INSPIRE COMPUTING

International

Student Book

YEAR 8

Pearson

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Overview contents

Detailed contents

Unit 4: Analysing Data

Unit 5: Programming

Unit 6: Software and communication

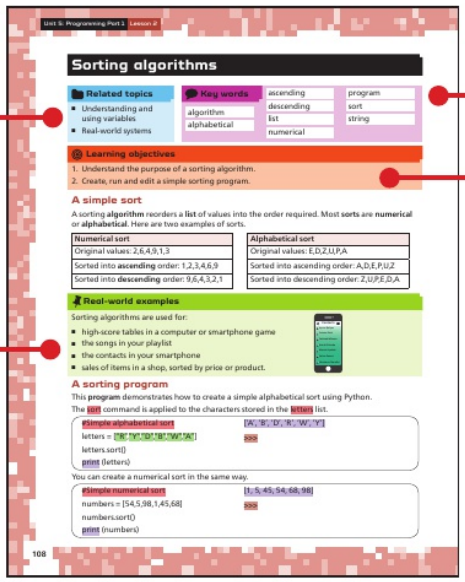
Welcome to Inspire Computing

Whether for school, fun, work or staying in touch with relatives around the world, digital technology is all around us.

Through coverage of ICT and Computer Science you will discover how this amazing technology works, how it connects the world together and it has revolutionised the classroom, workplace, and home.

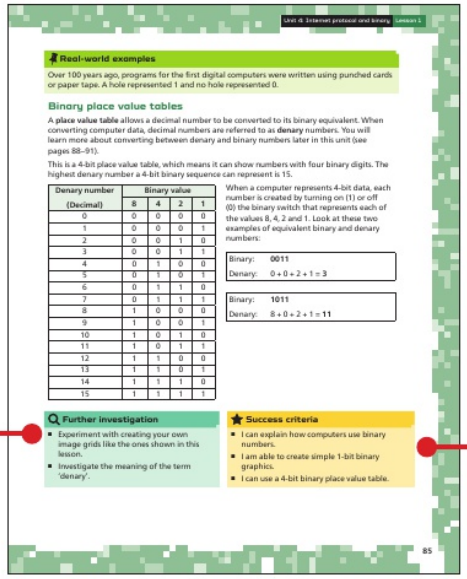
Related topics
Other topics linked to the subject that can also be explored.

Real-world examples
How the learning applies to the world outside the classroom.



Key words
These are important words to know!

Learning objectives
This is what you will know or be able to do by the end of the lesson.

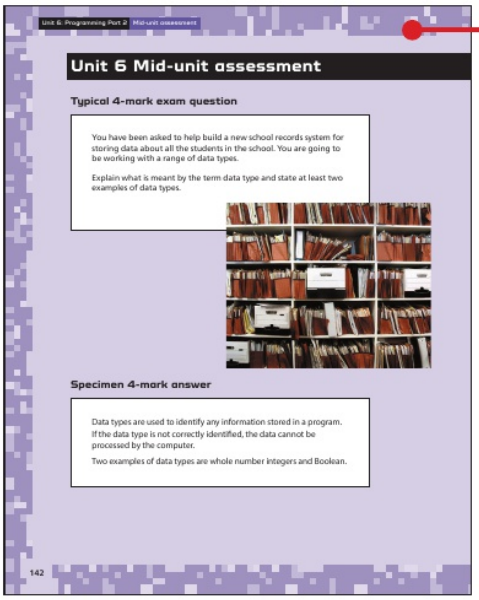


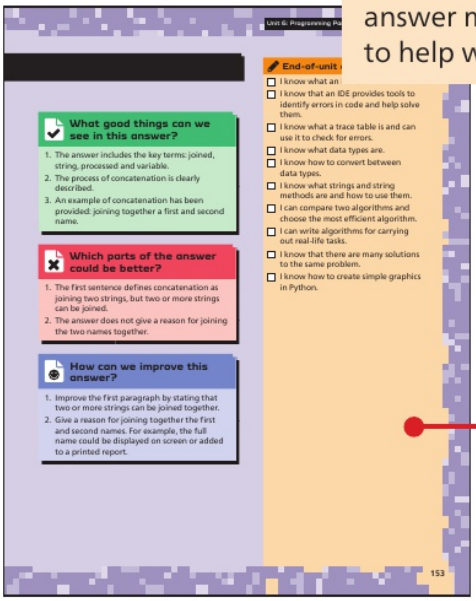
Further investigation
Take your learning from the lesson further!

Success criteria
What has been understood from the lesson.

We hope you will find this book useful in developing your knowledge of digital technology, its effective use of applications and in supporting future learning.

Each topic includes easy to understand theory, real-world examples, and ideas for further investigation. You can also test your knowledge of keywords and regular exam-quality questions with supported answers. A checkpoint at the end of each lesson is a quick and easy way to check your own understanding.





Assessment pages

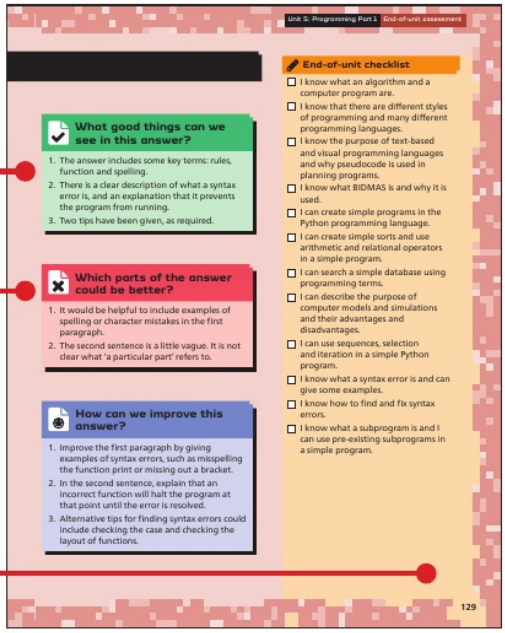
Example of exam question and answer midway and end of unit to help with exam preparation.

Analysis

Evaluation of example answer at mid-unit assessment and end-of-unit assessment to hone analytical skills and provide useful guidance.

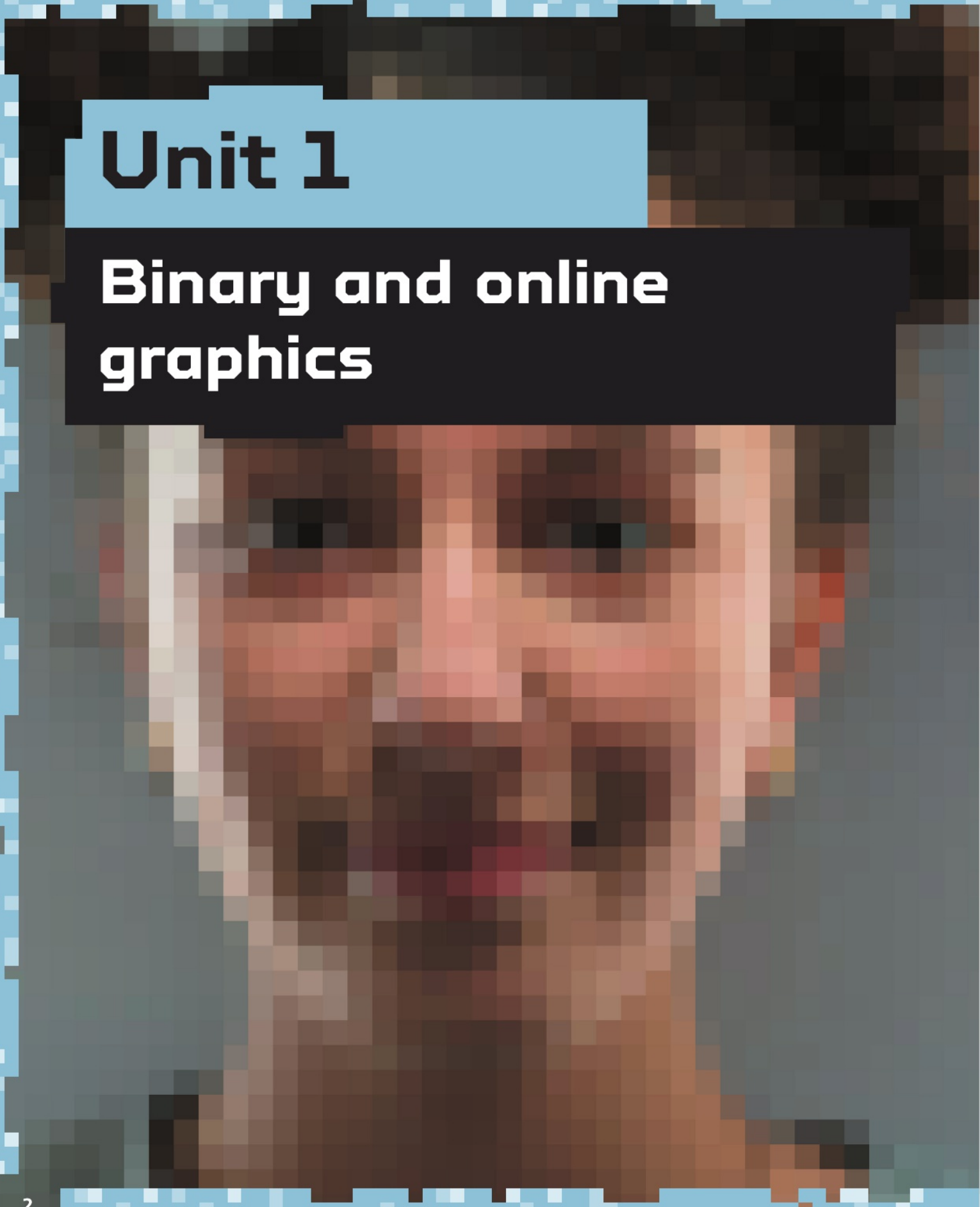
End-of-unit checklist

Checklist at the end of every unit to quickly assess your understanding and progress.



Unit 1

Binary and online graphics



You are already familiar with the use of multimedia elements in your classwork, for example a presentation can contain text, images, sound, and video. But how do computers store them? You will learn about how these files are created, saved, and processed and how binary isn't just a short sequence of zeros and ones.

Key objectives:

1. Learn about vector graphics and how they are created.
2. Learn about bitmap images and how they are created.
3. Learn about the properties of vector and bitmap images and the differences between them.
4. Be able to create simple vector and bitmap graphics.
5. Learn about the link between binary and pixel-based images.
6. Learn about how colour is displayed in binary.

By the end of the unit you will:

- be able to create simple vector graphics
- be able to create simple bitmap images
- be able to recommend either vector or bitmap graphics for a given scenario
- convert a bitmap into binary and back again.

Vector graphics

Related topics

- Algorithms and programming
- Creating graphics for a target audience

Key words

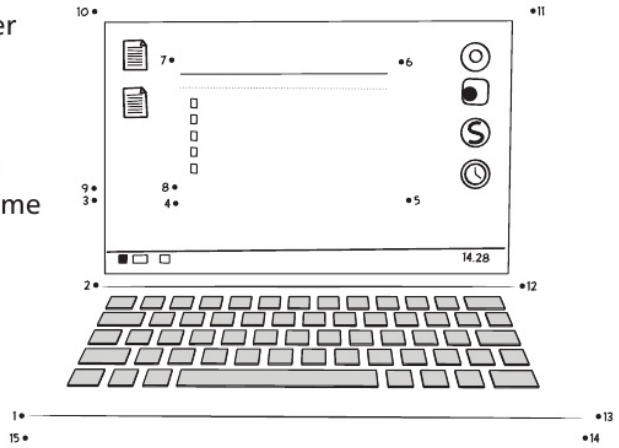
coordinates
file size
geometric shapes
image quality
scale down
scale up
vector

Learning objectives

1. Understand the nature and purpose of a vector image.
2. Understand how a vector image can be created using coordinates.
3. Know how and why vectors are used for specific situations.

What are vectors?

A **vector** is a type of image, created on a computer and used in graphic design all around the world. Consider a simple dot-to-dot image where the image is generated by following a series of coordinates (x and y positions from a fixed point) from start to finish. A vector image follows the same principle and requires the following instructions. These instructions form a simple algorithm.



1. A starting point
2. An end point
3. The type of line
4. Any curves or angles
5. Line and fill colours.

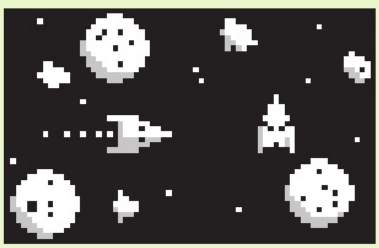
Vector graphics have some key benefits over other types of graphic. These include:

- Ability to be scaled without losing **image quality**
- Small file size
- Easily edited
- Ideally suited for **geometric shapes**.

Real-world examples

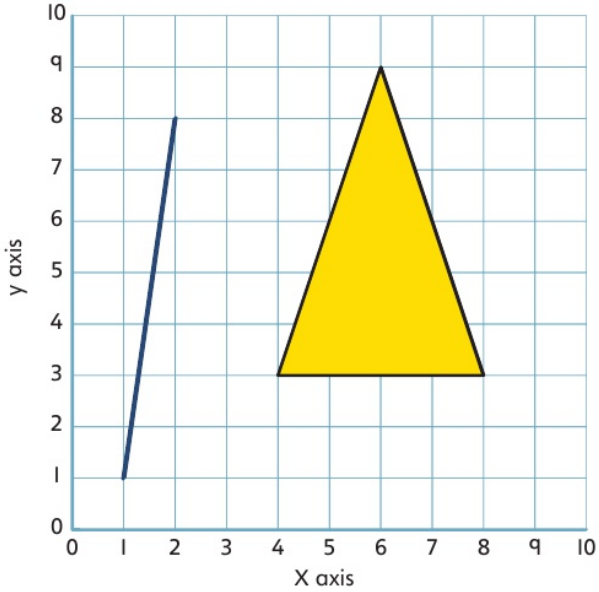
Vectors are used by graphic artists in many industries around the world. These include:

- 2D and 3D animation, from television shows to movies.
- Gaming – many of the early games were purely vector-based, however they are still used within modern console games.
- Advertising, from logos to cartoon characters.



Creating a vector graphic

Below is an example of how to create two simple vector graphics using a series of simple instructions. By plotting coordinates and then joining the dots, a shape is made.



Graphic 1 – Blue line
Start: X1,Y1
End: X2,Y8
Colour: Blue

Graphic 2 – Yellow Triangle
Start: X4,Y3
Mid: X6,Y9
End: Y8,Y3
Fill Colour: Yellow

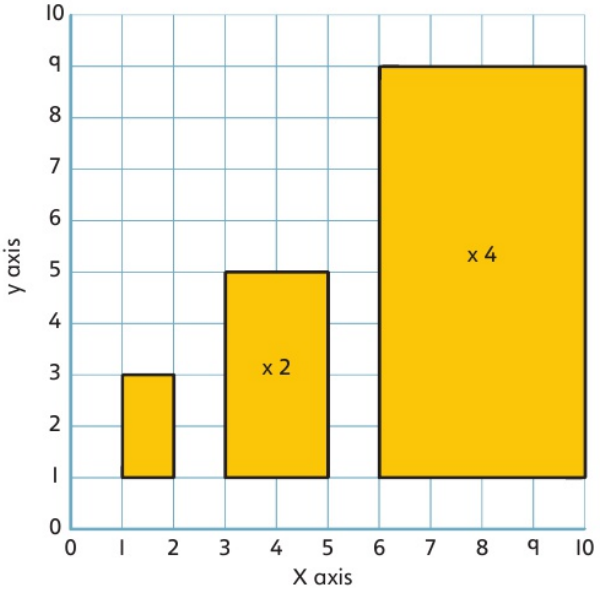
Scaling a vector graphic

One of the key benefits of a vector graphic is that it can be scaled to any size, big or small, without ever losing image quality.

Graphic 3 – Yellow rectangle
Start: X1,Y1
End: X2,Y3

Graphic 4 – Yellow rectangle × 2
Start: X3,Y1
End: X5,Y5

Graphic 5 – Yellow rectangle × 4
Start: X6,Y1
End: X10,Y9



Further investigation

- Create some similar shapes of your own - **scale up** or **scale down**.
- Investigate further uses of vector graphics in industry.

Success criteria

- I know what a vector graphic is.
- I know some of the benefits of vector graphics.
- I know how a simple graphic can be created using coordinates.
- I can scale a very simple vector graphic.

Creating a vector graphic

Related topics

- Algorithms and programming
- Creating graphics for a target audience

Key words

algorithm
coordinates
image quality
scaling
vector

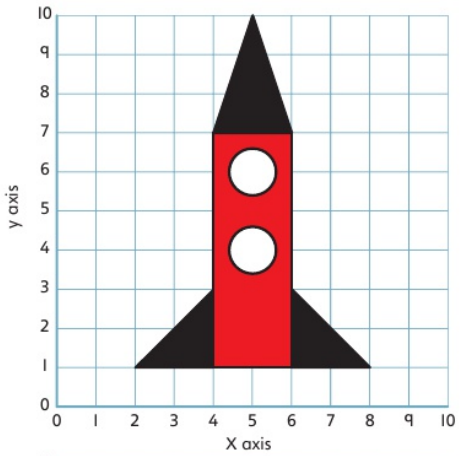
Learning objectives

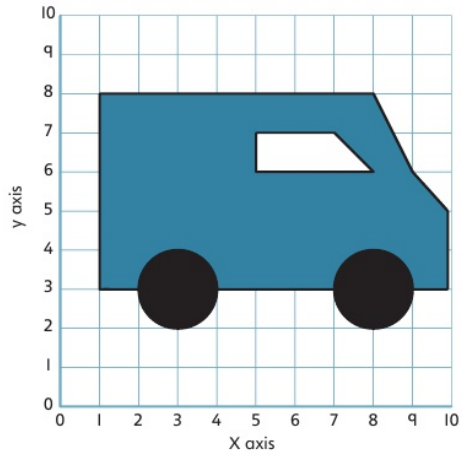
1. Understand how a graphic can be created using multiple points.
2. Demonstrate understanding of how to create a simple recognisable vector graphic.

Creating graphics using an algorithm

An **algorithm** is simply a set of instructions so a **vector** graphic can be plotted using a series of **coordinates** in a similar style to a dot-to-dot image.

Each line of instructions in the graphics shown creates a different shape. In the previous examples, each shape had a start and finish point. In these examples, multiple points are plotted, to create a triangle, for example. Circles are also created using the letter R to represent a radius from the XY centre.





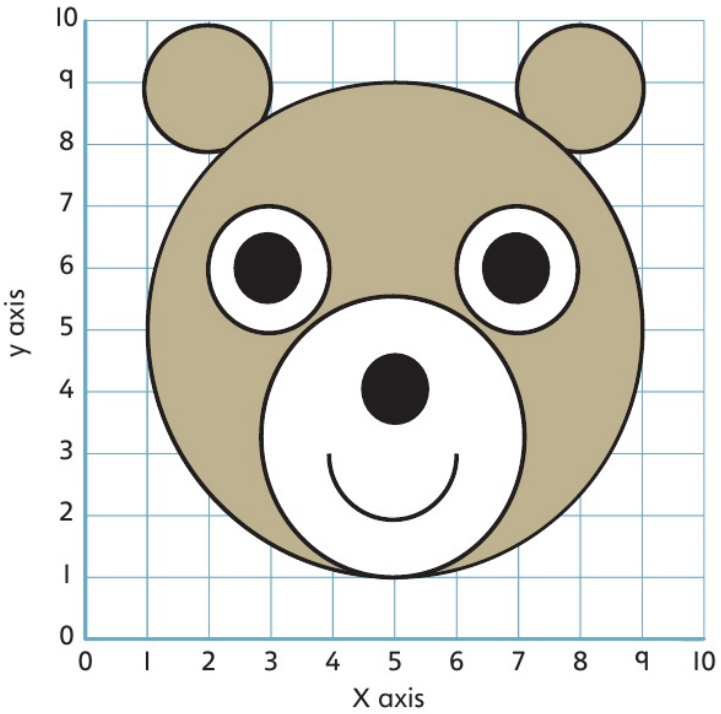
Graphic 1: Rocket
Black triangle left:
X2,Y1; X4,Y3; X4,Y1
Black triangle right:
X6,Y1; X6,Y3; X8,Y1
Red rectangle:
X4,Y1; X4,Y7; X6,Y7; X6,Y1
Black nose cone:
X4,Y7; X5,Y10; X6,Y7
White window 1:
X5,Y6,R0.5
White window 2:
X5,Y4,R0.5

Graphic 2: Car
Blue car body:
X1,Y3; X1,Y8; X8,Y8
X9,Y6; X10,Y5; X10,Y3
White window:
X5,Y6; X5,Y7; X7,Y7; X8,Y6
Black wheel 1:
X3,Y3,R1
Black wheel 2:
X8,Y3,R1

Real-world examples

The Scratch visual coding app has a pen tool that can be used to create simple vector graphics using coordinates in a similar style to this page.

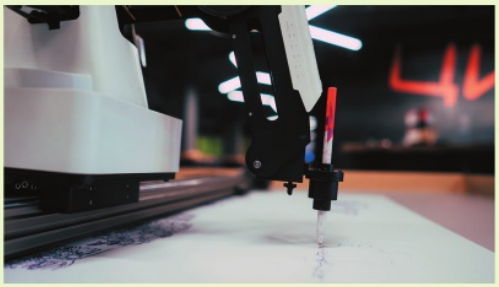
Graphic 3: Animal



Brown head:
X5,Y5,R4
Brown left ear:
X2,Y9,R1
Brown right ear:
X8,Y9,R1
White left eye:
X3,Y6,R1
White right eye:
X7,Y6,R1
Black left eye:
X3,Y6,R0.5
Black right eye:
X7,Y6,R0.5
White snout:
X5,Y2,R2
Black nose:
X5,Y4,R0.5
Black mouth arc:
X4,Y3; X5,Y2; X6,Y3

Real-world examples

A graphics plotter is a device that follows a series of instructions to create a graphic, for example architectural drawings. The pen is lowered onto the paper as required and lifted when it needs to start another shape.



Further investigation

- Investigate software packages designed to create vector graphics.
- Experiment with creating shapes of your own choice.

Success criteria

- I know how shapes can be created using a set of instructions.
- I can create a graphic of multiple parts using a set of instructions.

Bitmaps

Related topics

- Digital images
- Creating graphics for a target audience

Key words

bitmap
file size
gradient
image quality
pixel
pixels per inch (PPI)
resolution

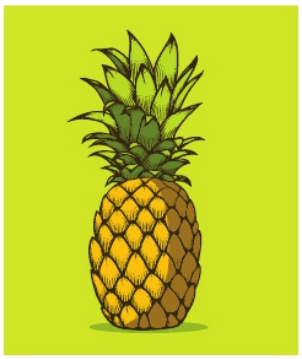
Learning objectives

1. Understanding of what a bitmap graphic is.
2. Understand the basic structure of a bitmap.
3. Understand the link between resolution and image quality

What is a bitmap?

A **bitmap** is an image file made up of dots, or pixels. Each **pixel** can be a different colour. The greater the number of pixels, the more detailed the image.

These two images both show a pineapple. The one on the left is a vector; the one on the right is a bitmap.



Bitmaps can be used for:

1. Digital photographs, either taken with a digital camera or scanned using a scanner.
2. High quality original game graphics.

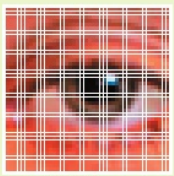
Bitmap structure and terminology

When exploring bitmaps, it is important to understand the following key terms:

1. **Pixel:** short for picture elements. Each pixel is a tiny coloured square that makes up an image.
2. **Resolution:** relates to the number of pixels within the image. The more detailed the image, the higher the resolution is required.
3. **Gradient:** describes the change from one colour to another, fading from black to white for example with the pixels moving from black to grey to white.

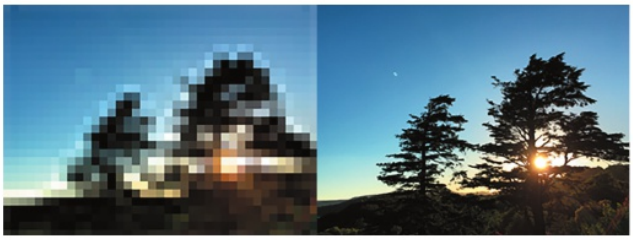
Real-world examples

Bitmaps are often referred to as raster images. Common bitmap filetypes include the following: BMP, JPG, GIF, TIFF, PNG and PICT.



Resolution and image quality

Consider the images shown. Each pair show the same image but one is clearly sharper than the other.



The key difference between the images is the resolution – the number of pixels used to create the image. The unit of pixel resolution is **pixels per inch (PPI)**.

The image on the right of each pair has a resolution of 300 PPI and the image on the left is 10 PPI.

The **file size** of the images is related to the resolution – the higher the resolution, the larger the file size.

This means that increasing the physical size of any bitmap will reduce the resolution, lowering the **image quality**.

Real-world examples

Games consoles are often compared based on their technical specifications. At the time of writing, the most recent Xbox and PlayStation consoles can play games at an 8K resolution of 7680×4320 pixels. This means controlling over 33 millions pixels at once!

Further investigation

- Open some images using photo-editing software and experiment by changing the resolution.
- Investigate the number of pixels a smartphone or tablet can display.

Success criteria

- I know what a bitmap is.
- I know how a bitmap is made.
- I can describe the link between resolution and image quality.