

Curriculum change: *The problem of Problem based learning*



Curriculum past

In Tsarist Russia only one child in 20 went to school.

After the revolution of 1917 the question arose — if you intend to educate the entire population, what changes are required?

Curriculum past

Official articles stressed that education should not consist of children just memorising what they were told; it should be a creative activity of the children themselves.

This would only happen if the children were interested in their work.

Curriculum past: 1920s

The existing textbooks were not suitable for creating such interest. Anyone looking at them would be led to believe that "***mathematics was the most unnecessary subject in the world, dealing only with idle and empty riddles***".

It was therefore necessary to have books that would relate mathematics to real life.

So far the argument is perfectly sound...
and strangely familiar.

A cautionary tale

But things got out of hand.

In 1923 in Russia it was decided to abolish mathematics as a subject.

The whole school program was reorganised around such themes as Man and Nature, Work and Society.

Mathematics was to arise naturally in the study of these themes.

A cautionary tale

It did not work out too well.

Pythagoras' Theorem was embedded in a section dealing with the Constitution of the Soviet Union, while fractional and negative indices were under Imperialism and the Struggle of the Working Class.

A cautionary tale

Children brought up under this scheme did not do well.

In 1931 it was decided to return to teaching based on academic subjects.

W. W. Sawyer, 1978

The Bulletin of the Institute of Mathematics and its applications 259-262.

From the past to the present

Inquiry-based learning (A general description)

Project learning (William Kilpatrick, 1918)

- Problem based learning
- Learning through design

We learn
what we live.

Mathematical modelling

Direct
Instruction
Engelmann, 1968

Curriculum design needs balance!

Same but different

Project Based Learning

To cover adequate domain knowledge, Mathematics is more frequently approached from **problem based learning**.

May be lengthy
(weeks or months)

Often fully authentic tasks and settings

Problem Based Learning

Often single subject

Tend to be shorter

Often use case studies or scenarios

Cylindrical storage tanks



Notice
the staircase.

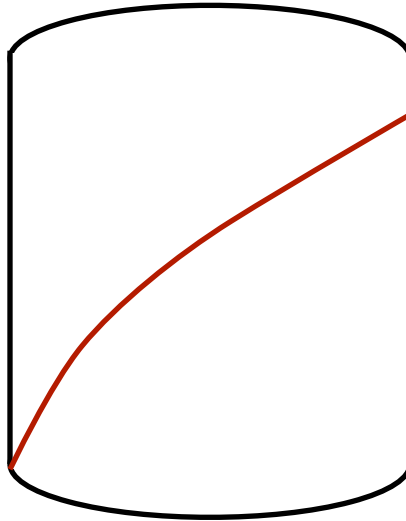
How long is the staircase?



How long is the staircase?

Would a model help?

How could you work it out?

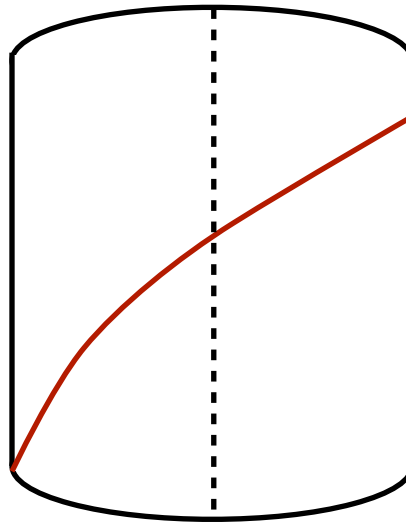


What do you need to know?

Can you draw what it would look like if you opened out the cylinder?

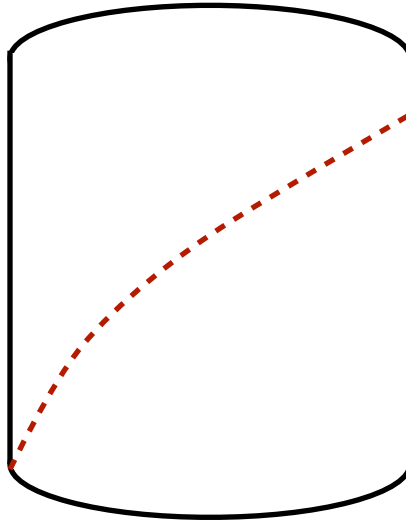
Opening out the cylinder

How many people mentally opened out the cylinder by 'cutting' vertically?



Opening out the cylinder

How many people mentally opened out the cylinder by 'cutting' along the staircase?



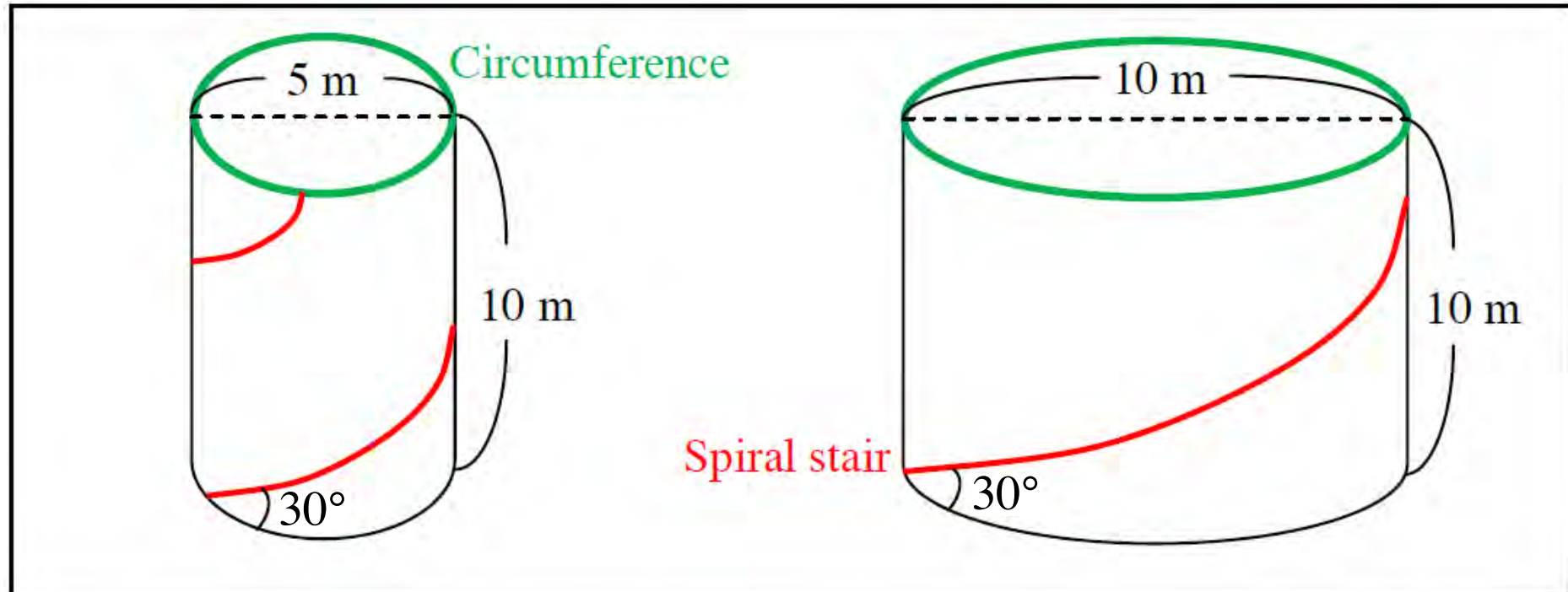
Race to the top



Heights are equal but diameters are not.

If diameter of No. 31 is 5 m and the diameter of No. 29 is 10m, does this make the staircase twice as long?

Which staircase is longer?



Let's vote!

How do you know?

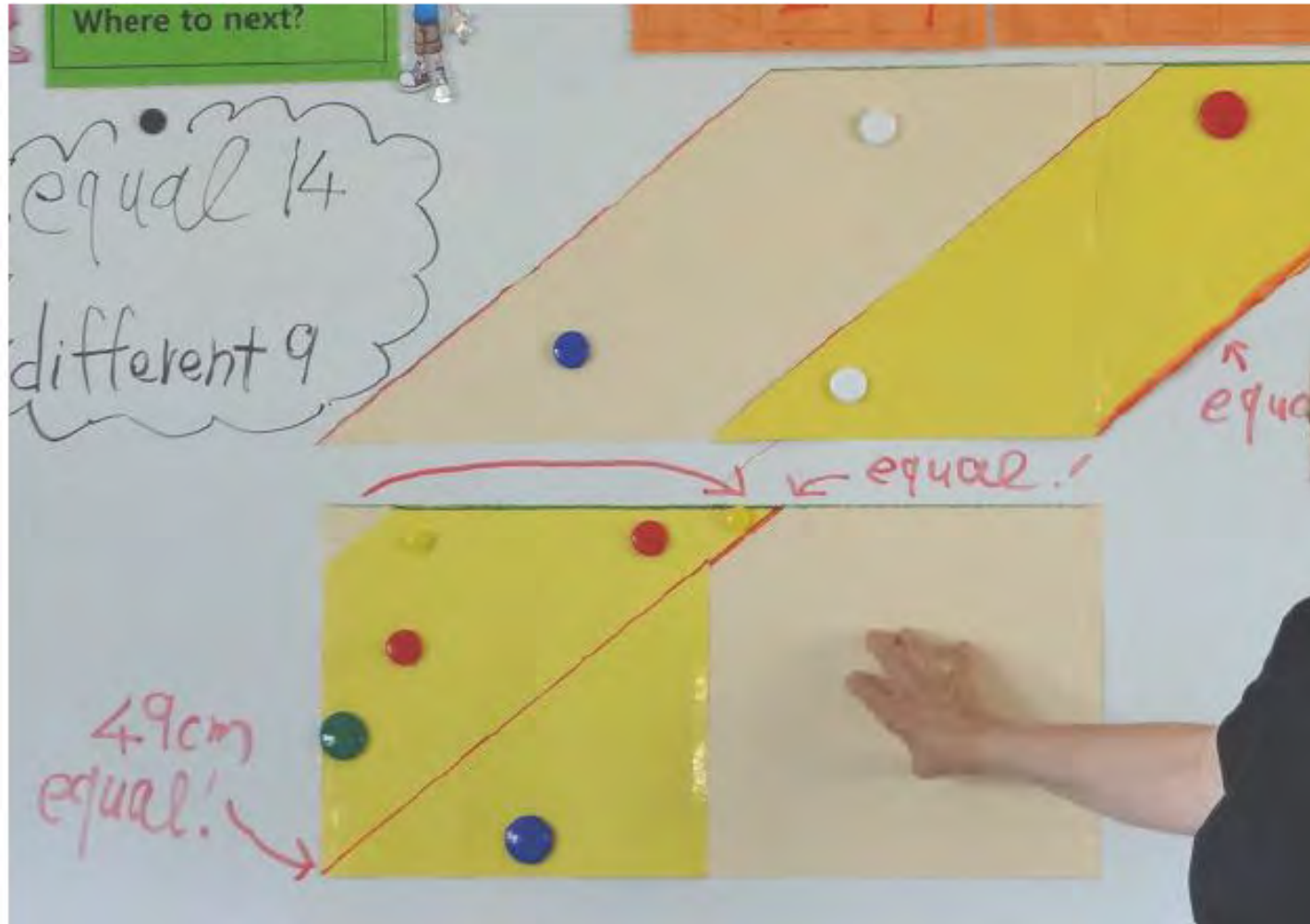
Mathematics is a reasoning activity.

How can you show which staircase is longer?

Introducing the models...

Does it matter which way you cut the cylinder to open it out?

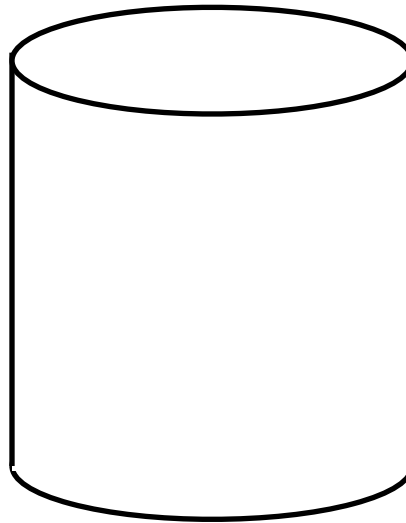
How do you know?



What have you learnt?

How else can you open out a cylinder?

What are the implications for curriculum?



Area and surface area
5.2

recognise the curved surface of a cylinder as a rectangle and hence calculate its area

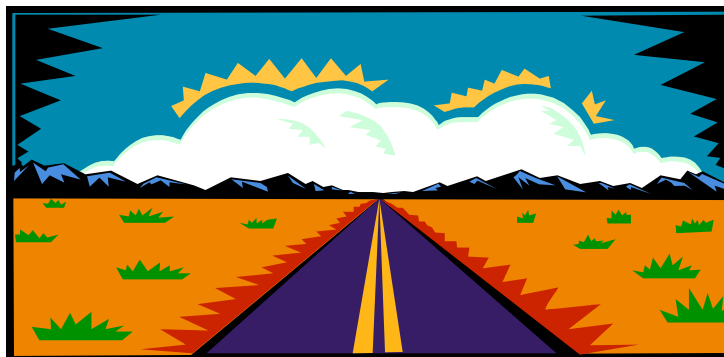
Sustained investigations

Recently Conrad Wolfram suggested that teaching should focus on students applying their mathematics skills in their everyday life by answering questions such as:
‘Will it rain tomorrow?’

Will it rain tomorrow?

Drawing on my extensive knowledge of the weather, I know that rain has something to do with clouds.

A story of clouds



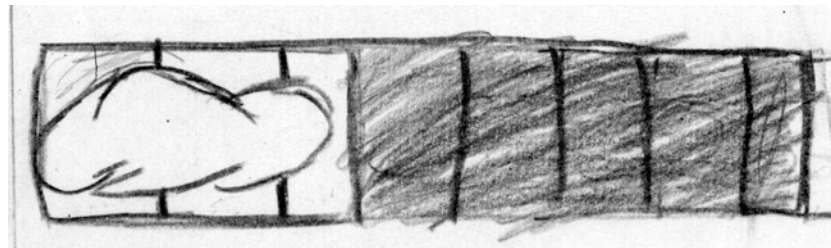
Whilst driving to work one day I heard the weather report say that there was three-eighths cloud cover.

What does that look like?



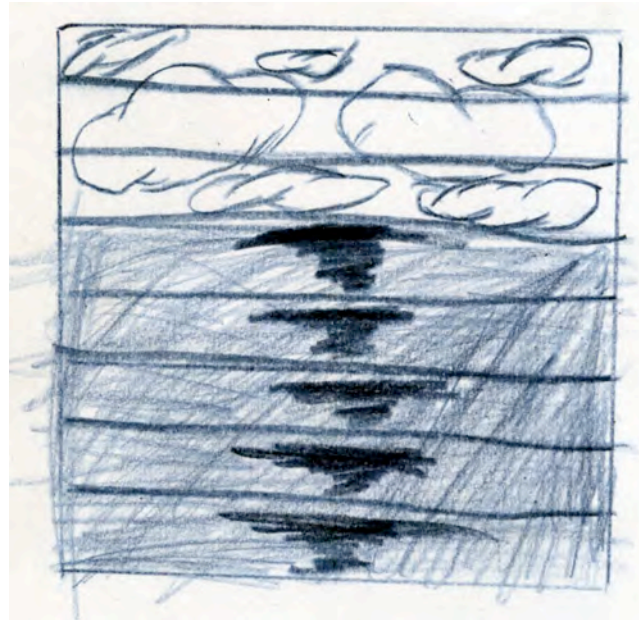
I asked Year 6 to help

The weather report said that there was three-eighths cloud cover. What might the sky look like?



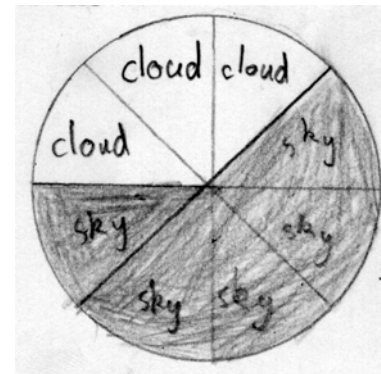
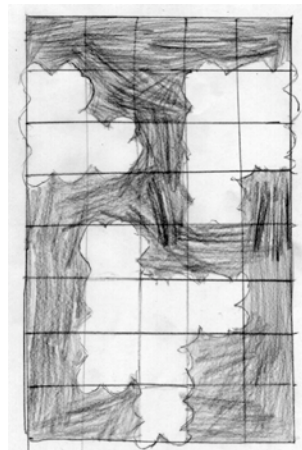
Clouds

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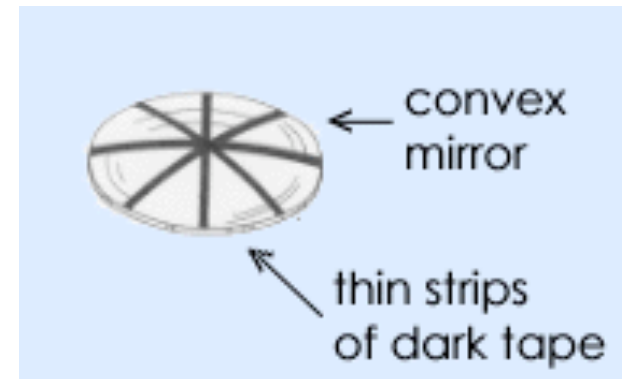
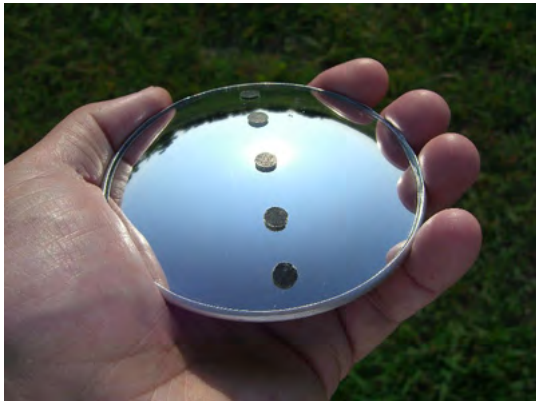


MA1-7NA represents and models halves, quarters and eighths

A challenge?

Cloud cover is measured in eighths or oktas.

Can your class develop a way to measure cloud cover?



Create a convex cloud mirror.