius. What does “minus three” mean?
(b) Compare the maximum temperatures of Bloemfontein and Pretoria. How much colder was it in Bloemfontein than in Pretoria on this day?
(c) Calculate the increase in temperature between the minimum and maximum for Pretoria, Durban and East London.
(d) If the temperatures in the table are typical winter temperatures for the five towns, where would you rather spend the winter? Why?
4. Record the temperature in the shade outside your classroom at 12 o’ clock from Monday to Friday. Your teacher may help you. Draw the table in your book and fill in each day’s temperature.

Day	Day 1	Day 2	Day 3	Day 4	Day 5
Temperature in °C					

- (a) Compare the temperatures of the different days. How did the temperature change over the week?
(b) Write the temperature readings from lowest to highest.

In this unit you will organise data, and draw and interpret tables and graphs of data to understand different situations.

9.1 Collecting and organising data in categories

The Student Council at a high school raised money to make hoodies for all the Grade 12s. They gathered data by asking some Grade 12s to write down which colour they prefer (black or blue) and which style (with a zip, or a pullover).

On the next page are the data they gathered. Imagine that they lost the data and that you found it. You can analyse the data for them and they can give you a hoodie to say thank you!



Pullover hoodie Hoodie with zip

1. Your task is to use the data to determine the most popular colour and the style that the students want.
 - (a) Make a tally table like this one to record the data in a way that will help you answer the questions.
 - (b) Write a short report to the Student Council to say what you found.

	Tallies	Total
Male		
Female		
Black		
Blue		
Zip		
Pullover		

Male/ Female	Colour	Style	Male/ Female	Colour	Style
F	Black	Zip	F	Blue	Zip
M	Black	Zip	F	Black	Zip
F	Black	Zip	F	Black	Zip
F	Black	Zip	M	Black	Pullover
F	Black	Zip	M	Black	Zip
M	Blue	Pullover	M	Black	Pullover
F	Black	Zip	F	Blue	Zip
M	Black	Zip	F	Black	Zip
F	Blue	Zip	F	Black	Zip
F	Black	Zip	F	Black	Zip
M	Blue	Pullover	M	Blue	Pullover
F	Black	Zip	F	Black	Zip
F	Black	Zip	F	Black	Zip
M	Blue	Pullover	F	Black	Zip
F	Black	Zip	M	Blue	Pullover
F	Black	Zip	F	Black	Zip
M	Black	Pullover	M	Blue	Pullover
F	Black	Zip	F	Black	Zip
F	Blue	Zip	F	Blue	Pullover
M	Blue	Pullover	M	Black	Pullover
F	Black	Zip	M	Black	Zip
M	Black	Pullover	F	Black	Zip
F	Black	Zip	M	Black	Zip
F	Black	Zip	M	Blue	Pullover
M	Black	Pullover	F	Blue	Zip
M	Black	Zip	F	Black	Zip
F	Black	Zip	M	Black	Pullover
M	Black	Zip	F	Black	Zip
F	Blue	Pullover	F	Black	Zip
F	Black	Zip			

2. Think about the information in your tally table.
- (a) Can you answer this question from your tally table: “How many students want blue hoodies?”
- (b) Can you tell from the tally table how many female students want blue hoodies?
Why do you say this?
3. The Student Council wants you to analyse the data a bit deeper. They want to consider if it is worth ordering different styles and colours for the male and female students.
They ask you to fill in the tables below.
Copy the tables into your book, then tally and total the data into the tables.

Filling in the information in the tables will help you to organise the data. You will then be able to say, for example, how many female students want black hoodies with a zip and how many want blue pullover hoodies.

FEMALES	Black	Blue	Total
Zip			
Pullover			
Total			

MALES	Black	Blue	Total
Zip			
Pullover			
Total			

4. Use the tally tables with data for female and male students to answer the questions.

- (a) Which style is more popular with female students: pullover or zip?

The *most popular category* is called the **modal category**.

We can ask the same question this way: Which style is the **modal** style?

- (b) How popular is the zip style among the male students?
(c) How popular is the colour blue among the female students?
(d) Which colour is more popular among male students?

We can also ask: Which is the **modal** colour for male students?

5. Write a report to the Student Council to earn your hoodie. Tell them about your findings. Give evidence from your tally tables.

9.2 Collecting and organising numerical data

Mrs Mholo is very unhappy about her electricity account this month. She pays her account every month and she is very careful to save electricity. Why is it so high this month?

This month, July, her account is R650. She believes that she used her usual amount of electricity. And there was lots of load shedding, so her account should be less than usual, not more than usual!

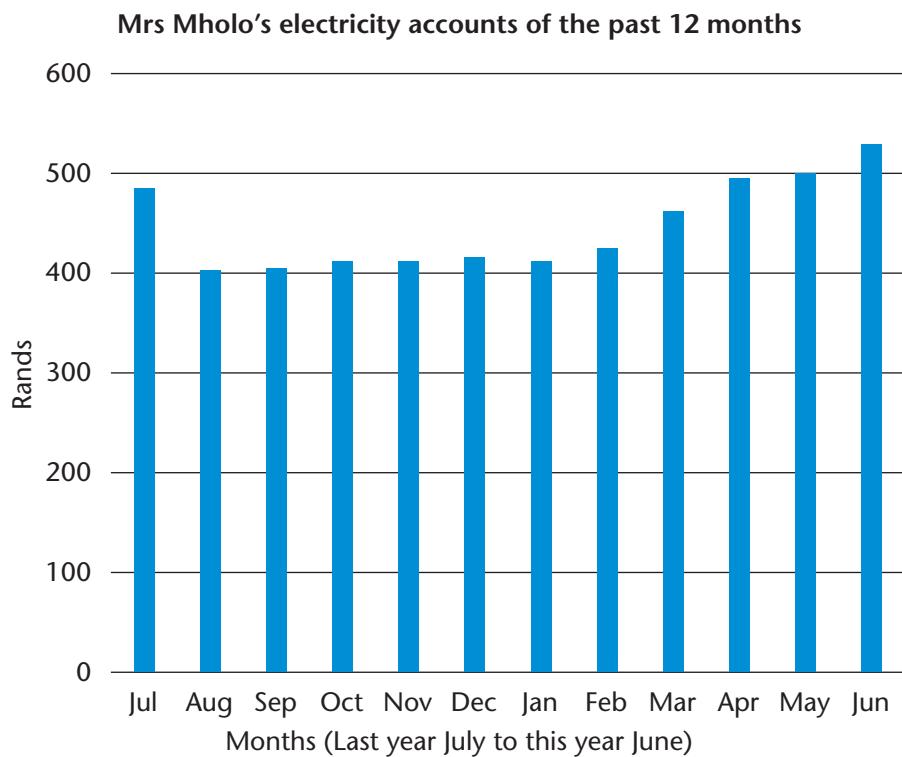
We will analyse Mrs Mholo's accounts over the past 12 months to see if there is a pattern in her use of electricity.

Here are Mrs Mholo's accounts, in rands, for the past 12 months, ordered by the months.

July last year						June this year					
Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
486	403	405	412	412	416	412	424	462	495	500	529

-
1. (a) What is the lowest account that Mrs Mholo got in the past 12 months?
 - (b) What is the highest account that Mrs Mholo got in the past 12 months?
 - (c) During which months did Mrs Mholo use the most electricity?
 - (d) What differences between accounts can Mrs Mholo expect in the winter months? And in the summer months?
 - (e) Do you think Mrs Mholo is right to be worried that her account is not correct?

If we make a graph of the data, the differences between the accounts are easy to see.



2. Work with the bar graph of the accounts and with the table to answer the questions.
- Would you be surprised if Mrs Mholo gets an account that is between R400 and R500? Why do you say so?
 - Would you be surprised if Mrs Mholo gets an account that is below R350? Why?
 - Would you be surprised if Mrs Mholo gets an account that is more than R500? Why?
 - Would you be surprised if Mrs Mholo gets an account that is more than R550? Why?
 - Does the graph show that Mrs Mholo's use of electricity is increasing or decreasing, or about the same over the past 12 months? Say what you think.

We can organise the data in a different way. Many questions can be answered if we simply order numbers from small to large.

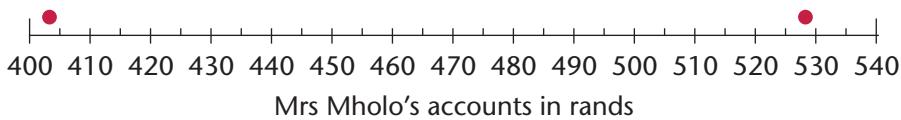
3. Here are Mrs Mholo's accounts for the past 12 months, ordered from small to large.

Mrs Mholo's accounts in rands, ordered from lowest to highest											
403	405	412	412	412	416	424	462	486	495	500	529

- What information do we lose when we order the accounts from small to large?
- Which amount will you choose if you want to tell Mrs Mholo about how much her account usually is?
- Which amount will you choose if you want to tell Mrs Mholo: "Half your accounts are more than this amount"?
- Which amount will you choose to tell Mrs Mholo: "Only one quarter of your accounts were higher than this amount"?

The **mode** is the amount that occurs *most frequently*. Think critically: Does the mode tell the story of the graph or not?

-
4. Use the list of accounts that are ordered from small to large in question 3. Use dots to draw a pictograph of the data on a number line like this one. The smallest amount (R403) and the biggest amount (R529) have been done for you. Place the dots as accurately as you can.



- (a) Look at your pictograph. Make a mark on the number line where you think the **mode** of all the amounts is. How did you decide?
- (b) If you have not already done so, make a mark on the number line that is exactly halfway between the sixth and the seventh amount. Estimate the value at the mark you made.
5. Check if the following statements are true. Use the ordered accounts and the pictograph to check.
- (a) Half of Mrs Mholo's accounts in the previous 12 months were higher than R416, but lower than R529.
- (b) Half of Mrs Mholo's accounts were also lower than R416, but not lower than R403.
- (c) When Mrs Mholo's accounts were lower than R412, they were, at most, about R30 lower.
- (d) When Mrs Mholo's accounts were more than R412, they were never more than R100 higher than R412.
- (e) The mode of R412 is a good representation of all the accounts.
- (f) The mode of R412 is a good representation of the accounts in summer.
6. Discuss with the class. If you were Mrs Mholo, how would you use the data to convince the municipality that an account of R650 must be a mistake? Write down your argument.

10.1 More sequences

1. The cost of hiring a mega bus to travel from Johannesburg to Polokwane and back is R4 800.
 - (a) If 30 people go on the trip, how much must each passenger pay if they share the cost equally?
 - (b) If 15 people go on the trip, how much must each passenger pay if they share the cost equally?
 - (c) Complete the table:

Number of passengers	5	10	20	40	80	160
Cost for each passenger (R)						

 - (d) Write a calculation plan to show how to calculate the cost for each passenger for *any* number of passengers travelling on the bus.- 2. For each of Sequences A to H:
 - (a) Describe the patterns in your own words.
 - (b) Continue the pattern for five more numbers.

Sequence A: 1, 2, 4, 8, 16, 32, ...

Sequence B: 512, 256, 128, 64, 32, ...

Sequence C: 3, 6, 12, 24, 48, 96, ...

Sequence D: 1, 3, 9, 27, 81, ...

Sequence E: 2, 6, 18, 54, 162, ...

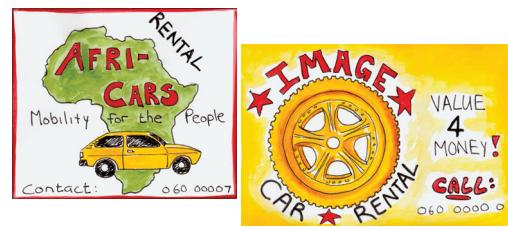
Sequence F: 1, 4, 9, 16, 25, 36, ...

Sequence G: 2, 5, 10, 17, 26, 37, ...

Sequence H: 3, 6, 11, 18, 27, 38, ...

10.2 Patterns in tables

- Avril wants to rent a car for one day. He wonders if he should rent from Image Car Rental or from AfriCars.



Both charge a *basic amount per day* plus a *rate per kilometre* for the distance driven, according to the values in the table. Avril now wonders which company is cheaper.

Company	Car	Per day	Per kilometre
Image	4-door sedan	R180	R2
AfriCars	4-door sedan	R80	R2,50

- Help Avril to decide which company is cheaper by completing the table of costs for AfriCars and for Image Car Rental, for travelling different distances with the hired car.

Distance (km)	0	50	100	150	200	250	300
Cost: Image (R)							
Cost: AfriCars (R)							

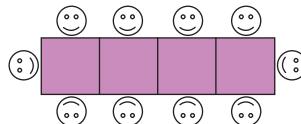
- Xolile fills up his car's tank with petrol. When full, the tank holds 60 ℓ of petrol. The table below shows how much petrol is left in the tank as Xolile drives.

Distance driven (km)	0	40	80	120	160
Petrol in tank (ℓ)	60	56	52	48	44

Based on this information, how many kilometres can Xolile expect to drive until the petrol tank is completely empty?

10.3 Using patterns to solve problems

For his party, Anand arranges small square tables in a straight line, so that one person sits at each side of the table. For example, if there are 4 tables, then 10 people can sit at the tables, as shown:

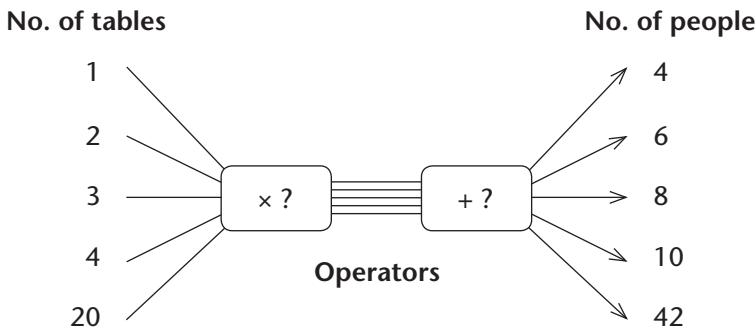


- (a) Complete this table to show how the number of people changes as the number of tables changes.

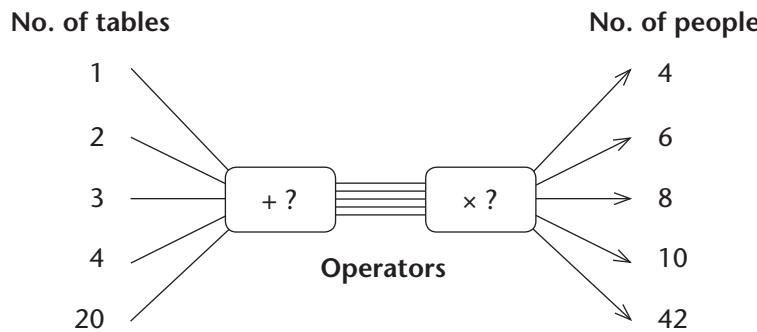
No. of tables	1	2	3	4	5	6	7	15	20	45
No. of people	4			10						

- (b) Describe your method.
(c) What patterns do you see in the table? Discuss!
- To calculate the number of people that can sit at the tables, Anand wants to use Flow diagram A below or Flow diagram B on the next page.
 - Help Anand by completing the operators.
 - Which flow diagram should Anand use?

Flow diagram A



Flow diagram B



If flow diagrams with different operators give the same output numbers for the same input numbers, they are **equivalent**. So we can choose which one to use.

3. Anand's friend Jake is helping him to plan the party.

Anand says that to calculate the number of people that can sit at the tables they must use this calculation plan (rule):

$$\text{Number of people} = 2 \times \text{Number of tables} + 2$$

Jake says they should use this plan:

$$\text{Number of people} = 2 \times (\text{Number of tables} + 1)$$

Who is correct, Anand or Jake?

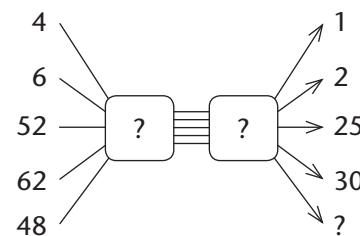
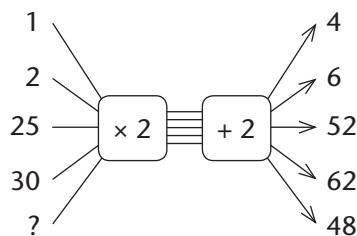
Complete this table using the two plans to see who is correct.

No. of tables	1	2	3	4	5	6	7	15	20	45
$2 \times \text{No. of tables} + 2$										
$2 \times (\text{No. of tables} + 1)$										

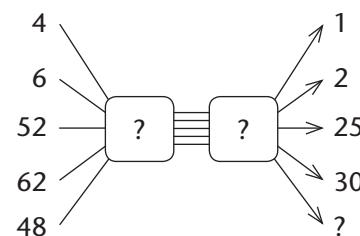
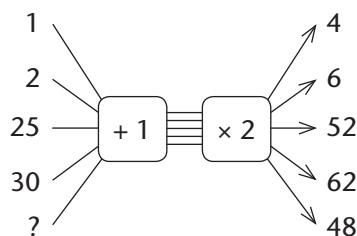
In questions 2 and 3 Anand calculated the number of people as output number. It will be easier to have a flow diagram with the known number of people as input number to calculate the unknown number of tables needed.

4. Below are the two flow diagrams that you used in question 2.
 - (a) Change the operators so that the number of people is the input number.
 - (b) Then calculate the number of tables needed if Anand knows there will be 48 people at the party (including himself).

No. of tables No. of people No. of people No. of tables



No. of tables No. of people No. of people No. of tables



11.1 Count, add, multiply and divide

On pages 271 to 273 you will see pictures of many bananas. Have a look at them. Then turn back to this page.

1. Read the question below.

How many more bananas are shown in Picture C than in Picture B?

- (a) Look again at Picture C and at Picture B. Think of a way in which you can find the answer to this question. Then describe your plan in writing. Do not work out the answer; just describe your plan.
- (b) See if you can think of a quicker way to find the answer. If you can, describe your plan in writing but do not work out the answer.

2. Now read this question:

How many bananas are shown in Picture A?

- (a) Look at Picture A and think of a way in which you can find the answer to the question. Describe your plan in writing but do not work out the answer.
 - (b) Can you think of a quicker way than the one you have just described? If you can, describe it in writing but do not work out the answer.
3. (a) How many bananas are shown in Picture B? Work out the answer.
(b) Describe what you did to find the answer.

Nare wanted to find out how many bananas there are in Picture C. He first thought of counting the bananas one by one and started like this: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, . . .

He then realised this would take a very long time.

Then he thought of counting in nines and started like this:
9, 18, 27, 36, 45, 54, ...

Nare realised that counting in nines would also take quite long, and he was worried that he might make mistakes. So he decided to count how many bunches there are, and he wrote it like this:

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18		

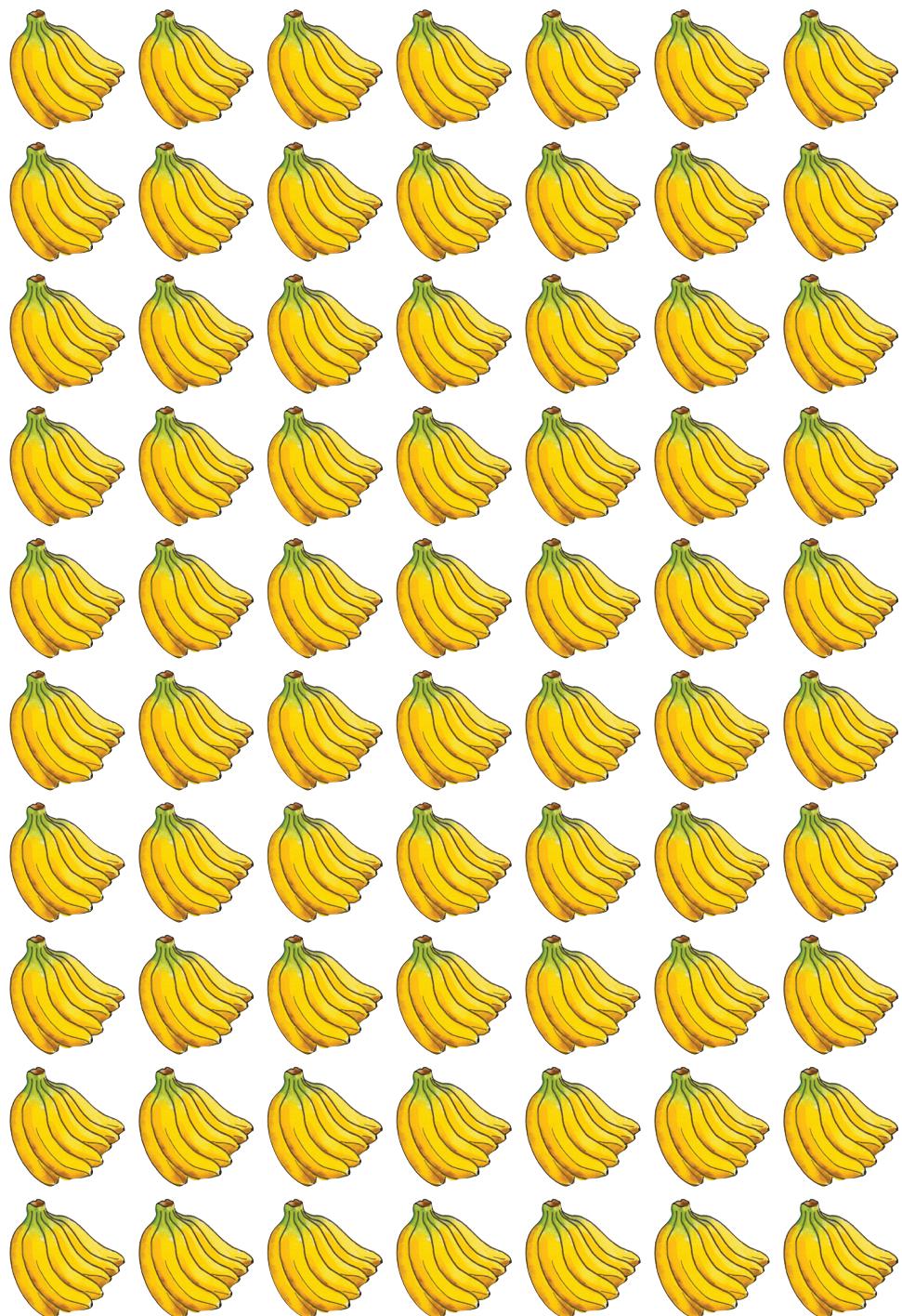
But Nare did not continue. He decided to just count how many rows there are.

What do you think of Nare's plan?

Now answer these questions:

4. How many bananas are shown in Picture C?
5. How many more bananas are shown in Picture B than in Picture A?
6. There is another picture of bananas. It is called Picture D but it is not shown in this book. It shows bananas in bunches of 5.
There are 8 bunches in each row, and 10 rows in total. How many bananas are shown in Picture D?
7. In each case below, find out how many bananas there are in total.
 - (a) There are 6 rows with 8 bunches of bananas in each row.
There are 10 bananas in each bunch.
 - (b) There are 10 rows with 6 bunches of bananas in each row.
There are 8 bananas in each bunch.
 - (c) There are 8 rows with 10 bunches of bananas in each row.
There are 6 bananas in each bunch.
8. Describe how you found your answers to questions 7(b) and (c).
9. There are 80 bunches of bananas in a crate. The number of bananas in each bunch is the same. There are 640 bananas in total in the crate. How many bananas are there in each bunch?
10. There are 720 bananas in bunches of 6 bananas each in a crate. How many bunches are there in the crate?

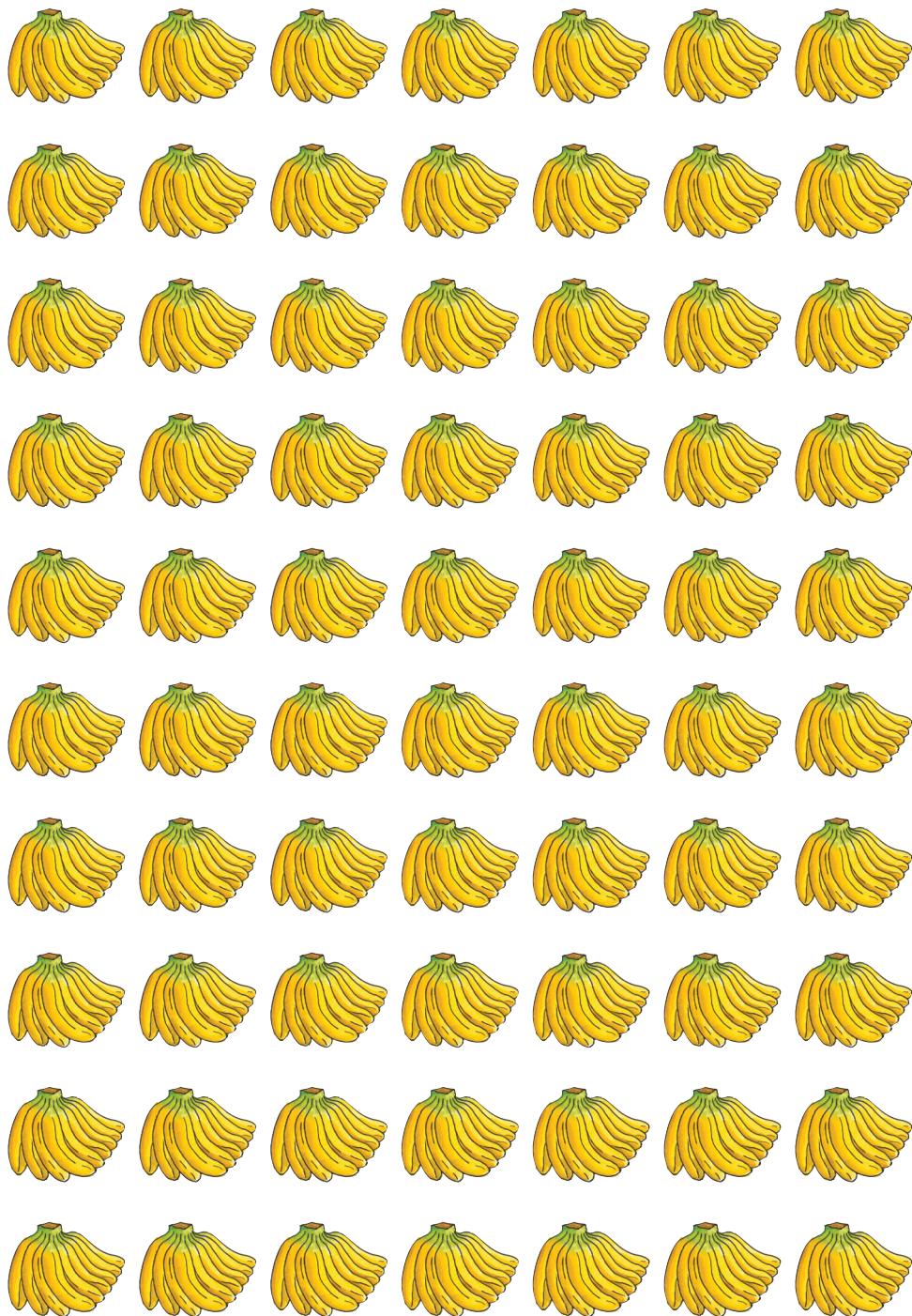
Picture A



Picture B

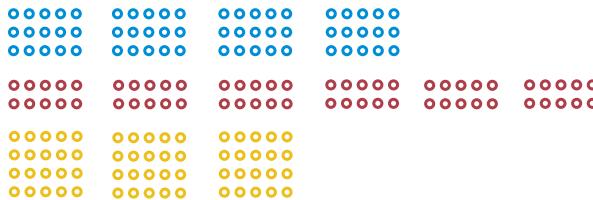


Picture C



11.2 Factors and multiples

- How many beads of each colour are shown below?

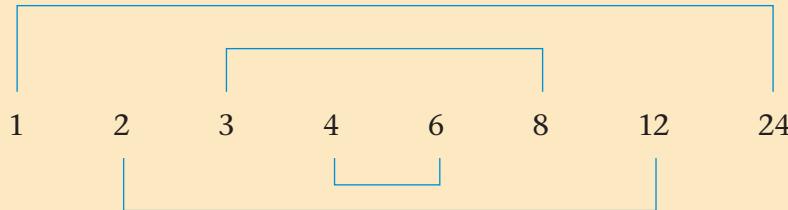


- The number 60 can be produced by calculating $4 \times 3 \times 5$. Write 60 by multiplying three other numbers.

We call $4 \times 3 \times 5$ a **product** and 4, 3 and 5 are the **factors** of this product.

- (a) Write 120 as the product of 3 factors in two different ways.
(b) Write 120 as the product of 4 factors.
(c) Write 120 as the product of 5 factors.
(d) Make a list of all the factors of 120.
- Grandpa likes to plant his bean plants in neat patches that look like rectangles. He planted his 30 bean plants in a patch with 5 rows and 6 plants in every row.
 - Is there another way in which Grandpa can arrange his 30 plants?
(b) Write 30 as a product of two numbers in three different ways.
- (a) How can Grandpa arrange 24 tomato plants in neat rectangular patches? Describe all the different ways.
(b) Write down all the factors of 24.
(c) Write 24 as a product of two factors in more than one way.
(d) Write 24 as a product of three factors.
(e) Write 24 as a product of four factors.

Mamele uses a trick to make sure that she knows all of the factors of a specific number. This is how she writes the factors of 24:



She links every factor, starting with 1, with the other number with which the product 24 will be formed: 1×24 ; 2×12 ; 3×8 ; 4×6 .

So 1, 2, 3, 4, 6, 8, 12 and 24 are all factors of 24.

Every one of 24's factors has a partner. The product of the two partners is the 24.

6. Use Mamele's trick and write down all the factors of 36. What do you notice?
7. Grandpa has 36 eggplants. How can he arrange them into neat rectangular patches?

All the numbers that can divide into a number without leaving a remainder are called the **factors** of that number. Two or more of the factors can be multiplied to form that number.

In questions 5(c), (d) and (e) you had to break up 24 into factors.

8. Siba says 1 is a factor of every number. Is this true?
9. What happens if you multiply 1 by any number?
10. The number 1 has a special property when it is multiplied. Write this property in your own words.

When the number 1 is multiplied by any number, the value of that number does not change.

11. Write the next five numbers in each pattern:

- (a) 5; 10; 15; ...
- (b) 12; 24; 36; ...
- (c) 9; 18; 27; ...

All the numbers in question 11(a) are multiples of 5. The numbers in (b) are multiples of 12 and those in (c) are multiples of 9.

12. Write down the first 5 multiples of 15.

13. Sami says that every multiple of 12 is also a multiple of 6. Is that true? Try to explain this in your own words.

14. (a) Is 1 001 a multiple of 13?
(b) What did you do to find out whether 1 001 is a multiple of 13?

A number can divide into any of its multiples without leaving a remainder.

11.3 Use factors to multiply

1. Calculate.

- (a) 35×52
- (b) $5 \times 52 \times 7$ (work from left to right)
- (c) $7 \times 52 \times 5$
- (d) Which calculation was the easiest?

2. Rearrange the factors in the products to make it easier to multiply.

- (a) $2 \times 17 \times 5 \times 3$
- (b) $53 \times 2 \times 7 \times 3$

Norma knows that it is easy to multiply by small numbers such as 2, 3 or 5. When she has to multiply larger numbers, she breaks up one of the numbers into factors. Then she rearranges the factors to make the multiplication easier.

11.4 Multiplication practice

Calculate.

1. (a) 265×13 (b) 14×265
(c) 248×34 (d) 68×124
(e) 248×68 (f) 246×37

2. (a) 347×24 (b) 42×347
(c) 402×53 (d) 54×201
(e) 671×17 (f) 16×671

11.5 Multiplication in real life

1. A local bus can carry 73 learners to school every day. This bus does 406 trips every year. How many learners can it carry on this route in one year?
 2. It takes Fred 13 hours to drive to his parents' farm. If he travels approximately 112 km every hour, how far does he travel?
 3. Steve needs 24 m of fencing to make a camp for his goats. The fencing material that he uses costs R153 per metre. How much will the fencing material cost him?
 4. A hotel group has 17 lodges throughout the country. Each lodge has 348 rooms. The managers of the hotel group want to put a new television set in each room. How many television sets do they have to order?
 5. A farm stall owner sells oranges. He puts 23 oranges in a pocket. If he fills exactly 57 pockets, how many oranges did he buy from the orange farmer?

-
6. (a) Farmer Tavuk forgot to record how many eggs he sent to the supermarket, but he remembers that 28 crates were loaded into the truck. Each of the 28 crates contained 12 trays, and each tray had 30 eggs.

Which of the following calculations will help Farmer Tavuk to record the correct number of eggs?

$$(28 + 12) \times 30$$

$$(28 \times 30) + 12$$

$$(20 + 8) \times 12 \times 30$$

$$(12 \times 30) + 28$$

- (b) How many eggs did he send to the supermarket?
7. The Trano Café sold 432 lunches on Saturday at R68 each. How much money did the café make on Saturday?
8. A nursery has a contract to deliver 168 trays of herb seedlings to a garden centre every week. How many trays will the nursery deliver over a period of 35 weeks?
9. A local supermarket has a special on tins of baked beans. If you buy four tins, you only have to pay for three tins. The price of one tin of baked beans is R6,15. Mr Fourie put 6 dozen tins in his shopping trolley. How much did he pay?
10. There are *about* 42 beans in one cacao pod. *About* 123 cacao beans are needed to make 1 kg of chocolate. *About* how many pods are needed for 14 kg of chocolate?

1 dozen tins = 12 tins

11.6 More calculations in real life

- Shop A has 53 glass jars in stock. Shop B has 18 times more glass jars in stock than Shop A. How many glass jars are available between the two shops?
- Yaro had R50. He bought sweets for R12 and three ice lollies for R12 each. How much money was left over?
- A theatre has 62 rows with 28 seats in every row. On Saturday night 690 tickets were sold at the door. If the show was a complete sell out, how many tickets were sold *before* Saturday night?

4. Waiters are setting tables for a dinner function. Sixteen round tables are set with 8 places each and 17 rectangular tables are set with 7 places each. At each of the places, 3 glasses are arranged. How many glasses are put on the tables altogether?



5. Wilhelmina and her daughters knit scarfs and caps for an income. They sell the caps for R124 each and the scarfs for R192 each. They have an order for 37 caps and 67 scarfs. How much is their income from this order?
6. When the National Cycling Championship took place and the cyclists passed Star Primary School, 12 classes went outside to watch. Five classes of 28 learners each, four classes of 24 learners each and three classes of 25 learners each cheered the cyclists on. Altogether, how many learners were outside?
7. Bike Bonanza sponsors T-shirts for first-time entries in the cross-country cycling race. Last year there were 47 cyclists who took part in the race for the first time. This year 18 times more newcomers entered than last year.
- How many T-shirts must Bike Bonanza have ready on the day of the race?
 - The T-shirt company only sells boxes of 100 T-shirts each. How many boxes must Bike Bonanza order?
8. Mrs Singh bought 18 books at a book sale. She paid R149 for each book. She later sold 13 of the books to a secondhand bookshop for R165 each. What is the difference between the total amount of money she bought the books for and the total amount of money she sold the books for?

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1.1 Order and represent numbers

1. Count in four hundreds from 120 000 until you pass 123 000.
Write down the number symbols as you go along.
2. Count in two thousands from 222 000 until you reach 244 000.
Write down the number symbols as you go along.
3. Copy the number grid and fill in all the numbers. You have to count in 40 000s to do this.

120 000	160 000	200 000		
				480 000
520 000				
		800 000		
			1 040 000	

4. Which numbers are missing at the marks on this number line?
Write the numbers from smallest to biggest in your book.
You have to count in 3 000s to do this.



5. Arrange the following seven numbers in ascending order (from smallest to biggest).

686 132 786 987 195 123 298 829
201 065 477 677 439 365

6. Arrange the following seven numbers in descending order (from biggest to smallest).

127 140 903 546 865 153 721 122
258 121 865 199 831 001

-
7. (a) How many whole numbers between 0 and 1 000 are odd?
(b) How many whole numbers between 0 and 10 000 are multiples of 10?
(c) How many whole numbers between 1 and 1 million are odd?
(d) How many whole numbers between 1 and 1 million are multiples of 10?
(e) How many whole numbers between 1 and 1 million are multiples of 3?
 8. Write the expanded notations *and* number symbols for these numbers.
 - (a) hundred and twenty-four thousand, five hundred and sixty-five
 - (b) two hundred and ten thousand, seven hundred and sixty-three
 - (c) four hundred and one thousand, eight hundred and seven
 - (d) seven hundred and eleven thousand, three hundred and twelve
 - (e) one hundred and twenty-seven thousand, seven hundred and ninety-five
 - (f) nine hundred and ninety-six thousand, six hundred and six
 9. Write the expanded notations and number names for these numbers.

(a) 216 786	(b) 785 092	(c) 670 548
(d) 108 805	(e) 632 104	(f) 405 696
 10. Round off each of the numbers in question 9 to the nearest:
 - (a) five
 - (b) ten
 - (c) hundred
 - (d) thousand.

1.2 Investigate even and odd numbers

An **even number** is formed when any whole number is doubled (multiplied by 2), for example:

$$2 \times 37 = 74, 2 \times 459 = 918 \text{ and } 2 \times 344\ 924 = 689\ 848$$

74 and 918 and 689 848 are all even numbers.

The *units part* of any even number is 0, 2, 4, 6 or 8.

An **odd number** is formed by adding 1 to an even number, for example:

$$74 + 1 = 75, 918 + 1 = 919 \text{ and } 689\ 848 + 1 = 689\ 849$$

75 and 919 and 689 849 are all odd numbers.

The *units part* of any odd number is 1, 3, 5, 7 or 9.

1. Can you think of a number that is not odd, and also not even?
2. (a) In each case, form an even number by doubling.
47 78 361
(b) Add 1 to each of your even numbers to form an odd number.
3. Is it true that when two odd numbers are added, the result is always an even number? Give *five* examples to support your answer.
4. Decide whether the statement is true or false. Give *one* example if the statement is false and *five* examples if the statement is true.
 - (a) When an *odd* number and an *even* number are added, the result is always an odd number.
 - (b) When *any three odd* numbers are added, the result is an even number.
 - (c) When any *even number* of odd numbers are added, the result is an even number.
 - (d) When any *odd number* of odd numbers are added, the result is an odd number.
 - (e) The difference between two odd numbers is an odd number.
 - (f) The difference between two even numbers is an even number.

2.1 Revision and practice

1. Write as single numbers.
 - (a) $30\ 000 + 400 + 6$
 - (b) $30\ 000 + 4\ 000 + 60$
 - (c) $30\ 000 + 4\ 000 + 6$
 - (d) $40\ 000 + 13\ 000 + 1\ 700 + 340 + 17$
 - (e) $40\ 000 + 3\ 000 + 10\ 700 + 1\ 340 + 17$
2. How much is each of the following?
 - (a) $8\ 000 + 7\ 000 + 4\ 000 + 8\ 000 + 3\ 000$
 - (b) $800 + 70\ 000 + 40 + 8 + 3\ 000$
 - (c) $20\ 000 + 40\ 000 + 30\ 000$
 - (d) $70\ 000 - 40\ 000$
 - (e) $170\ 000 - 40\ 000$
 - (f) $170\ 000 - 140\ 000$
3. Write as single numbers.
 - (a) $60\ 000 + 3\ 000 + 900 + 50 + 1$
 - (b) $952 + 62\ 999$
 - (c) $3\ 952 + 59\ 999$
 - (d) $50\ 000 + 12\ 000 + 1\ 800 + 140 + 11$
 - (e) $50\ 000 + 13\ 000 + 900 + 40 + 11$
4. How much is each of the following?
 - (a) $7\ 843 + 7\ 843 + 7\ 843 + 7\ 843 + 7\ 843 + 7\ 843 + 7\ 843$
 - (b) $7\ 843 + 7\ 843 + 7\ 843 + 7\ 843 + 7\ 843 + 7\ 843 + 7\ 843 + 7\ 843$
 - (c) $34\ 725 - 18\ 847 + 44\ 718 - 34\ 720$
 - (d) $34\ 725 - 34\ 720 + 44\ 718 - 18\ 847$
 - (e) $73\ 548 - 23\ 456 + 43\ 457 - 33\ 548$

-
5. Do not calculate the answers to these questions now. Just estimate the answers to the nearest 10 000.
- 23 767 is added to a certain number and the answer is 59 789. What is this number?
 - 23 767 is subtracted from a certain number and the answer is 59 789. What is this number?
 - A certain number is 23 767 more than 59 789. What is this number?
6. Calculate the exact answers for question 5. Then round off your answers to the nearest 10 000.
7. Which of the following will be useful replacements for 63 951 if you have to calculate $63\ 951 - 19\ 826$? Explain your choices by showing how you would do the calculation with each of your choices.
- $63\ 951 = 60\ 000 + 3\ 000 + 900 + 50 + 1$
 - $63\ 951 = 952 + 62\ 999$
 - $63\ 951 = 3\ 952 + 59\ 999$
 - $63\ 951 = 50\ 000 + 12\ 000 + 1\ 800 + 140 + 11$
 - $63\ 951 = 50\ 000 + 13\ 000 + 900 + 40 + 11$
8. $23\ 876 + 9\ 246 + 28\ 387 + 7\ 845$ can be calculated as shown on the right.
State which numbers were added to obtain each of the part answers in red.
Also write the final answer.
- | |
|-------------------|
| 23 876 |
| 9 246 |
| 28 387 |
| <u>+ 7 845</u> |
| <u>24</u> (a) |
| <u>230</u> (b) |
| <u>2 100</u> (c) |
| <u>27 000</u> (d) |
| <u>40 000</u> (e) |
| (f) |
9. (a) Can you think of a quick way to find the answer for $3\ 823 + 3\ 812 + 3\ 807 + 3\ 835 + 3\ 823 + 3\ 832 + 3\ 861 + 3\ 814 + 3\ 841 + 3\ 821$?
- (b) Find the answer.

10. On the right you can see what someone wrote to calculate $84\ 286 - 32\ 849$.
- $$\begin{array}{r} 84\ 286 \\ - 32\ 849 \\ \hline 52\ 643 \end{array}$$
- (a) Check the answer by doing addition.
(b) If the answer is incorrect, explain what the person may have done to get it wrong.
11. On the right you can see what someone wrote to calculate $42\ 843 - 18\ 264$.
- $$\begin{array}{r} 39\ 999 \\ - 18\ 264 \\ \hline 21\ 735 \end{array}$$
- (a) Do you think the answer is correct?
(b) If the answer is incorrect, explain what the person did to get it wrong.
12. Which of the following *do you think* will have the same answer?
- (a) $88\ 547 - 63\ 488 + 72\ 723 - 43\ 876$
(b) $88\ 547 - 72\ 723 + 73\ 488 - 43\ 876$
(c) $88\ 547 - 43\ 876 + 73\ 488 - 72\ 723$
(d) $88\ 547 - 43\ 876 + 72\ 723 - 63\ 488$
13. Do the calculations in question 12 to check your predictions.
14. Find the sum of the numbers in each column. Do it with as little work as possible.

(a)	(b)	(c)	(d)	(e)
21 856	8 546	7 234	6 762	6 324
8 235	8 548	7 234	6 762	3 676
679	8 550	7 234	6 762	6 324
34 538	8 552	7 234	6 762	3 676
21 856	8 554	7 234	6 762	6 324
8 235	8 556	7 234	6 762	3 676
679	8 558	7 234	6 762	6 324
34 538	8 560	7 234	6 762	3 676
	8 562	7 234	6 762	6 324
	8 564	7 234		3 676

2.2 Add and subtract in context

1. During 2013, the population of Town A increased from 67 867 to 71 264. What was the population increase?
2. At the beginning of 2013, the population of Town B was 56 692. The population increased by 6 534 during the year. What was the population at the end of 2013?
3. At the beginning of 2013, the population of Town C was 84 328. The population decreased by 5 307 during 2013. During 2014 it decreased by 6 378 and during 2015 by 8 704.
 - (a) What was the total decrease over the three years?
 - (b) What was the population of Town C at the end of 2013, at the end of 2014 and at the end of 2015?
 - (c) Use your answer for (a) to check your answer for the last part of question (b).
4. Here are the results of a local election, for three positions on a Council:

Candidate A: 23 713 votes
Candidate B: 11 908 votes
Candidate C: 18 976 votes
Candidate D: 14 327 votes
Candidate E: 15 989 votes

 - (a) Estimate the total number of votes to the nearest 10 000.
 - (b) Which three candidates won seats on the Council?
 - (c) How many votes were cast in total?
 - (d) How many more votes than Candidate D did Candidate A get?
 - (e) What is the difference between the number of votes for Candidates D and E?
5. A provincial document shows that 78 866 learners attended Grade 1 last year, while 10 236 more were enrolled at the beginning of this year. How many learners were enrolled this year?

-
6. On a hot day, 23 756 ℥ of water from a small farm dam is used for irrigation. At the end of the day, there is 46 700 ℥ left. How much water was in the dam at the beginning of the day?
 7. At the time of the 2011 election, there were 63 458 registered municipal voters. At the time of the 2015 election, there were 53 089 voters. Did the number of voters increase or decrease, and by how many?
 8. During a local election, 98 065 people voted for the Green Party and 97 676 people voted for the Anti-Corruption Party. By how many votes did the Green Party win?

2.3 Rounding off in context

The numbers of learners in the different schools in a certain region are given in the table below.

589	574	571	845	708	480
485	403	486	481	352	377
767	521	741	483	879	421
339	430	393	404	402	352
636	829	593	771	539	584
307	485	457	530	583	336
355	633	792	582	406	335
399	463	586	521	379	533
314	574	352	871	783	493
550	582	498	301	397	346
361	878	691	787	718	836
313	304	492	448	554	446
589	574	571	845	708	480

How can you quickly make a good estimate of the total number of learners in these schools?

Here are some plans:

- A. Multiply the number of schools by 500.
- B. Multiply the number of schools by 600.
- C. Multiply the number of schools by some other number you decide on.
- D. Add up the numbers in one column and multiply by 6.
- E. Round off each number to the nearest hundred and work from there.
- F. Work with the hundreds parts of the numbers only.

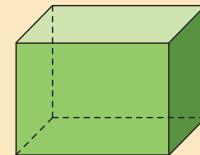
Answer the following questions.

1. (a) Which plan do you think will be quickest to follow?
(b) Carry out this plan.
2. (a) Which plan do you think will produce the best estimate of the total number of learners?
(b) Carry out this plan.
3. (a) Which plan do you think will produce the worst estimate of the total number of learners?
(b) Carry out this plan.
4. (a) Carry out any other one of the given plans.
(b) If you have not used Plan C yet, do it now.
5. Add up all the numbers in the table.
6. You made four or five estimates of the actual total number of learners. Which was the best estimate?
7. Can you think of a better plan to make an estimate than any of the plans given above?

3.1 Rectangular prisms

Boxes with *six faces* that are all *rectangles* are called **rectangular prisms**.

The pairs of opposite faces are exactly the same shape and size.

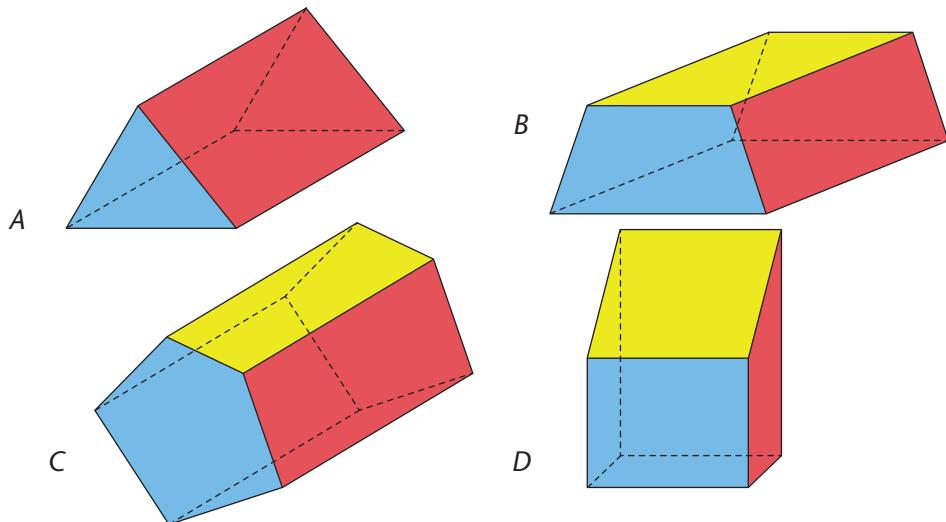


1. Draw the following rectangular prisms.
 - (a) The object has six faces. All faces are squares.
 - (b) The object has six faces.
Two opposite faces are squares.
All other faces are rectangles that are not squares.
2. Suppose you are told that a certain object has six faces.
 - (a) Is it possible that the object is a rectangular prism?
 - (b) Can you be sure that it is actually a rectangular prism?
If you think you cannot be sure, explain why.
3. Answer the same two questions (2(a) and 2(b)) in each of the following cases.
 - (a) All you know about the object is that it has rectangular faces.
 - (b) You only have information about two faces of the object, and what you know is that these two faces are rectangular.
 - (c) You only have information about three faces of the object, and what you know is that these three faces are rectangular.
 - (d) You only have information about four faces of the object, and what you know is that these four faces are rectangular.
4. (a) Which of the objects on the next page can be the object in 3(a)?
(b) Which of the objects on the next page can be the object in 3(b)?

If all six faces of a rectangular prism have exactly the same shape and size, the rectangular prism is called a **cube**.

(c) Which of these objects can be the object in 3(c)?

(d) Which of these objects can be the object in 3(d)?

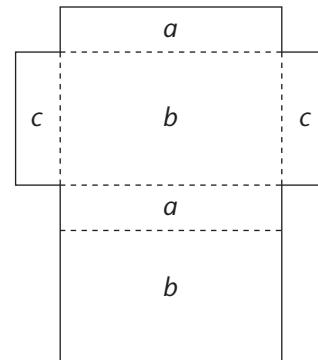


3.2 Nets of rectangular prisms

1. Use boxes that are rectangular prisms.

(a) Make as few cuts as possible to open each box flat onto your table. All the faces of the box must still be attached. Cut off all the overlapping pieces.

The flat figure that shows all the faces of a 3-D object is called the **net** of the object.

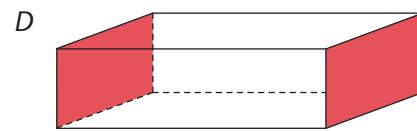
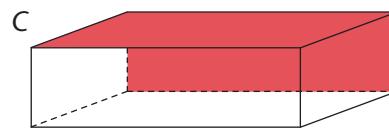
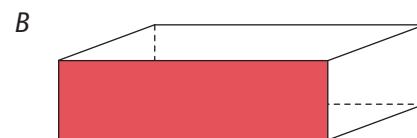
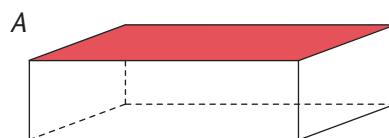
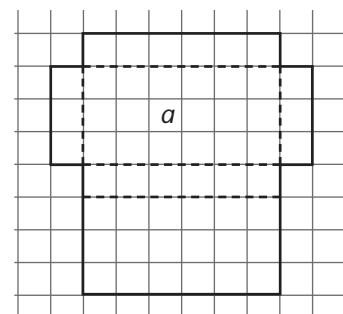


Net of a rectangular prism

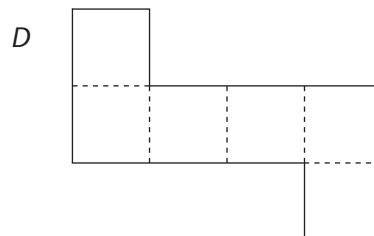
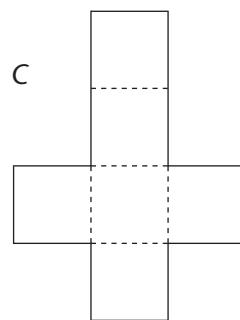
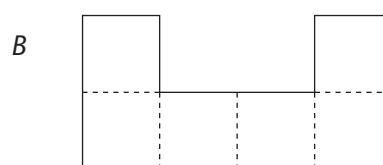
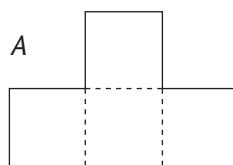
(b) Label the faces on the nets of your boxes to explain which faces are opposite each other when the net is folded into a prism. Write the same letter on the opposite faces.

(c) Compare your nets with a classmate's nets. Draw two different ways to cut open a box to make a net. Use the same letters to label the faces that are opposite each other when the net is folded into a prism.

2. (a) Draw four copies of this net on squared paper.
- (b) Shade the faces on your nets that are shown in red on the prisms below.
Let a be the face that is the base (it is at the bottom; it stays on the table).

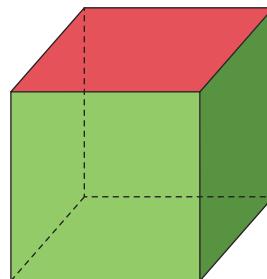


3. Work out which diagrams below are nets of a cube.
- (a) Draw the diagrams on squared paper.
- (b) Use the same letters to label the faces that are opposite each other when the net is folded into a cube.
- (c) If a diagram is not the net of a cube, explain why this is so.

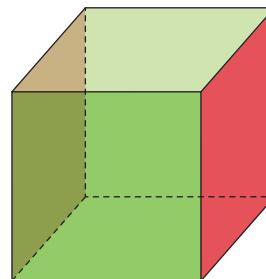


-
4. Draw the nets of the following cubes on squared paper. Shade the faces that are red on the cubes below. Let a be the face that is the base (it is at the bottom; it stays on the table).

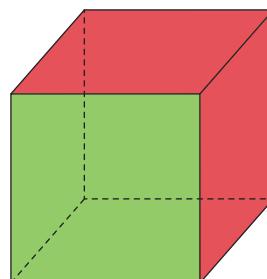
(a)



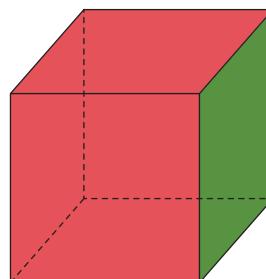
(b)



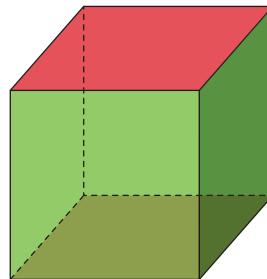
(c)



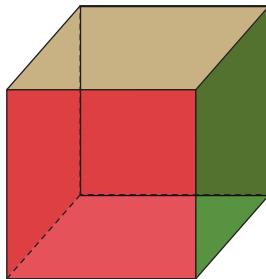
(d)



(e)



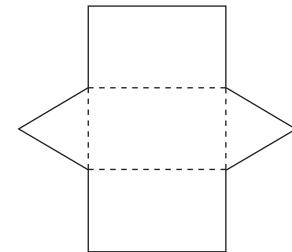
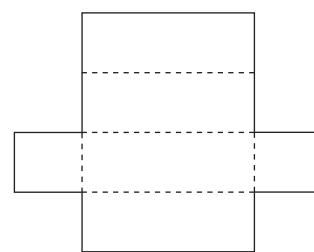
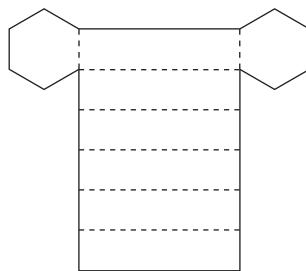
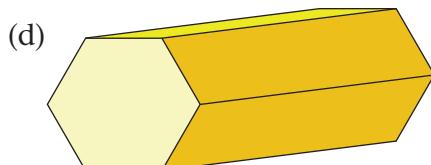
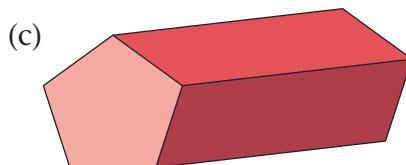
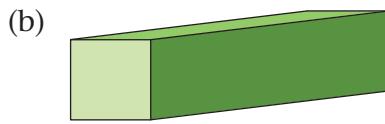
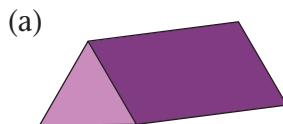
(f)



3.3 Nets of other prisms

The diagrams in questions 1(a) to (d) below show prisms. They are **prisms** because they have one pair of opposite faces that are exactly the same shape and size, and the other faces are all rectangles that are the same shape and size.

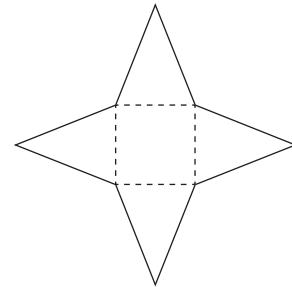
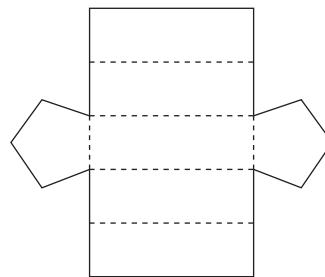
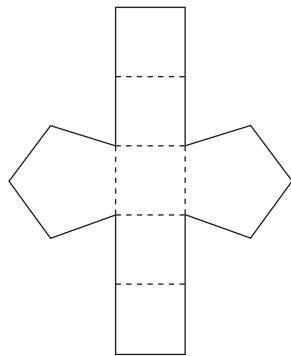
1. Match each prism with a net below.



A

B

C



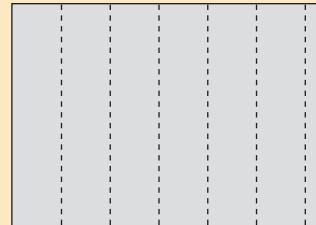
D

E

F

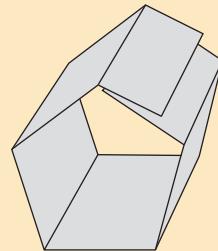
A quick way to make a paper prism

Step 1: Fold sections on a sheet of A4 paper, more or less as shown by the broken lines in the diagram on the right.



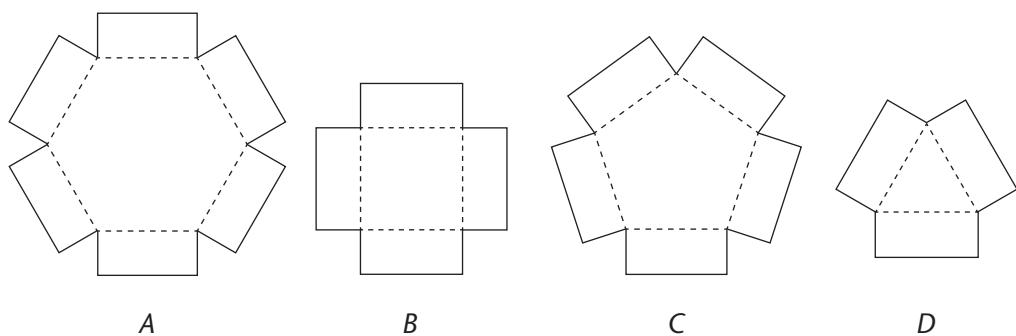
Step 2: Fold the sheet into a “tube” with five or six faces along its length.

Step 3: With a little extra work, you can now make a paper prism. You need to draw and cut out two bases so that they fit the openings.



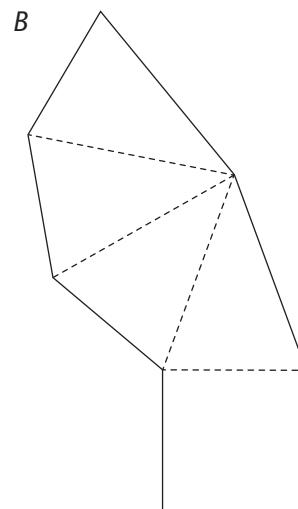
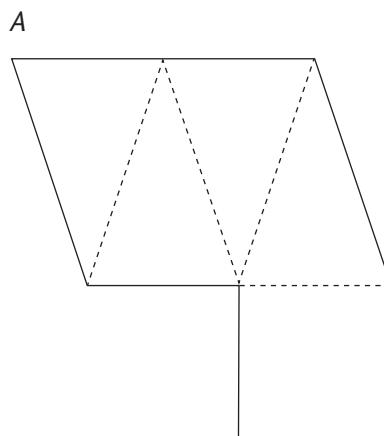
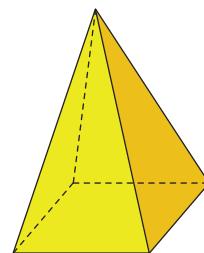
2. Make four prisms using the bases below. You can follow the instructions above to make the “tube” of rectangular faces for each prism.
 - (a) a prism with one pair of opposite faces that are triangles
 - (b) a prism with one pair of opposite faces that are squares
 - (c) a prism with one pair of opposite faces that are pentagons
 - (d) a prism with one pair of opposite faces that are hexagons

Trace the bases and cut them out. Use the flaps to stick the bases to the rectangular faces.



3.4 Nets of a square-based pyramid

1. Look at the diagram of a square-based pyramid.
 - (a) How many faces does a square-based pyramid have?
 - (b) Describe the shapes of the faces.
2. (a) Which of these diagrams is a net of a square-based pyramid? Explain your answer.



- (b) Draw a different net that can be folded to make a square-based pyramid. Cut out your net and test if it works.
- (c) Write to someone in another class. Explain how to make a net for a square-based pyramid. Make sure you say which sides of the polygons must have the same length.

3.5 Nets of a cylinder and a cone

1. Use the tube of an empty toilet paper roll.
 - (a) Trace the circles on a sheet of paper.
 - (b) Cut open the tube along a straight line.
 - (c) Trace the shape of the cut tube on a sheet of paper.
 - (d) Cut out the three flat figures and use them to make a closed cylinder.

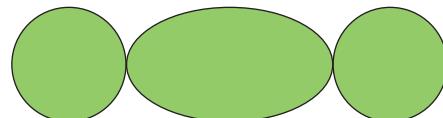


2. Which of the following diagrams are nets for a cylinder? Explain why the others will not make a cylinder.

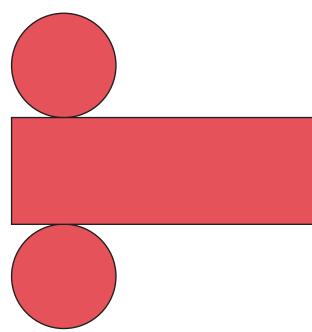
A



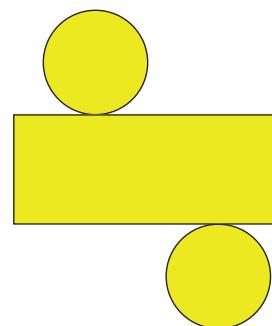
B



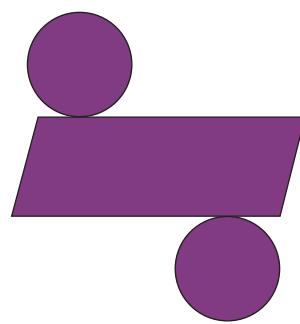
C



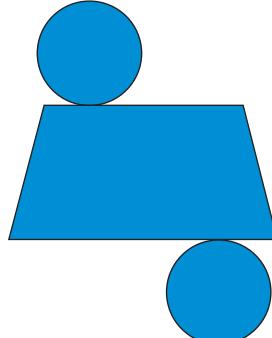
D



E

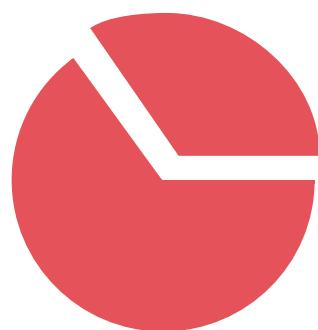
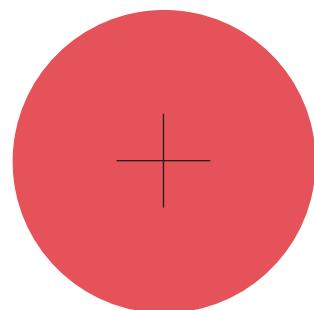


F

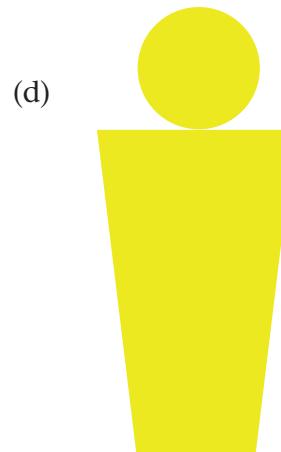
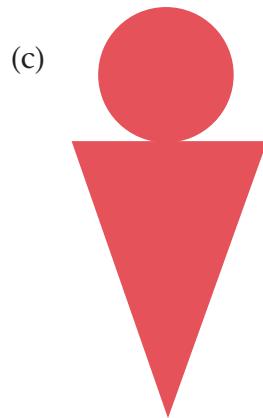
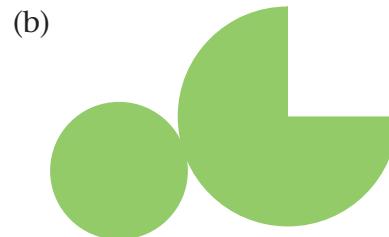
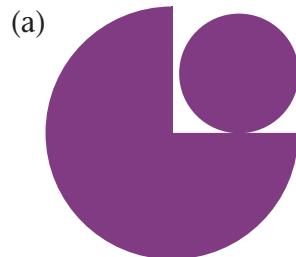


3. Make cones.

- (a) Draw a circle by tracing around a round object, such as a plate or a saucer. (You can also use a round paper plate.)
- (b) Find the centre of the circle by folding. Mark the centre.
- (c) Cut out a wedge from the circle, as shown.
- (d) Use both parts to make open cones.
- (e) Trace the openings of the cones to make the circle bases for the cones.
- (f) Describe the difference between the two completed cones.



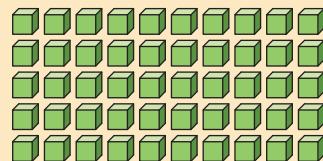
4. Which of the diagrams below are nets for a cone? Explain why the others will not make cones.



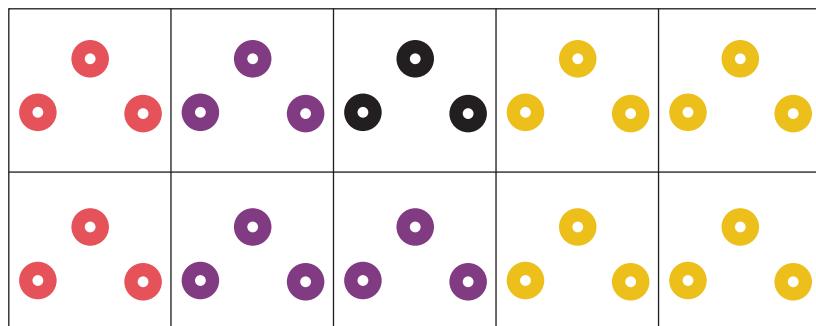
4.1 Fractions of whole numbers

$$50 \div 5 = 10$$

This means that $\frac{1}{5}$ of 50 is 10.



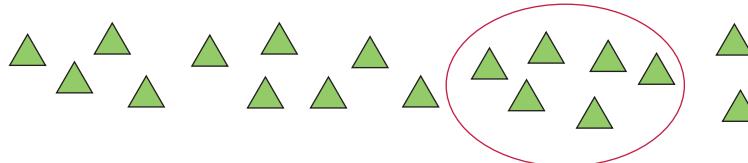
1. (a) How many beads are shown here, altogether?



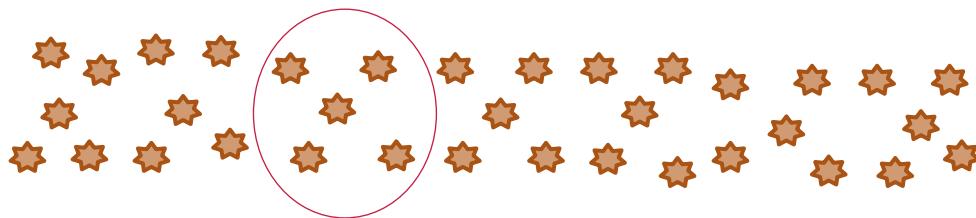
- (b) What fraction of all the beads is red?
 (c) What fraction of all the beads is purple?
 (d) What fraction of all the beads is black?
 (e) What fraction of all the beads is yellow?
2. (a) How many beads do you have if you have $\frac{1}{10}$ of 30 beads?
 (b) How many beads do you have if you have $\frac{3}{10}$ of 30 beads?
 (c) How many beads do you have if you have $\frac{4}{10}$ of 30 beads?
 (d) How many beads do you have if you have $\frac{2}{10}$ of 30 beads?
 (e) How many beads do you have if you have $\frac{4}{10}$ of 120 beads?
 (f) How many beads do you have if you have $\frac{2}{10}$ of 80 beads?

-
3. (a) How many beads are $\frac{1}{8}$ of 40 beads?
(b) How many beads are $\frac{3}{8}$ of 40 beads?
(c) How many beads are $\frac{4}{8}$ of 40 beads?
(d) How many beads are $\frac{2}{8}$ of 40 beads?
4. Below are some collections of objects.

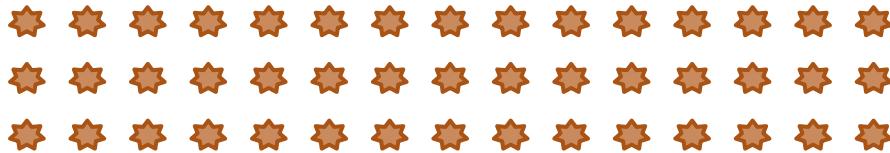
- (a) What fraction of the collection of triangles is in the circle?



- (b) Write down the steps that you followed when you found the fraction of the triangles in (a).
(c) Here are biscuits that look like stars. What fraction of the number of biscuits is in the circle?



5. This is one sixth of the biscuits that Mama Themba made for the church function. How many biscuits did she bake?



6. R420 was stolen from Biza's bag. He said: "Someone stole exactly one tenth of the money I earned this month." How much money did Biza earn this month?

7. Calculate:

(a) $\frac{2}{5}$ of 250

(b) $\frac{2}{3}$ of 99

(c) $\frac{5}{8}$ of 720

(d) $\frac{5}{9}$ of 819

(e) $\frac{7}{12}$ of 1 440

(f) $\frac{7}{10}$ of 12 340

(g) $\frac{3}{7}$ of 840

(h) $\frac{5}{6}$ of 1 440

Nick has to calculate $2\frac{5}{8}$ of 16. He thinks like this:

$2\frac{5}{8}$ means $2 + \frac{5}{8}$. So $2\frac{5}{8}$ of 16 means two 16s plus $\frac{5}{8}$ of 16.

That is 32 plus 10, which is 42.

8. Use your answers in question 7 and calculate:

(a) $1\frac{2}{5}$ of 250

(b) $1\frac{2}{3}$ of 99

(c) $2\frac{5}{8}$ of 720

(d) $3\frac{5}{9}$ of 819

(e) $1\frac{7}{12}$ of 1 440

(f) $2\frac{7}{10}$ of 12 340

(g) $2\frac{3}{7}$ of 840

(h) $1\frac{5}{6}$ of 1 440

9. You should be able to do the following mentally. This means you should be able to write down the final answer straight away without writing down anything else.

(a) $1\frac{1}{2}$ of 8

(b) $2\frac{1}{3}$ of 9

(c) $2\frac{1}{6}$ of 12

(d) $2\frac{3}{4}$ of 20

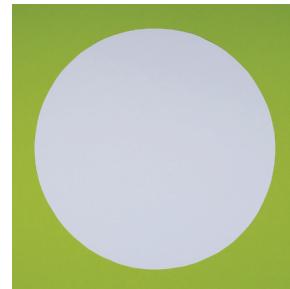
(e) $3\frac{2}{5}$ of 50

(f) $2\frac{3}{10}$ of 30

10. Three friends share two chocolate bars equally. How much chocolate does each one get?

4.2 Fractions in diagrams

1. Follow the instructions below and make *four* circles:



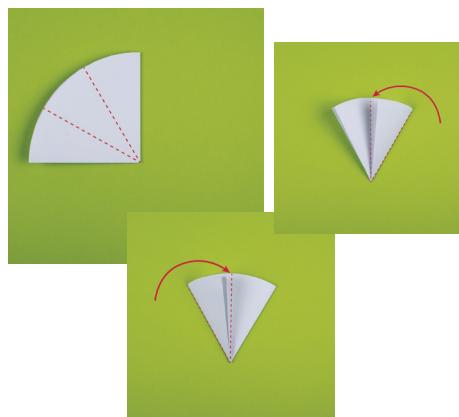
Step 1: Trace around a round object to draw a circle.

Step 2: Cut out the circle.



Step 3: Fold it in half.

Step 4: Fold it in half again. You now have four quarters.



Step 5: Fold the two sides over so that the two folded parts are exactly the same size.

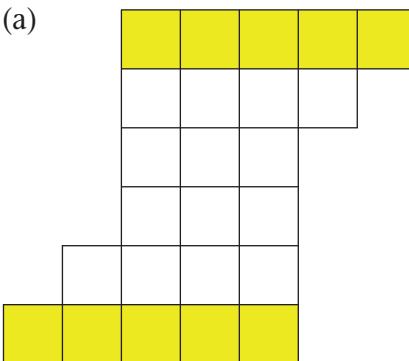
Step 6: Unfold and draw clear lines on the folds.

-
- (a) Shade one quarter of your first circle.
 - (b) Shade three twelfths of your second circle.
 - (c) Shade two twelfths of your third circle.
 - (d) Shade one sixth of your fourth circle.
2. (a) What do you notice about one quarter and three twelfths?
- (b) What do you notice about one sixth and two twelfths?
- (c) Write what you understand by *equivalent* fractions.

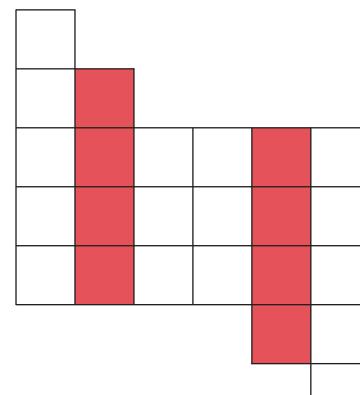
Equivalent fractions are fractions with different names but with the same value.

3. What fraction of the whole figure is shaded in each case? If possible, write the fraction in more than one way.

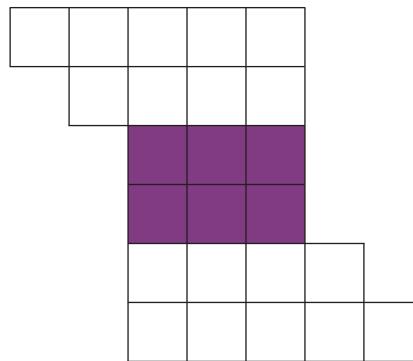
(a)



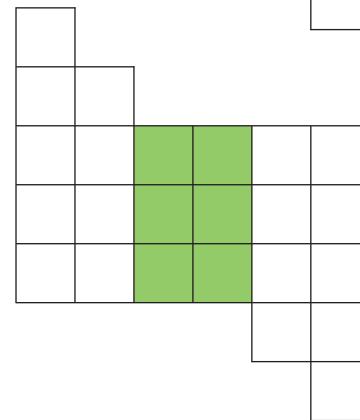
(b)



(c)



(d)



4.3 Fractions on the number line

1. Copy the four number lines below and write the following fractions at the correct places on the number lines. Note that it is sometimes possible to place more than one fraction in a certain position. Some fractions can also be put on more than one of the number lines. Try to find those fractions and do it.

(a) $\frac{1}{2}$

(b) $\frac{3}{4}$

(c) $\frac{8}{10}$

(d) $\frac{11}{12}$

(e) $1\frac{3}{5}$

(f) $\frac{2}{6}$

(g) $\frac{4}{12}$

(h) $\frac{6}{8}$

(i) $2\frac{6}{10}$

(j) $1\frac{1}{3}$

(k) $\frac{2}{10}$

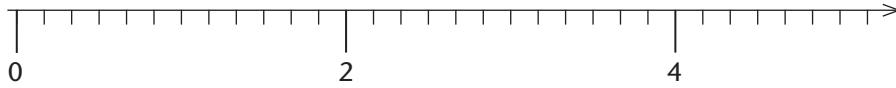
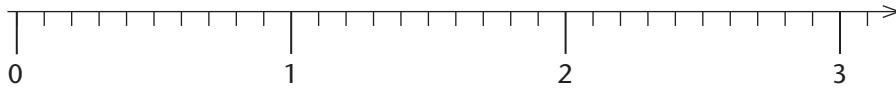
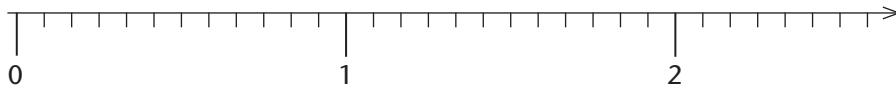
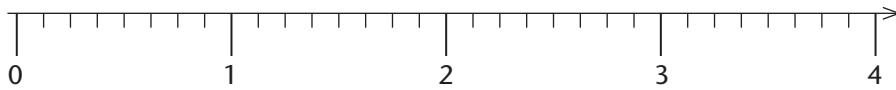
(l) $2\frac{5}{8}$

(m) $\frac{9}{12}$

(n) $1\frac{1}{4}$

(o) $1\frac{4}{6}$

(p) $2\frac{4}{8}$



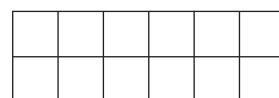
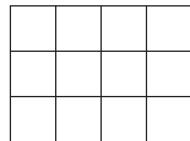
2. Make a list of all the equivalent fractions that you found in question 1.

4.4 Solving problems

1. 
- What part of the strip is green?
 - What part of the strip is red?
 - What part of the strip is white?
 - What part of the strip is yellow?
 - What is $1 - \frac{8}{9}$?
 - What is $1 - \frac{9}{10}$?
 - What is $5 - \frac{3}{10}$?
 - What is $3 - \frac{3}{7}$?
2. A cake is cut into ten equal slices. Katie eats 2 slices, Farida eats 1 slice and Busile eats 3 slices. What fraction of the whole cake is left over?
3. Each child at a party eats one third of a slab of chocolate. Each child drinks two fifths of a large bottle of juice. If there are 20 children at the party,
- how much chocolate do they eat?
 - how much juice do they drink?
4. (a) How many centimetres are in three-fifths of a metre?
(b) How many centimetres are in three-tenths of a metre?
(c) How many millimetres are in two and a half centimetres?
(d) How many metres are there in six-eighths of a kilometre?
(e) How many grams are in six-tenths of a kilogram?
(f) How many grams are in three-fifths of a kilogram?
(g) How many grams are in three-eighths of a kilogram?
(h) How many grams are in three-quarters of a kilogram?

-
- (i) How many millilitres are in two-fifths of a litre?
 - (j) How many millilitres are in three-quarters of a litre?
 - (k) How many millilitres are in three-eighths of a litre?
5. There are ten children at a camp and 12 loaves of bread are shared equally between them.
- (a) What fraction of all the bread does each child get?
 - (b) What fraction of all the bread do two of these children together get?
 - (c) What fraction of all the bread do three of these children together get?
 - (d) What fraction of all the bread do four of these children together get?
 - (e) What fraction of all the bread do five of these children together get?
 - (f) What fraction of all the bread do six of these children together get?
 - (g) What fraction of all the bread do eight of these children together get?
 - (h) What fraction of all the bread do nine of these children together get?
 - (i) What fraction of all the bread do ten of these children together get?
6. 34 loaves of bread are shared equally among 8 families. How much bread does each family get?
7. Nick, Faaiez and Thandeka worked on a project. Not everyone did the same amount of work. They decided that if they win the prize, they will share it in the following way:
- Thandeka will get half of the money. Faaiez will get three-eighths of the money. Nick will get the rest.
- (a) What fraction of the money will Nick get?
 - (b) How much money will each of them get if the prize is R600?

-
8. A chocolate slab is divided into 12 small blocks.
- (a) What fraction of the whole slab is 1 small block?
 - (b) What fraction of the whole slab is 2 small blocks?
 - (c) What fraction of the whole slab is 3 small blocks?
 - (d) What fraction of the whole slab is 4 small blocks?
 - (e) What fraction of the whole slab is 6 small blocks?
9. Juliet draws the chocolate slab in question 8 in two different ways:



- (a) She says: “In question 8(b) I wrote that two small blocks are two twelfths of the whole slab. If I colour the first column in my second drawing I can see that two blocks can also be one sixth of the whole slab.”



Can you explain Juliet’s thinking?

- (b) Look at the two drawings of the slab and find more than one way to write 3, 4 and 6 small blocks as a fraction of the whole slab.
- (c) What fraction of the whole slab is 10 small blocks?
- (d) Can you write that fraction in a different way?
- (e) What fraction of the whole slab is 5 small blocks?
- (f) What fraction of the whole slab is 8 small blocks?

5.1 Revision practice

1. Thivha's hens laid 908 eggs. Thivha packs the eggs into egg boxes that take 36 eggs each. How many egg boxes can Thivha fill? How many eggs are left over?
2. 32 boxes of fruit juice cost R416 in total. How much does one box cost?
3. The fruit seller fills bags with guavas. How many bags can he fill with 16 guavas each, if he picked 525 guavas from his orchard?
4. How many buses are needed to transport 342 learners to an athletics meeting if 48 learners may travel in one bus?
5. If the length of one shoelace is 46 cm, how many shoelaces can be cut from 830 cm shoelace string?
6. Daniel has to divide 488 toffees equally into 23 packets.
 - (a) How many toffees will go into each packet?
 - (b) How many toffees will be left over?
7. Calculate.

(a) $902 \div 27$	(b) $792 \div 47$
(c) $539 \div 18$	(d) $837 \div 34$
(e) $937 \div 84$	(f) $937 \div 42$
8. The mass of 13 same-sized bags of dog food is 325 kg. What is the mass of one bag of dog food?
9. (a) If an elephant eats 40 times as much as a goat in one day, how much does the elephant eat when the goat eats 2 kg of food?
(b) If an elephant eats 40 times as much as a goat in one day, how much does the goat eat when the elephant eats 200 kg of food?
10. A hotel needs 270 new dinner plates. The plates are sold in boxes of 24 plates each. How many boxes should the hotel buy?

5.2 Making pictures smaller and bigger



Picture 1



Picture 2

Look closely at the two pictures above. Picture 2 is exactly the same as Picture 1, only much larger. All the parts have been drawn bigger in exactly the same way.

1. A picture of another house is drawn bigger, so that it is 6 times as big.
 - (a) If a window is 5 mm high in the small picture, how high is it in the big picture?
 - (b) If a door is 120 mm high in the big picture, how high is it in the small picture?
 - (c) If the house is 192 mm high in the big picture, how high is it in the small picture?
2. A house is 60 times as big as the drawings on the plan of the house.
 - (a) If a window is 8 mm high on the plan, how high is the window in the actual house?
 - (b) A door of the actual house is 1 800 mm high. How high is the door on the plan?
 - (c) A wall of the actual house is 2 160 mm high. How high is the wall on the plan?

5.3 Ratios of enlargement and reduction

Three pictures of a bird are shown below.

1. Is it the same bird in the three pictures?
2. Are the pictures the same? If not, in what way do they differ?



Picture A



Picture B



Picture C

Picture A is 50 mm high and 75 mm wide.

3. How high is Picture B, and how wide is it?
4. Check whether Picture C is 30 mm high and 45 mm wide.
5. Measure the lengths of the red lines that have been drawn on the three pictures.

Picture A is an **enlargement** of Picture B. All the parts are made bigger in exactly the same way. To “enlarge” means to make bigger.

Picture C is a **reduction** of Picture B. To “reduce” means to make smaller.

6. Now check whether the measurements for Pictures A, B and C in this table agree with the measurements you made.

	Picture A	Picture B	Picture C
Height in mm	50	40	30
Width in mm	75	60	45
Length of red line in mm	90	72	54

7. Picture D is an enlargement of Picture C, and it is three times as big as Picture C. Picture D is not shown here.
- How high and how wide do you think Picture D is?
 - How long do you think the red line on Picture D is?
8. Picture E is a reduction of Picture B. Picture E is 20 mm high. Picture E is also not shown here.
- What do you think is the width of Picture E?
 - What do you think the length of the red line on Picture E is?
9. Is Picture F on the next page an enlargement of Picture E?
10. Which of Figures Y and Z below is a true reduction of Figure X?
Remember that in a reduction all the parts are smaller in exactly the same way.

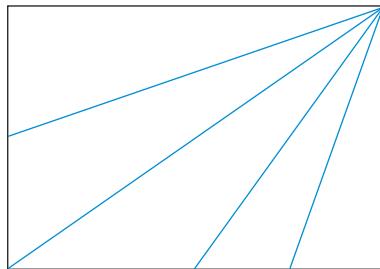


Figure X

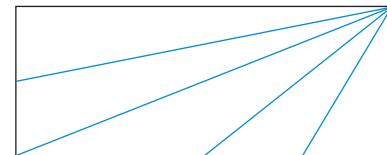


Figure Y

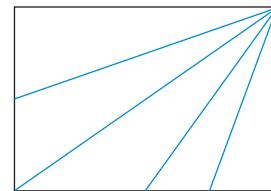


Figure Z

-
11. Take the measurements of Pictures D and E to check your answers for questions 7 and 8.



Picture D

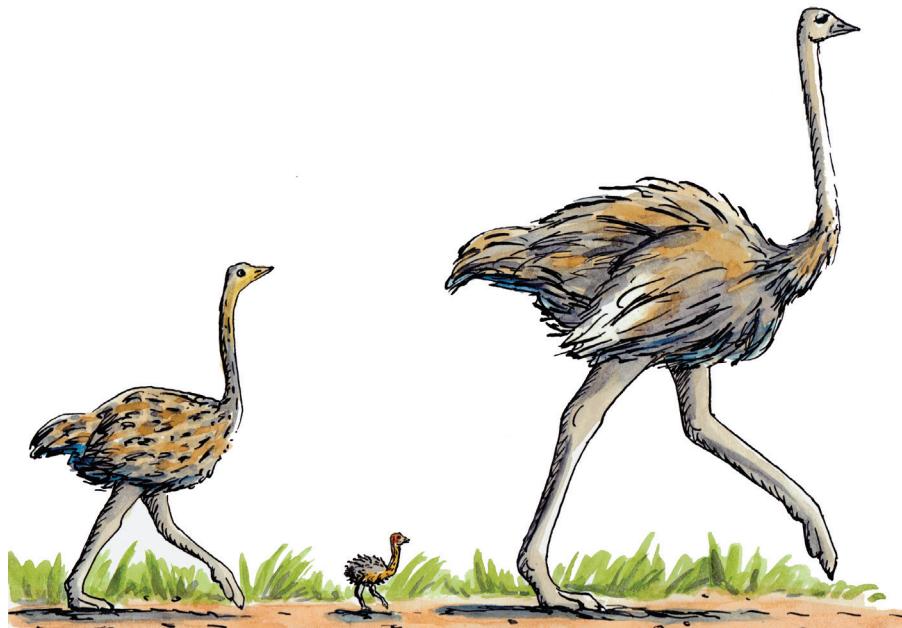


Picture E



Picture F

5.4 Ratio again



To keep up with his mother, baby ostrich Jasper has to take 20 steps for every one step his mother takes.

1. How many steps must Jasper take while his mother takes two steps, if he wants to keep up with her?
2. How many steps must Jasper take in each case below, to keep up?
 - (a) While his mother takes 3 steps
 - (b) While his mother takes 10 steps

The young ostrich Lenka, on the left in the picture, has to take 5 steps to keep up with the mother while she takes 3 steps.

3. How many steps must Lenka take in each case below?
 - (a) While the mother takes 6 steps
 - (b) While the mother takes 15 steps

-
4. Copy this table. Then complete it to show how many steps Jasper has to take while his mother takes 1, 2, 3, 6, 9, 15, 30 and 48 steps. You will have to do some calculations.

Number of steps by the mother	1	2	3	6	9	15	30	48
Number of steps by Jasper								

5. Copy this table. Then complete it to show how many steps Lenka has to take while the mother takes 3, 6, 9, 15, 30 and 48 steps. You will have to do some calculations.

Number of steps by the mother	3	6	9	15	30	48
Number of steps by Lenka						

To describe how Lenka's numbers of steps compare to the mother's numbers of steps when they walk together, we may say the following:

Lenka takes 5 steps for every 3 steps the mother takes.

We may also say:

Lenka's number of steps and the mother's number of steps are **in the ratio 5 to 3**.

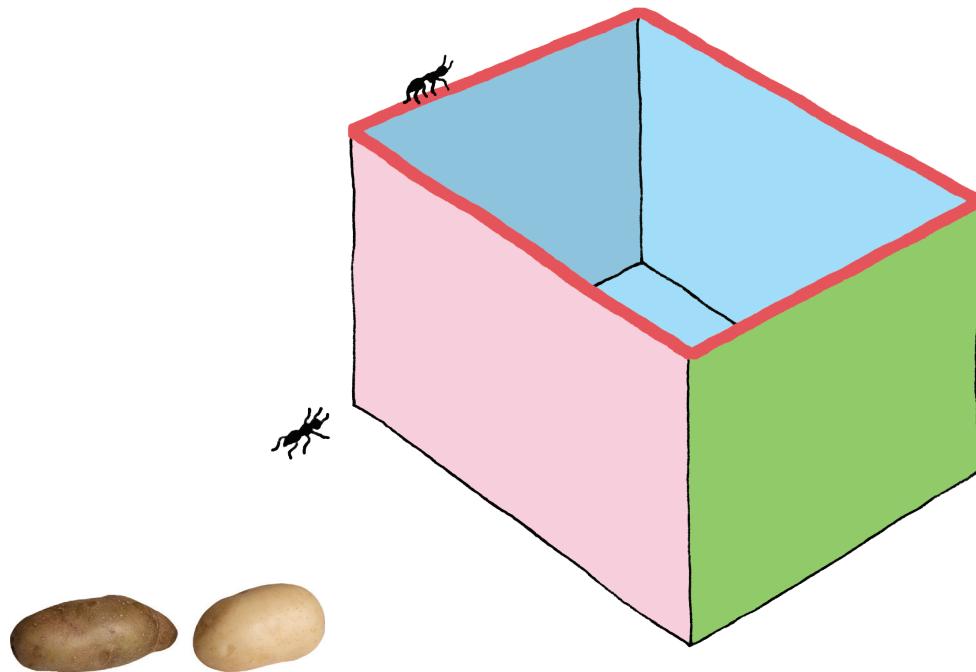
Here is another way of saying this:

The ratio between Lenka's number of steps and the mother's number of steps is 5 to 3.

The ratio between the mother's number of steps and Lenka's number of steps is 3 to 5. (Notice that the numbers are the other way round now.)

6. How many steps must Jasper take when Lenka takes 15 steps, to keep up?
(You may skip this question now if you wish, and try to do it later.)

-
7. (a) How many steps must Lenka take when the mother takes 30 steps, to keep up?
 - (b) How many steps must Jasper take when his mother takes 30 steps?
 - (c) How many steps must Jasper take when Lenka takes 50 steps?
 - (d) How many steps must Jasper take when Lenka takes 15 steps?
(You may skip this question again if you wish, and try to do it later.)
 8. (a) One day Jasper had to take 280 steps to keep up with his mother. How many steps did she take?
 - (b) On another day Jasper had to take 540 steps to keep up with his mother. How many steps did she take?
 9. (a) One day Lenka had to take 200 steps to keep up with the mother. How many steps did the mother take?
 - (b) One day Lenka had to take 350 steps to keep up with the mother. How many steps did the mother take?
 10. (a) How many steps must Jasper take for five steps that Lenka takes, to keep up with her and the mother?
 - (b) How many steps must Jasper take for 60 steps that Lenka takes, to keep up with her and the mother?
 11. (a) How many steps must Lenka take for 60 steps that Jasper takes, to keep up with him and his mother?
 - (b) How many steps must Lenka take for 300 steps that Jasper takes, to keep up with him and his mother?
 12. If you have not answered question 6 yet, try to answer it now.



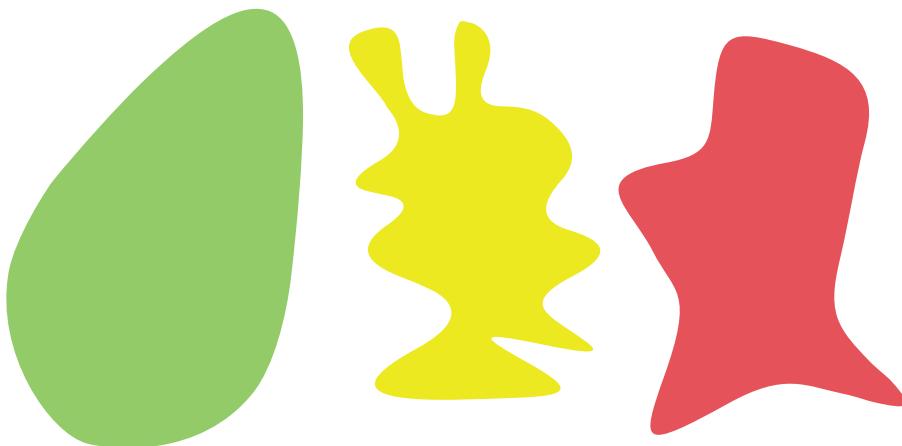
The ant can crawl right around the top edge of the box, until it is back at the corner where it started.

The **perimeter** of the open face of the box is the distance that the ant will crawl if it goes around once, and stays on the red edge all the time.

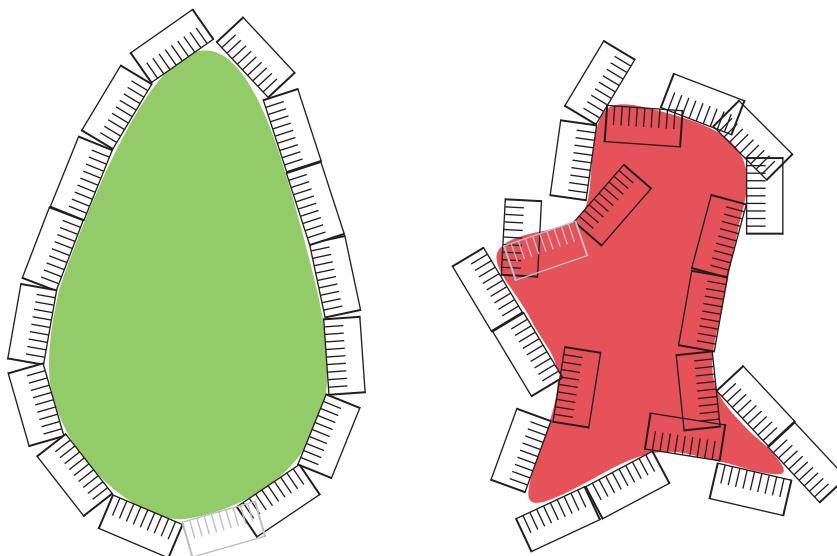
1. Do you think the perimeter of the green face is equal to the perimeter of the open face of the box?
2. Do you think there is enough space inside the box for 200 potatoes like the ones shown?
3. Which of the two potatoes do you think is the biggest?
4. Suppose you want to paint the side faces of the box with expensive paint. Which face will need more paint, the green face or the pink face?

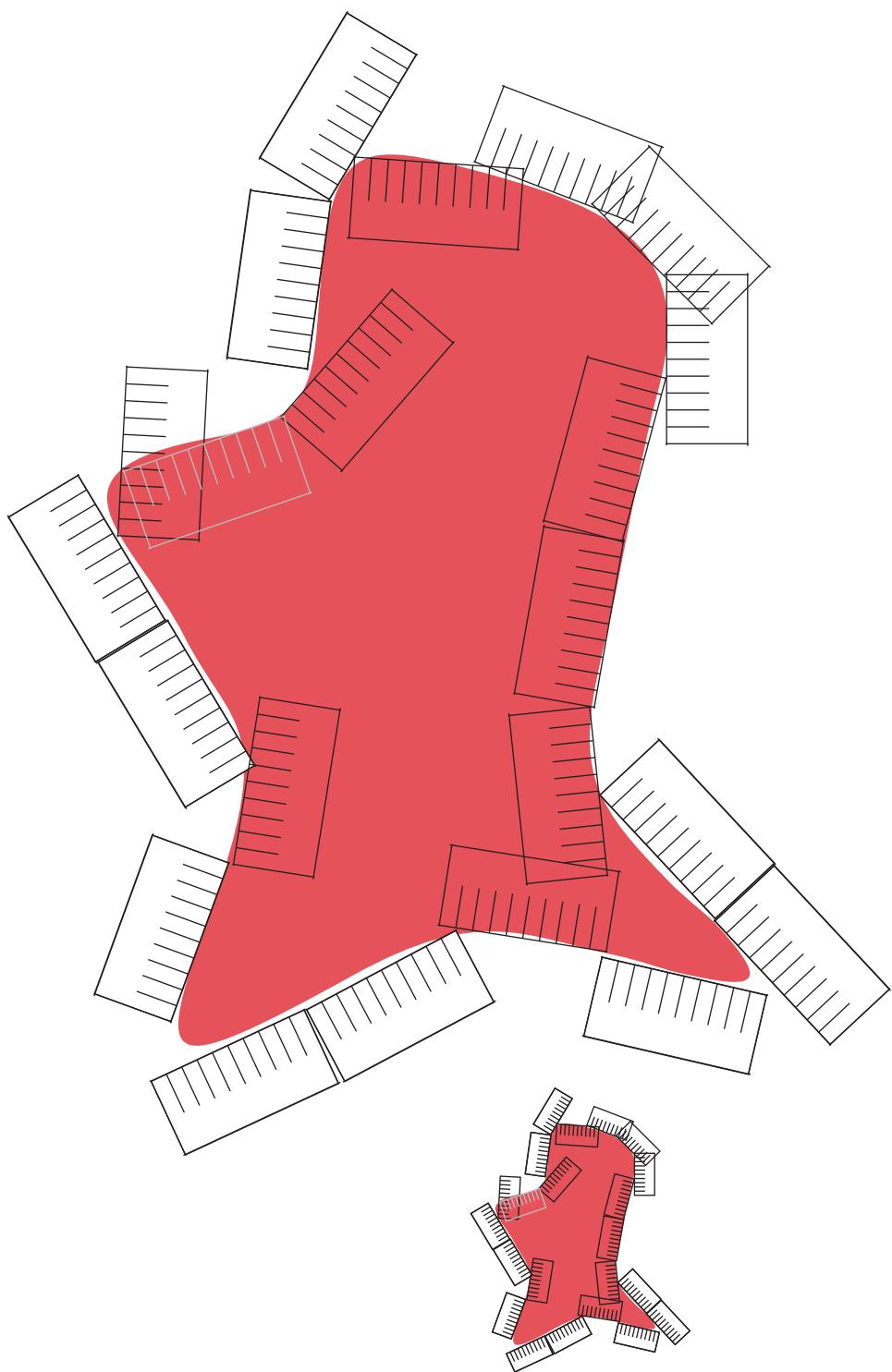
6.1 Perimeter

1. Which of these three splashes of paint do you think has the biggest perimeter, and which one has the smallest perimeter?



2. If you want to paint the splashes blue, which splash will need the most paint, and which will need the least paint?
3. The small rulers in the diagrams below are marked in millimetres. Measure the perimeters of the two splashes. Try to be accurate to the nearest millimetre. An enlargement of the diagram for the red splash is given on the next page, to make it easier for you.

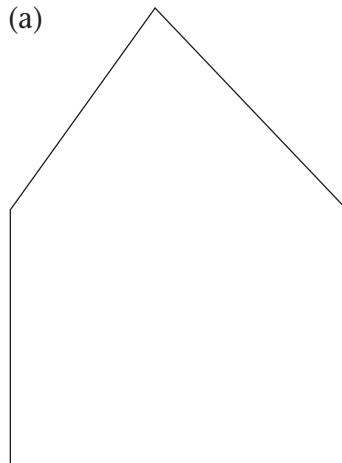




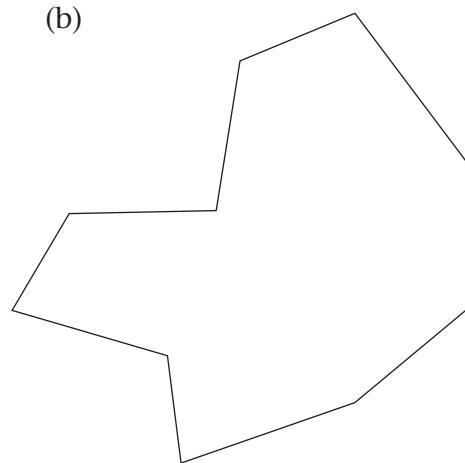
4. Measure the perimeter of these figures with your ruler.
Give each of your answers in millimetres, in centimetres and millimetres, and in centimetres and fractions of a centimetre, for example:

$$136 \text{ mm} = 13 \text{ cm and } 6 \text{ mm} = 13\frac{6}{10} \text{ cm.}$$

(a)

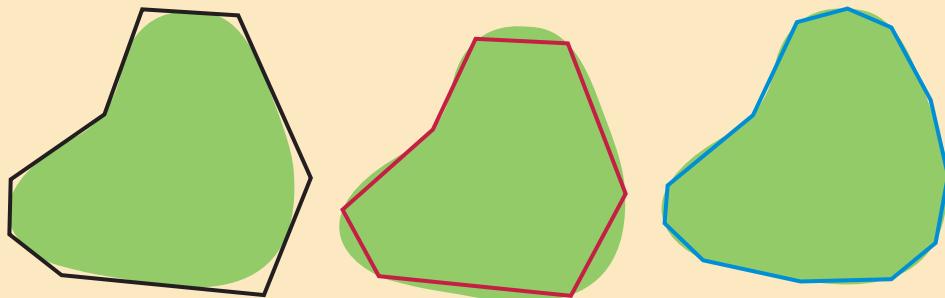


(b)



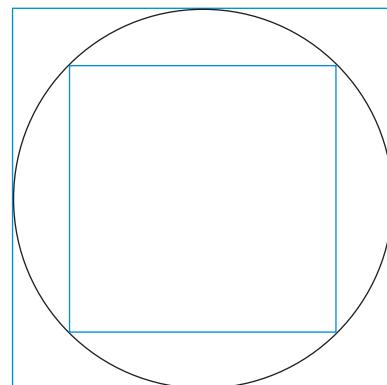
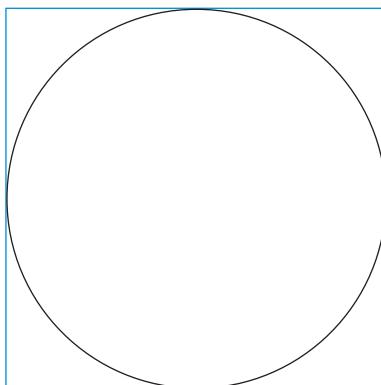
To approximately measure the perimeter of a curved figure, you can put a piece of string around the edge and then measure the length of the string.

Another method is to draw a polygon close to the curved figure, and then measure the perimeter of the polygon.



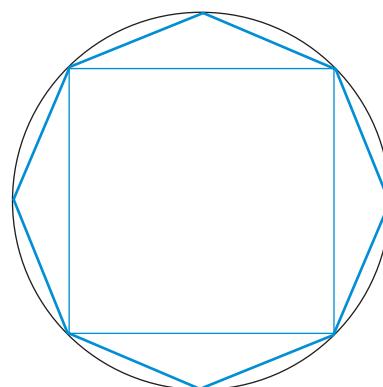
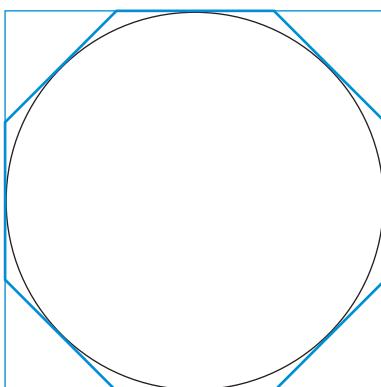
5. Which of the three polygons will provide the best approximation of the perimeter of the green curved figure?

-
6. Use a round object like a glass, mug, tin or saucer to draw a circle. Draw four copies of the circle.
 7. Draw a polygon inside or outside the first circle and use it to make an estimate of the perimeter of the circle.
 8. Draw a square outside the second circle, and another square inside the circle as shown below.



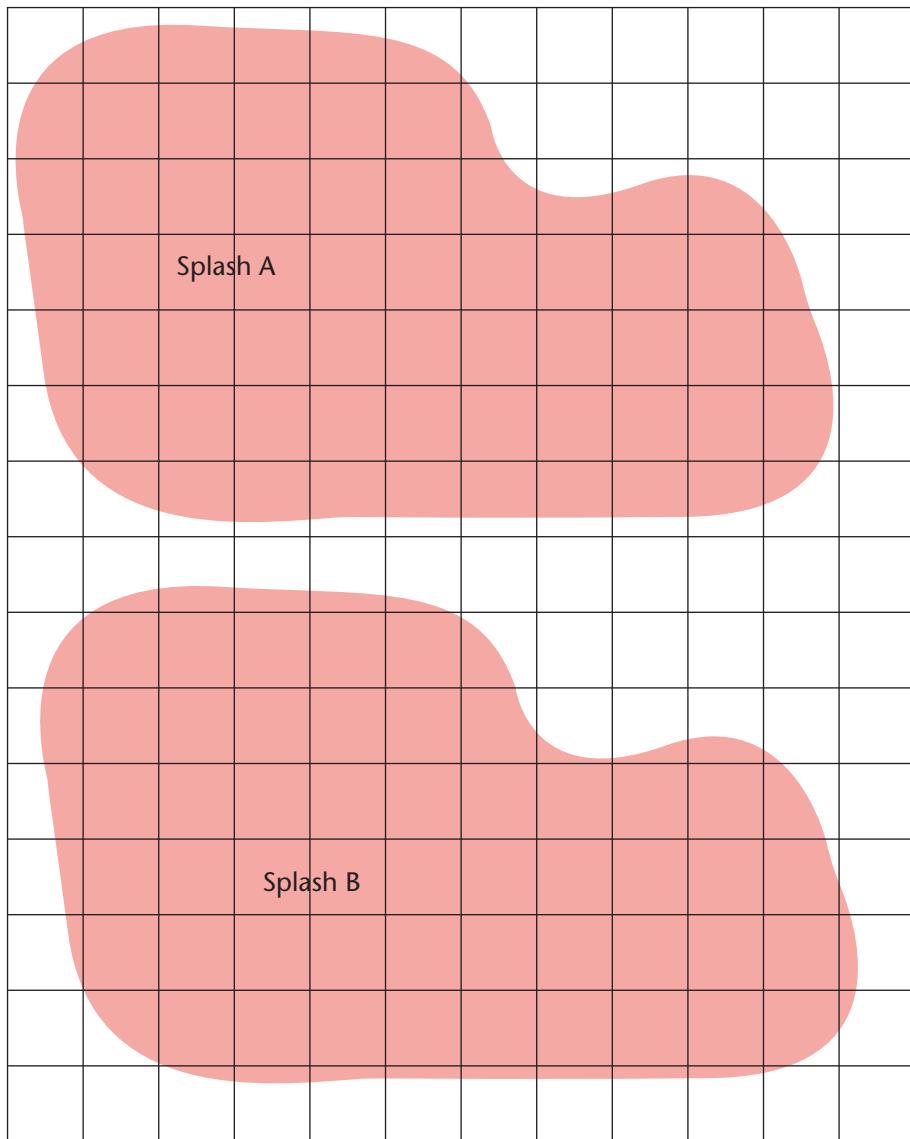
Do you think the perimeter of your circle is

- (a) bigger than the perimeter of the outer square, or
 - (b) smaller than the perimeter of the inner square, or
 - (c) a number between the perimeter of the outer square and the perimeter of the inner square?
9. Now use your third and fourth circles. Make drawings as shown below and use them to make a good estimate of the perimeter of each circle.



6.2 Area

1. (a) Estimate how many stickers like this can be cut from each of the coloured parts on the grid below.
(b) Draw a 2 cm grid on a loose sheet of paper and cut out some 2 cm by 2 cm squares. Pack the squares on the coloured areas below to see how many can fit without overlapping.



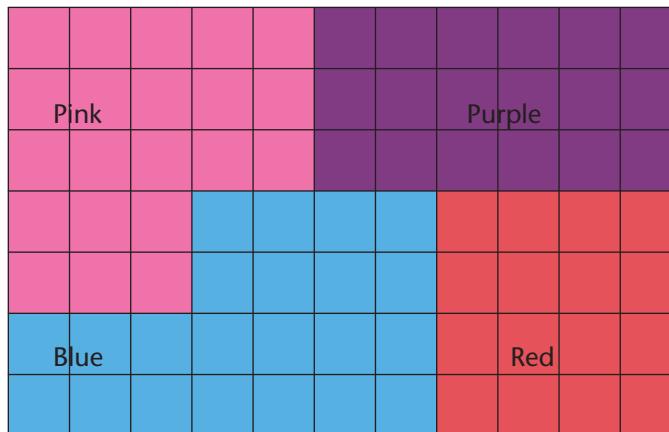
2. 240 ml of paint is needed to paint one square patch of wall, 1 m by 1 m. The grid over this picture of the wall of a building shows square blocks of 1 m by 1 m.



Make a good estimate of how much paint is needed to paint the wall shown in the picture.

3. This picture shows a wall painted in four different colours.

If the wall is repainted, which part will need the most paint, and which part will need the least paint?



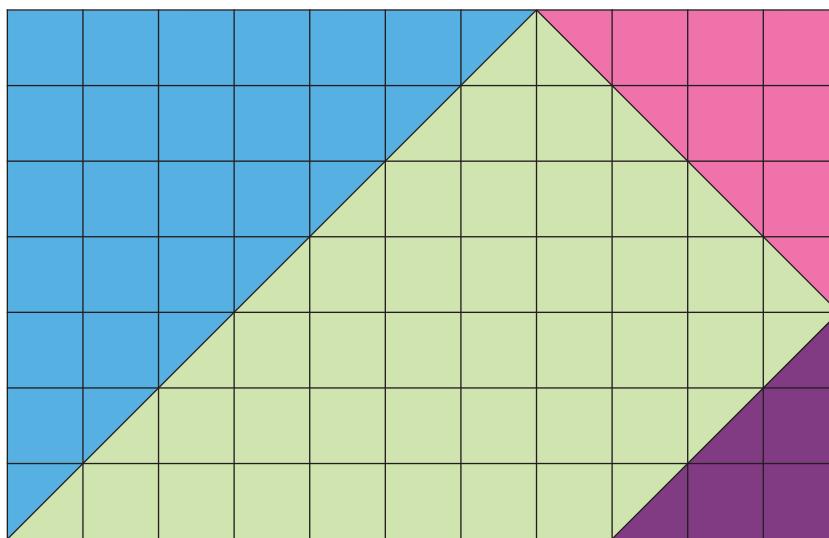
We say the red part of the wall has a smaller **surface area**, or **area** for short, than the pink part.

To compare the area of different surfaces or different parts of the same surface, you can put a grid over it and count the number of grid squares on each part.

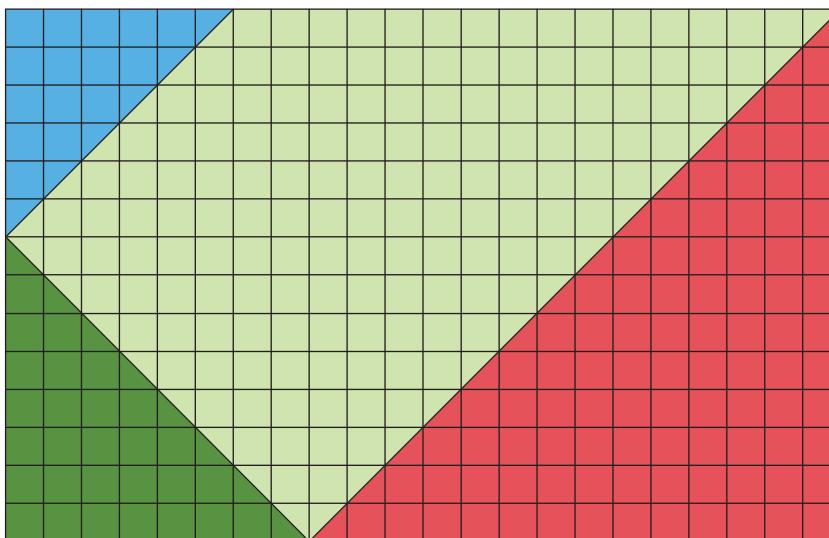
4. We can say the purple part of the wall has an area of 18 grid squares. How many grid squares is the area of each of the other three parts?

5. (a) What is the area of each coloured part of this surface?

(b) What is the area of the four parts together?

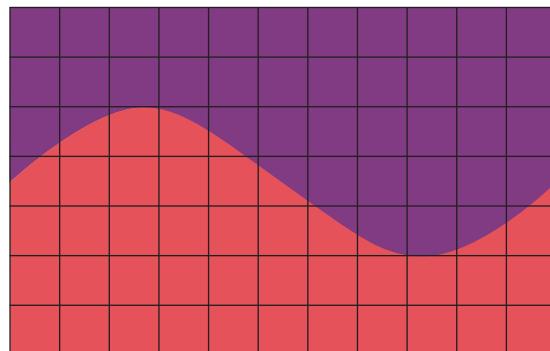


6. What is the area of each coloured part of this surface?

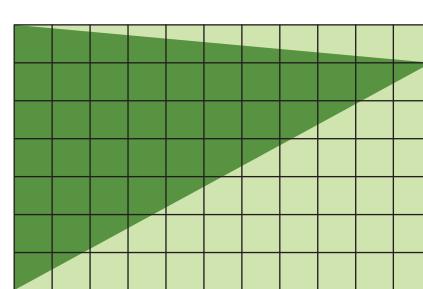
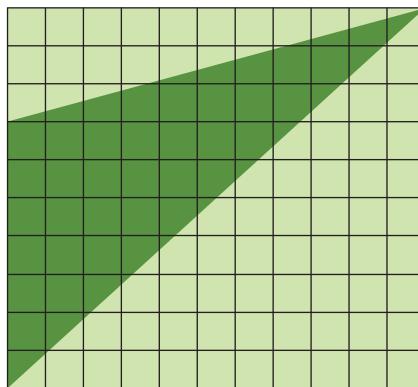
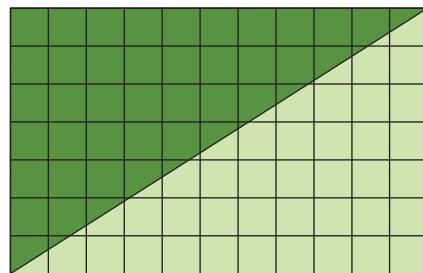
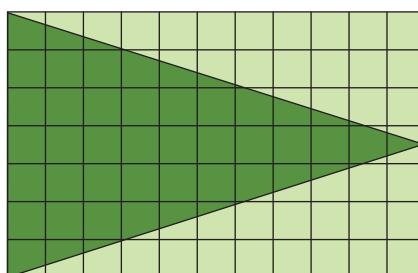


7. Is the blue triangle in question 6 bigger than the purple triangle in question 5?

8. The grid squares in question 1 on page 323 are 1 cm by 1 cm. Count the grid squares to find and compare the areas of Splash A and Splash B.
9. (a) Find the area of the purple part and of the red part of this rectangular surface.
(b) Find the approximate perimeter of each part.



10. (a) Do the four dark triangles have equal areas? Find out.
(b) Do the four dark triangles have equal perimeters? Find out.



6.3 Volume and capacity

Building bricks are made from wet clay.

To give shape to the bricks, wet clay is first put into trays. This is just as though you put dough into a bread pan to bake it.



1. Do you think the tray on the right has enough space for all the clay shown on the left?



To form a brick, the tray is filled with clay. The full tray is turned upside down and the tray is removed. The brick is then baked to make it dry and hard.



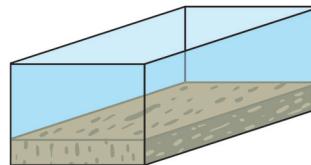
Almost 2 ℥ of clay is needed to make one normal brick. Hence the tray used to form bricks must have just enough space for 2 ℥ of clay. We say it has a **capacity** of 2 ℥.

An actual brick is slightly smaller than 2 ℥; it has a **volume** of 1 922 ml.



The **capacity** of a container tells us how much space the container has.

The **volume** of an object tells us how much space the object takes up.

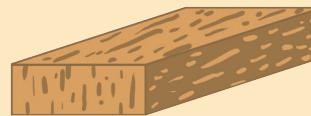
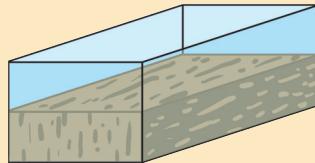


The capacity of this tray is $2 \ell = 2\ 000 \text{ ml}$



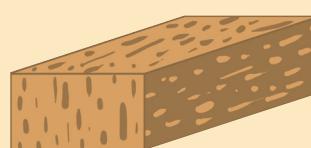
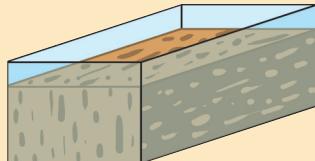
The volume of the brick is $\frac{1}{2} \ell = 500 \text{ ml}$

A 2ℓ brick tray can be used to make smaller bricks:



The capacity of this tray is $2 \ell = 2\ 000 \text{ ml}$

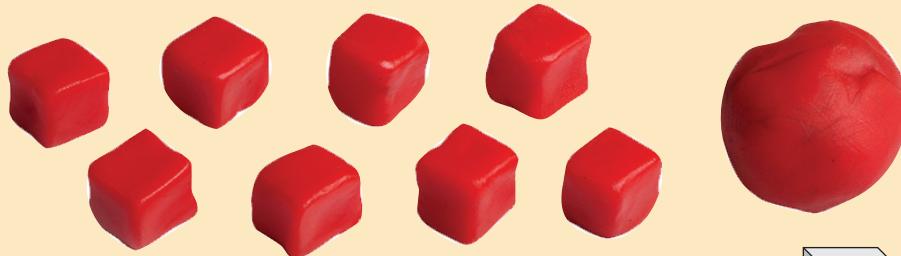
The volume of the flat brick is $1 \ell = 1\ 000 \text{ ml}$



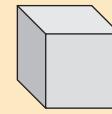
The capacity of this tray is $2 \ell = 2\ 000 \text{ ml}$

The volume of the flat brick is $1\frac{2}{5} \ell = 1\ 400 \text{ ml}$

The ball of clay on the right takes up about the same space as 8 millilitre cubes.

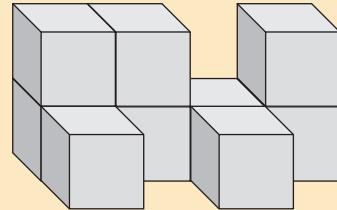


Hence we can say the volume of the clay is about 8 ml.
Each edge of a millilitre cube is 1 cm long.



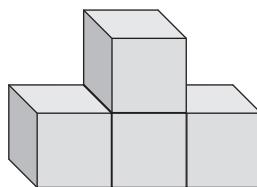
To describe the volume of an object with irregular surfaces, we can state how many cubes will take up the same space.

There are 9 cubes in this stack.
Hence we can say the volume of the stack is 9 cubes.

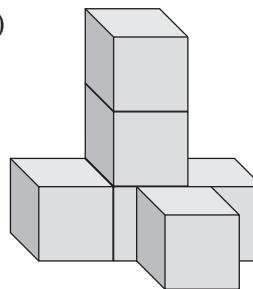


2. What is the volume of each of these stacks?

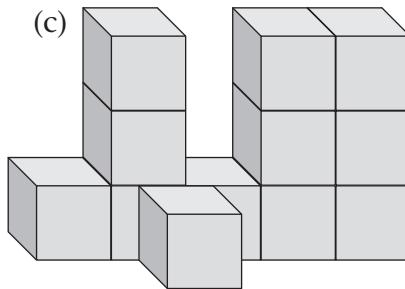
(a)



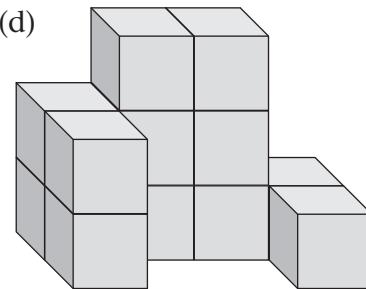
(b)



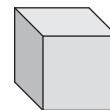
(c)



(d)

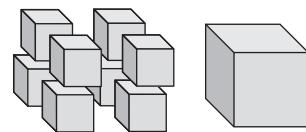


A millilitre cube is also called a **1 cm by 1 cm by 1 cm cube**, or a **centimetre cube**.

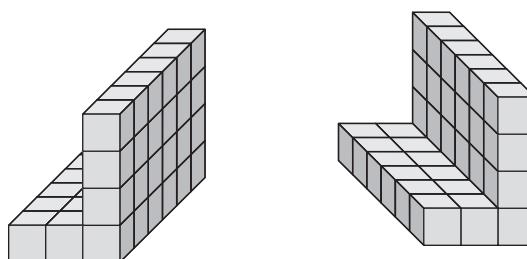


3. How many of these smaller cubes together, do you think, have the same volume as a 1 cm by 1 cm by 1 cm cube?

The edges of the smaller cubes are all 5 mm long.



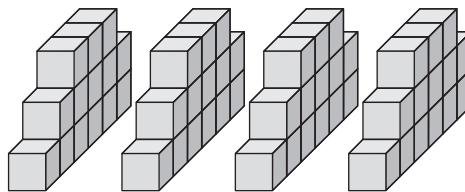
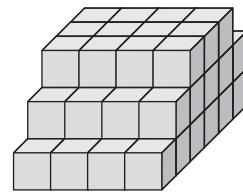
4. Here are two different views of the same stack of cubes.



How many cubes are there in this stack?

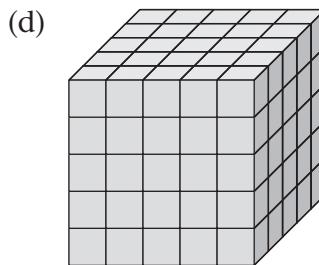
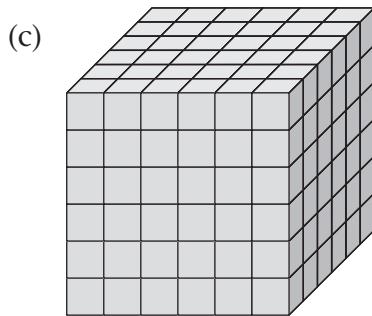
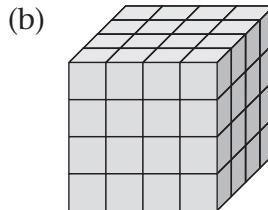
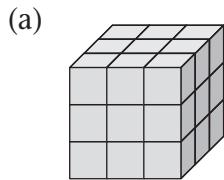
5. How many cubes are there in the stack on the right?

It was formed by putting the four stacks below together.



6. Each of the stacks below was formed by putting equal stacks together, like the stack in question 5.

How many cubes are there in each stack?



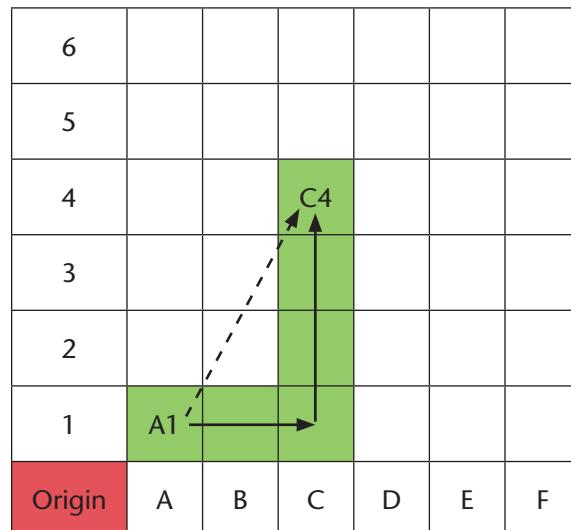
7.1 Moving between positions on a grid map

The rules for moving on a grid map are as follows:

- You may not move in a slanted direction.
- You may move right or left.
- You may move up or down.
- You may never move backwards.

For example, if you want to get from Block A1 to Block C4, you may move two blocks to the right and three blocks up.

Is there another way?



1. Work on squared paper. Make a grid map with the origin in the bottom left corner of the page. Your map must have 10 columns from left to right, and 10 rows from top to bottom. Label the blocks from left to right with the letters A to J. Label the blocks from bottom to top with numbers 1 to 10.

Let each block be 1 unit of distance.

This means we move 2 units from A1 to get to C1.

We move 3 units to get from C1 to C4.

We move 5 units to get from A1 to C4.

3. How many units do you move between the following blocks?
 - (a) A1 and C4
 - (b) A1 and D4
 - (c) A1 and E4
 - (d) A1 and J4
 4. Describe a different way to move between the pairs of blocks in question 2.
 5.
 - (a) Which two blocks on your grid map are the greatest distance from each other?
 - (b) Are the blocks that you identified in (a) the only blocks that are this far apart?
 6. You want to move from A1 to J10. Shade the following blocks for your journey:

A1 to C1; C1 to C3; C3 to E3; E3 to E5; E5 to G5; G5 to G7;
G7 to I7; I7 to I9; I9 to J9; J9 to J10.

Compare your journey with a classmate to make sure you did not miss any steps. What distance did you move from A1 to J10?
 7. Mark the following blocks on the grid: B10 and I2.

Write down two different grid routes to get from B10 to I2. Make sure you do not turn back with any move.

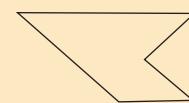
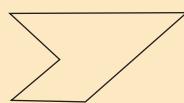
Compare the distances of your routes.

8.1 Rotations, reflections and translations in art

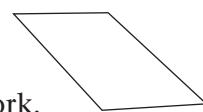


This is an artwork by the famous Ndebele artist Esther Mahlangu.

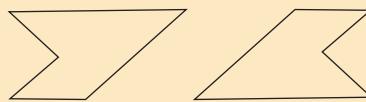
The drawing below shows one of the reflections in the above artwork.



1. In the above artwork, there is also a reflection of the figure shown here: Draw a copy of this figure, and its reflection as you can see it in the artwork.
2. Draw a copy of another figure and its reflection that you see in the artwork.

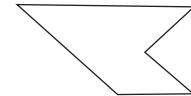


This drawing shows one of the rotations in the artwork.



3. There is also a rotation of this figure in the artwork:

- (a) Draw a copy of the figure and its rotation as you see it in the artwork.
(b) Draw a reflection of this figure.

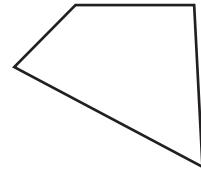


4. (a) Make a drawing of a black triangle and its rotation that you see in the bottom part of the artwork above.
(b) Make a drawing of another rotation of the same triangle that you see in the artwork.
5. (a) Make a drawing of a figure and its rotation in the artwork below, where the colours are the same in the two figures.
(b) Make a drawing of a figure and its rotation in the artwork below, where the colours are different in the two figures.

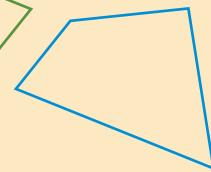
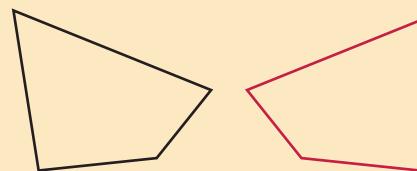


8.2 Tessellations

1. (a) Trace a copy of this quadrilateral onto thick paper or cardboard and cut it out.
- (b) Move your quadrilateral on the figures below to check whether the statements are true.



The red figure is a **reflection** of the black figure.

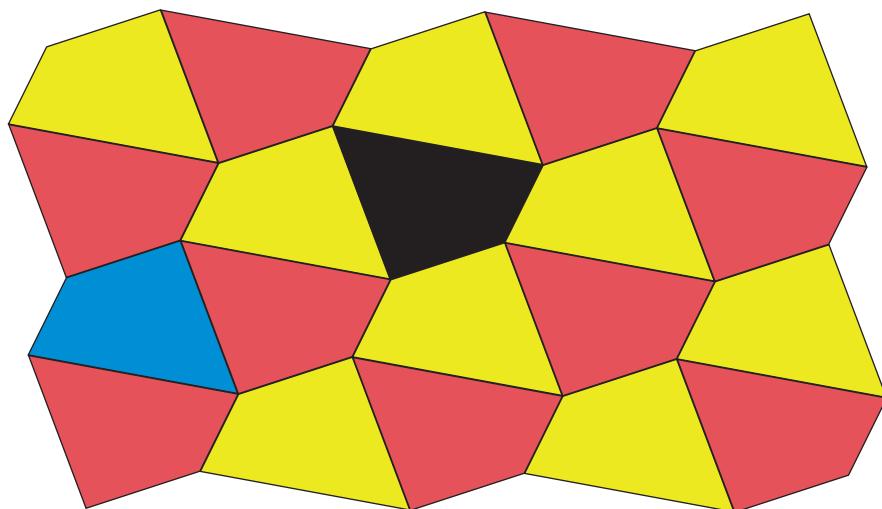


The green figure is a **translation** of the black figure.

The blue figure is a **rotation** of the black figure.

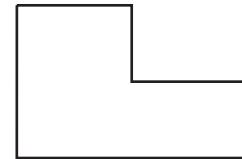
You can use your cut-out quadrilateral when you do question 2.

2. (a) Which quadrilaterals in the tessellation below are translations of the black quadrilateral?
- (b) Which quadrilaterals are rotations of the black quadrilateral?
- (c) Is there a reflection of the blue figure in the tessellation?



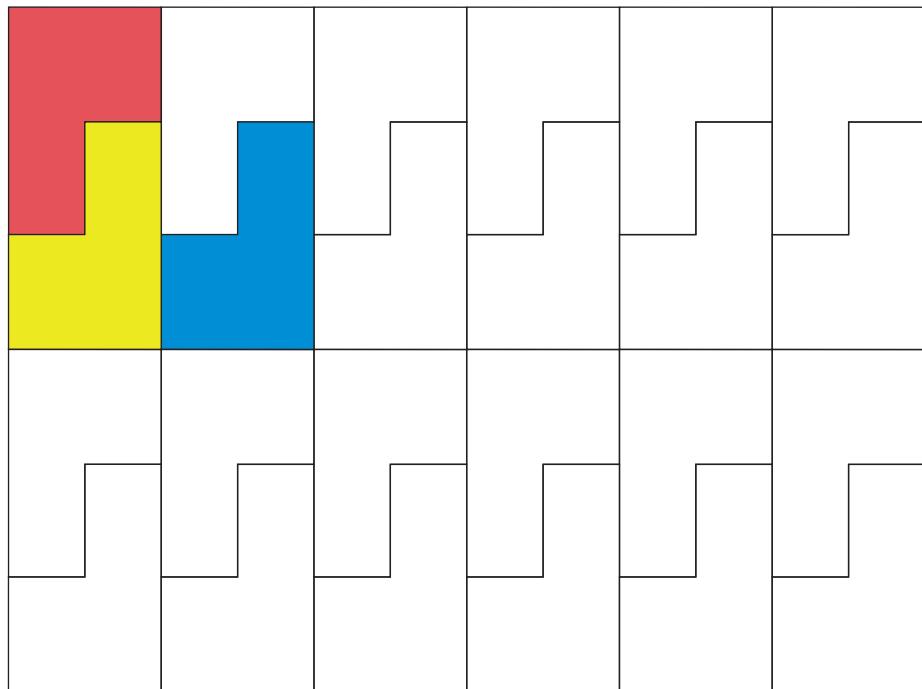
3. Use your cut-out quadrilateral to draw a copy of this tessellation.

4. Trace a copy of this hexagon onto thick paper or cardboard and cut it out.



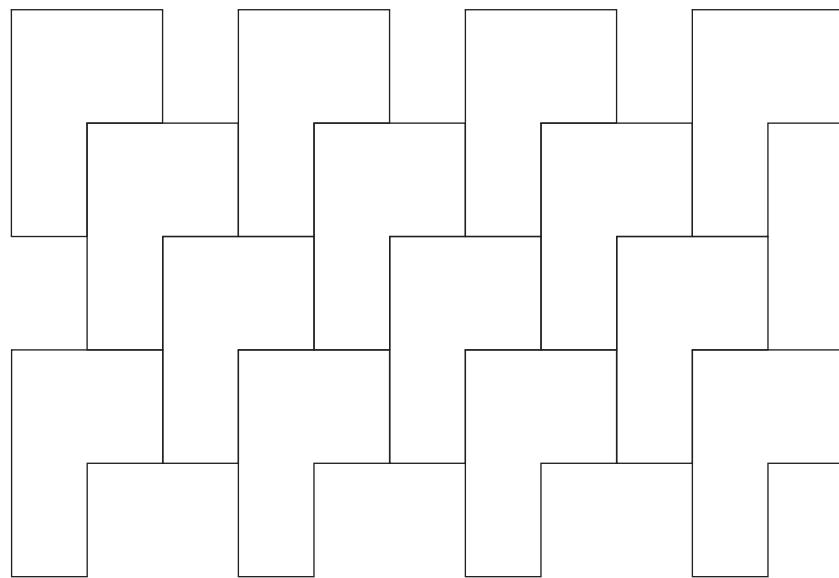
You will use it as a template to draw tessellations when you do questions 5 to 9.

5. (a) Put your template in the red position below, then rotate it to the yellow position.
(b) Translate the template from the yellow position to the blue position.

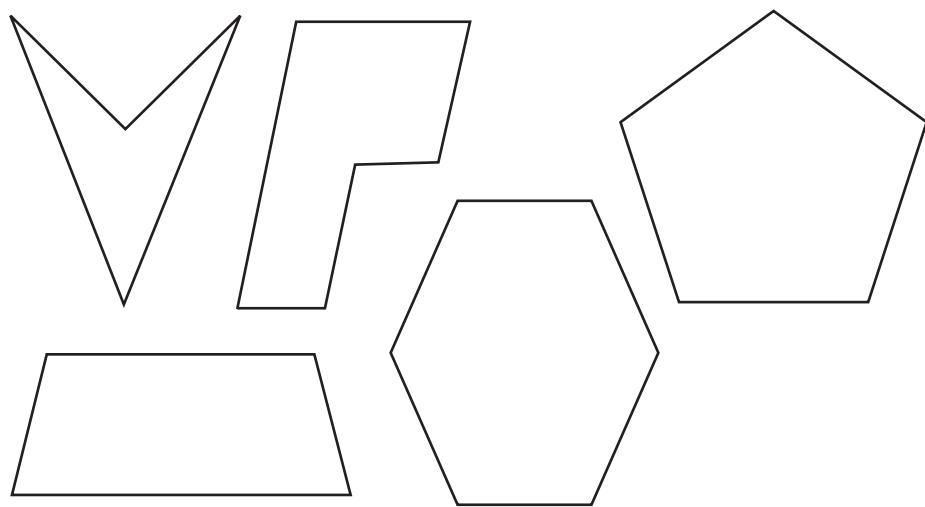


- (c) Continue to rotate and translate the template until you have covered all the hexagons in the tessellation.
6. (a) Can you draw the above tessellation by making rotations only?
(b) Can you draw it by making reflections only?
(c) Can you draw it by making translations only?
7. Can you draw the tessellation in question 2 by making rotations only with the quadrilateral template?

-
8. (a) Use your hexagon template to draw a copy of this tessellation.



- (b) In what way did you move the template to draw this tessellation?
9. Use reflections only to draw another tessellation with your hexagon template.
10. Select one of the figures below, make a template, and draw a tessellation if you can. Describe how you moved your template to draw the tessellation.



9.1 Making a geometric pattern

Mathume makes this interesting sequence of pictures. He makes each new picture by repeating the same steps.

- He starts with a square (Figure 1) and colours it.
- To make Figure 2, he first draws a square of the same size as Figure 1. He then connects the midpoints of the sides of the square to form a new smaller square inside the square and then he colours the smaller square.
- To make Figure 3, he again connects the midpoints of the sides of the new square as shown.
- He continues with these same steps to make more and more pictures.

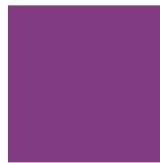


Figure 1

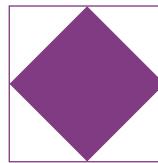


Figure 2

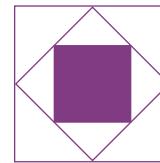


Figure 3

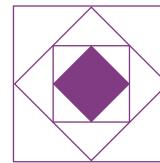


Figure 4

1. If we think of Figure 1 as the whole (1), what fraction of the whole figure is coloured in Figure 2? What fraction is coloured in Figure 3?
2. Complete this table to show Mathume's geometric sequence as a numeric sequence.

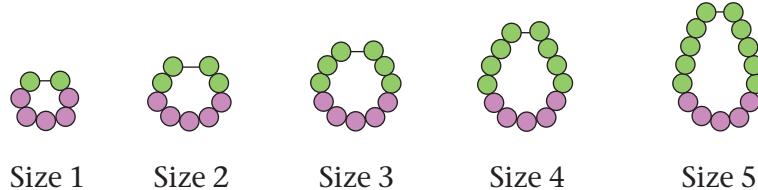
Explain your methods and discuss patterns in the table.

Figure no.	1	2	3	4	5	6	10
Fraction of figure that is coloured	1						

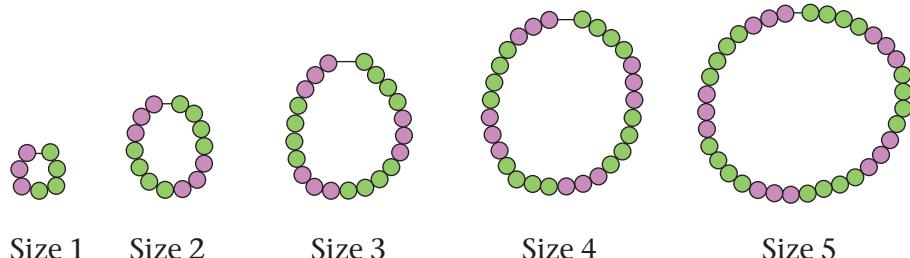
9.2 Describing patterns

Mandla makes these different patterns of bead necklaces of different sizes.

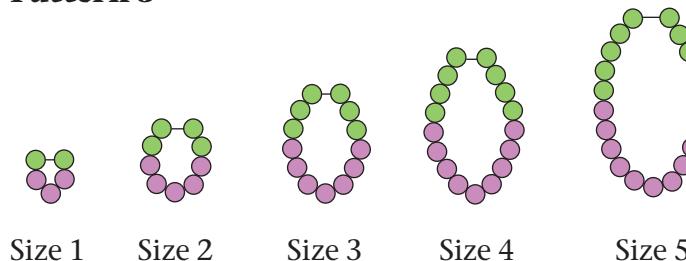
Pattern 1



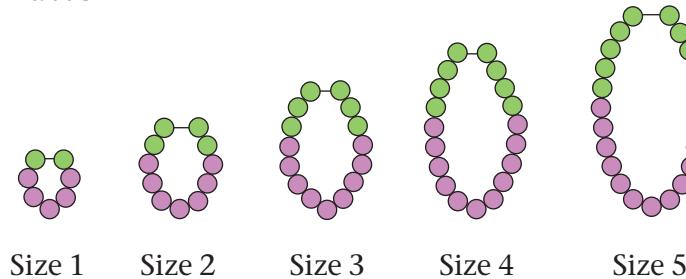
Pattern 2



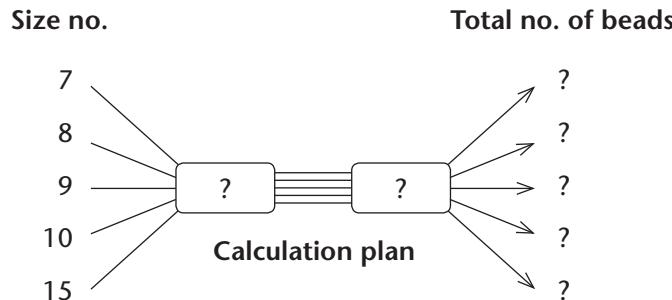
Pattern 3



Pattern 4



1. For Pattern 1:
- Describe a Size 6 necklace in words.
How many green beads, how many purple beads, and how many beads in total are there in a Size 6 necklace?
 - Describe a Size 20 necklace in words.
How many green beads, how many purple beads, and how many beads in total are there in a Size 20 necklace?
 - Complete this table. Describe and discuss your methods.
Describe and discuss what patterns you see in the table.
- | Size no. | 1 | 2 | 3 | 4 | 5 | 6 | \swarrow 20 |
|---------------------|---|---|---|---|---|---|---------------|
| No. of green beads | 2 | 4 | | | | | \swarrow |
| No. of purple beads | 5 | 5 | | | | | \swarrow |
| Total no. of beads | 7 | 9 | | | | | \swarrow |
- (d) Complete this flow diagram as a plan to calculate the total number of beads for different sizes of necklaces. Then calculate the missing output numbers.



- For Pattern 2, answer the same questions as for Pattern 1.
- For Pattern 3, answer the same questions as for Pattern 1.
- For Pattern 4, answer the same questions as for Pattern 1.

9.3 Completing tables

Look at this growing geometric pattern of triangles:



Figure 1

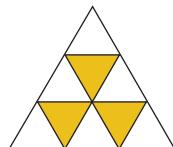


Figure 2

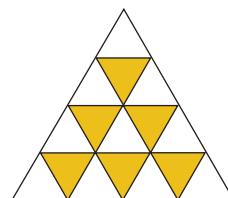


Figure 3

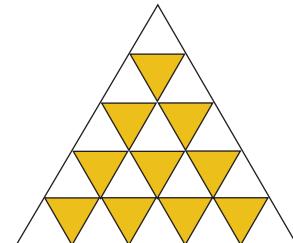


Figure 4

1. Complete this table. Describe and discuss the methods that you used.

Figure no.	1	2	3	4	5	6	10
No. of yellow tiles	1	3					
No. of white tiles	3	6					
Total no. of tiles	4	9					

2. Describe and discuss horizontal numeric patterns in the table.
3. How many triangles are there in total in Figure 50?

10.1 Solve and complete number sentences by trial and improvement

Here is a puzzle to think about:

Hundred minus three times a certain number is equal to four less than five times the number. What is this number?

Can this number be 5?

Mpho investigated:

$$100 - 3 \times 5 = 100 - 15 = 85$$

$5 \times 5 = 25$ and 4 less than 25 is **21**.

No, 21 is far less than 85!

1. Investigate whether the missing number in the puzzle can be 10.
2. Investigate whether it can be 20, or maybe 15.
3. Find out what the number is!
4. Find the number that will make this number sentence true:
 $100 - 3 \times \square = 5 \times \square - 4$
5. (a) Investigate whether any of the numbers 20, 10 or 5 will make this number sentence true:
 $4 \times \square + 7 = 6 \times \square - 9$
(b) For which of the three numbers you tried are $4 \times \square + 7$ and $6 \times \square - 9$ closest to each other?
(c) For which of the three numbers you tried is $4 \times \square + 7$ bigger than $6 \times \square - 9$?
(d) Investigate more numbers until you find the number that makes the number sentence true.
(e) Write ten different numbers for which $4 \times \square + 7$ is smaller than $6 \times \square - 9$. (We can also write $4 \times \square + 7 < 6 \times \square - 9$.)
(f) Write three different numbers for which $4 \times \square + 7 > 6 \times \square - 9$.

The work that you did in questions 1, 2 and 3 can be recorded in a table like this:

Number investigated	5	10	20	15	13
$100 - 3 \times \square$	85	70	40	55	61
$5 \times \square - 4$	21	46	96	71	61
Difference	64	24	(56)	(16)	0

6. When the number was increased from 5 to 10, the difference between $100 - 3 \times \square$ and $5 \times \square - 4$ decreased from 64 to 24.

(a) What happened to the difference when the number was increased to 20?

"To increase" means to make bigger and "to decrease" means to make smaller.

(b) What happened to the difference when the number was decreased again?

7. Try 5, 10 and other numbers until you find a number for which $40 + 3 \times \square$ is equal to $10 \times \square - 9$.

Record your work in a table like the above.

8. Try 1, 5 and 10 and other numbers until you find a number for which $5 \times \square - 12 = 4 \times \square + 12$.

Record your work in a table.

9. Try 2 and 100, and other numbers of your own choice until you find a number for which $3 \times \square + 50 = 5 \times \square - 70$.

10. In each case, find the number that makes the number sentence true.

(a) $3 \times \square + 100 = 5 \times \square - 20$

(b) $3 \times \square + 120 = 5 \times \square$

(c) $120 = 2 \times \square$

11. In each case, find the number that makes the number sentence true.

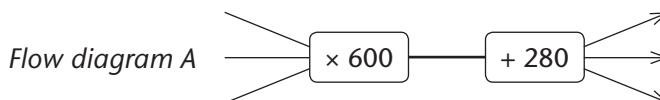
(a) $6 \times \square - 30 = 4 \times \square + 6$

(b) $200 - 3 \times \square = 5 \times \square - 56$

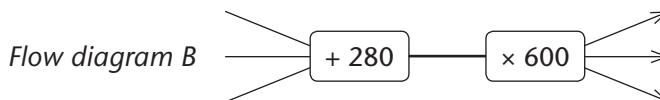
(c) $13 \times \square - 5 = 20 - 12 \times \square$

10.2 Flow diagrams, number sentences and tables

- What are the output numbers for the input numbers 5, 2 and 3 in Flow diagram A?



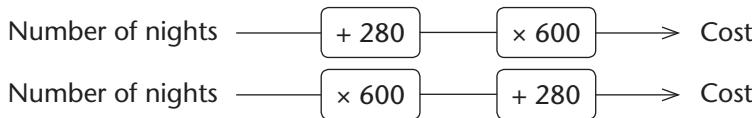
- What are the output numbers for the input numbers 5, 2 and 3 in Flow diagram B?



At the private hospital *Careplace* you have to pay R280 to be admitted, and then R600 for each night that you sleep there.

For example, Thabile was admitted to *Careplace* and stayed for three nights. She had to pay $R280 + 3 \times R600$ which is $R280 + R1\ 800 = R2\ 080$.

- How much do you have to pay if you are admitted to *Careplace* hospital and sleep there for two nights?
- How long was Ben in the hospital if he had to pay R2 080?
- Which of these flow diagrams show how the cost of staying at *Careplace* can be calculated?



Here is another way to describe how you can calculate the cost of staying in the private hospital *Careplace*:

Cost = $600 \times$ the number of nights + 280, or

Cost for \square nights = $600 \times \square + 280$

At *Goodcare* private hospital the admission cost is R100 and the rate for one night is R620.

7. Calculate the total cost for admission and accommodation at the *Goodcare* private hospital for
 - (a) 6 nights
 - (b) 12 nights
 8. Which hospital do you think is cheaper, *Careplace* or *Goodcare*? Explain your answer.
 9. Make a table like this to show the costs of staying in the *Careplace* or *Goodcare* hospitals. The costs for *Thulare*, a third hospital, are also shown in the table below.

Number of nights	1	2	3	4	5
<i>Careplace</i>	880	1 480	2 080		
<i>Goodcare</i>					
<i>Thulare</i>	960	1 460	1 960	2 460	2 960

6	7	8	9	10	11	12
3 460	3 960	4 460	4 960	5 460	5 960	6 460

10. When you have completed your table for question 9, look again at question 8 and at your answer. You may now give a better answer if you want to.
 11. (a) What is the admission fee and the daily rate at *Thulare*?
(b) Using a flow diagram or another method, describe how the cost of staying at *Thulare* can be calculated.

11.1 A coin-tossing experiment

- Imagine you toss a coin many times. You check every toss to see if it is “heads” or “tails”.
 - Write down what you think the results will be when you toss a coin 20 times.
 - How many “heads” do you think you will get if you toss the coin many, many times?
 - How many “tails” do you think you will get if you toss the coin many, many times? Explain why you say so.
- Work with a classmate to do the coin-tossing experiment. Record your results in a tally table.

Each of you must toss the coin 20 times. At the end you should have the result of your 20 tosses, and your classmate should have the result of his or her 20 tosses.

A coin has two sides. The “tail” side of a coin is the side that says what the coin is worth. The “head” side is the side with the country’s coat of arms. A coin toss has **two outcomes**, either “heads” or “tails”.

Frequency means how often a certain outcome has occurred; in this case, how many times you got “heads” and how many times you got “tails”.

	Tallies	Frequency
Heads		
Tails		

- What fraction of *your* 20 results is “heads” ($\frac{?}{20}$)? Did your experiment work out the way you thought it would? Explain why you say so.
- What fraction of *your classmate’s* 20 results is “heads” ($\frac{?}{20}$)? Do you think there is a problem with the experiment if your results are very different? Explain why you say so.

3. You recorded 20 tosses and your classmate recorded 20 tosses. Put your results together with those of two other classmates, so that you have the results of 80 tosses altogether.
- What fraction of the results is “heads”?
 - What fraction of the results is “tails”?
 - Are you surprised by the results? Explain why you say so.

11.2 Spinner Experiment 1

Make your own spinner

Look at the picture. Take a square piece of cardboard and make a hole in the centre. Put your pencil through the hole. Then make a dot or mark at the centre of each of the sides of the square.



Make sure you have paper to record your results in tally tables and to draw graphs.

Practise spinning your spinner properly at a fast speed. When the spinner stops and topples over, the dot on the side on which the spinner comes to rest gives the position of the spinner.

Fold a clean page in half, and crosswise in half again.

Open up the page. It now has *four* parts of equal size.

Mark the central point, that is, the point where the folds intersect. Colour two of the four parts red (or just write RED in them). Colour the other two parts blue (or just write BLUE in them).



Put your spinner on the central point of the page and spin it properly. Note whether the dot lands on a blue or a red part of the page. Spin the spinner 20 times. Each time write down the result of the spin (outcome) in a tally table.

-
1. Think about Spinner Experiment 1.
 - (a) Do you think the results could be influenced by where you place the spinner when you start to spin?
 - (b) Do you think your experiment could be influenced by how slow or fast you spin the spinner?
 - (c) Will it matter if the parts are coloured in such a way that the two red parts (areas) are next to each other and the two blue parts are next to each other?
Why do you say so?
 - (d) What are the possible outcomes of Spinner Experiment 1?
 2. Compare your data (that is, the results of Spinner Experiment 1) with that of other classmates. What fraction of the 20 spins in their experiments was RED?
 3. Work with the rest of the class.
Use the information in your tally tables to make a pictograph to show how many REDS each classmate got out of 20 spins.
 - (a) Draw a number line in your book that runs from 0 to 20.
Nobody will be able to get more than 20 REDS in 20 spins.
 - (b) As each learner says how many REDS he or she got, make a cross above that number.
 - (c) Write a short paragraph about the story of the graph.

Sometimes people think the number of RED results and the number of BLUE results must be the same in any experiment, because the page is divided into two equal parts. This is not true.

Only when we do an experiment with many, many spins can we expect to see *almost* the same number of RED and BLUE results if the page is divided into two equal parts. We cannot expect that in small experiments.

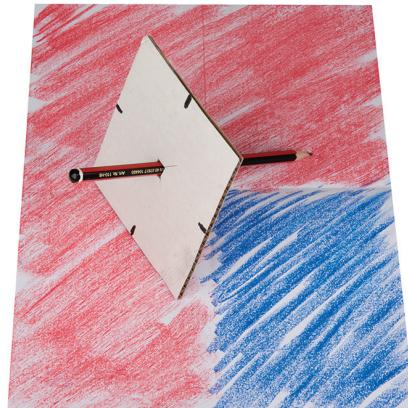
11.3 Spinner Experiment 2

Fold a clean page in half, and crosswise in half again. Your page now has four parts of equal size.

Open the page up and mark the point where the folds intersect.

Colour three of the four parts red (or just write RED in them).

Colour the remaining part blue (or just write BLUE in it).



1. Before you start, first think about the experiment.
 - (a) What are the possible outcomes of Spinner Experiment 2?
 - (b) Do you think the results will be similar to your results for Spinner Experiment 1? Why do you say so?
2. Now do Spinner Experiment 2. Put your spinner at the centre of the page and spin it properly. Note whether the dot lands on a blue or a red part of the page.

Spin the spinner 20 times. Each time record the result of the spin in a tally table.

 - (a) Combine your data with the data of four classmates so that you have 100 results.
 - (b) What fraction of the 100 results was RED? What fraction was BLUE?

