Gradients

For use in conjunction with "Integrating ICT into the mathematics classroom"

This Notebook file is designed for whole class work with a SMART Board™ interactive whiteboard to help introduce and reinforce the concept of the gradient of a straight line.

It includes samples of materials sent free to every maintained secondary school in England in Autumn 2005 by the Association of Teachers of Mathematics (ATM), funded by the Department for Education and Skills (DfES).

Notes

Materials

The materials consist of a book, called "Integrating ICT into the mathematics classroom", and a CD. The image below shows the index page of the CD.

The 'Maths Gallery' is a large collection of photographic images (in the form of 'jpeg' files) taken by Richard Phillips. The gallery contains an album called `Straight Lines and Gradients'. The 'Becta' section of the CD contains a collection of resources called:
Lesson Plans from Project A07 (Dec 2004)

These units include lesson plan notes, images, presentation files and data sheets. They include a core activity, an extension activity and support materials.

- Overview
- Food labels
- Weather data
- Transformations
- Slopes
- Modelling penguins
- Real life graphing

The 'Slopes' link offers you three related folders: 'Slopes extension', 'Slopes core' and 'Slopes support'.

Slopes

Year 7

Pupils use graphical calculators to investigate straight line graphs. The extension lesson has pupils using interactive geometry software, matching straight line graphs onto superimposed pictures of slides and staircases.

Starter: Use angle measure; distinguish between and estimate the size of acute, obtuse and reflex angles.

Solve simple problems about ratio and proportion using informal strategies.

Main: Generate points and plot graphs of functions.

Starter: Resource M01 How Steep? – core ("The Geometer's Sketchpad" or "Cabri-Geometry file").

Dynamic geometry software ("The Geometer's Sketchpad" or "Cabri-Geometry").

Main: Graphical calculators and whole screen projection.

Resource M1 "Target Points – core" (Microsoft® Word file).

"TI-83 Plus Graphical calculator Helpsheet Drawing graphs – core" (Microsoft® Word file).

Objectives: Use angle measure; distinguish between and estimate the size of acute, obtuse and reflex angles. Solve simple problems about ratio and proportion using informal strategies.

Vocabulary:
angle estimate horizontal steepness

This SMART Notebook™ file uses ideas from this lesson plan, and images from the 'Maths Gallery'.

Notes

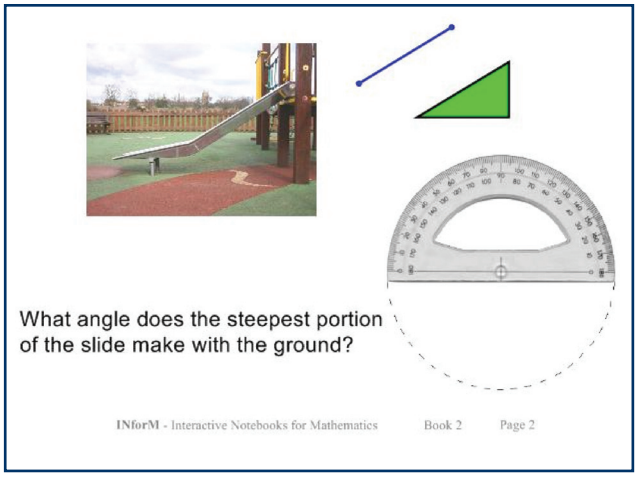
Organisation of the materials

The SMART Notebook file is saved as 'Gradients.notebook'. It consists of eight pages of which the first is the title page, shown above. There are five pages to support the main activity. Page 7 is a blank page. Page 8 contains teacher notes which are amplified here.

First Activity

Estimating the angle of slopes

Display page 2 and ask the class where they think the steepest section of the slide is to be found. Ask for suggestions for estimates of the angle this makes with the ground. Introduce the word 'horizontal'. You can drag either the blue line or the green triangle over the image to emphasise the angle under consideration. You, or a pupil, can drag the protractor over the image, line or triangle to measure the angle of slope – which should be about 30º.



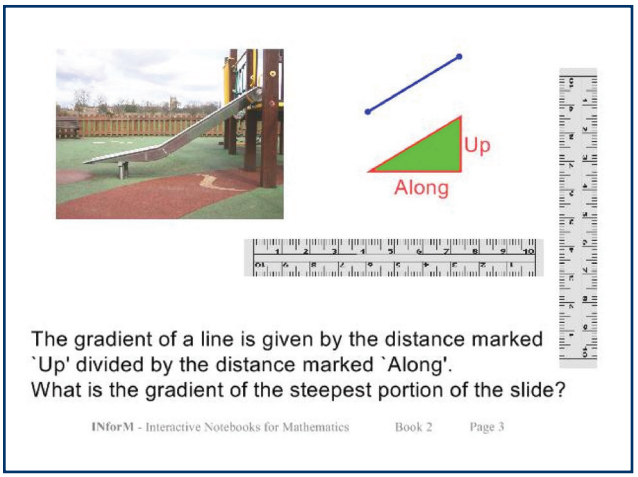
Page 2

Notes

Second Activity

Finding the gradient

Introduce the idea of the gradient of a sloping straight line as the fraction formed by the distance risen vertically over the distance travelled horizontally. Ask for estimates of the sizes of the sides of the green triangle called `Up' and `Along' in suitable units. Drag the two rulers to find approximate values. You should get a value around 0.6. Ask what the angle will be if the slope is exactly 1. What sort of value will you get for an angle between 45º and 90º?

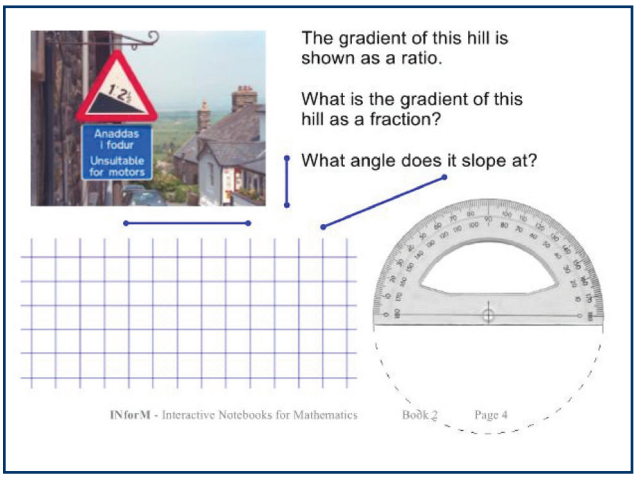


Page 3

Third Activity

Interpreting road signs – gradient as a ratio

The image on page 4 is a road sign in Wales with the gradient expressed as 1:2. Ask what this could mean in terms of horizontal and vertical distances. Use the square grid at the foot of the page to drag the lines to create a right-angled triangle whose sides are 5 units horizontally and 2 units vertically. So the fraction representing the gradient should be 2/5. Use the protractor to approximate the angle.

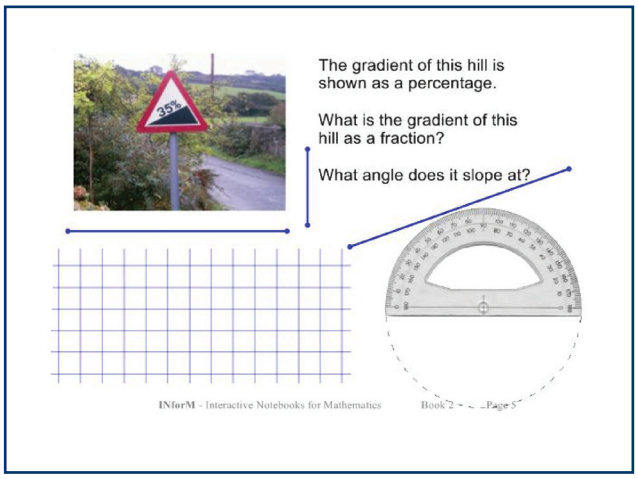


Page 4

Extension Activity

Interpreting road signs – gradient as a percentage

This time the image on page 5 shows a sign giving a gradient as 35%. Ask for equivalent fractions, such as 35/100 or 7/20. Drag the lines over the squared grid to form a right-angled triangle with a horizontal side of 10 units and a vertical side of 3.5 units. Estimate the angle, then measure it.

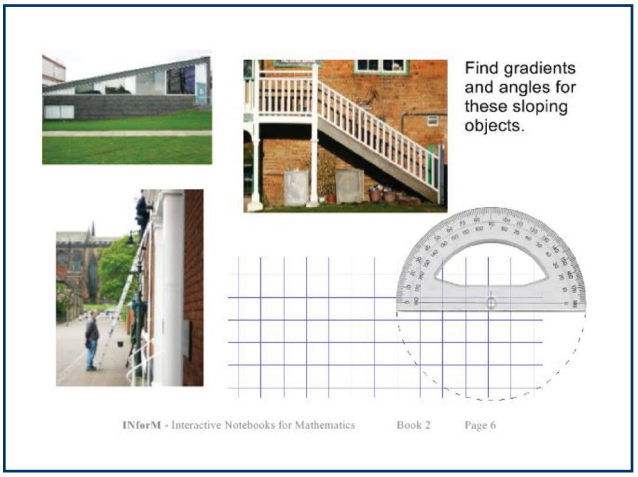


Page 5

Consolidation

Practising estimation of slope angle and gradients

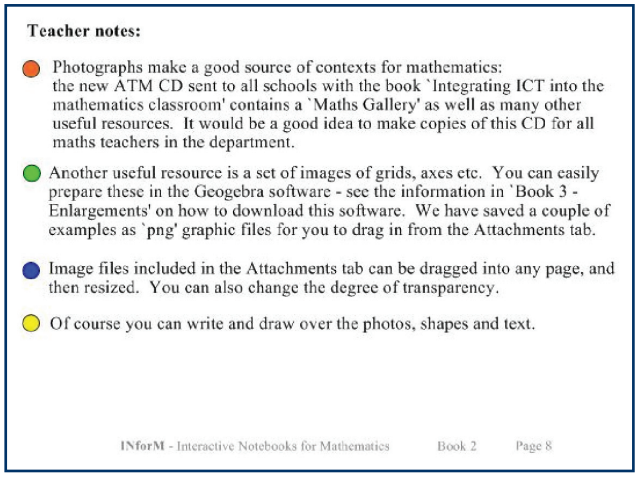
Page 6 contains a variety of photographs. You might like to replace these by ones you have taken yourself, or by ones contributed by pupils. You can again introduce lines and/or triangles to match up against sections of the images – but you should also be able to drag each of these images over the squared grid to help estimate the angle and gradient. You might like to introduce the convention that a downwards slope is represented by a negative gradient in preparation for further work on fitting straight line graphs – which is the main activity in the lesson plans on the ATM CD.



Page 6

Teachers Notes

The 'Attachments' Tab – at the bottom right of the Notebook – provides a useful way of linking to other useful files, such as Microsoft™ Word documents, dynamic geometry files, and websites. It also allows you to keep a store of useful images with your Notebook which you can drag in as required. In this instance we are using 'jpeg' files of photographs from Richard Phillips' 'Maths Gallery' on the ATM CD, as well as grids we have created using the GeoGebra software and saved as 'png' image files. Sometimes image files can be too big for a Notebook page. If this is the case, Microsoft® Photo Editor can be used to resize and/or crop the image.



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Notes

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