

# Using maths at work

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**Clocking In to Clocking Out**  
**Improving workplace basic education**

*Published by:*

**FÁS**

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*Produced by:*

DV Fulfilment, Print & Graphics Solutions

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**ISBN: 1-871737-86-9**

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## ***Vocabulary***

**Absorbed**

**Additions**

**Approximate**

**Assessing**

**Bar chart**

**Column**

**Cylinder**

**Data**

**Decimal point**

**Deducted**

**Estimate**

**Expenditure**

**Expenses**

**Formulae**

**Heat**

**Height**

**Horizontal axis**

**Income**

**Intuitive**

**Length**

**Metric unit**

**Number sense**

**Overheads**

**Parallel lines**

**Pay**

Net pay

Payslip

Pay period

**Profit**

**Released**

**Standard margins**

**Survey**

**Tax Credit Certificate**

**Technique**

**Temperature**

**Tessellation**

**Themes**

**Title**

**Vertical axis**

**Volume**

**Wage**

Basic wage

Gross wage

**Wear and tear**

**Weight**

**Width**

## Developing your mathematical eyes

Every adult uses mathematics and comes up with ways to solve their own everyday mathematics problems. This 'everyday' mathematics can be quite complicated. However, most people underestimate their mathematical abilities because they think what they do is just common sense.

Developing your mathematical eyes allows you to see the different types of mathematics that you do everyday. It also helps you understand that mathematics is more than the skills and **formulae** you might have learnt at school. To help you develop your mathematical eyes, it is useful to think about the following 5 mathematical **themes**.

<b>Quantity and number</b>	Notice all the things that relate to number in everyday life, for example, prices, car registration numbers, bus numbers and telephone numbers.
<b>Space and shape</b>	Notice all the different shapes that make up our everyday world, for example rectangular windows, round wheels, square tiles, spherical balls, boxes, and pipes ( <b>cylinders</b> ).
<b>Data handling and chance</b>	Notice all the information around you and how you can interpret it, for example, notice the price of petrol going up or down. You might look at sports results and place bets. You might follow the results of a <b>survey</b> . You often see information presented in charts, tables and graphs.
<b>Patterns and relationships</b>	Notice the patterns that surround us in our daily lives, for example road markings, window panes, railings, tiles and floor coverings.
<b>Problem solving</b>	Notice the range of everyday problems you solve such as getting to work on time. To do this you have to estimate how long the journey will take. You also have to take into account how heavy the traffic will be. You have to allow enough time for other jobs like taking children to school or getting petrol.

## ***Try it out***

### **Picture problems**

**Look at the pictures and discuss them with your group.**

What are the pictures of? Where do you think they were taken?



Picture A



Picture B

### **Use your mathematical eyes**

**Look at the pictures again and discuss all the mathematics you can see.**

Remember to consider each of the 5 themes.

Things to think about:

#### **Picture A**

1. What shapes can you see? Name as many as you can.
2. What is the pattern of the paving?
3. What do you notice about the trees?
4. Estimate how long a paving stone is (hint: use the man's foot).

#### **Picture B**

1. How many cakes are there?
2. How many have been sold?
3. Can you see any patterns? **Parallel lines?**

## Extension activities



### At home

Look around your home with mathematical eyes. Share your newly developed eyes with family and friends.



### At work

Think about your own job and list all the mathematics you do at work. Compare the mathematics you do in your job with what your colleagues do.



### Computer skills

Look up mathematics pictures on the Internet. Explore some sites that deal with **tessellation** (making patterns).



### Writing

Keep a diary of all the mathematics you do during a particular day. Take pictures of the mathematics you see during your day.



### Design

Design and write a leaflet for a guided walk in the area where you live. Design it to make the readers use their mathematical eyes.



### Talk about

What mathematics do you remember from school? What type (or theme) of mathematics was it? How does it relate to your everyday life now?



## Number sense and estimating

Everyone has heard of common sense, but did you know that everybody has number sense as well? **Number sense** is an **intuitive** feel for numbers and their relationships. Think, for example, about the size of a gram compared to a kilogram.

Number sense is part of everyone's daily mathematical lives. It slowly grows and develops over time. Your ability to **estimate** depends on your number sense. To be good at estimating you must have a good number sense. You must also understand the difference between, for example, grams and kilograms, metres and kilometres, millilitres and litres.

Estimating is a key skill in mathematics and in everyday life. When you estimate, you find an **approximate** answer, rather than an exact answer. To be able to estimate you need two different skills. First, you use **techniques** like rounding up or down. For example:

Exact:

Mary's new jumper  
cost €49.95

Estimate:

Mary's new jumper  
cost almost €50



The second skill, which is harder, is recognising how accurate you have to be. For example, if you are buying a new door, it is important that you have the exact measurement of the door rather than an approximate measurement.

When people estimate, they use a range of words that tell you they are not being exact. These words include *'nearly', 'almost', 'about', 'just over', 'just under', 'approximately', 'a little bit less than', 'a little bit more than'*.

### An interesting fact

It takes about 12 days for a million seconds to pass but nearly 32 years for a billion seconds to pass.



## ***Try it out***

### **Estimate**

**Work with a partner and write estimates for these questions.**

Use only **metric units**.

1. How far is it from the front door of this building to this room?
2. How much does an egg weigh?
3. What is the temperature of the room today?
4. How far is it from Donegal to Killarney?
5. How long is a matchstick?
6. How high is the ceiling?
7. What is the weight of a bucket of water?
8. If everyone in the room lay head to toe, how far would we stretch?

### **Share and compare**

**Talk together about how you made your estimates.**

1. What did you need to know in order to estimate the answers? Knowledge of units? The length of other things so that you could compare?
2. Did you learn any new tips to help you estimate the answers?
3. What calculation skills did you use? (  $+$ ,  $-$ ,  $\times$ ,  $\div$  or comparisons)
4. How could you check your answers?
5. Did the exercise help you develop your number sense?

## Extension activities



### At home

What estimations do you do every day at home? In which situations do you have to be exact?



### At work

What estimations do you do every day at work? In which situations do you have to be exact?



### Using numbers

Estimate different **weights, lengths, volumes** and check out how accurate you are.

Draw a number line and put these numbers onto the line to see their relative size.

	10	100	
1,000		10,000	100,000
	one million		one billion



### Writing

Write sentences that include the words we use when we estimate.



### Find out

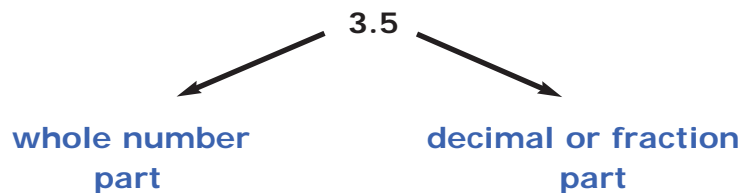
Estimate what year it was a million hours ago.

Estimate what year it was a billion minutes ago.

Now find out the answers.

## The important point

The **decimal point** is used to separate the whole number from the decimal (or fraction) part of a number, for example



Sometimes things just don't make sense if there are no decimal points. Look at the sentences below. Notice the difference a decimal point makes.

1. Patrick is 18m tall.  
Patrick is 1.8m tall.
2. My new baby daughter was 25kg when she was born.  
My new baby daughter was 2.5kg when she was born.
3. It takes about 35 hours to travel from Cork to Dublin.  
It takes about 3.5 hours to travel from Cork to Dublin.
4. You can tune into RTÉ Radio 1 on 891FM.  
You can tune into RTÉ Radio 1 on 89.1FM.
5. Fred's new suit cost €14995.  
Fred's new suit cost €149.95.

In the workplace, errors in placing the decimal point can be costly. However, deciding where the decimal point goes usually only requires common sense. The best approach is to concentrate only on what the whole part is most likely to be.

## An interesting fact

In Ireland and the United Kingdom the decimal point is written as a full stop . .

Example: 1.8m or 2.5kg.

In other countries in Europe it is written as a comma , .

Example: 1,8m or 2,5kg.

## Try it out

### True or false

Read the sentence and tick True or False.

Check with the information sheet if you need to.

	True	False
1. Sean bought a 15kg chicken to cook for Sunday lunch.	<input type="checkbox"/>	<input type="checkbox"/>
2. Rosemary's baby's temperature was 395°C.	<input type="checkbox"/>	<input type="checkbox"/>
3. Susie is 40 years of age and weighs 5.5kgs.	<input type="checkbox"/>	<input type="checkbox"/>
4. The temperature of a freezer is about -15°C.	<input type="checkbox"/>	<input type="checkbox"/>
5. The local shop is only 2 kilometres from the village.	<input type="checkbox"/>	<input type="checkbox"/>
6. A broadband package costs around €49.95 per month.	<input type="checkbox"/>	<input type="checkbox"/>
7. Donal lifted the 2.5kg weight with one hand.	<input type="checkbox"/>	<input type="checkbox"/>
8. The tallest man in the world is 2.57m in height.	<input type="checkbox"/>	<input type="checkbox"/>

If you think a statement is false, write it again so it is true.

.....

.....

.....

.....

.....

.....

## Extension activities



### At home

Look around your home for numbers. Where is the decimal point used? For example, look at medicine bottles or the content labels of food items.



### At work

Look at your payslip and notice where the decimal point is used. If the decimal points were in different places, how much difference would this make to you?

### Using numbers

Change the position of the decimal point and write out in words the new numbers you can make.



Take measurements of the things around you, the building you are in and even yourself. Use **metric units**. What are the different ways you can say and write the lengths, **heights**, **widths** or weights by putting in or taking out the decimal point? For example, you can write 1m 50cm or you can write 1.5m.



### Writing

Find a short article in a newspaper or magazine. Change the decimal point in the numbers. What effect does this have on the outcomes of the story? Rewrite the article in your own words.



### Find out

Find out how people in different countries use the decimal point and how they label things. Find out if other countries have different ways of using numbers in signs, for example road signs or parking signs.

## ***Payslips made simple***

Your **payslip** gives you a few pieces of information. It lets you know that you have been paid. It gives you details of your **basic wage**. It gives you details of any additional money you have earned. It also shows you any money that has been taken off or **deducted** at the end.

### **Additions to your basic wage**

Your basic wage is the wage you get for working a normal week or month before any **additions**.

On top of your basic wage, you may receive overtime pay or other bonus payments. These additions are added on to your basic wage. All the money you have earned in a payment period before any money is taken off is known as your **gross wage**.

### **Deductions from your wage**

Deductions are payments taken off your wage. You must, for example, pay tax by law. This tax is called PAYE (Pay As You Earn). It is deducted from your wage. The amount of tax you pay will depend on how much you earn.

You must also pay PRSI (Pay Related Social Insurance).

You might also be making payments into a pension scheme. A pension scheme allows you to invest some of your earnings for your retirement. If you are paying into a pension scheme, the amount will be deducted from your weekly or monthly wage. This will be shown on your payslip. Another deduction might be a weekly or monthly payment to a trade union.

The money you have left, after deductions, is your **net pay**.

## Try it out

Look at the payslip and answer the questions.

EMPLOYER NAME:		Money Bags			
EMPLOYEE NAME:		Gerard Fitzgerald		PPS NO:	1234567G
WEEK NO:		30		DATE:	25/07/08

PAYMENT DETAILS		DEDUCTION DETAILS		SUMMARY OF PAY	
Basic Wage	400.00	PAYE	46.00	GROSS PAY	450.00
Overtime	50.00	PRSI	20.72		
		Pension	20.00		
				TOTAL DEDUCTIONS	86.72
				NET PAY	363.28

- What is Gerard's basic wage?

.....

- What is Gerard's gross wage?

.....

- List the deductions.

Description

Amount

.....

.....

.....

- Which is bigger, the total deductions or the overtime earned?

.....



## Extension activities



### Talk about

Why do we pay tax? What tax amounts are there? What do you think the government should be doing with our tax? Apart from income tax, what other ways are we taxed?



### Find out

Early in each new year, your local tax office sends you a notice about your personal tax credits. Look at your own **Tax Credit Certificate** and see what tax credits you have. Go to the Irish Revenue Commissioners website at [www.revenue.ie](http://www.revenue.ie) and check if you are entitled to any other tax credits.



### At work

Look at your own payslip. Notice your basic wage, any additions to your basic wage and the tax you paid. Do you know how to check that it is all accurate? If you needed to query it, who should you talk to?



### Computer skills

Set up a payslip on a spreadsheet with the formulae for additions and deductions. Investigate how much net pay a person might get in different situations.



### Using numbers

Weeks and months are marked as **pay period** on your payslip. Look at Gerard's payslip on page 14. Does he get paid by the week or by the month, and what pay period is it? Are you paid weekly or monthly in your work, and what pay period are you in?



### Writing

Produce a glossary of words and abbreviations related to a payslip. Check out exactly what they mean.

## Costing a job

In the business world, costing a job is essential. Costing a job means calculating exactly how much the business will spend on doing the work. It is important because if a business doesn't cost a job correctly it may not make a **profit**. Even worse, it may lose money. Costing a job means calculating exactly how much the business will spend on doing the work. When it knows the costs, the business can make sure that the money it gets from the job (the **income**) is more than the costs (or **expenditure**).

If you want to work out the cost of a job, you need to think about much more than the time it is going to take and the labour costs. You also need to think about the cost of materials and also the **overheads**. Overheads include **expenses**, such as rent, insurance and electricity, and also **wear** and **tear** on equipment and furniture. Overheads are the unseen expenses that a company must pay for in its day-to-day operations.

So if you want to cost a job, you need to think about:

Materials	The cost of the materials, including VAT and wastage
Expenses	Examples are rent, heating, lighting, advertising, postage and insurance
Wear and tear	The upkeep of machines and equipment, furniture, offices and buildings, and work vehicles

Also, calculating labour costs involves more than you might think. It is not just the amount the workers are paid. It also includes tax and PRSI contributions.

So remember, when you cost each job you need to think about:

<b>Labour</b>	<b>Materials</b>	<b>Expenses</b>	<b>Wear and tear</b>
---------------	------------------	-----------------	----------------------

## Try it out

### Cost the jobs

Write in all the costs you need to think about if you are pricing these jobs.

1. An electrician wiring a garage.

<b>Labour</b>	
<b>Materials</b>	
<b>Expenses</b>	
<b>Wear and tear</b>	
<b>Other</b>	

2. A gardener doing monthly maintenance on a garden.

<b>Labour</b>	
<b>Materials</b>	
<b>Expenses</b>	
<b>Wear and tear</b>	
<b>Other</b>	

## Extension activities



### Talk about

Why is it important to keep accurate and up-to-date information in a business? Why are accurate records and accounts useful?



### At home

Make a list of the overheads of running a home. Calculate (or cost) the weekly overheads for running your own home.



### At work

Cost yourself. How much does it cost you to do a particular task at work? Think about how long the task takes, how much you are paid per hour, the materials you use, and all the overheads (wear and tear, electricity, heating, and so on).



### Writing

Write an estimate for a client who wants you to repair the exhaust of his car, paint her garden wall, deliver some materials, or provide lunch for her business colleagues. You will need to list all the costs very clearly.



### Find out

Some industries have **standard margins**. A standard margin is a set percentage that is added to the total cost to allow for rises in fuel prices or materials, errors in calculation and so on. Research what the standard margins are in your industry. Compare them to standard margins in other industries.

Employers can calculate the rate of pay for a job by carrying out a time and motion study. Find out about time and motion studies and how they work.

## ***Lifting and loading***

There are a number of steps we can take to help us lift and carry objects safely.

### **1. Think**

Where possible we should avoid lifting heavy or bulky objects. Instead, we should think about using mechanical aids, such as a trolley or pallet truck, or perhaps we can push, pull or 'walk' the object.

### **2. Assess the risks**

If we take the decision to lift an object, we must consider two things.

#### **The load**

- Is it heavy, bulky or an awkward shape?
- Is it difficult to grip and hold?
- Is it too large to see over or round?
- Is it unstable or unsteady?
- Is it possibly harmful, for example dangerously hot or contain sharp edges?

#### **The action**

- Does it involve holding the load away from the body?
- Does it involve repetitive lifting?
- Does it involve lifting objects awkwardly, for example from ground level?
- Does it involve twisting, stooping or reaching upwards?
- Does it involve carrying over a long distance?

### **3. Reduce the risks**

After **assessing** both the load and the actions involved in moving the object, we are in a position to reduce the risks to our health. We can:

- ask for help;
- break the load into separate parts;
- use a mechanical aid; and
- make sure our walkway is clear and ask colleagues to hold open doors.

## ***Try it out***

### **Spelling**

**Find the 10 spelling mistakes in the text and rewrite it correctly.**

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- braik the load into separate parts;
- use a mekanical ade; and
- maik sure our walkway is cleer and ask colleegs to hold open doors.

### **Situations**

You have to move the following items:

- 2 bales of briquettes
- A television
- A bookcase (2m high x 1.5m wide)
- A stack of 10 chairs

**Work with a partner and write your ideas in your notebook.**

- What is it about each object that makes it difficult to carry?
- Think about the load, and then think about the actions involved when you move the object. Is there anything that makes it dangerous?
- What can you do to make lifting and moving the load safer?

## Extension activities



### Talk about

When we assess the risks involved in lifting and carrying a load safely, how do we use our 'mathematical eyes'?



### At home

Make a list of all the objects you regularly lift and carry at home. Do you take the same care at home that you are required to take at work?



### At work

Make a list of all the objects you regularly lift and carry at work. Estimate what weight they are. Then find out the real weight.

What weight are you comfortable lifting? What would you do if you were asked to lift a load you considered unsafe? Find out about the safe handling and lifting policy in your workplace.



### Find out

Do a **survey** about safe handling and lifting among your colleagues. How many of them lift things safely? How many ask for help, assess, reduce the risks or do all of these things? How many of your colleagues know the safe handling and lifting policy in your workplace? Write up your findings.



### Computer skills

The HSA website has a section on manual handling where you can see videos of how to handle different objects. Go to the website at [www.hsa.ie](http://www.hsa.ie) and click 'Work Safely'. What can you



### Design

Design a poster for your workplace to raise awareness about safe lifting. The NALA workbooks **Safe and Well** and **Steps to Safety** both have information on safe lifting.



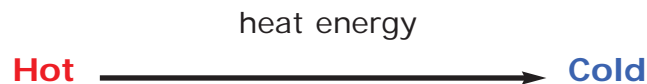
## Heat and temperature

We use the words 'hot' and 'cold' all the time. When the weather is very hot, for example, we need to store certain foods in a cold place. Used in this way 'hot' means having a lot of heat, whereas 'cold' means that there is a lack of heat.

But what exactly is **heat**? What is the connection between heat and **temperature**?

### Heat

Heat is a form of energy. It is a form of energy that always flows from warm objects to cooler ones, never the other way round.



### Temperature

Temperature is not a form of energy. However, temperature tells us that energy is present in an object.

If the temperature of an object goes up, we know that heat was **absorbed**. If the temperature of an object goes down, we know that heat was **released**. We measure the temperature by using a thermometer.



In the picture, Nadia's hands are being warmed up by a cup of cocoa. Heat flows from the warm object (the cup of cocoa) to the cool object (Nadia's hands).

- The cool object gets warmer as heat is absorbed.
- The warm object gets cooler as heat is released.

When there is a difference in the temperature between objects touching each other, the flow of heat from hot to cold can never be stopped. It can only be slowed down. For example, during the winter, insulation in houses slows the movement of the warm air inside a house to the cold air outside.

## Try it out

### Words

Fill in the missing words with a word from the box.

The first one is done for you.

cool	energy	absorb	thermometer	warm	releases
------	--------	--------	-------------	------	----------

1. Heat is a form of ..... energy
2. Heat always flows from a ..... object to a ..... object.
3. If we want to find out the level of heat energy in an object we can use a .....
4. On a cold day we can warm our hands by holding a cup of hot tea or coffee. Our hands become warm because they ..... the heat from the cup. The cup becomes cold because it ..... heat.

### Answer these questions.

1. Which has a higher temperature, water or ice? .....
2. Explain what happens (and why) to ice when it is put into a glass of water.  
Use some of the words from the information sheet.

.....

.....

.....

.....



## Extension activities

### At home



Find out the temperature of:

- your fridge;
- the different rooms of your house (with and without heating);
- your freezer; and
- yourself.

What can you do around the house to slow down the loss of warm air?



### Design

Design a poster to promote saving energy at home.



### At work

Investigate the different types of energy used at work.

What are the different types of energy used to make heat energy?

For example: Electric kettle boils water.

electricity energy → heat energy.



### Computer skills

Use the internet to research different temperatures around the world. Make a bar chart of the hottest and coldest countries or of countries in the same continent.



### Using numbers

Keep a record of the daily temperatures for a week. Try to take the temperature at the same time every day. Draw a line graph of your results.



### Find out

Research and explain why deserts get very cold at night.

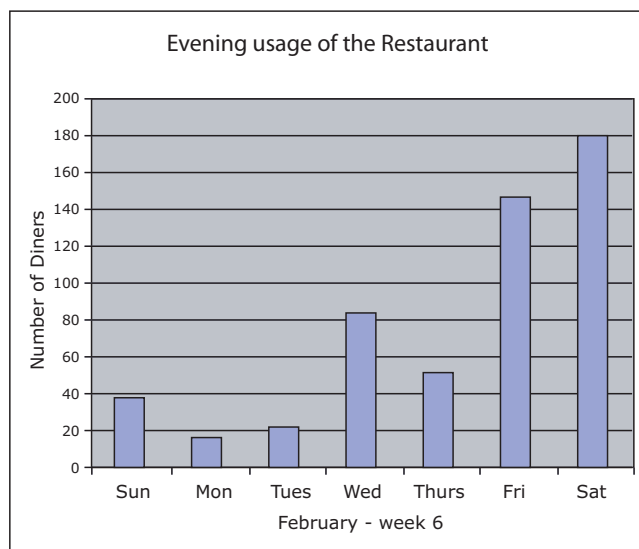
## Reading and interpreting graphs

In the modern workplace, charts and graphs are often used to explain information (or **data**). The trained eye can read and understand graphs and charts quickly. They are very useful in helping us to spot trends and to make decisions.

In the following example, hotel staff use a **bar chart** to display information about the number of evening diners visiting the restaurant in a single week.

### Reading a chart or graph

1. Always read the **title** of the chart. In this case the title is 'Evening usage of the Restaurant'.
2. Look at the **vertical axis** and note how it is labelled.
3. Look at the **horizontal axis** and note how it is labelled.



If we look at the title, the vertical axis and the horizontal axis, we can see that the chart tells us how many diners used the restaurant on each day of a particular week in February. For example, if we look at the **column** for Sunday, we can see that it just passes above the line for 40 on the vertical axis. This tells us that on the Sunday of this week just over 40 people used the restaurant

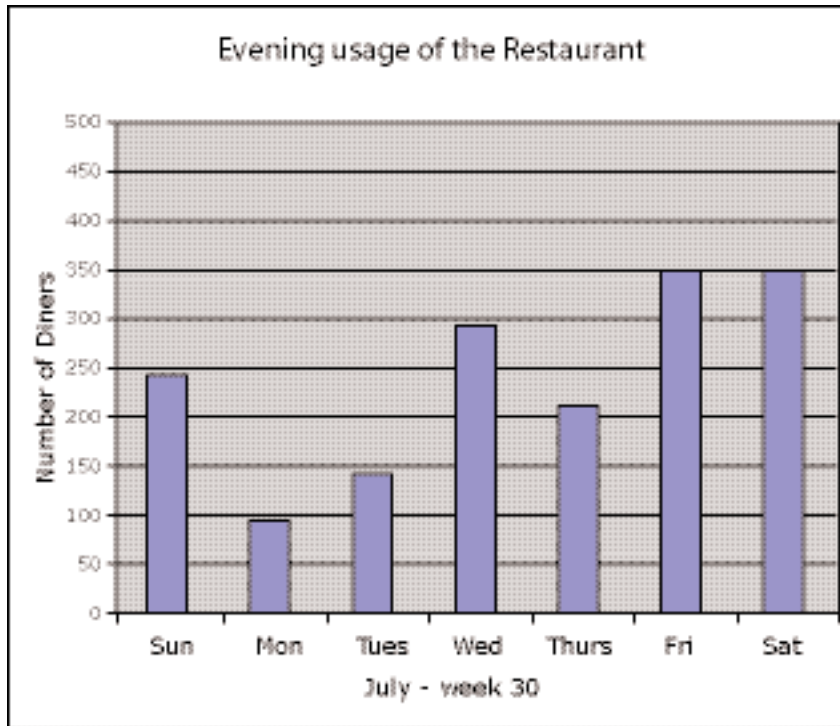
### The language of graphs

Very often people use the words 'increase' and 'decrease' when explaining the information in charts and graphs. For example, we can say that:

- On Thursday evening the number of diners using the restaurant decreased compared to Wednesday.
- On Friday evening there was a sharp increase in the number of diners using the restaurant compared to Thursday

## Try it out

Read the following bar chart:



### Answer these questions.

Work with a partner and write your ideas in your notebook.

1. What is the bar chart telling us?
2. Which is the busiest day of the week?
3. Which is the quietest day of the week?

Look again at Chart 1.

4. What do you think is the main difference between business in February and business in July?
5. How is business in February similar to business in July?

### Make a line graph

Put a dot at the top of each column. Then join up the dots with a line.

## Extension activities



### Talk about

Why is the information in the bar chart useful for the hotel? What decisions will the hotel or restaurant manager take when she or he reads the data?



### At home

Collect articles from newspapers, magazines and brochures that present information in a bar chart or line graph. Bring them into class and explain what the charts and graphs are telling us.



### At work

Look out for charts and graphs in your workplace. What are they used for?



### Computer skills

Learn how to enter data on a spreadsheet and turn it into a graph. Use the spreadsheet programme to explore other types of charts and graphs and find out what type of data they are useful for presenting.

### Design

Do a survey. Collect your own data and design your own charts or graphs. Ideas might include:



- the number of hours members of the group spend watching television every day;
- the number of cups of tea/coffee you and your colleagues drink every day; or
- the number of hours you and members of your family take exercise every day.



### Writing

Write an article explaining the data you collected (your survey). Refer to your chart or graph

## Notes



