

Trial and Improvement

Junior high school

Objective

Mentally estimate and approximate solutions to numerical calculations.

Understand and use the concept of place value in decimals and relate it to computation.

Explanation of the activity

Use “trial and improvement” to find the length of the side of a cube-shaped box that can hold 100 cm³ of ice cream.

The two mental calculations $4 \times 4 \times 4 = 64$ and $5 \times 5 \times 5 = 125$ should suggest a possible starting calculation such as $4.5 \times 4.5 \times 4.5 = 91$, which can be shortened to $4.5^3 = 91$.

This activity gives students the opportunity to enhance their understanding of decimals and improve their skills in estimation.

Using the calculator

Calculator functions used: Multiplication, FSE, TAB

When using the EL-506V, EL-546V, EL-546VA, EL-520V, EL-520VA, EL-531VH, EL-509VH, EL-509V and EL-531V models:

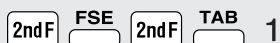
Press the following buttons and then start operation.



Set the calculator to “fixed point” notation with a TAB value of 0.

(Doing this will display answers to the nearest whole number.)

Adjust the TAB setting to 1 and then continue to improve the accuracy of the answer



$$4 \times 4 \times 4 =$$

$$5 \times 5 \times 5 =$$

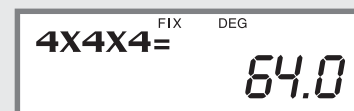
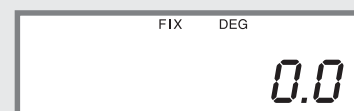
$$4.9 \times 4.9 \times 4.9 =$$

⋮

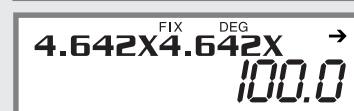
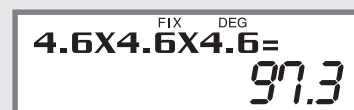
$$4.7 \times 4.7 \times 4.7 =$$

$$4.6 \times 4.6 \times 4.6 =$$

From this we can see the answer lies between 4.6 and 4.7. Continue to search for the answer repeating this operation.



⋮



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Switch FSE and TAB to normal display for further operation.

ON/C **2ndF** **FSE** **2ndF** **FSE** **2ndF** **FSE**

DEG
0.

Press FSE until FIX, SCI, or ENG are not shown on the display.

When using the EL-506W, EL-520W, EL-531WH, EL-509W and EL-531W models:

Press the following buttons and then start operation.

ON/C **MODE** **0**

Set the calculator to “fixed point” notation with a TAB value of 0.

(Doing this will display answers to the nearest whole number.)

Adjust the TAB setting to 1 and then continue to improve the accuracy of the answer.

DEG
0.

SET UP

0

0

SET UP

1

1

4 **×** **4** **×** **4** **=**

5 **×** **5** **×** **5** **=**

4.9 **×** **4.9** **×** **4.9** **=**

⋮

FSE **TAB** DEG
0

FIX **SCI** **ENG** DEG
0 1 2

FIX **DEG**
0.

FSE **FIX** **TAB** **DEG**
0 1

FIX **DEG**
TAB(0-9)?

FIX **DEG**
0.0

FIX **DEG**
4X4X4= 64.0

FIX **DEG**
5X5X5= 125.0

FIX **DEG**
4.9X4.9X4.9= 117.6

⋮

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$$4.7 \times 4.7 \times 4.7 =$$

$$4.6 \times 4.6 \times 4.6 =$$

From this we can see the answer lies between 4.6 and 4.7. Continue to search for the answer repeating this operation.

4.7X4.7X4.7= 103.8

4.6X4.6X4.6= 97.3

4.642X4.642X → 100.0

Switch FSE and TAB to normal display for further operation.

SET UP

0



3

FSE TAB 1

FIX SCI ENG 1 2

NORM1 NORM2 3 4

0.

N.B. To go back to a normal display, skip the buttons and press the [3] key.

••••• Using the activity in the classroom •••••

This activity may be given to students with little introduction or, with the use of the OHP unit, this or a similar task may be introduced to the whole class followed by individual work on one or more of the extension activities. The use of the multi-line playback function will be of practical benefit in tackling questions involving trial and improvement.

••••• Points for students to discuss •••••

It will be necessary to familiarize the students with FSE and TAB in order to understand, for example, why 4.641^3 and 4.642^3 both have the value 100 to the nearest unit. In the context of similar problems, students will need to consider what degrees of accuracy are appropriate; in the case of cubic centimeters of ice cream, possibly only to one decimal place.

Further Ideas

- Find the side of a cubical carton whose volume is $\frac{1}{2}$ liter. It may be necessary to remind students of the equivalence of 500 ml (fluid measure) and 500 cm^3 (solid measure).
- Find the dimensions of a fruit juice carton whose sides are in the proportion 1 : 2 : 3 and whose capacity is 1 liter.
- Find the Golden Ratio x by trial and improvement of the relation

$$\text{Guess } x \text{ (Guess} + 1) = 1$$

Use the playback function on the calculator to show that

$$x = 1 / (1 + x) \text{ and that } x = \sqrt{(1 - x)}.$$

All metric paper has the same shape (except golden). If A0 has an area of 1 m^2 and the longer side is $\sqrt{2}$ times bigger than the smaller side, find these dimensions. What are the dimensions of A4? Have the students confirm their calculations by measuring a sheet.