

# 1

## Running a nursery



“ My name is Meera. I have just completed my two-weeks’ work experience shadowing a worker at the local ‘Tiny Tots’ nursery. I spend my time caring for the babies and playing with the toddlers.

The owner, Sally, explained the business of running the nursery to me. I was surprised at how much of the maths I was learning is needed in Sally’s job.



### Talk about it

Is there a nursery near where you live?

Can anybody start a nursery for young children?

Does anybody you know send their children to a nursery?

Why do you think nurseries are inspected in addition to other types of school?

How much do you think it costs to send a child to nursery school?

What number skills would be important for people working in nurseries?

### These are the skills you will practise in this unit.

Which are the most useful for you? Tick the boxes.

- ☐ Using positive and negative numbers
- ☐ Calculating ratios and proportion
- ☐ Working out values using rules and formulae (in words and symbols)
- ☐ Working out one number as a fraction of another
- ☐ Working with percentages and percentage increase and decrease
- ☐ Finding percentage parts of quantities and measurements
- ☐ Using a calculator efficiently

#### Skill code

N1/L2.1

N1/L2.3

N1/L2.4

N2/L2.3

N2/L2.7

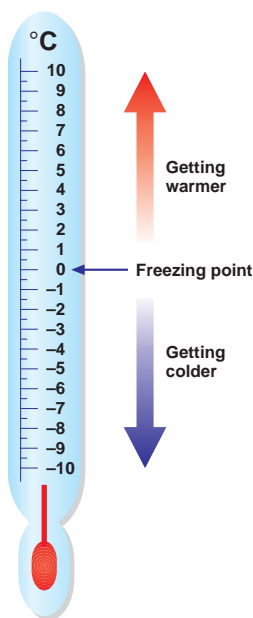
N2/L2.8

N2/L2.10

# Don't be negative

The children's milk should be kept at 5 degrees Celsius (5 °C). Higher temperatures allow bacteria to grow in the milk, which means that milk must be thrown away. Temperatures lower than 5 °C will make the milk too cold for the children to drink without feeling chilled. Below 0 °C degrees the milk will be frozen.

## Activity 1



The nursery refrigerator was faulty, so on Tuesday the assistant took some readings in degrees Celsius: 7, -4, 6, 0, -1, 2, 5, 1, -2.

- 1 a Use the thermometer to arrange the temperature readings in order from the coldest to the warmest.  
-4 ..... 7
- b List the temperatures which would lead to the milk being thrown away.  
.....
- c List all the temperatures which are at or below freezing point.  
.....

On Wednesday it was my turn to read the temperatures. These are my readings: 5, -3, 4, 7, -2, 6, 3, 0, 8.

- 2 a Arrange the temperature readings in order from the coldest to the warmest.  
.....
- b List the temperatures which would lead to the milk being thrown away.  
.....
- c Do you think the fridge is working better or worse than on Tuesday? .....  
Explain your answer .....  
.....

- 3 The older children are going to an adventure park. They will be able to go on the caterpillar ride if they are 70 centimetres (cm) or more tall.

The children's heights are given below:

Name	Height (cm)
Bethan	73
John	68
Leroy	71
Bharwinder	75
Raj	65
Zoe	63
James	70
Sally	81

- a Put the children in order of height, starting with the shortest.

Write their names and heights in the table.

Height (cm)	63			70				81
Child	Zoe			James				Sally
Difference from 70 cm	-7			0				+11

Below 70 centimetres the difference will be **negative**; above 70 centimetres the difference will be **positive**.

Zoe's difference is -7 because she is 7 cm below the minimum height (63 cm is 7 cm below 70 cm).

- b Complete the third row showing how many centimetres away from the 70 cm height barrier each child measures.
- c How many children will be able to go on the ride? .....

### Remember

- **Negative numbers** are less than zero. **Positive numbers** are greater than zero.
- -6 is smaller than -4 but 6 is bigger than 4.

### Review

Do you need more practice in working with negative numbers?

Yes ☐ No ☐

For more work on this, go to H1 (page 19).

# Keeping everything in proportion

Nurseries must have a minimum of two adults on duty. They must also meet the **ratios** for adults to children shown below.



Children	The ratio of the number of adults to children Adults:Children
Under 2 years	1 : 3 or 1 adult for every 3 children
Aged 2 years	1 : 4 or 1 adult for every 4 children
Aged 3–7 years	1 : 8 or 1 adult for every 8 children

There is 1 adult for every three children under 2 years old.

If the number of children is multiplied by 2 then there will be 6 children and they will need 2 adults (1 for every 3 children).

The ratio of adults to children is still the same, because  $1 : 3 = 2 : 6$ .

If the number of children is multiplied by 5, so there will be 15 children. They will need 1 adult for every 3 children, and so they will need 5 adults. There will then still be 1 adult for every 3 children

because  $1 : 3 = 5 : 15$

When comparing amounts, ratios are kept in the same order.

The ratio 1 : 3 is written with the number of adults first.

How many adults would the nursery need for 12 children under 2 years? .....

Write this as the ratio of adults : children .....

## Activity 2

- 1 Put a (✓) by the correct ratios for adults : children under two years (1 : 3) and a (✗) if the ratios are wrong.

a 3:9 ☐      b 3:2 ☐      c 10:30 ☐  
d 2:4 ☐      e 3:1 ☐      f 6:18 ☐

- 2 How many adults would you need for 8 children under 2 years?

Adult : children = 1 : 3  
= 2 : 6  
= 3 : 9

So 2 adults is only enough for 6 children.

This would not satisfy the legal requirement so ..... adults would be needed (there will be one spare place for a child).

- 3 How many adults would you need for 11 children under 2 years?

.....

- 4 How many adults would be needed for 16 children under 2 years?

.....

## Activity 3

As children get older fewer adults are required to supervise them. The ratio of adults to children aged 2 years is 1 : 4. Other ratios are equivalent to 1 : 4.

For example  $6 : 24 = 1 : 4$   
because  $6 : 24 = (1 \times 6) : (4 \times 6)$ .

Both parts of the ratio have been multiplied by the same number.

- 1 Calculate the missing numbers to make these ratios equivalent to 1 : 4. Fill in the boxes.

a 3 :       b 2 :       c  : 40      d 5 :       e  : 16.

- 2 The ratio for adults : children aged 3–7 years is 1 : 8.

Other ratios are equivalent to 1 : 8.

For example  $7 : 56 = 1 : 8$  because  $(1 \times 7) : (8 \times 7) = 1 : 8$ .

Calculate the missing numbers to make these ratios equivalent to 1 : 8.

a 2 :       b 10 :       c  : 32      d 5 :       e  : 24.



## Activity 4



Ratios can be used to help you to solve problems in scaling recipes.

If three bars of chocolate cost 90p, then one bar costs 30p.

Bars : Cost in pence

3 : 90

1 : 30 (divide 3 and 90 by 3 for the cost of 1 bar)

2 : 60 (multiply 1 and 30 by 2 for the cost of 2 bars)

10 : 300 (multiply 1 and 30 by 10 for the cost of 10 bars)

The price is in direct proportion to the number of bars.

But in real life, when you buy several of the same item, you may pay a lower price per item the more you buy. The ratio changes.

- 1 An assistant is preparing individual materials for children. It takes him 20 minutes to prepare materials for 5 children. How long will it take him to prepare the same materials for

1 child? .....

10 children? .....

8 children? .....

- 2 The children make biscuits. The nursery assistant needs to know how much of each ingredient they need.

The ingredients for 10 biscuits are 250 g flour, 100 g butter, 50 g sugar.

The ratio flour: butter: sugar = 250 g : 100 g : 50 g = 5 : 2 : 1

Complete the table.

Biscuits	Flour	Butter	Sugar
1	$250 \text{ g} \div 10 = 25 \text{ g}$	$100 \text{ g} \div 10 = \dots\dots\dots \text{g}$	$50 \text{ g} \div 10 = \dots\dots\dots \text{g}$
20			
4			
7			
5			
15			



- 3 The nursery assistant is using a new recipe for long-lasting salt dough, which the children will use to make models. Fill in the table for the missing ingredients.

Cups of flour	Cups of salt	Tablespoons of cooking oil	Cups of boiling water	Tablespoons of food colouring
2	1	1	2	1
4	2	2		2
6			6	3
	5			5
20			20	
	6	6		

- 4 One day when there were only 3 older children in the nursery Sally made soup for them. The next day all 9 children wanted to have it. Here is Sally's recipe for soup for 3 children. Write down the amounts needed for 9 children.

Ingredient	Measure for 3 children	Measure for 9 children
Onion	100 g	
Carrot	150 g	
Potato	80 g	
Tomato	50 g	
Water	400 ml	



## Review

Do you need more practice with ratios and proportion?

Yes ☐ No ☐

For more work on this, go to H2 and H3 (page 19).

This work links to mini-projects M2 and M3 (page 22).

## Formulae rule okay!

Sometimes you need to do the same calculation for different quantities. It is quicker to put the new numbers into a **rule** or **formula**. The rule for working out the total cost of packs of baby bottles is to multiply the cost of a single pack by the number of packs needed.

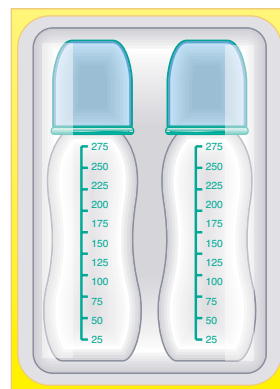
Each pack costs £3.

Let the number of packs be **n**.

Total cost (in £) = (the cost of each pack [£3]) × (number of packs)

$$T = 3 \times n \text{ or } T = 3n$$

so, the total cost of 6 packs is  $T = 3 \times 6 = £18$ .



### Activity 5

- 1 £11 is the charge for each session for a child aged 3–7 years to attend the nursery. The rule for the cost is (cost per session [£11]) × (number of sessions).

$$C = 11 \times n = 11n$$

Use the formula  $C = 11n$  to find the cost of the following numbers of sessions.

- a  $n = 10$ .  $C = 11n$ , so  $C = 11 \times 10 = 110$ . The cost of 11 sessions is £110.  
 b  $n = 8$  .....  
 c  $n = 7$  .....

- 2 The nursery nurse is making up different bottles of milk for the babies. She puts 5 scoops in each bottle.

- a Write down a rule, in words, for finding the total number of scoops for any number of bottles.

.....

Now choose suitable single letters for the **total number of scoops** and **number of bottles**.

is the total number of scoops.  is the number of bottles.

Write your rule as a formula (in symbols) .....

- b Use your formula to find the total number of scoops needed.

Number of bottles	Total number of scoops
20	
6	
13	



### Remember

A **formula** is a rule written in **symbols** (letters, numbers and signs).



## Activity 6

The nursery needs brightening up so Sally is going to stick new tops onto the tables. She wants to know which coverings she can afford. Therefore, she will need to know the size and area of each table.



The formula for the area of a rectangle is  $A = lw$  ( $A = l \times w$ ).

The children grow a lot while they are at nursery, so the tables are all rectangles of different sizes.

Use the formula for the area of a rectangle to work out the area in  $\text{cm}^2$ .

	Length	Width	Area = $A = lw = \text{length} \times \text{width}$
a	30 cm	20 cm	$A = 30 \times 20 = 600 \text{ cm}^2$
b	50 cm	35 cm	$A = \quad \times \quad \text{cm}^2$
c	42 cm	34 cm	$A =$
d	100 cm	65 cm	$A =$
e	80 cm	58 cm	$A =$

## Activity 7

On Monday the room looked much better and Sally asked me to buy edging to go round the play tables.

Meera used the formula  $P = 2(l + w)$  to work out the lengths of the perimeters.

Use the formula  $P = 2(l + w)$  to find how much edging needs to be cut to go around the play tables in the nursery.

	Length	Width	Perimeter = $P = 2(l + w) = 2 \times (l + w)$
a	30 cm	20 cm	$P = 2 \times (30 + 20) = 2 \times 50 = 100 \text{ cm}$
b	50 cm	35 cm	$P = 2 \times ( \quad ) = \quad \text{cm}$
c	42 cm	34 cm	$P =$
d	100 cm	65 cm	$P =$
e	80 cm	58 cm	$P =$

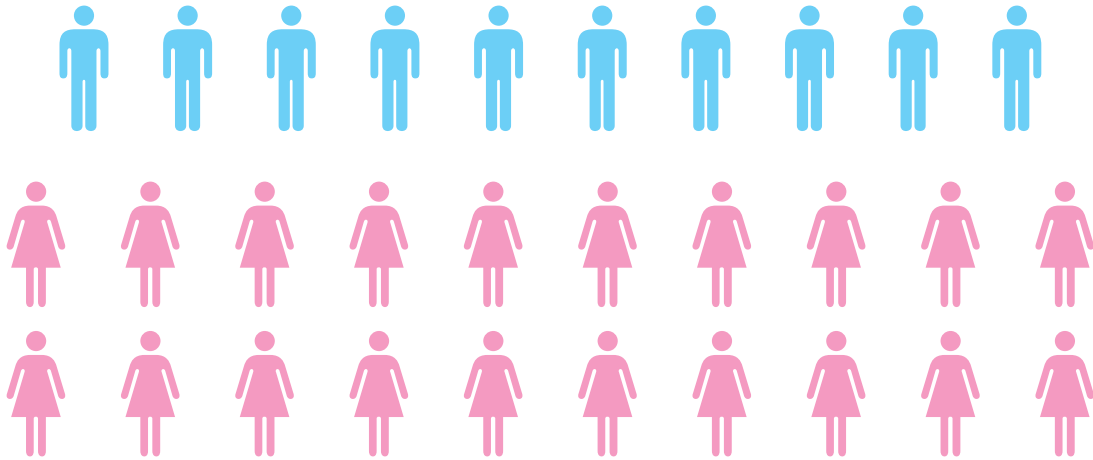
## Review

Do you need more practice using formulae?

Yes ☐ No ☐

For more work on this, go to H4 (page 19), H5 and H6 (page 20) and E1 (page 21).

# What fraction is it?



There are 30 children in the nursery.

The fraction of boys =  $\frac{\text{number of boys}}{\text{total children}} = \frac{10}{30} = \frac{1}{3}$  (divide top and bottom by 10)

The fraction of girls =  $\frac{\text{number of girls}}{\text{total children}} = \frac{20}{30} = \frac{2}{3}$  (divide top and bottom by 10)

We have 'cancelled' the original fraction to get a fraction in its simplest form.



## Activity 8

- 1 During a survey of nursery workers the following information was collected.  
Responses came from 15 men and 25 women.

How many people answered the survey? .....

a What fraction of the people who answered were men? .....

b What fraction of the people who answered were women? .....

The responses by age were: 16 to 24 years = 10

25 to 39 years = 16

40 to 60 years = 12

over 60 years = 2

What fraction of the people who answered were

c 16 to 24 years? .....

d 25 to 39 years? .....

e 40 to 60 years? .....

f over 60 years? .....

### Remember

Treat fractions and ratios alike, divide both parts by the same number.

$$\text{e.g. } \frac{15}{40} = \frac{15 \div 5}{40 \div 5} = \frac{3}{8}$$

2 Write your answers to these parts of question 1 in their simplest form.

a \_\_\_\_\_ = \_\_\_\_\_

d \_\_\_\_\_ = \_\_\_\_\_

b \_\_\_\_\_ = \_\_\_\_\_

e \_\_\_\_\_ = \_\_\_\_\_

c \_\_\_\_\_ = \_\_\_\_\_

f \_\_\_\_\_ = \_\_\_\_\_

3 The ratio of men: women is  $15:25 = 15 \div 5 : 25 \div 5 = 3:5$

Use the values in question 1 to write these ratios in simplest form.

a age 16 to 24: age over 60

.....

b age 40 to 60: age 25 to 39

.....

4 In the nursery there are

Age	Number of children
Under 2 years old	15
2 years old	9
3 to 7 years old	6

(although the older ones only come after school until they can be collected).

Work out these ratios in their simplest form.

a under 2: 2 years

.....

b age 3 to 7: under 2

.....

c age 3 to 7: total

.....

### Review

Do you need more practice in cancelling fractions and ratios?

Yes ☐ No ☐

For more work on this, go to H7 (page 20).

## Percentage amounts

*Sally is worried! She has heard that her electricity bill is going up by 9%. She has to keep the nursery warm so this is an important item in her accounts. She looks at all her electricity bills for the last year and works out that she paid £628.47.*



Meera and Sally did a quick check or estimate of the increase. They used 10% which is near enough 9% but easier to calculate, and £630.

$$10\% \text{ of } £630 = £630 \div 10 = £63$$

### Remember

To find 10% divide by 10.



### Activity 9

Sally wanted to know the exact figure, however, so she got the calculator out.

This is what she did to find 9% of £628.47.

9% is 9 hundredths of £628.47.

To find 1% (1 hundredth) she divided £628.47 by 100.

Then to find 9% (9 hundredths) she multiplied the answer by 9.

We put **6 2 8 . 4 7 ÷ 1 0 0 × 9 =** into the calculator.



Do this on your calculator and check that you get 56.5623.

How much extra will Sally have to pay in money?

£ ..... (to the nearest penny).

Sally's last quarterly bill was £58.63.

Write down what you would put into a calculator to work out how much an extra 9% will be .....

Check this answer before you go on.

For each question write down what you would put in your calculator before you work out your answer.

Julie, the nursery nurse, told me that babies gain 5% of their body weight each month.

1 These are the weights of the babies one month ago.

How much did the babies gain in the last month?

a John 6000 g .....

b Shafi 5500 g .....

c Sarah 7100 g .....

2 45% of a nursery class are boys. If there are 20 children in the class, how many are boys? .....

.....

3 Nursery nurses earn £9400 a year. They pay 27% of their earnings in stoppages including income tax, national insurance and pension contributions.

How much does each nurse pay in stoppages?

a Write down and work out a quick check or estimate.

.....

.....

b Work out the accurate value. ....

.....

4 The nursery changes the telephone company it uses and saves 7% on its bills. How much does it save on the following quarterly bills?

a £160 .....

b £87 .....

c £46.86 .....

d £69.27 .....

5 When she orders replacement furniture Sally has to pay a deposit of 12% of the cost. Work out the deposit Sally has to pay on these items.

Table £16 .....

.....

Bed £96 .....

.....

Chairs £48 .....

.....

Shelves £39 .....

.....

Cupboard £134 .....

.....



## Review

Do you need more practice in working out percentages?

Yes ☐ No ☐

For more work on this, go to H8 (page 20).

## More or less

Sally buys as much as possible in bulk (large amounts) because her suppliers give her a discount or decrease. This is usually given as a percentage of the cost.



At the Nursery Warehouse, Sally gets 6% off bills that come to £150 or more and 8% off bills that are £270 or more.

### Activity 10

1 Work out what Sally actually pays when her shopping comes to:

Total	% decrease	Working	Discount	Sally pays
£173.62	6	$\begin{array}{r} 6 \div 100 \times \\ 173.62 = \end{array}$	10.42	$173.62 - 10.42 = £163.20$
£226.49				
£281.37	8			
£321.18				

Buying in bulk causes problems! Now Sally needs more storage space so she needs to buy cupboards.

The prices of the cupboards are given without Value Added Tax (VAT). VAT is an extra 17.5%. (The nursery has to pay VAT now, but can claim it back at a later date.)

Meera and Sally could have used a calculator to work it out but they didn't have one with them so they had to do it this way.

Since  $17.5 = 10 + 5 + 2.5$  then  $17.5\% = 10\% + 5\% + 2.5\%$ .

One cupboard was £200 so 17.5% of £200 is  $£20 + £10 + £5 = £35$ .

The goods including VAT will now cost  $£200 + £35 = £235$  including VAT.

2 Use this way to work out the 17.5% VAT and the full price of these cupboards.

Cost	New price including VAT
a £300	.....
b £640	.....
c £150	.....
d £657	.....



## Tip

### Another way

- 5% increase means 5% more than the 100% price:  $100\% + 5\% = 105\%$  so this time you have to work out 105% of the original price.
- 5% decrease means 5% less than the 100% price :  $100\% - 5\% = 95\%$  so you can work out how much you have to pay directly by working out 95% of the original price.

So for a 6% reduction on the cost of a cupboard that costs £134, work out

$$100\% - 6\% = 94\%$$

$$\text{Reduced price} = 94\% \text{ of } £134 = \frac{94}{100} \times £134 = £125.96$$

$$\text{or } 134 \div 100 \times 94 = £125.96$$



## Activity 11

Choose either way to work out these questions on percentage increase and decrease.

- 1 The nursery workers are getting a 5% increase on their annual pay (p.a.). How much extra will these workers receive after their pay rise?
  - a Level 2 qualified staff earning £11 500 p.a. ....
  - b Unqualified assistants earning £8 800 p.a. ....
  - c Trainees earning £7 000 p.a. ....
- 2 A company offers 5% discount if the nursery pays for its goods in cash. Find the discount and new price for the following orders.

	Order	Discount	Price paid
a	Play equipment £400		
b	Nappies £60		
c	Food and drink £220		
d	Baby food £310		
e	Cleaning product £45		
f	Toys £146		
g	Nursery furniture £2350		

Check your answers using the other method.

## Talk about it

Which way do **you** prefer? Discuss the advantages/disadvantages of these methods in your group with your teacher.

It is good to have as many ways as possible to work out problems but remember that you can always use the way you like best.

Shops often offer  $\frac{1}{3}$  off in a sale, but sometimes they write it as  $33\frac{1}{3}\%$  off – it looks more. Whenever you see this, stick to the fraction which is easier to work out.

Here is an example.

$33\frac{1}{3}\%$  is the same as  $\frac{1}{3}$  and that tells you to divide by 3.

$12 \div 3 = 4$  so the discount is £4 and the teddy bear will cost  $£12 - £4 = £8$ .



## Activity 12

Work out the answers in this activity without using a calculator. All the percentages have easy fraction equivalents.

- 1 The toy warehouse is having a sale. It is decreasing the price of all its stock by  $\frac{1}{3}$ .

Find the reduction and the new price of the following toys.

	Reduction (£)	New price (£)
a Lego bricks £48	$48 \div 3 = £\dots\dots\dots$	$£48 - £\dots\dots\dots = \dots\dots\dots$
b Jigsaws £23.40	$\dots\dots\dots$	$\dots\dots\dots$
c Dolls £55.20	$\dots\dots\dots$	$\dots\dots\dots$
d Dressing-up outfits £108.75	$\dots\dots\dots$	$\dots\dots\dots$
e Sand and water toys £17.70	$\dots\dots\dots$	$\dots\dots\dots$
f Paints £13.62	$\dots\dots\dots$	$\dots\dots\dots$

- 2 The nursery is holding a summer fair. The pupils bring foods and other goods to be sold.

The staff decides to charge 50% or  $\frac{1}{2}$  of the usual cost of the goods.

Work out the prices they will charge for the following items.

a Cakes at 30p each	$\dots\dots\dots$
b Tea towels at £2.40 each	$\dots\dots\dots$
c Plants at £1.40 a tray	$\dots\dots\dots$
d Books at £0.80 each	$\dots\dots\dots$

- 3 At the end of the summer fair the staff reduced the goods by 20% of the fair price.

What will the items in question 2 cost after this further reduction (use the answers you found for 50%)?

Remember that 20% is the same as  $\frac{1}{5}$ .

a Cakes	$\dots\dots\dots$
b Tea towels	$\dots\dots\dots$
c Plants	$\dots\dots\dots$
d Books	$\dots\dots\dots$



- 4 Julie says that the visitors buying at the end of the fair are getting 70% off the original price of the goods. John says that it is only 60% off the original price. Who is right, Julie or John?

Original price	Price at 70% off	Price at 60% off
Cakes 30p		
Tea towels £2.40		
Plants £1.40		
Books £0.80		

Who is right? .....

Discuss this with your teacher.

- 5 Another nursery is increasing the cost of each term by 10%.

The old cost per term was £50 for one child.

- a How much will a term for one child cost after the increase in price?

.....  
 .....

- b How much will a term for two children cost after the increase in price?

.....  
 .....

- c But if two children from the same family attend then there is a 10% reduction off the new price. How much will a term for two children cost after the 10% discount?

.....  
 .....

- 6 The owner is writing to parents to inform them about the new prices. When she wrote about the 10% discount for two children, she typed 'the new charge will be 10% of the cost for two children' instead of 'the new charge will be 10% off the cost'. What difference does that make to the £110 cost for two children? Work out:

- a 10% of £110 = .....

- b 10% off 110 = .....

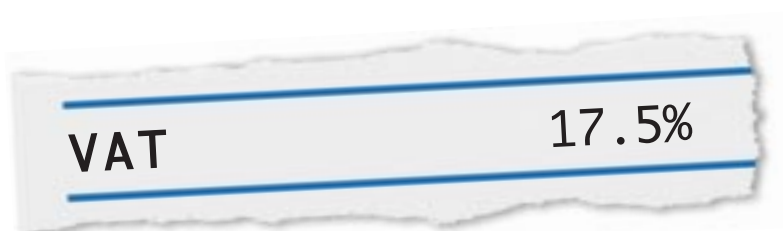
- c Explain your findings in words.

.....  
 .....  
 .....

## Talk about it

Discuss what you have found with others in your group and with your teacher.

- 7 When Sally took the minibus to the garage for a service, it cost £90. The mechanic said that he had added £17.50 on as VAT, charging £107.50 in total.



- a Check the calculation to see if what the mechanic did was right.

17.5% of £90 = .....

Cost inclusive of VAT = .....

- b Was the mechanic right or wrong? .....

Calculate the cost, inclusive of VAT, for the services costing these amounts.

Service cost

Service cost + 17.5%

- |        |       |
|--------|-------|
| c £200 | ..... |
|        | ..... |
| d £120 | ..... |
|        | ..... |
| e £60  | ..... |
|        | ..... |
| f £139 | ..... |
|        | ..... |

## Review

Do you need more practice in using percentages?

Yes ☐ No ☐

For more work on this, go to H8 (page 20) and E2 (page 21).

This work links to mini-project M1 (page 22).

## Activity H1

The children play in the playground when the temperature is above freezing (over  $0^{\circ}\text{C}$ )! Put these daily temperatures (in degrees Celsius) in order of size from the lowest to the highest.  $8^{\circ}\text{C}$ ,  $6^{\circ}\text{C}$ ,  $-1^{\circ}\text{C}$ ,  $-4^{\circ}\text{C}$ ,  $-3^{\circ}\text{C}$ ,  $1^{\circ}\text{C}$ ,  $0^{\circ}\text{C}$ .

- 1  $-4^{\circ}\text{C}$        $8^{\circ}\text{C}$
- 2 How many days did the children play in the playground?
- 3 How many temperatures are below  $1^{\circ}\text{C}$ ?
- 4 Write down the highest temperature?
- 5 Write down the lowest temperature?

## Activity H2

Write down four ratios equivalent to 3:1

- a       b       c       d

## Activity H3

A play area has to be covered with concrete (which is a mixture of sand and cement) in the ratio sand : cement is 4 : 1. Using this ratio find the missing values.

	Sand	Cement
1	20 kg	
2		25 kg
3		100 kg

## Activity H4

- 1 Use the formula  $T = 6n$ , where  $n$  is the number of packs of books, to find the total cost of buying the following number of packs of books at £6 a pack.

a 10 .....

b 4 .....

- 2 The cost of a session at the local nursery school is £15. The rule for the cost is (number of sessions)  $\times$  £15.

Write a formula for this rule .....

and use it to find the cost of :

a 6 sessions .....

b 10 sessions .....



### Activity H5

The nursery is replacing all the floor coverings and needs to work out the area for the man who will lay the flooring. Complete the table below.

	Length	Width	Area = length $\times$ width $A = lw$ (squared units)
1	4 m	3 m	$A =$
2	12 m	8 m	

### Activity H6

The decorator is putting borders around the rooms of the nursery. He needs to know the perimeter of each room. Complete the table below.

	Length	Width	Perimeter = 2 (length + width) = 2 (l + w)
1	15 m	10 m	$P =$
2	9 m	8 m	

### Activity H7

In a survey of 40 workers the responses by ethnic background were:

White	African-Caribbean	Indian	Pakistani	Other
20	10	3	5	2

What fraction of the workers were:

$$1 \text{ White} = \frac{\boxed{20}}{\boxed{\phantom{00}}} = \frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}}$$

$$2 \text{ African-Caribbean} = \frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}} = \frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}}$$

$$3 \text{ Pakistani} = \frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}} = \frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}}$$

$$4 \text{ Other} = \frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}} = \frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}}$$

### Activity H8

The nursery staff wants to buy a new TV and video recorder. They get two companies to give them prices. The recommended retail price is £660. Which shop should they choose? Explain your decision.







## Extension



### Activity E1

Some formulas are not in direct proportion because they have additional charges. This is the case with telephone, gas and electricity bills and when postage and packaging are paid on parcels. A telephone bill costs 2p per minute in calls plus €10 (1000 p) in line rental.

The rule is the **bill** equals two times the number of **minutes** plus 1000 pence

The formula is  $b = 2 \times m + 1000p = 2m + 1000$

The formula can be used to find the bill for 250 minutes of calls.

$b = 2 \times 250 + 1000 = 500 + 1000 = 1500p = £15.00$

- 1 The gas **bill** is made up of the cost for each therm used, at 35p a therm plus a rental charge of €34 (3400 p).
  - a The rule is .....
  - b The formula is .....
  - c Use the formula above to find the gas bill when 110 therms are used.  
.....



### Activity E2

When four friends went by car to an adventure park in Ireland they saw this notice.

- Entry to **ADVENTURE PARK** 70 euros per person
- Car park 50 euros
- 10% reduction in entry if tickets are purchased when buying a car-parking ticket.

- 1 How much should they pay in total?  
.....
- 2 The girl in the kiosk charged 290 euros, 50 for the car plus 4 tickets at 60 euros. Her boss was not happy. Why?  
.....



## Mini-projects



### Activity M1

Use the telephone directory and yellow pages to find out how many children's nurseries there are in your area.



### Activity M2

Contact the Early Years Section of your local authority. Ask them for information about running a nursery. They will be able to tell you about ratios of adults to children, the salaries of nursery staff and much more. Write a report on your findings and include graphs and calculations.



### Activity M3

You are planning a birthday party for Sarah's 4th birthday. There will be 20 children attending the party. She said that she would like:

- a birthday cake
- sweets
- crisps
- biscuits
- lots of sandwiches
- orange squash

Work out the amounts and cost of the party food, remembering to adjust the ratios in recipes for larger numbers of people.





# Check it



## Activity C1

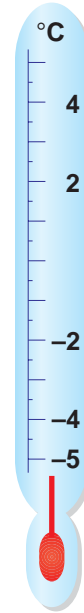
Write the following temperatures on the thermometer.

5 °C, -3 °C, 0 °C, -1 °C, 3 °C, 1 °C

Which temperature is colder -5 °C or -3 °C? .....

Water changes to ice at 0 °C and below. List the temperatures that would make ice.

.....



## Activity C2

I want to make a birthday cake for 20 children. The recipe makes enough cake for 5 children. Complete the table to find the amount of ingredients needed.

Ingredients	For 5 children	For 20 children
Flour	600 g	
Sugar	400 g	
Butter	400 g	
Eggs	3	



## Activity C3

The cost of a stamp is 22 pence. The rule for the cost of a book of stamps is

$$b = 22 \times s = 22s$$

Use the formula to find the cost of books of:

1 6 stamps ..... 2 10 stamps ..... 3 4 stamps .....



## Activity C4

1 Find three fractions that are equivalent to  $\frac{1}{5}$ .

a

b

c

2 Tick the fractions which are equivalent to  $\frac{2}{3}$ .

a  $\frac{6}{9}$

b  $\frac{40}{60}$

c  $\frac{9}{12}$

d  $\frac{10}{15}$



## Activity C5

**Quick ways** Complete these quick ways

A quick way of working out 10% is to divide by 10.

A quick way of working out 5% is to .....

A quick way of working out 2.5% is to .....

A quick way of working out 1% is to .....



Reduce these prices by the percentage given

Original price	% reduction	Working out	New price
£200	10%		
£700	5%		
£80	25%		
£150	1%		
£350	2%		



### Activity C6

Work out the VAT at 17.5% and the cost including VAT on the following goods.

Cost	10%	5%	2.5%	17.5%	Cost + VAT
£100					
£280					
£1200					
£80					



### Activity C7

Work out following percentage amounts.

- 1 a 6% of 700 cm      b 2% of 1500 m      c 43% of £400

.....

.....

.....

Children increase their height by 4% every month. Find the increase in one month for:

- 2 a Peter 1000 mm      b Li 800 mm      c Anya 600 mm

.....

.....

.....

### How am I doing?

Look back at the skills listed on page 1.

Now complete the sentences below.

I am confident with

.....

.....

I need more practice with

.....

Date .....



# Answers

## Activity 1

- 1 a  $-4^{\circ}\text{C}$ ,  $-2^{\circ}\text{C}$ ,  $-1^{\circ}\text{C}$ ,  $0^{\circ}\text{C}$ ,  $1^{\circ}\text{C}$ ,  $2^{\circ}\text{C}$ ,  $5^{\circ}\text{C}$ ,  $6^{\circ}\text{C}$ ,  $7^{\circ}\text{C}$   
 b  $6^{\circ}\text{C}$ ,  $7^{\circ}\text{C}$ ,  $10^{\circ}\text{C}$   
 c  $-4^{\circ}\text{C}$ ,  $-2^{\circ}\text{C}$ ,  $-1^{\circ}\text{C}$ ,  $0^{\circ}\text{C}$   
 2 a  $-3^{\circ}\text{C}$ ,  $-2^{\circ}\text{C}$ ,  $0^{\circ}\text{C}$ ,  $3^{\circ}\text{C}$ ,  $4^{\circ}\text{C}$ ,  $5^{\circ}\text{C}$ ,  $6^{\circ}\text{C}$ ,  $7^{\circ}\text{C}$ ,  $8^{\circ}\text{C}$   
 b  $6^{\circ}\text{C}$ ,  $7^{\circ}\text{C}$ ,  $8^{\circ}\text{C}$   
 c Check with teacher.

3 a,b

Height (cm)	63	65	68	70	71	73	75	81
Child	Zoe	Raj	John	James	Leroy	Bethan	Bhawinder	Sally
Difference from 70 cm	-7	-5	-2	0	+1	+3	+5	+11

c 5

4 adults are needed for 12 children (ratio 4 : 12)

## Activity 2

- 1 a, c and f ✓ b, d and e ✗  
 2 3  
 3 4  
 4 6

## Activity 3

- 1 a 12 b 8 c 10 d 20 e 4  
 2 a 16 b 80 c 4 d 40 e 3

## Activity 4

- 1 4 minutes, 40 minutes, 32 minutes.  
 2

Biscuits	Flour	Butter	Sugar
1	$250\text{ g} + 10 = 25\text{ g}$	$100\text{ g} + 10 = 10\text{ g}$	$50\text{ g} + 10 = 5\text{ g}$
20	500 g	200 g	100 g
4	100 g	40 g	20 g
7	175 g	70 g	35 g
5	125 g	50 g	25 g
15	375 g	150 g	75 g

3

Cups of flour	Cups of salt	Tablespoons of cooking oil	Cups of boiling water	Tablespoons of food colouring
2	1	1	2	1
4	2	2	4	2
6	3	3	6	3
10	5	5	10	5
20	10	10	20	10
12	6	6	12	6

- 4 Onion 300 g  
 Carrot 450 g  
 Potato 240 g  
 Tomato 150g  
 Water 1200 ml

## Activity 5

- 1 a  $C = 11 \times 10 = \text{£}110$   
 b  $C = 11 \times 8 = \text{£}88$   
 c  $C = 11 \times 7 = \text{£}77$   
 2 a Total number of scoops is equal to (the number of bottles)  $\times$  5 scoops.  
 T is the total number of scoops.  
 n is the number of bottles (learner's own choice of letter).  
 $(T = n \times 5 = 5 \times n = 5n)$

Number of bottles	Total number of scoops
20	$5 \times 20 = 100$
6	$5 \times 6 = 30$
13	$5 \times 13 = 65$

## Activity 6

- a  $(A = 30 \times 20 = 600\text{ cm}^2)$   
 b  $A = 50 \times 35 = 1750\text{ cm}^2$   
 c  $A = 42 \times 34 = 1428\text{ cm}^2$   
 d  $A = 100 \times 65 = 6500\text{ cm}^2$   
 e  $A = 80 \times 58 = 4640\text{ cm}^2$

## Activity 7

- $(P = 2 \times (30 + 20) = 2 \times 50 = 100\text{ cm})$   
 $P = 2 \times (50 + 35) = 2 \times 85 = 170\text{ cm}$   
 $P = 2 \times (42 + 34) = 2 \times 76 = 152\text{ cm}$   
 $P = 2 \times (100 + 65) = 2 \times 165 = 330\text{ cm}$   
 $P = 2 \times (80 + 58) = 2 \times 138 = 276\text{ cm}$

## Activity 8

- 1 40 people a  $\frac{15}{40}$  b  $\frac{25}{40}$   
 c  $\frac{10}{40}$  d  $\frac{16}{40}$  e  $\frac{12}{40}$  f  $\frac{2}{40}$   
 2 a  $\frac{3}{8}$  c  $\frac{5}{8}$  c  $\frac{1}{4}$  d  $\frac{2}{5}$  e  $\frac{3}{10}$  f  $\frac{1}{20}$   
 3 a  $10 : 2 = 5 : 1$  b  $12 : 16 = 3 : 4$   
 4 a  $15 : 9 = 5 : 3$  b  $6 : 15 = 2 : 5$  c  $6 : 30 = 1 : 5$

## Activity 9

Sally will have to pay £56.56 extra.  
 The quarterly bill increase is

5 8 . 6 3 ÷ 1 0 0 × 9 =

She will have to pay £5.28 extra a quarter.



- 1 a 300 g c 355 g  
b 275 g  
2 9  
3 a Check with your teacher.  
b £2538  
4 a £11.20 c £3.28  
b £6.09 d £4.85  
5 Table £1.92  
Bed £11.52  
Chairs £5.76  
Shelves £4.68  
Cupboard £16.08

### Activity 10

1

Total	% decrease	Working	Discount	Sally pays
£173.62	6	$6 \div 100 \times 173.62 = 10.42$ $173.62 - 10.42 = 163.20$	10.42	173.62 - 10.42 = £163.20
£226.49	6	$6 \div 100 \times 226.49 = 13.59$ $226.49 - 13.59 = 212.90$	13.59	226.49 - 13.59 = £212.90
£281.37	8	$8 \div 100 \times 281.37 = 22.51$ $281.37 - 22.51 = 258.86$	22.51	281.37 - 22.51 = £258.86
£321.18	8	$8 \div 100 \times 321.18 = 25.69$ $321.18 - 25.69 = 295.49$	25.69	321.18 - 25.69 = £295.49

- 2 a £30 + £15 + £7.50 = £52.50 £352.50  
b £64 + £32 + £16 = £112 £752.00  
c £15 + £7.50 + £3.75 = £26.25 £176.25  
d £65.70 + £32.85 + £16.43 = £114.98 £771.98

### Activity 11

- 1 a £12075  
b £9240  
c £7350  
2 a £380 e £42.75  
b £57 f £138.70  
c £209 g £2232.50  
d £294.50

Discuss the methods with the group.

### Activity 12

- 1 a £16 £32.00  
b £7.80 £15.60  
c £18.40 £36.80  
d £36.25 £72.50  
e £5.90 £11.80  
f £4.54 £9.08  
2 a 15p  
b £1.20  
c 70p  
d £0.40 or 40p  
3 a 12p  
b 96p  
c 56p  
d 32p

4

Original price	Price at 70% off	Price at 60% off
Cakes 30p	9p	12p
Tea towels £2.40	72p	96p
Plants £1.40	42p	56p
Books £0.80	24p	32p

John is right.

- 5 a £55  
b £110  
c £110 - £11 = £99  
6 a £11  
b £99  
c Explanations will vary but 10% of is equivalent to 90% off.  
This makes a difference of 80%.  
7 a £15.75, £105.75  
b Wrong  
c £235.00  
d £141.00  
e £70.50  
f £163.33 (to nearest penny)

### Help

#### Activity H1

- 1 -4 °C, -3 °C, -1 °C, 0 °C, 1 °C, 6 °C, 8 °C  
2 3  
3 4  
4 8 °C  
5 -4 °C

#### Activity H2

Any of the following 6:2, 9:3, 12:4, 15:5, 18:6 etc.

#### Activity H3

- 1 5 kg cement  
2 100 kg sand  
3 400 kg sand

#### Activity H4

- 1 a £60  
b £24  
2 C = 15n a £90 b £150

#### Activity H5

- 1 12 m<sup>2</sup>  
2 96 m<sup>2</sup>





### Activity H6

- 1 50 m
- 2 34 m

### Activity H7

- 1  $\frac{20}{40} = \frac{1}{2}$
- 2  $\frac{10}{40} = \frac{1}{4}$
- 3  $\frac{5}{40} = \frac{1}{8}$
- 4  $\frac{2}{40} = \frac{1}{20}$

### Activity H8

Murray's = £440; Techmatic = £462  
Murray's is better.

### Extension

#### Activity E1

- 1 a The rule is the bill equals 35 times the number of therms plus 3400p.  
b The formula is  $B = 35t + 3400$   
c  $b = 35 \times 110 + 3400 = 7250p = £72.50$

#### Activity E2

- 1 Correct charge is  $(£280 - £28 = £252 \text{ for entry tickets}) + £50 \text{ for the car} = £302$
- 2 Girl charged £10 less for each ticket instead of 10% less i.e.  $4 \times £60 + £50 = £290$ . Her boss would not have been happy that she charged £12 less than she should have.

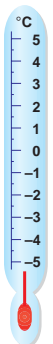
### Mini-projects

Check with your teacher.

### Check it

#### Activity C1

1



2  $-5^{\circ}\text{C}$

3  $-3^{\circ}\text{C}, -1^{\circ}\text{C}, 0^{\circ}\text{C}$

### Activity C2

Ingredients	For 5 children	For 20 children
Flour	600 g	2400 g = 2.4 kg
Sugar	400 g	1600 g = 1.6 kg
Butter	400 g	1600 g = 1.6 kg
Eggs	3	12

### Activity C3

- 1 132p = £1.32
- 2 220p = £2.20
- 3 88p

### Activity C4

- 1 Any fraction equivalent to  $\frac{1}{5}$  e.g.  $\frac{2}{10}, \frac{3}{15}, \frac{4}{20}, \frac{20}{100}$ .
- 2 Tick a, b, d.

### Activity C5

Quick ways can vary.

A quick way of working out 5% is to halve 10%.

A quick way of working out 2.5% is to halve 5%.

A quick way of working out 1% is to divide 10% by 10.

Original price	% reduction	Working out the reduction	New price
£200	10%	$£200 - £20$	£180
£700	5%	$£700 - £35$	£665
£80	25%	$£80 - £20$	£60
£150	1%	$£150 - £1.50$	£148.50
£350	2%	$£350 - £7$	£343

### Activity C6

Cost	10%	5%	2.5%	17.5%	Cost + VAT
£100	£10.00	£5.00	£2.50	£17.50	£117.50
£280	£28.00	£14.00	£7.00	£49.00	£329.00
£1200	£120.00	£60.00	£30.00	£210.00	£1410.00
£80	£8.00	£4.00	£2.00	£14.00	£94.00

### Activity C7

- 1 a 42 cm    b 30 m    c £172
- 2 a Peter 40 mm    b Li 32 mm    c Anya 24 mm