

Naku te rourou
Nau te rourou
Ka ora ai te iwi

With your food basket
With my food basket
The people will be
fed/well



k0129254 www.fotosearch.com

Helping Learners Understand Calculations in a course:

Moving Learners from Step 4 to Step 5/6 of the Numeracy Progressions

Presenter: Jenny Amaranathan

Numeracy Team Leader.

National Centre Of Literacy and Numeracy for Adults



I am good at adding and subtracting whole numbers but multiplication and division with bigger numbers is hard.

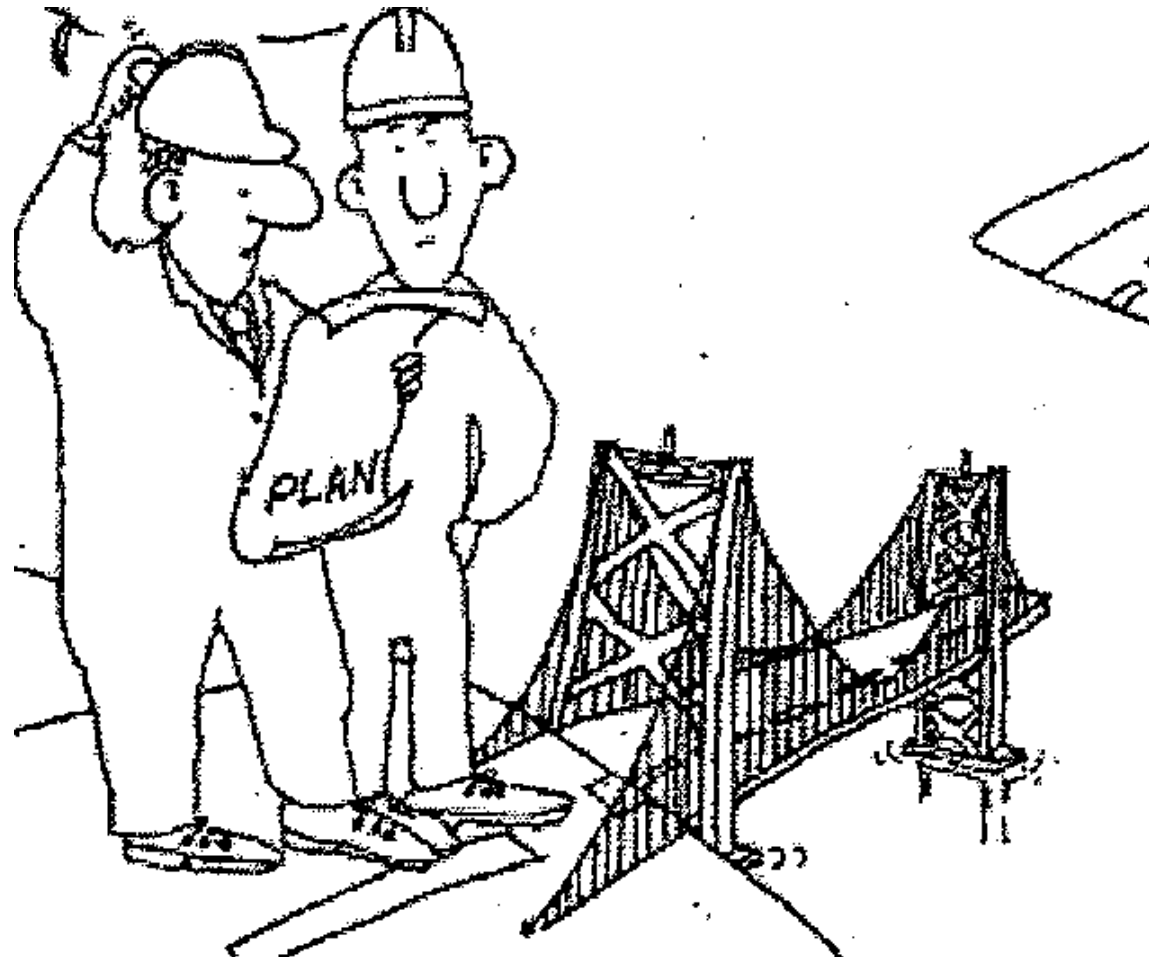
I know what fractions and decimals are and I can find a fraction of a number.

I can estimate lengths or heights using benchmarks that I know, like door heights.
I know 2 m is 2000 mm.

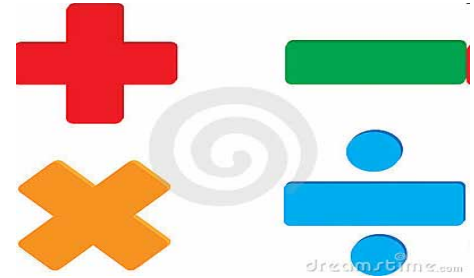
I'm starting to understand area.
I can measure 200 ml using a jug.

Step Four Profile

You're right
The decimal point is in
the wrong place.



Misconceptions

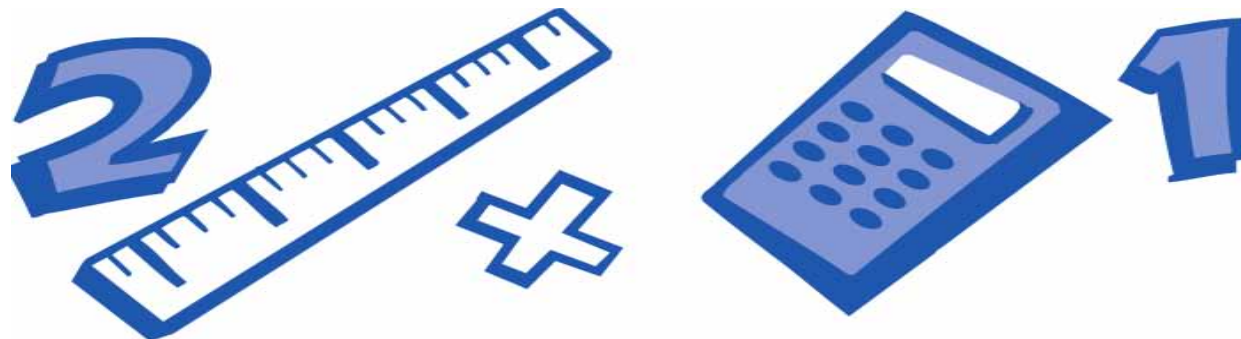


- Learners usually know that $658 > 71$
- What about 0.658 and 0.71? (which is larger and why)
- What about 0.607 and 0.670 (Is there any real difference?)

- Pat has a 355ml drink.
- Hone has a 1.5L drink.
- Pat says his 355 is bigger.



- 150 is ten times as large as 15
So 1.50 must be ten times as large as 1.5
- 023 is the same as 23
therefore 0.023 must be the same as 23
or 0.23



What about? $9 + 1 = 10$ therefore $0.9 + 0.1 = 0.10$

What about?

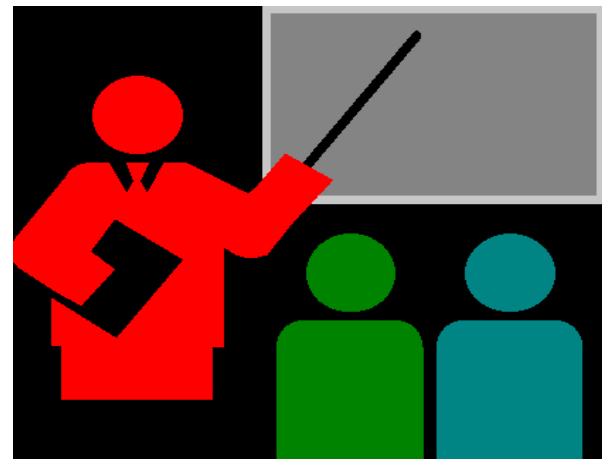
$$4.3 + 1 = 5.4$$

$$1.5 \times 10 = 10.50$$

What has happened?

Why?

What teaching might be needed?



Bill worked out that:

$$2.4\text{m} \times 5.9\text{m} = 10.36\text{m}$$

Is the answer reasonable?

Explain Bill's thinking?

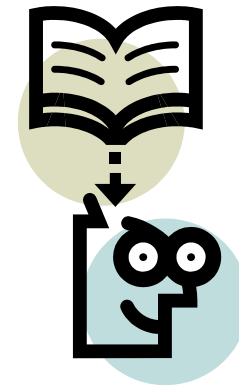


Example of a misconception

- A tutor had a class of young males (16-18 year olds) and they were discussing distances and lengths which were very small
- One learner believed that 0.2mm and 0.02mm looked the same so were probably the same
- Would it make a difference?
- They were starting trade careers in automotive work . . .



So if we realise they do not know so much about decimal numbers then what can we do?



Some kind of focus on place values
And...how about finding some kind of representation which might give them things to (temporarily) work with during their vocational learning?

Place Value Charts

∴

Thousands			Ones		
H	T	O	H	T	O
					6
				6	0
		8	0	0	0
			8	0	0

What does the decimal point do?

∴

Whole numbers

Decimals

H

T

O



•

4

•

4

7

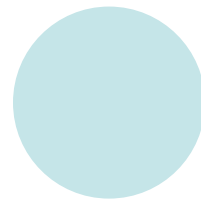
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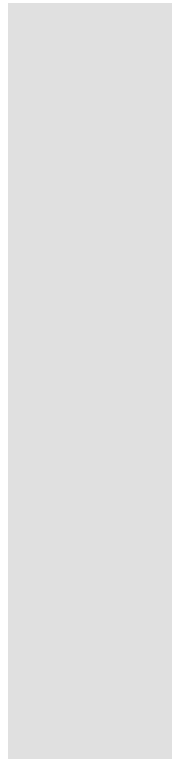
The place-value system for decimal quantities?

- To the right of the decimal point, the values represented by the places get progressively smaller by the factor of ten each time.



- This sheet has four rectangle strips, all four the same length; the first two are shown together

1



Back to our automotive story . . .

- On the second strip, how could you indicate a value of 0.2?
- On the third strip how could you indicate a value of 0.02?
- Decide – are these the same number?
- How could you explain the relationship between 0.2 and 0.20?



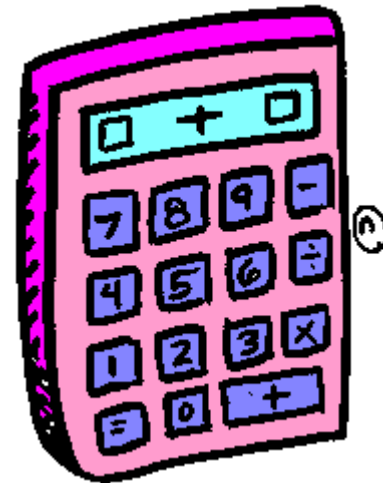
The importance of zero?

- 0 as a place holder.
- In the number 300, don't think of 00 meaning hundreds. It is the *position of the 3* that indicates it stands for three hundred. Zeros indicate there are no extra tens nor ones. This leads to misconception why some people write 30045 for “three hundred and forty-five.
- $3.46 - 1.732$

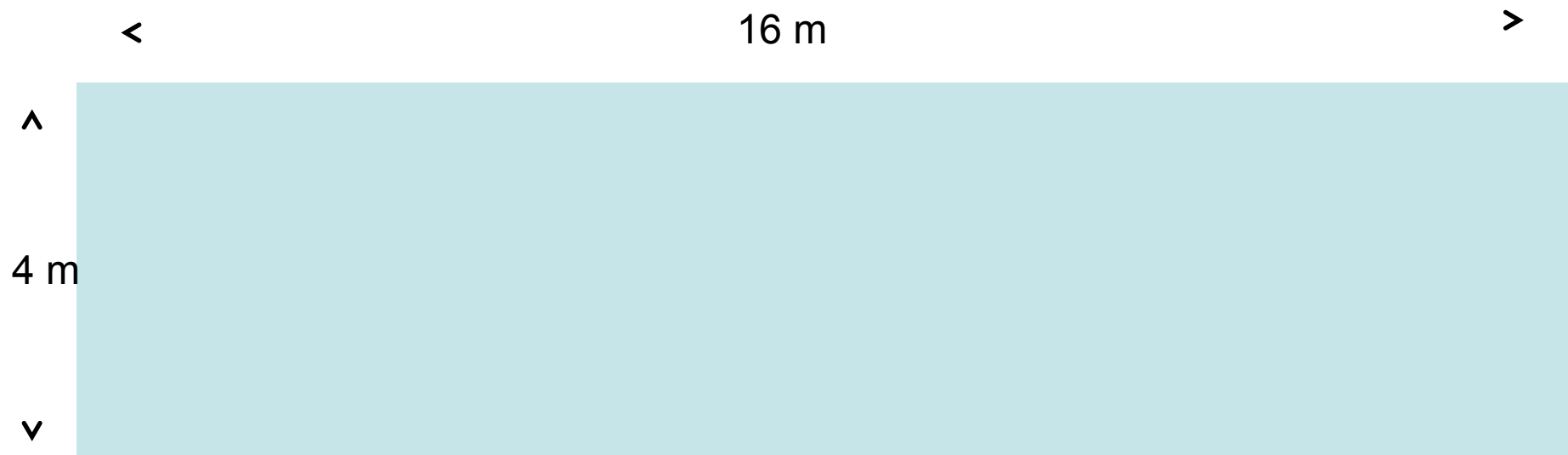


Reasonableness

- If they can reason that 26×7 is about 180, then how might this assist them to 'see' 2.6×0.7 ?
- Other understandings to assist?
- What about $2.6 \div 0.7$?
- Calculator sense!



What is the area (in m^2) of a floor that is 4 m x 16 m?



What is the area (in m^2) of a floor that is 4 m x 1.6 m?



What is the area (in m^2) of a table that is 0.4 m x 1.6 m?



I notice...
I wonder...

$$4 \text{ m} \times 16 \text{ m} = 64 \text{ m}^2$$

$$4 \text{ m} \times 1.6 \text{ m} = 6.4 \text{ m}^2$$

$$0.4 \text{ m} \times 1.6 \text{ m} = 0.64 \text{ m}^2$$

Knowing the Numeracy
Demands



Knowing the Learner



Knowing What to Do



I have whole numbers sorted and I am pretty comfortable using common fractions, decimals and percentages.

I know how to change between fractions, decimals and percentages.

I can calculate area and perimeter from measurements.

I can change 2.38 m to 2380 mm or 238 cm.

Step Five Profile



I can solve problems that involve proportions, rates and ratios

I know how to solve problems that include harder fractions decimals and percentages

I can calculate the surface area and volume of containers and cylinders.

I know that 1 inch is 25.4 mm and 2.54 cm.

Step Six Profile