What US Mathematics Leaders Can Learn from the Dutch about Aligning Curriculum, Instruction, Assessment, and Professional Development

Annual NCSM Conference
Atlanta
March 21, 2007

NSF Benchmark Assessment Project

- Visit the Freudenthal Institute in Utrecht, The Netherlands.
- Benchmark with the Dutch on how high stakes assessments are done there.
- Present at academic meetings in the U.S. based on this trip.

Freudenthal Institute

- Part of the Utrecht University, the largest university in the Netherlands
- Founded in 1971 by the German/Dutch writer, pedagogue and mathematician, Hans Freudenthal (1905-1990)

Freudenthal Institute

Its goal is to improve the teaching of arithmetic and mathematics at all levels, but particularly in kindergarten, primary, secondary and vocational education.
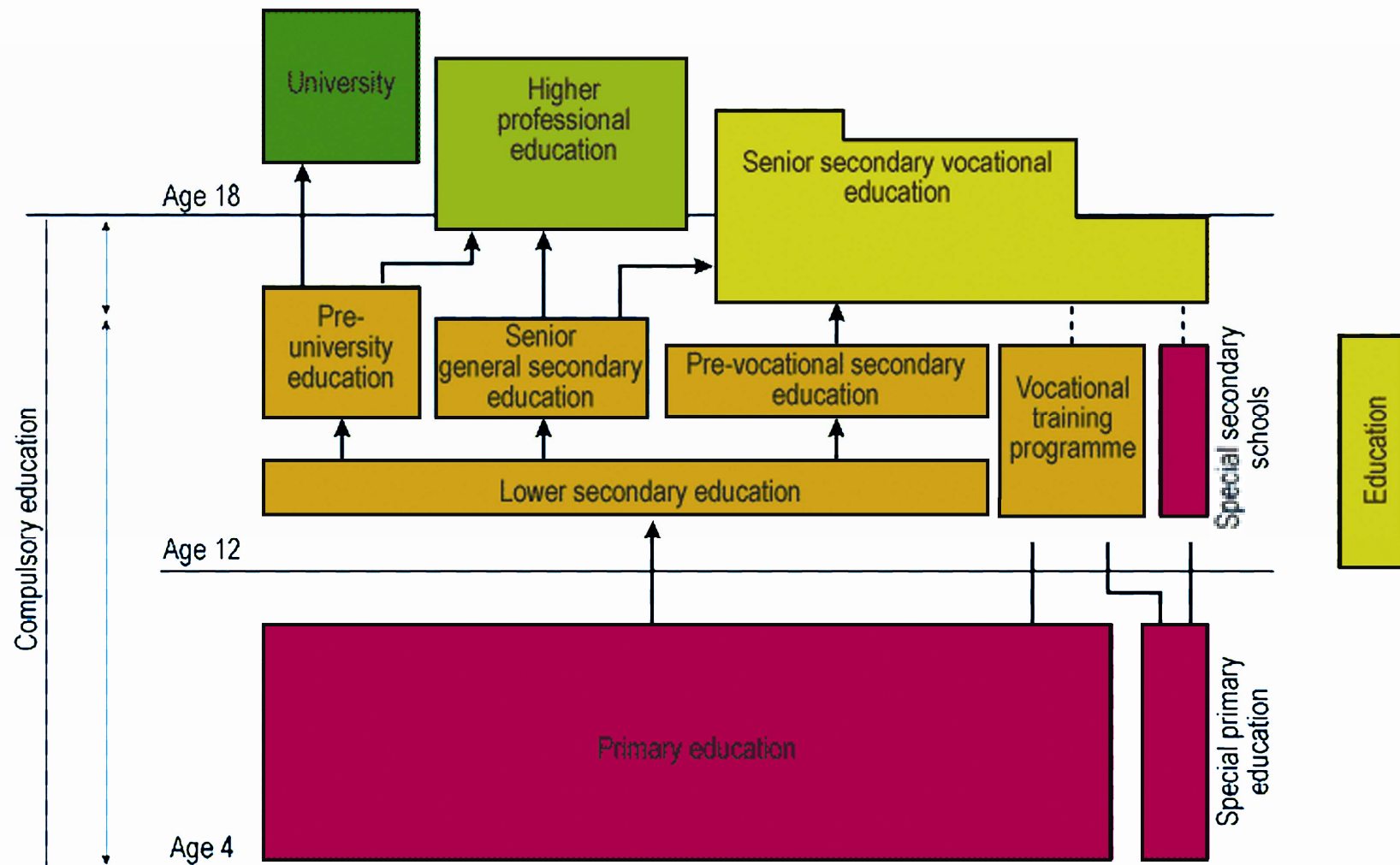
Freudenthal Institute

- Conducts research on mathematics education.

- Focuses on implementing Realistic Mathematics Education, a dynamic theory of learning and teaching mathematics.

The Education System in the Netherlands

- differentiated system
- compulsory for children from age five until the age of sixteen
- four different types of secondary education

The Education System in the Netherlands

The Netherlands and the U. S.

National Standards

The Netherlands and the U. S.

Field Tests

Field Tests

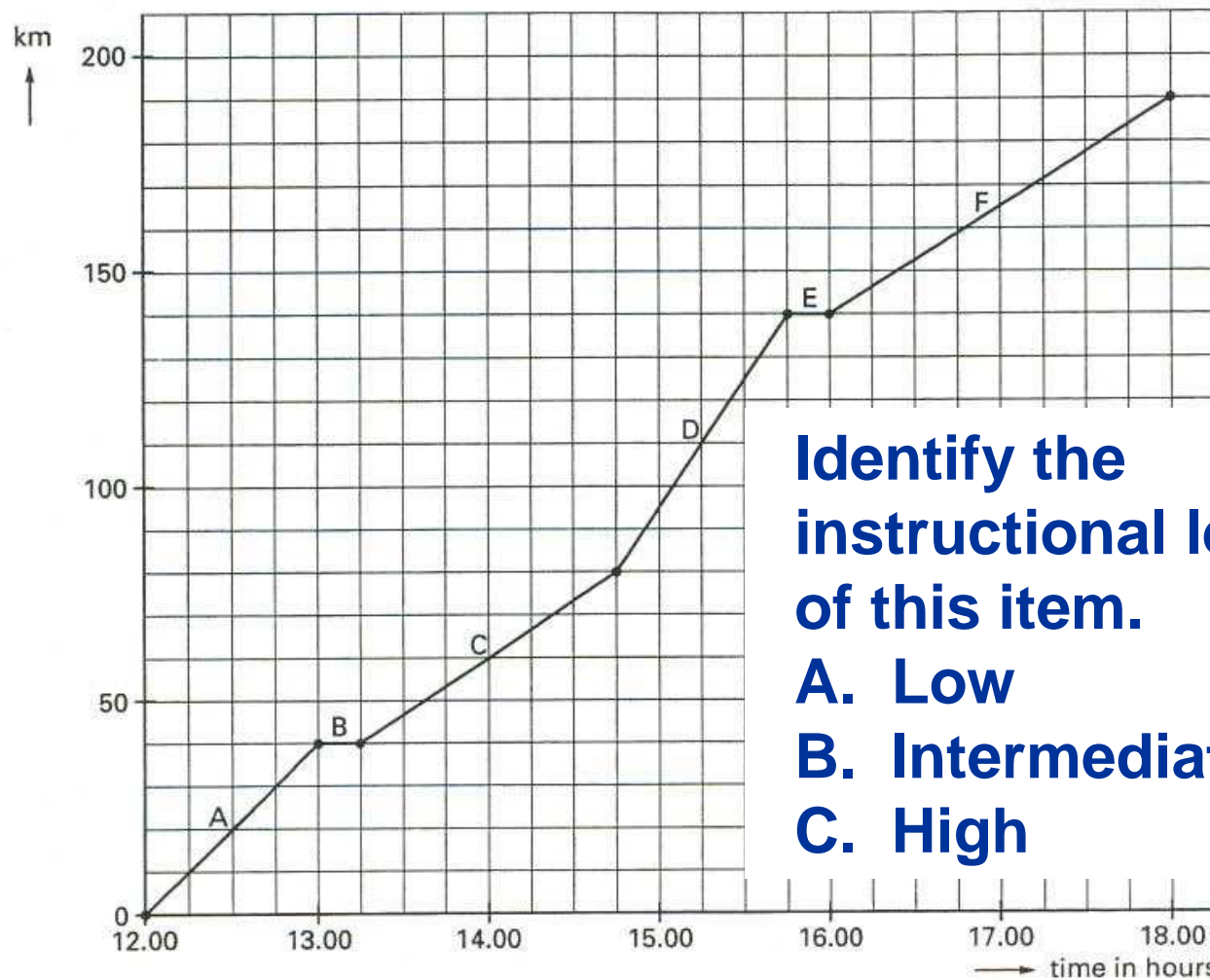# National Field Examinations

- Low: VMBO (ages 12-16)

- Intermediate: HAVO (ages 12-17)

- High: VWO/Gymnasium (ages 12-18)

4. Find with the help of the graph the time-slot(s) in which the cyclist stops for a rest or to repair his cycle.
   Write down the time period(s) and the corresponding letter(s).

5. Find with the help of the graph the time-slot(s) in which the cyclist has ridden fastest.
   Write down the time period(s) and the corresponding letter(s).

6. Find with the help of the graph the time-slot(s) in which the cyclist rode slower than 30 km/hour.
   Write down the time period(s) and the corresponding letter(s).

7. How many kilometres did the cyclist cover on the sections C and D together?

8. Compute for these sections together the mean velocity of the cyclist.

FERRIS WHEEL

In amusement parks and on fairs there is often a Ferris wheel. In the figure below such a Ferris wheel has been drawn with a gondola *A* and a gondola *B* as examples. The radius of the wheel is 18 metre; at the point *M* is the axle. The velocity of rotation is constant. In the lowest position (the roof of) the gondola is 2 metres above the ground.

figure
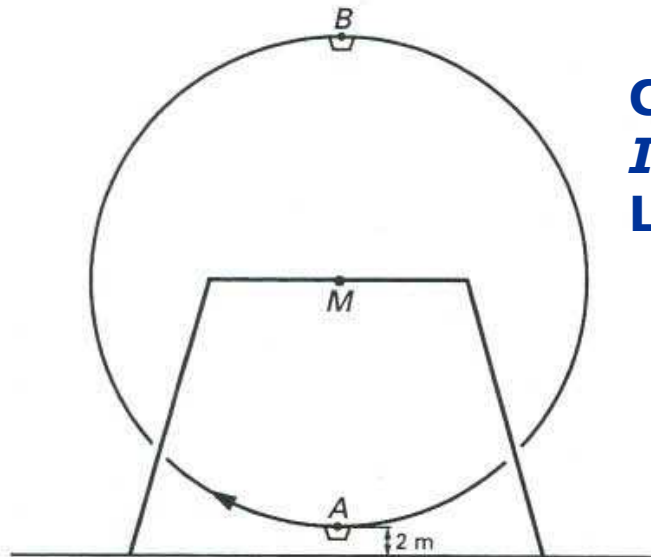
On the working sheet for the questions 19, 20 and 21 is a drawing of a part of the graph which gives the relation between the time (in seconds) and the height (in metres) of gondola *A*, while the wheel is turning.

2p **19** How much time does gondola *A* need for a complete rotation?
(91)

2p **20** What is the height of (the roof of) gondola *A* one minute after the lowest position?
(76)

At the moment gondola *A* is in the lowest position, gondola *B* is in the highest position. See the figure above.

TAKS
Exit Level
July 2006

8 The graph below shows the relationship between temperature and the density of water.
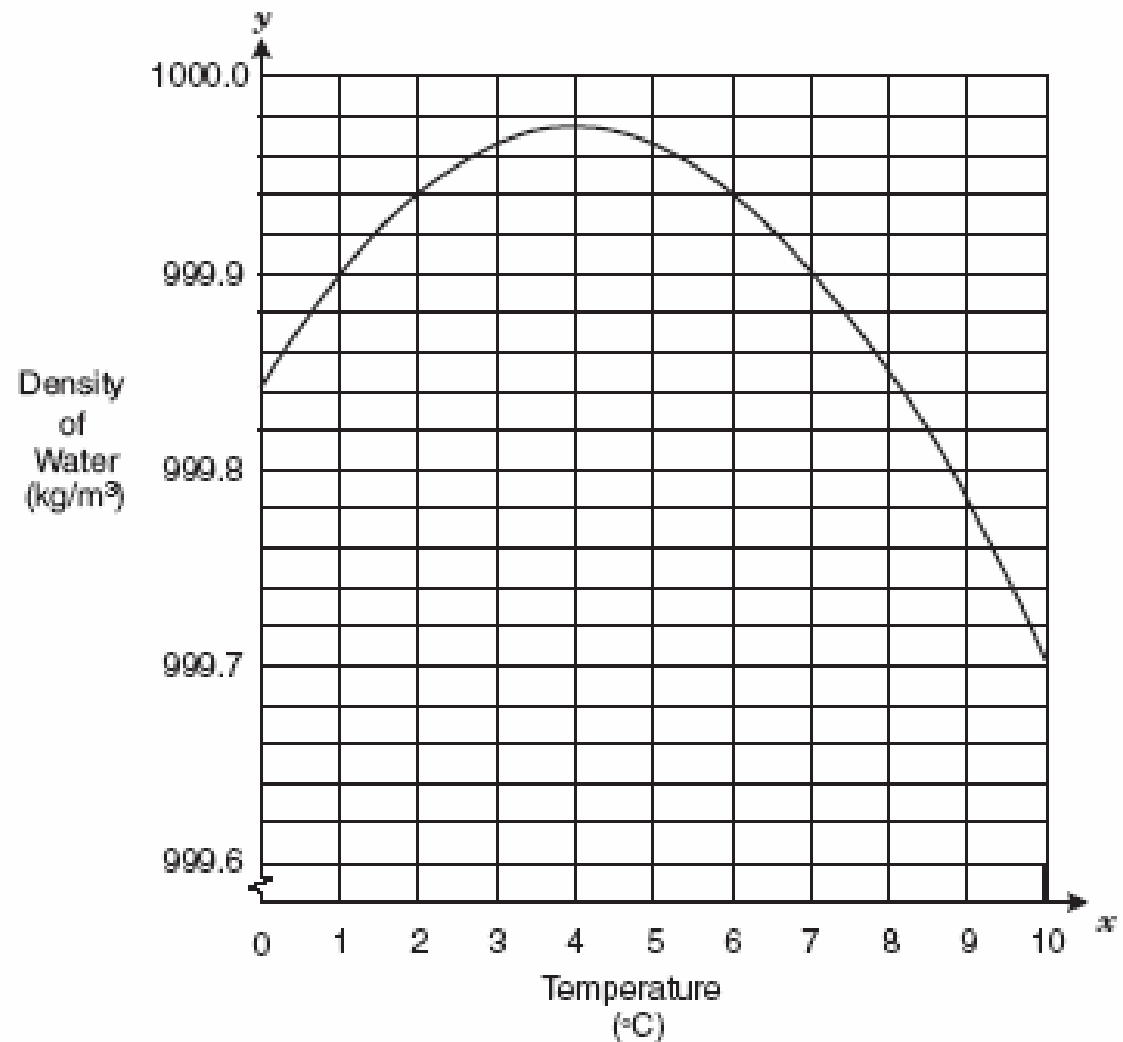
Which of the following statements best describes this relationship?

F   The density of water increases as temperature increases between 4°C and 10°C.

G   The density of water decreases as temperature increases between 0°C and 4°C.

H   The density of water decreases as temperature increases between 4°C and 10°C.

J   The density of water remains constant as temperature increases.

PROBLEM 2 HEPATITIS A

Hepatitis A is generally regarded as an innocent infection disease, but some people can become seriously ill from Hepatitis A.

The body can make antibodies against the Hepatitis A virus. If this has happened to someone, he becomes immune. It means that he cannot fall ill from this disease anylonger.

With an AHA-test it can be established if somebody has antibodies. Without antibodies he is not immune and he runs a risk of contamination.

In figure 1 you can see for every age how many percent of the Dutch population (of that age) is *not* immune for the Hepatitis A-virus.

fig 1
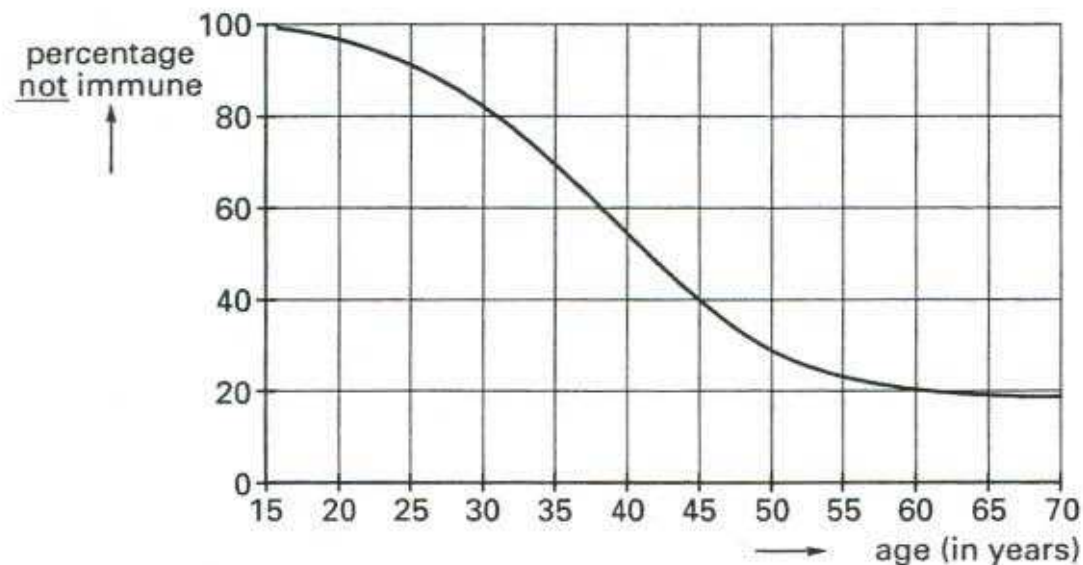
For the Dutch population the percentage of the 45-years old that is immune is more than three times the percentage of the 30-years old.

4p **4** Show using figure 1 that this is correct.
(91)

In the tropics the risk of contamination with the Hepatitis A-virus is large for people who are not immune. Dutchmen who are travelling to the tropics, can be vaccinated. Then they are temporary immune for Hepatitis A.
The health authorities can choose between 2 procedures:
1 'Blind vaccination'; meaning that every 'tropics traveller' will be vaccinated. There is no previous examination whether he is already immune for Hepatitis A.
2 'Selective vaccination'; meaning that every 'tropics traveller' has to take an AHA-test first. If the traveller is not immune than he will be vaccinated, otherwise he won't.

Assume that a vaccination will cost f 200.- per person and an AHA-test f 40.-.
We consider a group of 20 randomly chosen Dutchmen of the same age who will travel to the tropics. There are two possibilities: 'blind vaccination' or 'selective vaccination'.

Assume that the age of all the members of the group is 50.

6p **5** Show with a calculation that 'selective vaccination' for this group is expected
(91) to be cheaper than 'blind vaccination'.

For a group of 20 people of another age than 50 the expected costs of 'selective vaccination' equals the costs of 'blind vaccination'.

6p **6** At which age does this occur? Explain your answer.
(77)

Using figure 1 it is possible to derive probabilities. For example the probability that a randomly chosen Dutchman, aged 25, is not immune, equals 0.92.

4p **7** Find with the help of figure 1 the probability that in a group of 20 randomly
(70) chosen Dutchmen, aged 60, everybody is immune, so nobody has to be vaccinated.

CITO, May 1999 *CITO International Product Samples,* Level – Intermediate, p. 9

Problem 2

Given is the function $f : x \rightarrow \dfrac{1+\ln x}{1-\ln x}$

figure 1

In figure 1 the graph of f is drawn.

4p **4** Find an equation of each of the two
(77) asymptotes of the graph of f.
Explain your answer.

7p **5** Find $\lim\limits_{x \downarrow 0} f(x)$ and $\lim\limits_{x \downarrow 0} f(x)$.
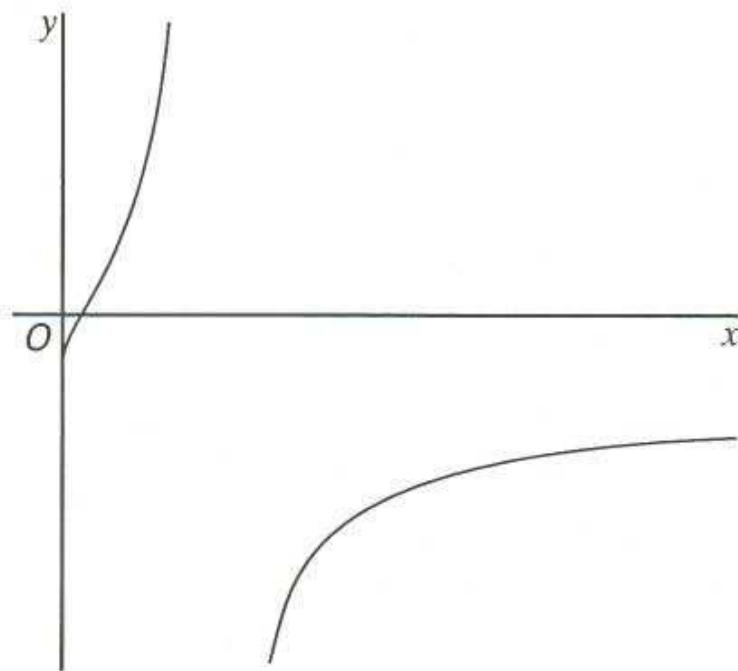
(59) Explain your answer.
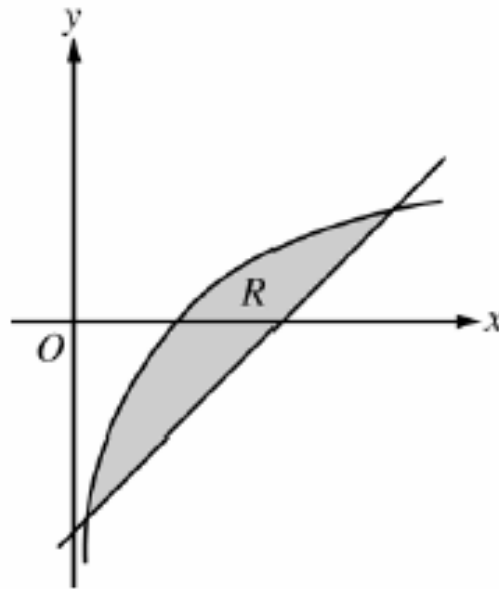
Given is the function $g: x \rightarrow 2\ln x$.
The line $x = p$, with $p > e$, intersects the
graph of f in the point A and the graph of
g in the point B.

8p **6** Find for which values of p holds that
(65) $AB = 8$.

CITO, May 1999 CITO International Product Samples, Level – High, p. 48

AB Calculus 2006

1. Let R be the shaded region bounded by the graph of $y = \ln x$ and the line $y = x - 2$, as shown above.

   (a) Find the area of R.

   (b) Find the volume of the solid generated when R is rotated about the horizontal line $y = -3$.

   (c) Write, but do not evaluate, an integral expression that can be used to find the volume of the solid generated when R is rotated about the y-axis.

Coherence between multiple levels of schooling

- The classroom
- The school
- The larger system

Is an important precondition for successful school reform.

Fullan, Hill, Crévola p. 27

Three factors that explain student achievement

- Motivation to learn and high expectations
- Time on task and opportunity to learn
- Focused teaching

Fullan, Hill, Crévola pp. 31-32

Griftland College

INSTITUUT BLANKESTIJN

1965 2006

naar website

particuliere scholengemeenschap voor VWO, HAVO en VMBO

This presentation
may be found at
http://rusmp.rice.edu