

# Mathematics lessons for Grade 5

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## Lessons in this section

1	Multiplication and division problems	111
2	Measuring angles	114
3	Area and perimeter problems	117
4	Line graphs	120
	Resource sheets for the lessons	123

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## Using these lesson plans

These sample lessons for Grade 5 are suitable for use with a whole class. The lessons are single examples to illustrate different teaching and learning activities. They are not intended to be taught as a sequence. They are drawn from different topics and points in the teaching year to show spread rather than sequence.

The objectives for the lessons are drawn from the standards for Grade 5. Occasionally, a standard from an earlier grade is revised. The relevant standards are shown in the lesson plans.

The lessons are organised in three parts: a starter to introduce the lesson, a main activity, and a final phase to help students to reflect on the lesson and consolidate their learning. Before the starter, you should outline the purpose of the lesson, drawing out for students what they will learn and how this builds on previous work. In the final part of the lesson, you will need to establish the key learning points, what students need to remember and what they will go on to learn next. There is no expectation that students should copy out the key learning points in their exercise books.

The lesson plans do not include homework tasks because the lessons are single examples taken out of sequence. You will need to provide this, since homework is an important part of a lesson.

Each lesson plan has enough material to support about 45 minutes of teaching. You may need to supplement the activities with simpler or more challenging tasks if the students in your class have a range of attainment. You could choose from activities in textbooks or from your own resources. If you wish, different tasks can be given to different groups of students, according to their needs.

There may be too much material in the lesson plan for 45 minutes, since this will depend on the class. In this case, you could designate one of the activities in the lesson as homework, or carry it forward to the next lesson. Be selective about which activity to cut – it does not have to be the last one merely because it comes at the end.

Answers to questions are provided to help you to correct students' responses and give feedback. Sometimes, alternative answers are possible that are equally correct.

# 5.1

## Multiplication and division problems

### Objectives

- Without a calculator, solve missing-number problems involving inverse operations.
- Identify and carry out the steps needed to solve a problem involving more than one step.
- Use a calculator for calculations involving several digits, including decimals, interpreting the display.

### Starter

#### Vocabulary

product  
problem  
calculation  
inverse

#### Resources

Mini-whiteboards  
Calculators  
OHP calculator  
OHT 5.1a

Show the first problem on **OHT 5.1a**.

*I multiply my number by 27. The product is 702. What is my number?*

Remind the class of the meaning of ‘product’. Ask students to write an equation that represents the problem.

Write on the board  $\square \times 27 = 702$ .

**Q What strategies would you use to solve this problem using a calculator?**

If necessary, prompt them about using inverse operations. Establish that:

$\square \times 27 = 702$  is equivalent to  $\square = 702 \div 27$ .

Demonstrate finding the answer on an OHP calculator. Check the answer by substituting it back in the box and confirming that  $26 \times 27 = 702$ .

**Q What if you had no calculator and did not know how to divide 702 by 27? What strategies would you use?**

Give students a couple of minutes to discuss their possible strategies in pairs. They should recognise that the units digits of the unknown number must be 6, since  $6 \times 7$  is the only multiple of 7 in the seven times table that ends in 2. Possibilities for the unknown number would be 16, 26, 36, 46, ... and so on.

Discuss some approximations for the product. For example,  $16 \times 27$  is less than  $20 \times 27 = 540$ , so 16 is too small.  $30 \times 27 = 810$ , which is too big. The unknown number must lie between 20 and 30 and so must be 26.

Check by multiplying 26 by 27, using a written method.

Give students the second and third problems on **OHT 5.1a** to solve using their calculators.

$1053 \div \square = 39$       $\square \div 19.2 = 14.5$

### Main activity

#### Vocabulary

factor

#### Resources

Calculators  
OHT 5.1a

Write on the board  $\square\square \times 8 = 14\square$ , or show the fourth problem on **OHT 5.1a**.

Explain that, unlike the previous problem, this time each box stands for a single digit, so that  $\square\square$  is a two-digit number.

**Q How would you explain the problem using your own words?**

Establish that the task is to find a two-digit number which, when multiplied by 8, results in a ‘one hundred and forty-something’ number.

**Q How could we begin to solve this problem?**

**Q What could the last digit of the three-digit number be?**

Establish that this digit can be only 0, 2, 4, 6 or 8, since a number multiplied by 8 must be even.

**Q What could the first digit of the two-digit number be? Could it be 5?** (no, the product would be at least 400) **Could it be 2?** (it is still too big, as  $20 \times 8 = 160$ )

Discuss ways of finding the answer by working systematically. For example, students could multiply every number between 10 and 19 by 8 in turn to see which one produces a solution.

**Q Is there another way of representing the problem in an equation?**

Prompt them to think of the inverse, and invite a student to the board to write:

$$14\square \div 8 = \square\square$$

By working systematically, they could try each of the numbers 140, 142, 144, 146, 148 to see which are divisible by 8. This second way involves fewer trials, so is preferable.

Ask students to use one method or the other to find the solution ( $18 \times 8 = 144$ ). Confirm that this must be the only solution because we have worked systematically through all the possibilities.

**Q What is the next multiple of 8 after 144? (152) And the multiple of 8 before 144? (136)**

Write on the board  $\square\square \times \square = 371$ , or show the fifth problem on **OHT 5.1a**. Ask the class to explain the problem in their own words. Confirm that they are looking for a pair of factors of 371, one two-digit and one single-digit number. Remind them that each factor will divide exactly into 371.

**Q How else could we write the equation?** ( $371 \div \square = \square\square$ )

**Q How could we begin to solve this problem?**

Establish that they might consider the possibilities for the units digits.

Ask students to work in pairs to find a solution to the problem. When they have a solution ( $53 \times 7 = 371$ ), invite a pair to the board to explain their method.

**Q Is this the only solution?** (yes)

**Q How do you know?** (the only possible pairs of units digits are 3 and 7, 1 and 1, or 9 and 9.  $371 \div 3$  is too big, as is  $371 \div 1$ , and  $371 \div 9$  is not a whole number)

Show the last problem on **OHT 5.1a**,  $(1 + \square) \times \triangle = 100$ . Explain that this time the boxes represent whole numbers, not digits.

**Q How would you explain the problem using your own words?**

Remind the class that the contents of the brackets are worked out first. The sum of 1 and  $\square$  is then multiplied by  $\triangle$ , to make a product of 100.

**Q How can we tackle this problem? What information can we use?**

Establish that  $\triangle$  is a factor of 100, and that  $(1 + \square)$  is the other factor, since factors occur in pairs. Draw the outline of a table on the board. Work through the pairs of factors of 100 and enter them into the table.

$1 + \square$	$\triangle$
100	1
50	2
25	4
20	5
10	10
5	20
4	25
2	50
1	100

$\square$	$\triangle$
99	1
49	2
24	4
19	5
9	10
4	20
3	25
1	50
0	100

Use the left-hand column of the first table to work out the possible values of  $\square$ , and the nine possible solutions to the problem.

Substitute a  $(\square, \triangle)$  pair into the original equation to check that the numbers work: for example,  $(1 + 19) \times 5 = 100$ .

On the board, write  $(3 + \square) \times \triangle = 100$ .

**Q Can you give me some answers to this problem?**

Collect answers. Draw out how the tables on the board also help to answer this problem.

**Q What other problems could we solve using our table?**

Note students' suggestions on the board. Make sure that  $(\square - 1) \times (\triangle + 2) = 100$  is included.

## Other tasks

If necessary, choose further related activities, selecting from available textbooks or your own materials.

## Consolidation

Invite pairs of students to the board to demonstrate their solutions to the problems that they have worked on in the lesson.

**Q Did anyone have a different way of tackling this problem?**

**Q Would your method be different if you had used a calculator?**

**Q Are there any other solutions?**

**Q How can you be sure that you have found all the solutions?**

### Summary for students

- When finding missing numbers, use the inverse operation to rewrite the equation.
- Look at the last digits to see if you can use your knowledge of number facts to eliminate possible values.
- Try out values that you can work out quickly in your head.
- Work systematically.

## 5.2

# Measuring angles

### Objectives

- Associate  $360^\circ$  with one whole turn,  $270^\circ$  with a three quarters turn,  $180^\circ$  with a half turn or a straight line, and  $90^\circ$  with a quarter turn or right angle.
- Estimate and compare the size of acute angles; use a protractor to measure acute angles in degrees and to draw a given acute angle.
- Use the labelling conventions for angles.

### Starter

#### Vocabulary

north  
south  
east  
west  
turn  
clockwise  
right angle  
degrees  
compass

#### Resources

OHT 5.2a

Remind the class that one whole turn is four right angles. Ask students to stand up and face north. Show them which direction it is and face north yourself. Tell them to follow your instructions and to copy you.

**Q Turn to face west. How far did we turn?** (a quarter turn, or a right angle)

**Q Turn clockwise to face east. How much did we turn that time?** (a half turn, or two right angles)

Repeat for some other turns, then ask the class to sit down. Say that turns are also measured using *degrees*. Write on the board: 1 right angle = 90 degrees =  $90^\circ$ . Explain that the symbol  $^\circ$  stands for degrees.

**Q How many degrees in two right angles?** ( $180^\circ$ )

Write on the board: 2 right angles =  $180^\circ$  (a half turn, or a straight line). Repeat for 3 right angles =  $270^\circ$ , and 4 right angles =  $360^\circ$ .

Sketch on the board an eight-point compass.

**Q Imagine turning from north to north-east. How many degrees would you turn?** ( $45^\circ$ )

**Q How many degrees are there between south-east and south-west? (90°)  
Between south and north-west? (135°)**

**Q Imagine facing north. Turn clockwise through two right angles. Which direction are you facing now?** (south)

**Q Imagine facing east. Turn clockwise through three right angles. Which direction are you facing now?** (north)

Show **OHT 5.2a** and guide the class through the problem.

### Main activity

#### Vocabulary

angle  
protractor  
acute  
obtuse

#### Resources

Rulers and protractors  
Blank OHT  
Mini-whiteboards  
OHT 5.2b  
Copies of Resource 5.2c

Place a transparent protractor on the projector. Tell the students that it is called a *protractor* and is used for measuring and drawing angles. Explain that it has two measuring scales: an inner one and an outer one. Each scale starts at  $0^\circ$  and ends at  $180^\circ$ , and is labelled in intervals of  $10^\circ$ . Point out the zero line, connecting the centre of the protractor to  $0^\circ$  on either side.

Display **OHT 5.2b**. Point to the first angle.

**Q Do you think that this angle is more or less than  $45^\circ$ ? Estimate its size.**

Record some of the students' estimates.

Demonstrate how to measure the first angle, explaining to the class what to do. Place the zero line on one arm of the angle, making sure that the protractor covers

the other arm. Slide the protractor along until the centre point is at the meeting point of the two arms of the angle. Use the scale that starts at zero on the first arm of the angle. Read the position of the other arm on the scale.

**Q What is the size of the angle?** (e.g.  $40^\circ$ )

Write  $40^\circ$  between the arms of the angle.

Repeat the process, measuring several different angles.

Give out copies of **Resource 5.2c**. Ask students to work in pairs. One student should measure the even-numbered angles and the other student the odd-numbered angles.

Students should then exchange sheets and check each other's angles.

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Show the class how to use a ruler and protractor to draw an angle of  $35^\circ$ , explaining what to do. Draw a short line about 7 cm long on a blank OHT, using a transparent ruler. Place the zero line of the protractor on the drawn line, with the centre of the protractor at one end. Call this end Y. Use the scale that starts at zero on the line. Mark the required angle with a point. Use the ruler to join the marked point to the point Y to form the angle.

Ask students to use a ruler and protractor to draw an angle of  $65^\circ$ .

Repeat with other angles.

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Draw an acute angle on the board, labelling its arms ABC. Tell the class that it can be referred to as angle ABC or angle CBA, reading from the end of one arm, to the meeting point of the two arms, to the end of the other arm.

**Q Is this angle more or less than a right angle? Estimate its size.**

Tell the class that angles less than  $90^\circ$  are called *acute angles*. Write *acute* beside the angle. Invite a student to measure it with a protractor.

Ask students to sketch another acute angle on their whiteboards.

Ask students who need more consolidation to use their rulers and protractors to draw angles of  $35^\circ$  and  $85^\circ$ . Then working with more able students, draw an obtuse angle on the board and label its arms.

**Q Is this angle more or less than a right angle? Is it more or less than two right angles?**

Establish that it lies between  $90^\circ$  and  $180^\circ$ . Tell the class that angles between  $90^\circ$  and  $180^\circ$  are called *obtuse angles*. Write *obtuse* beside the angle.

Ask the students to estimate the size of the angle and invite a student to measure it.

Ask the students to use a ruler and protractor to draw an angle of  $150^\circ$ .

Repeat with other angles.

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## Other tasks

If necessary, choose further related activities, selecting from available textbooks or your own materials.

## Consolidation

### Resources

OHTs 5.2d, 5.2e  
OHP protractor  
Mini-whiteboards

Display **OHT 5.2d**. Work through the questions with the class, inviting students to explain their reasoning.

Ask students to estimate the sizes of angles A, C, D and F, and to write their estimates on their whiteboards. Look out for students who forget to include the degrees symbol.

Invite individual students to the projector to measure these angles with the protractor in order to check the estimates.

Display **OHT 5.2e**. Work through the questions, asking students to explain their reasoning.

### Summary for students

- One whole turn is the same as four right angles.
- Angles that are less than  $90^\circ$  are called acute angles.
- Angles between  $90^\circ$  and  $180^\circ$  are called obtuse angles.

## 5.3

# Area and perimeter problems

### Objectives

- Find the perimeter or area of shapes formed from two or more squares or rectangles.
- Recognise that shapes with the same area can have different perimeters.
- Solve simple problems involving the area and perimeter of squares and rectangles.

### Starter

#### Vocabulary

wide  
long  
square  
perimeter  
area

Ask the class to imagine a single, square paving tile. The paving tile is 1 metre by 1 metre. Ask them to imagine 12 of the paving tiles placed in a line to make a long thin path.

**Q How long is the path? How wide is it?**

**Q What is its perimeter? What is its area?**

Next, ask them to think of a path two stones wide and 10 long.

**Q How many paving tiles would you need to make the path?**

**Q What would be the perimeter of the path? (24 m) And its area? (20 m<sup>2</sup>)**

**Q If you had 15 paving tiles, what square or rectangular pavements could you make? What if you had 25 paving tiles?**

Collect and discuss solutions.

### main activity

#### Vocabulary

identical  
tetromino  
pentomino  
symmetry  
area  
perimeter

#### Resources

cm squared paper  
Rulers  
Mini-whiteboards  
OHT 5.3a (two copies)  
OHT 5.3b

Say to the class:

**Q Imagine two identical 1-centimetre by 1-centimetre squares, side by side, joined by one edge. What is the area of the whole shape? (2 square centimetres) What is the perimeter of the whole shape? (6 cm)**

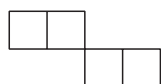
Ask the class to imagine adding a third identical square to the shape. Invite a student to the board to sketch the new shape.

**Q Does anyone have a different shape?**

Establish that there are two possibilities: three squares in a row and an L-shape.

**Q Which shape has the longest perimeter? (they are both the same)**

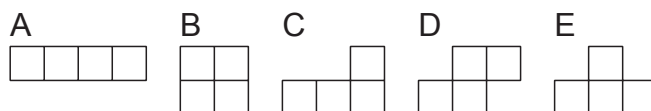
Ask students to work in groups of four. Give each student a piece of centimetre squared paper and ask them to draw secretly a shape made from four squares touching edge to edge. They should make sure that nobody else can see their shape. When they have drawn it they should turn over their piece of paper. Stress that the shapes must connect with each other along a whole edge, so that a shape such as this would not be acceptable:



In turn within the group, each student then describes their shape for the rest of the group to draw. When the three students have finished their drawings, they should compare these with the original shape.

Tell the class that the shapes made from four squares are called tetrominoes. Ask each group to cooperate and to draw as many different tetrominoes as they can. Tell them that just turning a shape around or flipping it over doesn't count as different.

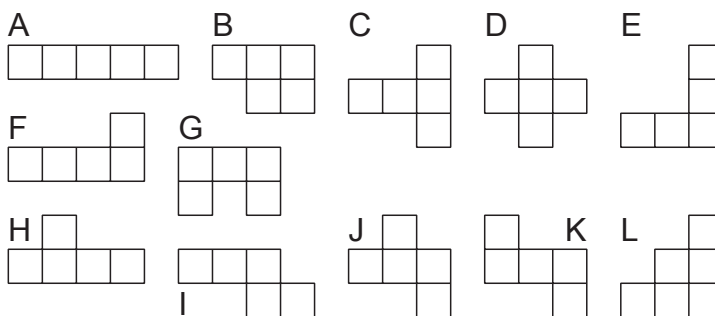
Display a copy of **OHT 5.3a**. Invite different students to come to the projector to draw a tetromino. Continue adding tetromino shapes until all five have been collected. Label the five shapes A to E. Discuss how to check the different possibilities by considering systematically adding one more square to the two shapes they made from three squares.



Ask the class to answer the following questions using their whiteboards.

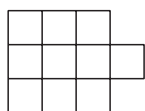
- Q What is the area of each tetromino?** (4 square centimetres)
- Q Which tetromino has the shortest perimeter?** (B)
- Q Which of the tetromino shapes have a line of symmetry?** (A, B, E) **Do any have more than one line of symmetry?** (A, B)

Repeat by asking the groups to make shapes from five identical squares (pentominoes). Remind students to be systematic and to think how they can use what they already know. Invite different students to add different shapes to another copy of **OHT 5.3a**. When they have run out of suggestions, display the top part of **OHT 5.3b** to show the complete set of 12 different shapes.

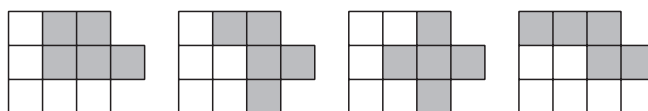


- Q What is the area of each pentomino?** (5 square centimetres)
- Q Which pentomino has the shortest perimeter?** (B)
- Q Which of the pentomino shapes have a line of symmetry?** (A, C, D, E, G, L) **Do any have more than one line of symmetry?** (A, D)

If any groups finish quickly, reveal this shape on **OHT 5.3b**.



Ask them to investigate the different pairs of pentominoes that will fit into this shape. There are four possibilities:



## Other tasks

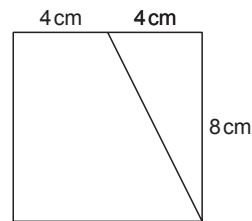
If necessary, choose further related activities, selecting from available textbooks or your own materials.

## Consolidation

### Resources

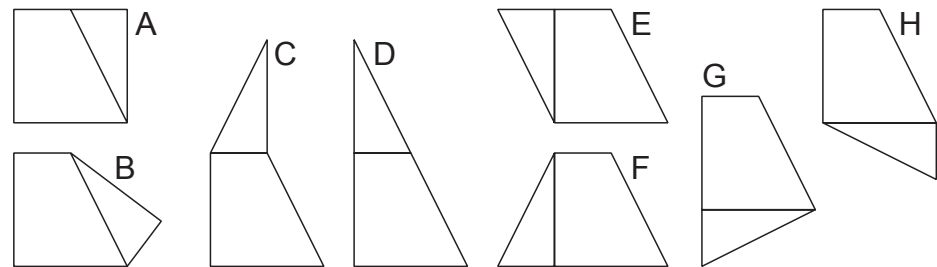
Squared paper  
Scissors

Give each student a piece of squared paper. Tell them that they will need their rulers. Ask them to use a ruler to draw an 8 cm by 8 cm square on the squared paper, and to join the mid-point of one side to the opposite corner. They should cut out the two pieces formed.



Working with a partner, they should put the pieces together, joining edges that are the same length.

**Q How many different shapes can you make? (8 including the original)**



**Q How do you know that you have found them all?** (each possible pair of matching edges has been joined in two ways)

**Q What is the same about all the shapes that you have made?** (they all have the same area) **How do you know?** (they were all made from the same original 8 cm by 8 cm square)

**Q Can you explain why the perimeter of shape B is the same as the perimeter of the original square?**

**Q Which shape has the smallest perimeter? (A and B) And the longest? (C and D) Why?**

Agree that as the shortest sides have been joined, the longest possible sides form the perimeter.

Ask students to use their rulers and to find out by measuring and calculating the length of the longest perimeter (just less than 42 cm).

### Summary for students

- Shapes with the same area can have different perimeters.
- Organise your work systematically.

# 5.4

## Line graphs

### Objectives

- Pose questions and answer them by collecting and analysing data.
- Represent a given set of data, or data from an experiment, in a line graph.
- Interpret line graphs in order to solve problems.

### Starter

#### Vocabulary

bar chart  
title  
horizontal axis  
vertical axis  
label  
scale  
gridlines

#### Resources

OHT 5.4a  
Mini-whiteboards

Show the bar chart on **OHT 5.4a**.

**Q What is this type of graph called?**

Confirm that it is a bar chart.

**Q What is missing from the bar chart?**

Establish that a title and labels on the axes need to identify what the graph shows.

**Q Suppose the horizontal axis shows the days of the week. What could the vertical axis show?**

Establish that it might be how many of something or how much of something related to each day of the week. Label the horizontal axis 'Days of week' and the individual bars 'Sun', 'Mon', 'Tue', 'Wed', 'Thu', 'Fri', 'Sat'.

Say that the bar chart in fact shows the number of people treated for minor injuries at a hospital on each day of the week. Invite a student to write a title for the chart. Say that the greatest number of people treated in a day was just over 70 people.

**Q What numbers should we put on the vertical scale?**

Identify the tallest bar and use it to establish that that the axis would be marked in intervals of 10. Invite a student to label the vertical axis and mark the gridlines in steps of 10.

Now ask students to estimate the number of people treated on each day of the week, and to answer using their whiteboards.

Erase the labels on the vertical axis and the title of the chart. Say that this time the bar chart shows the number of hours someone spent each day watching TV. Say that the greatest amount of time was just less than 4 hours.

**Q What numbers should we put on the vertical scale?**

Identify the tallest bar. Establish that that the axis would be marked in intervals of half an hour or 30 minutes. Label the vertical axis 'Hours watching TV' and mark every other gridline 0, 1, 2, 3, 4.

Ask students to estimate the number of hours and minutes the person spent each day watching TV.

### Main activity

#### Vocabulary

line graph

#### Resources

Copies of Resources  
5.4b, 5.4c  
OHT 5.4d

Give out copies of **Resource 5.4b**.

Say that some boys are going on a sponsored walk for charity. They will get QR 10 for every kilometre that they walk. This graph shows how much money the boys will raise, depending on how far they walk. Point out that the graph has two different scales: one horizontal (for the kilometres walked) and one vertical (for the money raised). It is called a *line graph*.

Say that one boy walked 6 kilometres. Show the class how to find 6 kilometres on the horizontal scale, to follow the gridline upwards to the graph, and then to read off the money that he raised by following a gridline sideways to the vertical scale.

Say that another boy raised QR 70. Show the class how to find out how many kilometres he walked by finding QR 70 on the vertical scale, following it sideways to the graph, and then reading off the kilometres by following a gridline downwards to the horizontal scale.

Repeat by finding out the amount raised for a walk of 9 kilometres, and the distance walked if the amount raised was QR 50.

Show the class how to read the graph when the amounts fall in between the gridlines, if necessary by using their rulers to guide them.

**Q Ahmed walked 7.5 kilometres. How much money did he raise?**

**Q Mohamed raised QR 35. How far did he walk?**

Invite a few students in turn to make up a question for other students to answer by reading the information from the graph.

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Give out copies of **Resource 5.4c**.

**Q What is this graph about? What does the horizontal axis show? What does the vertical axis show?**

Explain that on some graphs not all the gridlines are labelled. Get students to label the intermediate gridlines on the vertical axis.

**Q What was the temperature on 13 January? 17 January? 14 January?**

Explain that where a reading falls between two gridlines an estimate has to be made.

**Q Estimate the temperature on 16 January. (20.2°C or 20.25°C)**

Ask students to complete the rest of the questions working in pairs. Collect and go through responses, then ask:

**Q Estimate the change in temperature between 14 and 15 January. (2.75 degrees)**

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Show the line graph on **OHT 5.4d**.

**Q What do we call this type of graph?**

Say that it represents the cost of making a telephone call to Bahrein in the evening for up to 20 minutes. Write on the board: 'The cost for 10 minutes is QR 10'.

**Q What labels should we put on the axes?**

Establish that the horizontal axis represents the time in minutes and the vertical axis the cost in riyals. Invite a student to label the axes.

**Q How much time will each interval on the horizontal axis represent if the phone call lasts for 20 minutes?**

Using the students' suggested step sizes, count along the horizontal axis with the class. Establish that each interval is worth 2 minutes. Invite a student to label each gridline along the horizontal axis.

Remind the class that the cost for a 10 minute phone call is QR 10. Identify the point on the graph that represents 10 minutes costing QR 10.

- Q What would be the cost for a 20 minute phone call? (QR 20)**
- Q Which point on the graph represents 20 minutes costing QR 20? (the highest point at the top right)**
- Q How much will each interval on the vertical axis represent?**

Establish that there are eight intervals for the QR 20, so that each interval represents QR 2.50. With the class, count up the vertical axis to check, and label the gridlines.

Use the graph to ask questions about the cost of phone calls, for example:

- Q How much does a 12 minute phone call cost? A 7 minute phone call?**

Remind students how to read the information, working from the horizontal axis, to the graph, to the vertical axis.

- Q How long were you talking on the telephone if your call cost QR 12.50?**

This time make sure that students can read the information transferring from the vertical axis to the horizontal axis via the graph.

## Other tasks

If necessary, choose further related activities, selecting from available textbooks or your own materials.

## Consolidation

### Resources

Resource 5.4e

Give out copies of **Resource 5.4e**. Ask students to work through the questions in pairs.

Go through the questions, inviting individual students to describe how they worked out the answer.

### Summary for students

- There are two scales on a line graph. The line shows the relationship between the values on one scale and the values on the other.
- Make sure that you understand the values that the scales represent before you answer questions about line graphs.