Learning Decimal Numbers

Workshop for KV teachers
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Some student errors

- 12.4 < 12.17

Some student errors

- 12.24 < 12.7
- 12.94 < 12.7

Some student errors

- 3.09 < 3.8
- 0.03 < .004
- 0.3 _?_ 0.30

a) 37.6 is bigger than 37.06 ...incorrect (both are same)

b) 57.9 = 57.90 = 57.900 .....57...90.....

c) 5.8 is smaller than 5.08 ....incorrect (both are same)

d) 37.02 is same as 37.2 ..correct

- What error is this student making?
- How do we deal with this error?
- The role of zero

An unexpected error!

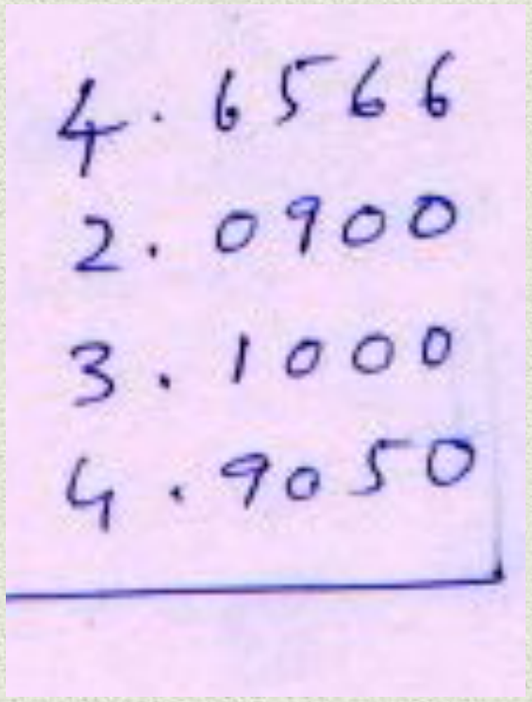
Multiply 0.46×0.40

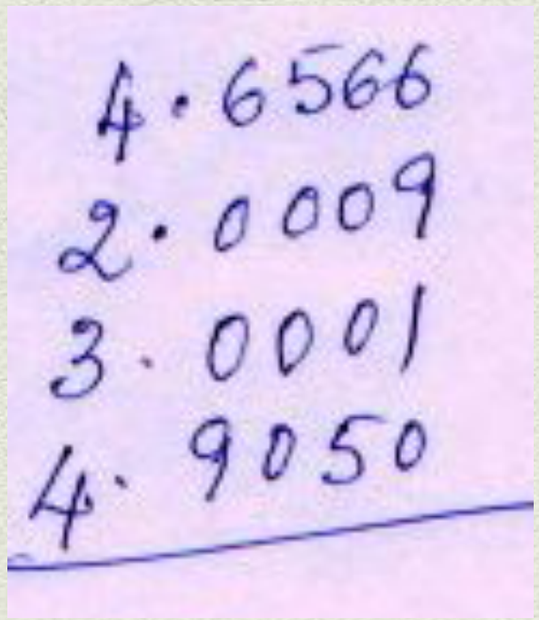
$46 \times 40 = 1840$

$0.46 \times 0.40 = 0.0184$

Unexpected error!

- Add 2.09 + 3.1 + 4.905 + 4.6566





Understanding the role of zero

- Are 3.9 and 3.900 always the same?

Understanding the role of zero

- Are 3.9 and 3.900 always the same?

Relation between fractions and decimals

- 2/10 = ? (What is the basis for the answer?)
- 1/5 = ?
- Fraction representations of the same rational number are not unique.
- What about decimal representations?

Decimals and units

- How do we read 1.3 cm?

Decimals and units

- Which is longer 1.2 cm or 1.13 cm?

Decimals and units

- Which is better?
- Rs. 2.50 p
- Rs 2.5
- Rs 2.502

Decimals and units

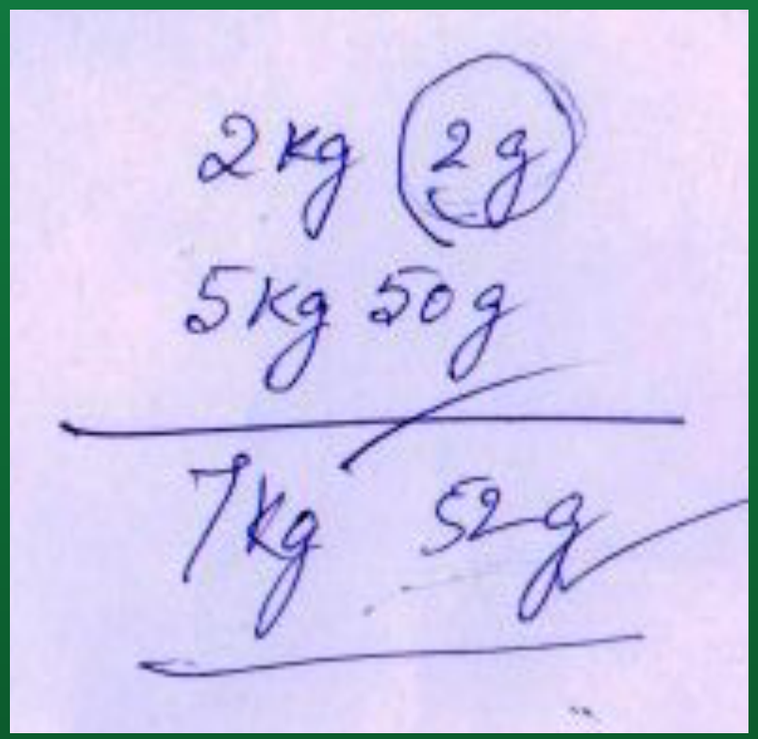
- 0.50 p or 0.50 Rs?
- 0.002 cents or 0.002 dollars?
- Verizon company complaint

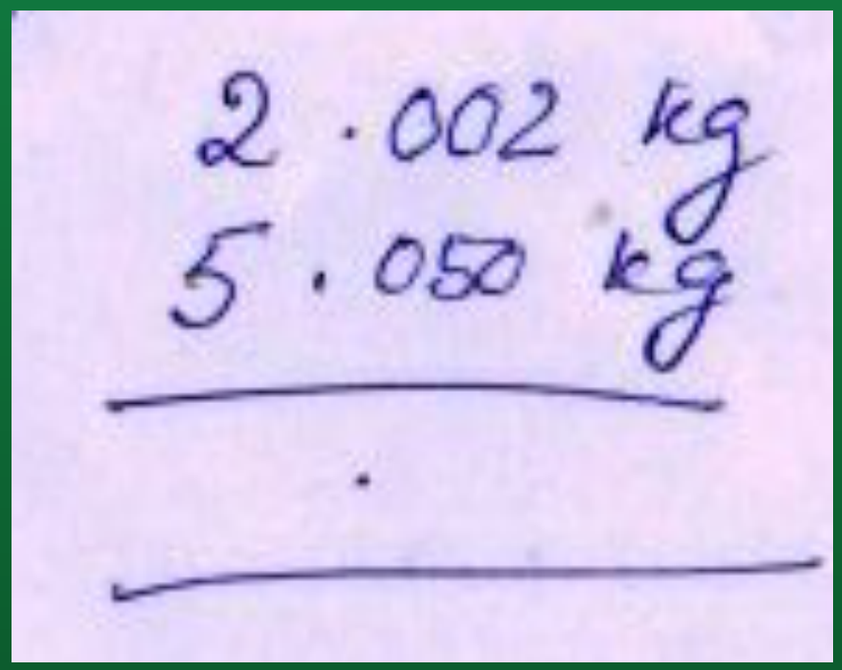
Average runs per over

- India made 65 runs in 6.3 overs. Calculate the average runs per over.

Different units or the same?

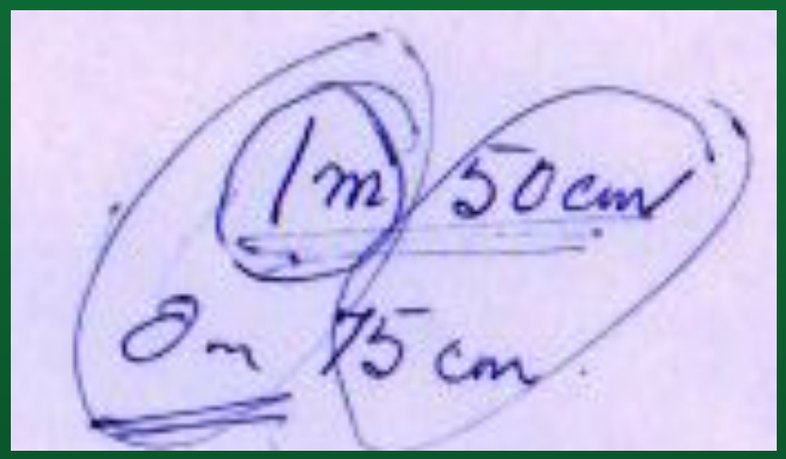
- Rs 2.50 p
- 6.3 overs
- 3.30 pm
- Kothari Commission Report Section, 4.15

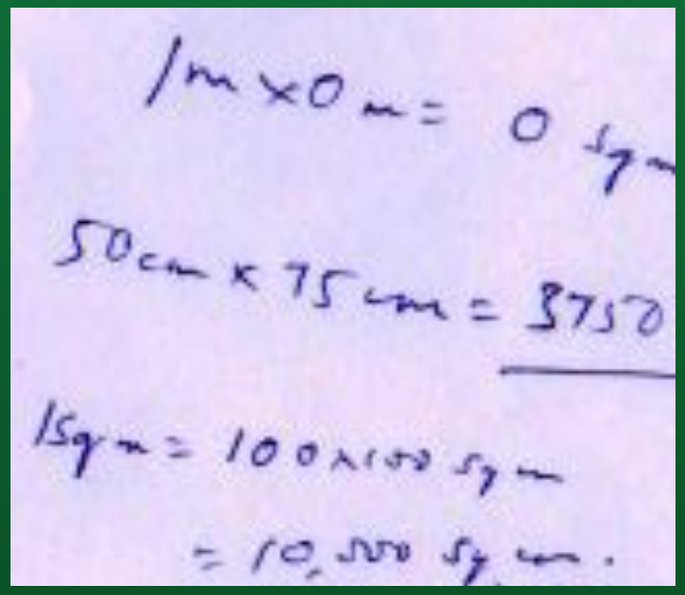


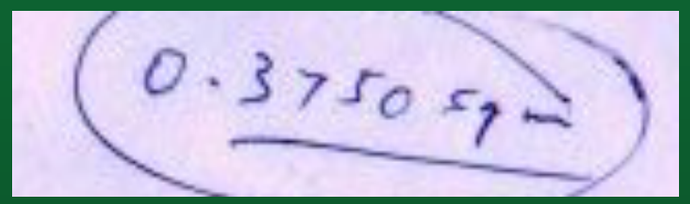


- These are two ways of adding the weight measures.
- Are both correct?

- A rectangle has length 1m 50 cm and breadth 75 cm. What is its area?

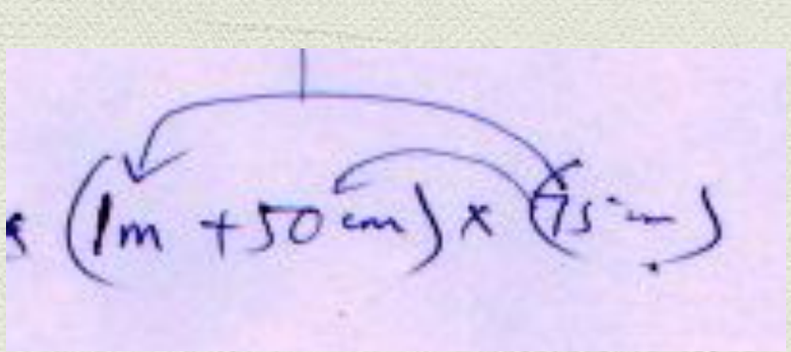


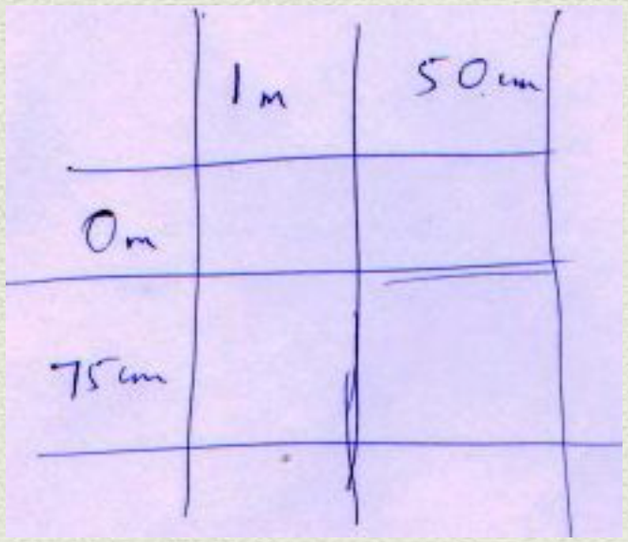




Multiplying the units separately

- You need to deal with composite product units!





- Show 37.0648 using place value columns.
- Student question: Can we write 37 ones instead of making a separate column for tens?

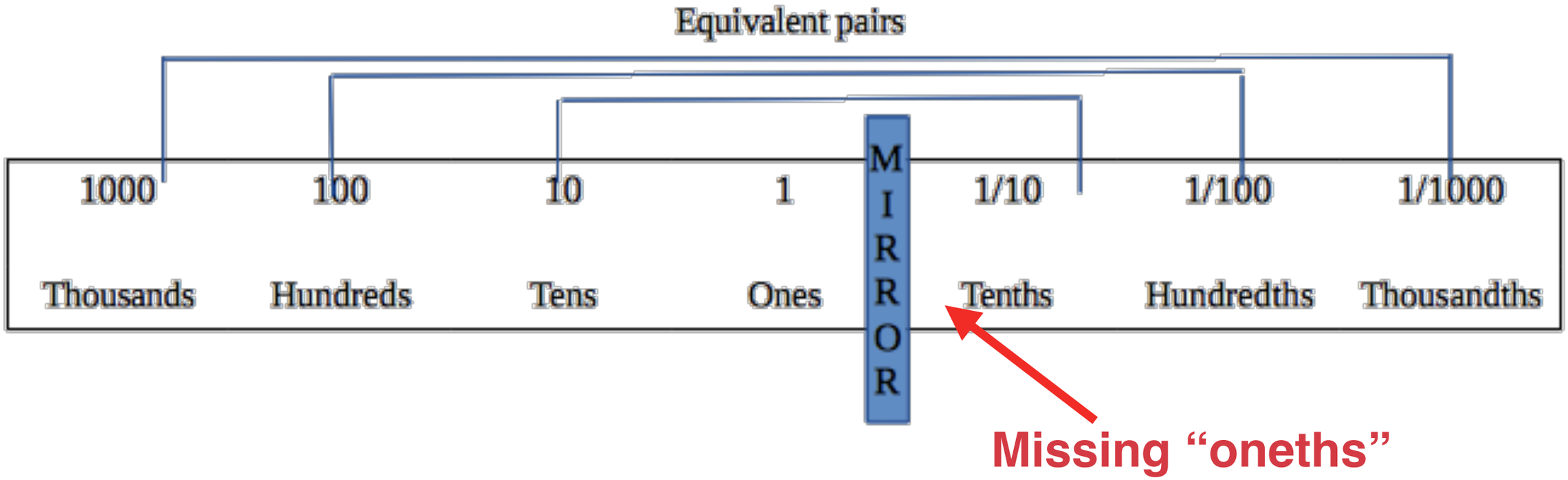
A student's question

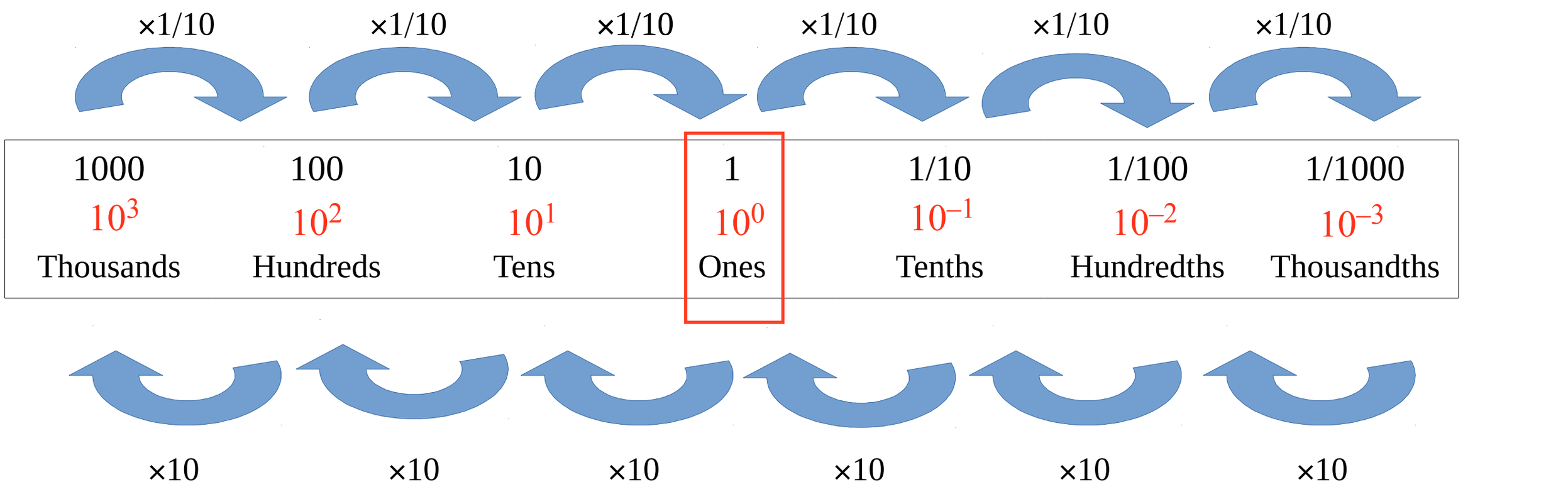
683.12

Hundreds, tens, ones, (.) tenths, hundredths

Student's question: Why is there no (distinct place) for "oneths"?

Notice the teacher's attempt to connect whole number place values with decimal place values.


Equivalent pairs
1000
100
10
1
MIRROR
1/10
1/100
1/1000
Thousands
Hundreds
Tens
Ones
Tenths
Hundredths
Thousandths
Missing “oneths”


×1/10
×1/10
×1/10
×1/10
×1/10
×1/10
1000
10^3
Thousands
100
10^2
Hundreds
10
10^1
Tens
1
10^0
Ones
1/10
10^{-1}
Tenths
1/100
10^{-2}
Hundredths
1/1000
10^{-3}
Thousandths
×10
×10
×10
×10
×10
×10

Why are there no “oneths”

- In order for the teacher to deal with the student’s question, the teacher needs to draw on two kinds of knowledge.
- Part of the knowledge is mathematical.
- Part is knowledge about the way students think.

How to introduce decimals?

- How do you explain to students what decimal numbers are?

Example 1

Currency conversion (Class 5 textbook), typical exercises:

- Mithun's uncle sent 10 US dollars. How much is it in rupees?
- Leena's aunty bought a present from China costing 30 Yuan. How much is it in rupees?

Country	*Money*	*Changed into Indian Rupees*
Korea	Won	0.04
Sri Lanka	Rupee (SL)	0.37
Nepal	Rupee	0.63
Hong Kong	Dollar (HK)	5.10
South Africa	Rand	5.18
China	Yuan	5.50
U.A.E.	Dirham	10.80
U.S.A.	Dollar	39.70
Germany	Euro	58.30
England	Pound	77.76

Making a decision

Decision for the teacher while preparing:

Should one teach multiplication of decimal numbers?

- The textbook says “no”.
- But teachers go beyond the textbook!

Possible choices:

- Teach the decimal multiplication algorithm.
- Scaffold or teach alternative strategies.
- Let children use their own strategies.
- Modify the task to make it more accessible.
- Drop the topic.

Classroom examples from:
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Shweta Naik

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Thank you!

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