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Who is this section for?

Most tutors won't have to worry very much about helping their students with numeracy as most adult literacy students can manage their everyday numeracy tasks well enough. Some however, will ask for some help with calculating change, measuring, etc or they may not understand the concepts involved in everyday mathematical language such as *percentage*, *ratio*, *average* or *fraction*.

This section will give some ideas to help students with everyday numeracy tasks, but it will not offer suggestions for helping children with their homework, or preparing for the maths needed in a course or making up for the 'school' maths your student may feel they missed out on. This section deals with very basic, everyday numeracy concepts.

The list of websites and other references at the end of this section will help you if your student wants to tackle more complicated maths.

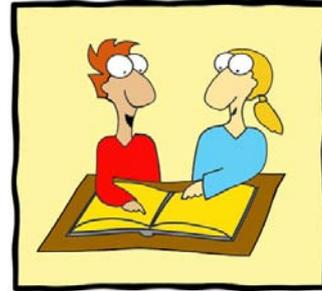
Determining your student's numeracy needs

You don't need to be a maths whiz to help your student with everyday numeracy and you don't need to remember the school maths that you may not have used since. As with literacy, many students' numeracy skills are often better than they think. The main job then is to help the student develop the self-confidence to have a go, and

realize that they can work a lot of it out for themselves (with a bit of help with the basics).

Find out what your student's immediate needs are. Don't test; just ask about the areas they are not confident with. For example:

- recognising numbers and counting
- addition and subtraction
- multiplication and simple division
- simple fractions
- the concept of percentages
- calculating change
- measuring and weighing
- time
- the calculator
- estimation



A few general principles

- Developing confidence and feelings of success are really important. For students with a history of failure in this area, it is not good to place them in a testing situation in which they will probably fail again. When you test or review something, make sure it has been well learnt and practised first.

For this reason practice ... practice ... practice is important. Something understood today may well be forgotten tomorrow if it is not practised and reviewed often.

- In the main, you will be helping the student to develop an understanding of the way in which numbers work, rather than just rote learning of the mechanics. Helping the student to discover underlying number principles will result in much more effective learning than simply telling them.
- Since discovery learning should be your aim, it is important to use practical activities and hands-on materials to help the discoveries. By this we mean making use of everyday items such as measuring cups, kitchen scales, tape measures, money, straws, paper clips etc (for counting).
- Where possible, deal with numeracy tasks in their proper context. This usually means that the use of numeracy skills is integrated with the use of literacy skills.

For example, if you are helping your student interpret the electricity bill, there are words to be understood but also numbers to be interpreted. *What is the significance of -00.00cr (against Payments received)? ... How is 10% GST worked out? ... Look at the simple bar graph comparing present and past usage on the back of the bill ...* This could then lead to some more work, over the next few weeks, on percentages and simple graphs.

A lesson in which you exchange recipes for your favourite dishes could lead to some work on measurement or even fractions or multiplication and division.

This recipe makes 12 tarts. How would I work out what quantity of the ingredients I would need if I only wanted to make 6? Or if I wanted to make 24?

- Make sure the student understands the concepts behind the maths language which we take for granted, for example, *percentage, three quarters, ratio, and decimal place*. If your student is from a non-English speaking background in particular, you will need to pay attention to this.
- Constantly talk about, and encourage your student to talk about, what you are doing.

Rules for writing numbers

From 'No nonsense numeracy', CD ROM, TAFE NSW Access & General Education Curriculum Centre, 2005

Decimal point

In Australia and in most English speaking countries we use a period (27.36) rather than a comma (27,36) as the decimal marker. The use of a comma is common practice in many non-English speaking metric countries. Start all values less than one with a zero, eg 0.5.

Thousand marker

Use a space, never a comma, as a thousand marker, eg 532 137. With four digit numbers, the space is optional, eg 1376 or 1 376. As stated above, the comma is used widely in many metric countries as a decimal marker. The comma was approved for use in Australia when the country adopted the metric system but it found little support. By 1979, the decimal point was accepted as the standard decimal marker in Australia. However, there is some justification for using the comma as a thousand marker in money transactions because a space provides an opportunity for fraudulent entry of an extra figure.

3 456 789

\$567,678.95

Spacing

Leave a space between numbers and symbols, eg 17 kg not 17kg, and between the parts of symbols for compound names, eg kW h. However, leave no space between a numerical prefix and symbol, eg kg, mm, not k g, m m.

36 km

26 kW h



The following activities give some models of strategies which you could use. Use these models to develop activities which are relevant to your student's needs, interests and experience.

The four operations (addition, subtraction, multiplication and division)

Your aim is to help your student:

- understand the concepts involved
- relate these to real life situations
- memorise some number facts.

Addition

Most students are anxious about not knowing their multiplication tables but in fact the addition facts for numbers up to ten are even more useful.

- Start with a ruler and help your student work out some simple additions. Then show them how it is written, horizontally ($4+3=7$) then vertically:

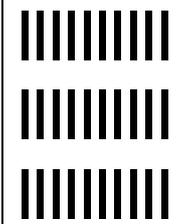
$$\begin{array}{r} 4 \\ +3 \\ \hline =7 \end{array}$$

- Plenty of practice with hands-on, concrete objects will be necessary before the facts go into long term memory.
- Show your student how to work out the addition combinations which give particular numbers, starting with the combinations which give 10 ($1+9$, $2+8$, $3+7$...)
- Show your student short cuts. For example, $9+7$ is the same as $10+6$.
- Draw up an addition table and help your student fill it in, then look for patterns in the table and see if you can work out an explanation together. Have your student fill out the grid randomly; otherwise it can become an exercise in counting.

Addition Table

+	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

- When you introduce numbers beyond 10 it is useful to use concrete items such as drinking straws bundled into 10s to represent the 10s column and individual straws in the units column.

Hundreds	Tens	Units
		

Show how this equals 34.

If you add another 6 straws to the units column, you have made another bundle of 10 which you can move to the 10s column

- When adding a column of numbers:

<p>Numbers carried over must be added in</p>	$ \begin{array}{r} 213 + \\ 423 \\ 42 \\ \hline 1,69 \\ 847 \end{array} $	<p>← All the numbers must be kept in columns, in a straight line from the right</p>
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Subtraction

- Work in a similar way to the suggestions for addition.
- There are several pen and paper methods of doing subtractions. The method shown below is called 'regrouping' and is the most common method taught in schools today as it is the easiest to understand.

In the example below, we're taking 418 from 523. Start with the units column on the right. The 8 is bigger than the 3 so we need to take one ten from the tens column (the middle one) and add it to the 3 to make 13. That means there's only one ten left in the tens column and the 2 becomes a 1. You can now take 8 from 13 (and then finish the sum).



$$\begin{array}{r} 1 \\ 5 \ 2 \ 3 - \\ \underline{4 \ 1 \ 8} \\ 1 \ 0 \ 5 \end{array}$$

Multiplication

- Introduce multiplication as 'lots of' and use drinking straws, paper clips etc. For example, 4 lots of 3:



- Show that it means the same as $3+3+3+3$.
- Relate it to real life problems. *If my fares to work each day cost \$4, how much do I pay in a five day working week?* Show your student how this is written down.
- Do a number of problems like this, using short multiplication (no carrying) and helping your student to use, or visualise, some concrete objects as they do them.
- When you get to problems which involve 'carrying' it is helpful to use objects such as drinking straws as in the example above for addition.

For example:

	Tens	Units
14		

14 x 4 = 4 lots of 14		
		
		
		

We now have 16 straws in the units column, so we can make another bundle of 10 and move it to the tens column. Do this with pen and paper as well.

	Tens	Units
= 56		
		
		
		
		

- If your student wants to commit multiplication tables to memory, it will take a lot of practice, using as many different activities as you can devise, in addition to just rote learning.
- Start by helping your student count by 2, 3, 4 and 5, up to about 20.
- Show how to multiply by 10 and 100.
- Help write out the multiplication tables to use as a reference, using concrete objects if necessary as counters.

- Look for patterns in the multiplication grid below and together see if you can work out an explanation for the patterns.

Multiplication grid

X	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

Division

- The everyday language of division can be confusing, but it is best thought of in terms of 'sharing out'. It can also be thought of as the inverse (opposite) of multiplication.

3 lots of 4 make 12.

12 shared among 4 is 3.

- Begin by demonstrating the concept of simple division (no borrowing and carrying) with concrete objects, and show how it is written.

I have 9 paper clips and I want to share them among 3 people.

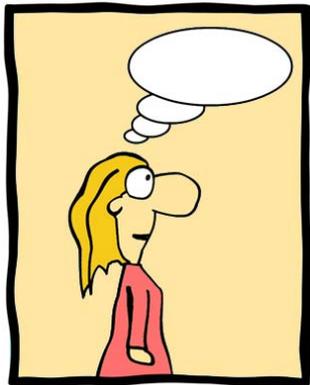
How many does each person get?

Relate it to real life problems. *I pay \$20 in fares to work each week. How much is this per day for a five day week?* And show your student how it is written down.

- Introduce the concept of the 'remainder' or 'left over'.

10 pens shared among 4 children gives 2 each with 2 left over.

- Show your student how to divide by 10 and 100.
- Long division is probably best done with a calculator.



Fractions

Your aim is to help your student:

- visualize some common fractions
- name some common fractions
- use the written symbols
- understand and use everyday fractions.

- Start with several circles of paper, the same size and preferably in different colours.
- Cut one circle in halves, one in quarters, one in eights, thirds, fifths etc.
- Show the student how these fractions are written ($\frac{1}{2}$, $\frac{1}{4}$ etc).
- Ask the student to write the correct fraction on each piece.
- Explain what the numbers at the top and the bottom mean:

The number at the bottom means how many parts we have divided the thing into.

The number at the top is how many of those parts we have.

- Ask the student to explain what some of the fractions mean. Make sure that they can see or hold the appropriate fraction pieces.

This is a quarter. It means the whole is divided in four equal parts and I have one part.

This is two thirds. It means that the whole was divided into three equal parts and here are two of those parts.

- Draw the student's attention to the fact that the larger the number at the bottom, the smaller the fraction is and ask them to explain it.

Equivalent fractions

Experiment to see how many quarters fit on a half, how many eights fit on a quarter ... and on a half ... *Can we make any number of thirds fit exactly onto a half? etc*

Write down the fractions that match exactly, eg:

$$\frac{2}{4} = \frac{1}{2}$$

$$\frac{4}{8} = \frac{1}{2}$$

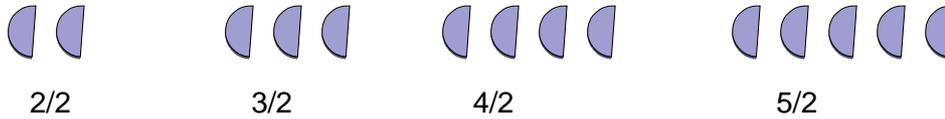
$$\frac{2}{6} = \frac{1}{3}$$

Explain that we usually refer to one half rather than four eights, etc. If we have equal fractions, we usually refer to the one with the smallest number at the bottom.

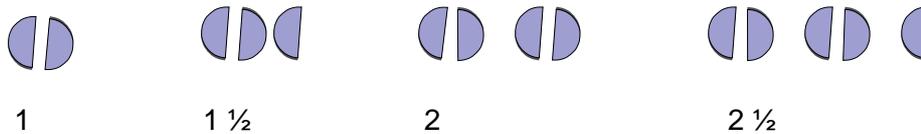
Improper fractions

(whole numbers and fractions, eg $1\frac{1}{2}$)

- Cut several circles in halves and lay them out as:



- Imagine they are halves of a pizza and arrange them like this:



- Draw the student's attention to fractions such as $\frac{4}{4}$, $\frac{2}{2}$.

You could also do these activities with strips of paper, or using measuring cups filled with water or kitchen scales and foodstuffs such as rice.

Don't try to introduce the formal rules that are involved here unless the student tries to work it out independently. It is important that they can visualise what the fractions are and make sense of them that way.

Everyday problems

Make sure your student can do simple number operations (addition, subtraction, multiplication and division) or can use a calculator to perform these operations.

Recipes

Take a recipe and ask your student what amount of each ingredient is needed to make twice the amount, half the amount, etc.

If the recipe asks for 6 eggs and they only have 3 eggs, how much of the other ingredients would they use?

Time

Look at a clock face (not digital):

How many minutes are in $\frac{1}{4}$ hour?

How many minutes are in $\frac{3}{4}$ hour?

What fraction of an hour is 20 minutes?

You leave home at 8 o'clock. It takes you half an hour in the train and a quarter of an hour walk. What time do you get to work?

Money

George takes home \$300 per week. He pays \$100 rent. *What fraction of his pay is this?*

He spends $\frac{1}{6}$ of his total pay on a loan repayment. *How much is this per week?*

He spends \$25 on lunches each week. *What fraction of his pay is this?*

$\frac{1}{10}$ of his pay is spent on car expenses. *How much is this?*

Petrol gauge

The petrol tank in your car holds 40 litres. *How much petrol will you have in the tank when it is showing half full? When it is showing a quarter full?*

You go out with a full tank and use a quarter of the tank. You go out again and use 10 litres. *What fraction is left?*

Percentages

Your aim is to help your student:

- understand the meaning of percent
- be able to visualize percentages
- do simple calculations with percentages
- understand and use everyday percentages.

- Make sure your student knows what *percent* means (per hundred).
10% discount means \$10 off each \$100.
- Look for references to percentages in newspapers, magazines and advertising fliers and discuss what they mean without necessarily trying to work out the maths involved.
25% off means that if the mattress cost \$100, it would be \$25 less or \$25 off each \$100. So if it was \$200, it would be \$50 off.
30% of the people surveyed means 30 of every 100 people surveyed.
Discuss what 100% means (all). *100% Australian owned, 100% wool.*
- Take a metre ruler or tape measure and show that 1 metre is 100 centimetres.
50 cms is 50%, 25 cms is 25%, 10 cms is 10% etc.
Make the connection to simple fractions: half, quarter, three quarters, one tenth.
- Draw several bars 10 cms long and ask your student:
Imagine this is the number of people who answered a survey. 30% answered no to a question. Shade this in on the bar.
The bar represents your income. 15% is spent on car repayments. Mark this on the bar.
20% is spent on food. Mark this on the bar.
- If we first find 1% of a number, we can use that answer to find any percentage of the same number, eg:
3% of 500 = ?
1% of 500 = 5 $3 \times 5 = 15$ therefore 3% of 500 = 15
- Show your student how to calculate:
1% by moving the decimal point 2 places to the left
10% by moving the decimal point one place to the left

7% by working out 1% and multiplying by 7
20% by working out 10% and multiplying by 2
etc ...



- If you need to calculate 50%, 25% or 75% of a number, it is usually easiest to convert the percentage to a fraction to work it out.

Examples of percentages in everyday activities

Make sure your student can do simple number operations (addition, subtraction, multiplication and division) or can use a calculator to perform these operations.

- You lay-by a pair of shoes that cost \$90. You have to leave a deposit of 10%. *How much do you leave?*
You have to leave a deposit of 20%. *How much do you leave?*
- George's income tax is 30%. *How much does he pay in each dollar?* He earns \$600 a week gross. *How much of that does he pay in tax?*
- A shop adds 50% to the cost of their goods before they sell them. They buy towels from the manufacturer for \$20 each. *How much would they sell them for?* They buy sheet sets for \$60 each. *How much would they sell them for?*

Estimation

Your aim is to help your student:

- understand when and why it is important to estimate
- use the rounding off method of estimation.

- It is often not necessary to make an accurate calculation of something, but it is important to get a rough idea. For example, when we are shopping and buy a number of items, we need to know if we have enough cash with us before we get to the check-out.
- Estimation is also important in order to check the reasonableness of an answer which we have worked out either on paper or with the calculator. It is easy, for example to get the decimal point in the wrong place, or to do the wrong operation in a complex problem (to multiply when we should divide, for example).
- The usual process of estimating involves rounding off. Show your student how to round up or down to the nearest 10 or 100. For example, if three items in the supermarket cost:

\$3.15	this is closer to 3.00 than 4.00 so we round down to	3.00
\$7.85	this is closer to 8.00 than 7.00 so we round up to	8.00
\$4.65	this is closer to 5.00 than to 4.00 so we round up to	<u>5.00</u>
		\$16.00

We know our items will cost about \$16.

Calculator

Your aim is to help your student:

- perform simple calculations on a calculator.

- Encourage your student to use a calculator, if they don't already. Many students feel it is cheating and they want to learn to do it the proper way, but you have to understand the maths involved in what you are doing before you can use a calculator. You have to know what to tell it to do. It just does the hack work.
- Most everyday uses for a calculator are best performed with simple calculators that have the four operations plus %, $\sqrt{\quad}$ and a simple memory function. Scientific calculators are not necessary unless your student needs to use one for work or for a vocational course.
- Students first need to understand decimals. They also need to understand that our money system is a decimal system when working out money problems on the calculator. 50c is \$0.5 so is entered in the calculator as .5
- It is easy to hit the wrong key, so to begin with, encourage your student to check the display each time they enter a number. They should then be encouraged to estimate the answer and check the 'reasonableness' of what the calculator says.
- Remind the student that the order in which you enter the numbers for subtraction and division is important. 10-8 is not the same as 8-10 (although 8+10 is the same as 10+8).
- Different calculators work differently, so it is important for your student to find out how their particular calculator works but in general, the four operations are straightforward.
- Finding a percentage of a given total is a useful and simple operation.
- To find 25% of \$36:

Press **AC** then $\textcircled{3}$ $\textcircled{6}$ $\textcircled{\times}$ $\textcircled{2}$ $\textcircled{5}$ %

Note that you enter the total number first and then the percentage number and you don't press the = key to get the total, you press the % key.

Weights & measurement

Your aim is to help your student:

- visualise common metric measurements
- estimate weight and size.

Length

- On a metre ruler or tape measure, show your student 1 mm, 1 cm, 1 metre.

Ask them to count how many mms in a cm? How many cms in a metre?

10 mm = 1 cm 100 cms = 1 m 1000 mm = 1 m 1000 m = 1 km

It may help to remember this if you know that:

milli- means one thousandth

centi- means one hundredth

kilo- means one thousand

Using this information, ask your student to explain what the words *millimetre*, *centimetre* and *kilometre* mean.

- Ask your student to estimate:
 - the width of their index finger
 - the height of the door
 - the length of a small car
 - the width of their hand
 - the thickness of a 5c piece

Then measure them.

- For future reference, it may help to remember that:
 - 1 mm is about the thickness of a 5c coin
 - 1 cm is about the width of an index fingernail
 - 1 m is a long stride or the length from your fingertip with your arm outstretched, to your opposite shoulder.
 - 10 cms is about the width of a hand, across the knuckles
 - 2 m is a standard door height

Weight

Weight is sometimes called mass.

- On a set of scales show your student a kilogram, a gram and a milligram.

Ask your student to estimate how many milligrams in a gram? How many grams in a kilogram?

$$1000 \text{ mg} = 1 \text{ gram} \quad 1000 \text{ g} = 1 \text{ kg} \quad 1000 \text{ kg} = 1 \text{ tonne}$$

(Remember *milli-* means thousandth, *kilo-* means thousand)

- Using this information, ask your student to explain what the words *milligram* and *kilogram* mean.
- For future reference, it may help to remember that:
 - 1 milligram is about the weight of an ant's egg
 - 1 gram is about the weight of 3 aspirin or 2 paper clips
 - 5 grams is about a 10 cent coin
 - 1 kilogram is a small packet of sugar or a litre of water
 - 1 tonne is about the weight of a small car
- Now give your student practice in estimating the weight of some objects in the room etc.

Liquid volume

- Using a measuring jug, ask your student to estimate how many millilitres in a litre.

$$1000 \text{ mL} = 1 \text{ litre}$$

$$1000 \text{ L} = 1 \text{ kilolitre}$$

(Remember, *milli-* means thousandth, *kilo-* means thousand)

- Using this information, ask your student to explain what the words *millilitre* and *kilolitre* mean.
- For future reference, it may help to remember that:
 - 1 mL is about 1/5 teaspoon
 - 5 mLs is one teaspoon
 - 250 mLs is one metric measuring cup
 - 1 L is a bottle of milk
 - 1 kL is a cubic metre of water
- Now give your student practice in estimating the volume of some containers or products in the kitchen etc.

Some useful references for this section

- Goddard R. & Regan M. *The Value of Time: Numeracy for Workers in Manufacturing*, CAE, Melbourne, 1995.¹
- Goddard R. Marr B. & Martin J. *Strength in Numbers*, ARIS, 1997.¹
- Lukin A. & Ross L. *The Numeracy Handbook*, NSW AMES 1997.²
- Marr B, Anderson C and Tout D, *Numeracy on the Line - Language based numeracy activities for adults*, National Automotive Industry Training Board, 1994.¹ (Designed for employees in vehicle manufacturing but with application to any modern workplace.)
- Marr R. & Helme S. (eds) *Mathematics: A New Beginning*, State Training Board, Victoria, 1987.¹
- Ross L. *The Numeracy Workbook*, NSW AMES, 1997.²
- Shank M and Grove M, *Survival Maths*, Hawker Brownlow Education, Australia, 1988.
Titles include: Around the Home; Food Shopping; Money; On the Job
- Tout D, *Car Costs II: A numeracy workbook*, CAE Melbourne, 2006.¹
- *No Nonsense Numeracy*, CD Rom, TAFE NSW Access & General Education Curriculum Centre, 2005.³

Available from:

1. CAE press: www.caepress.edu.au
GPO Box 372
Melbourne
Vic 3001
Ph: (03) 9657 8111
2. AMES NSW: www.ames.edu.au
PO Box 1222
Darlinghurst
NSW 1300,
Ph (02) 9289 9255
3. TAFE NSW Access & General Education Curriculum Centre
PO Box 357
Granville NSW 2142
Ph: (02) 9846 8101

Websites

<http://www.dest.gov.au/literacynet/numcomp/overview.html>

Numeracy and Computing resources developed by Canberra Institute of TAFE. For activities to teach numeracy fundamentals, click on the link to *Some fundamentals*. The main part of the site has numerous activities related to numeracy for *Work*, for *Home and Leisure* and for *Making Sense of the World*.

http://www.dest.gov.au/ty/litnet/numeracy/home/nh_0000.htm

Vocational Numeracy Online - a resource for students in vocational education and training. Click on *next* to choose your industry.

<http://www.bbc.co.uk/skillswise/> .An excellent interactive site, written for adults, with exercises in literacy and numeracy.

www.aaamath.com Includes some very basic practice activities including activities relevant to NESB learners.

www.ames.net.au Click on *AMES Shop* and *Money! Money!* then scroll down to free downloadable activities.