Is the Answer Reasonable?

Overview

There are many ways of making mistakes when using calculators or computers to perform calculations. With calculators it is easy to put the decimal points in wrongly, press the zero button too many times, or even to enter a digit twice without realising. Every time we make calculations with a calculator or computer we need a way of checking that the answers it gives are reasonable; that they make sense. This activity presents exercises designed to introduce students to this way of thinking and give them practice at estimating simple calculations.

It draws on some of the skills presented in '*In the Head Calculations*' activities '*Multiplication by Tens*' and '*Dividing by Tens*', as well as skills from the previous activities in this section, '*About How Much?*' and '*Talking Money with Calculators*'.

Skills and Knowledge

- Rounding whole numbers
- Rounding decimal numbers
- Estimation of calculations
- Using calculators

Preparation and Materials

- Calculators (a few for students to share during discussion only)
- Photocopy Practice Sheets 1 - 5 (one for each person). (These may be used over several sessions)

Suggested Procedure

Introducing Idea

To begin this discussion with students pose some questions, such as:

- *Do you think that calculators are really smart?*
- *Smarter than you?*
- *Do they always get the right answer no matter what?*

Invent a story illustrating a calculator error that you may have made or use the following example. You may want to insert some realistic item and price that makes the example more real for you.

The other day I was working out how much I could save if I stopped buying ice-cream for six months. My favourites cost $4.95 at my local shop. I worked out that I buy about 6 every week.

I did the calculation and got a saving of $7900.2 on my calculator. If that's how much I would save then it is well worth the sacrifice.

My friend tried the calculation and she got $71280. – even better savings!

- *Do you think the calculator got it right?*
- *How could we check it?*

Write the two results on the board exactly as they would be seen on the calculator: $7900.2 and $71280.

Check that students know how to interpret the amounts as $7,900.20 and $71,280.00. If not, they need further practice, (see '*Talking Money with Calculators*').

Give students a few minutes to share opinions about the likelihood of the results and their reasoning.

Then demonstrate how to use 'friendly' or 'sensible' numbers to estimate approximately what the result should be:

1 ice-cream is $4.95 → almost $5

Each week 6 ice-creams → about 6 x $5 = $30

Each month is approximately 4 weeks → 4 x $30 = $120 → $100 (more friendly)

6 months 6 x $100 = $600

As this result is nowhere near the amounts calculated before, there must have been mistakes in both of the original calculations.

In fact the first error was caused by using an exact calculation using 26 weeks in half a year and instead of 26, the 6 was double entered as 266. Approximating 4 weeks in a month is close enough for an estimate and uses a friendlier number.
The second error was caused by forgetting the decimal point in $4.95 and instead entering 495.

Note: The error is with the user rather than the calculator.

Further examples

Work through one or two more estimated calculations together to illustrate the thinking further. You could ask for suggestions of other ways of saving money, or perhaps calculate the total cost of something like petrol, public transport, cigarettes or coffee over a year. [A year can be thought of as approximately 50 weeks for estimation purposes.]

Practice sheets

Explain to students that the Practice Sheets will assist them to develop skills with estimating and checking results. These skills will help them recognise when a wrong answer comes up on their own calculations. Stress that these methods do not only belong in these classes, but should be used whenever they use a calculator to work something out.

After students have completed Practice Sheet 1 it is worth drawing their attention to the fact that they are using the approximate number to decide on how big the answer will be, that is, where the decimal point goes in the answer, rather than any rules involving counting decimal places.

These sheets could be used over a number of sessions.

One model response is provided at the beginning of each practice sheet.

Note for Practice sheet 2: For addition and subtraction the sensible numbers need to be a little more carefully chosen. Say to the nearest 50 rather than 100 but since they are not being multiplied that will be manageable.

Is the answer reasonable?

Practice Sheet 1

Estimate the answers to these calculations. **Without** using a calculator, circle the answer which seems to be correct.

Calculation	Estimation	Circle Correct Answer
1. 61 x 123	60 x 100 = 6000	750.3 **(7503)** 75030
2. 2.35 x 4.7		11.045 8.245 110.456
3. 64.1 x 23		14743 1474.3 14.743
4. 7 x 32.9		23.03 230.3 2303
5. 64.3 x 8.14		523.4 5234 52.34
6. 91.6 x 7.32		670.51 67.05 6705.1
7. 89.6 x 59.7		534.9 5349.12 53.49
8. 293 x 478		140054 14005.4 140.05
9. 5.4 x 19.8		1069.2 10692 106.92
10. 109.8 ÷ 2.09		52.536 5.2536 525.36

Is the answer reasonable?

Practice Sheet 2

Estimate the answers to these calculations. **Without** using a calculator, circle the answer which seems to be correct.

Calculation	Estimation	Circle Correct Answer		
1. 247 + 359	250 + 350 = 600	456	716	606
2. 6214 + 2102		8316	10206	9112
3. 28.9 + 3.08		31.98	59.7	697
4. 41 – 9.7		40.3	3.13	31.3
5. 17.35 + 1.9 + 9.6		28.85	46.65	10.6
6. 8.1 x 3.09		32.1	25.029	240.9
7. 27.74 ÷ 1.9		1.42	104.1	14.6
8. 301.1 - 109.9		19.12	281.2	191.2
9. 152.6 ÷ 2.8		54.5	5.45	545
10. 2,557 - 251.9		38	2,305.1	4.1

Is the answer reasonable?

Practice Sheet 3

If these answers came up on the calculator would you think they were reasonable?

Use estimation skills, not a calculator.

	Calculation and result	Estimation	Reasonable
1.	2 x $3.48 = $16.90	2 x $3 = $6	No
2.	$15.09 + $2.98 = $54.07		
3.	$20 - $6.15 = $13.85		
4.	$24.90 x 2 = $41.80		
5.	$10.35 + $4.90 = $59.35		
6.	$50 - $21.19 = $28.81		
7.	10 x $5.15 = $15.15		
8.	½ of $63.59 = $31.80		
9.	59 c + $4.50 = $5.09		
10.	85 c x 20 = $170		

Is the answer reasonable?

Practice Sheet 4

If these answers came up on the calculator would you think they were reasonable?

Use estimation skills, not a calculator.

	Calculation and result	Estimation	Reasonable
1.	20 x $5.99 = $1,198	20 x $6 = $120	No
2.	$12.95 + $6.05 + $130 = $149		
3.	$100 - $35.48 = $64.52		
4.	$6 x $2.05 = $12.30		
5.	13.5 x $18.95 = $663.25		
6.	$178.90 ÷ 3 = $59.63		
7.	$151.90 + $3.67 + 85 c = $240.57		
8.	90 x 75c = $16.75		
9.	$50 - 2 x $12.15 = $121.50		
10.	$379.80 ÷ 4 = $94.95		

Is the answer reasonable?

Practice Sheet 5

If these answers came up on the calculator would you think they were reasonable?

Use estimation skills, not a calculator.

	Calculation and result	Estimation	Reasonable
1.	27.9 x 3.24 = 90.396	30 x 3 = 90	Yes
2.	22.1.68 x 5.73 = 96.264		
3.	684 x 53 = 362,520		
4.	4981 ÷ 36 = 13.8361		
5.	3.785 x 91.6 = 346.706		
6.	981.7 ÷ 2.89 = 308.55		
7.	3.51 + 28.4 + 51.3 + 194.7 = 723.17		
8.	49.2 + 81.6 + 427.1 + 121.3 = 679.2		
9.	36.25 x 2 x 4.17 x 3 = 9069.75		
10.	4 (3.15 + 9.814) = 5.1856		

Shift the decimal point – A challenge Practice Sheet

A student who did these calculations did not concentrate on where to put the decimal points.

Use your estimation skills to re-write each one correctly by moving only one decimal point.

Do it without a calculator!

1. 3.4 x 5.6 = 190.4

2. 105.4 ÷ 6.2 = 1.7

3. 2.73 ÷ 3 = 91.0

4. 1.64 x 3.7 = 60.68

5. 212.42 ÷ 8.17 = 2.6

6. 62.7 x 0.5 = 313.5