Percentages - Introduction

An important part of numeracy

Percentages are one of the most common means that people use to describe what's happening in our world. In the media they are used to describe unemployment rates, a plethora of health and welfare statistics and the allocation of government resources, such as how much is spent on education or the military in comparison to other countries.

In more personal and immediate matters, percentages are used to inform us about interest rates on credit cards and loans, to explain salary deductions, to announce increases in pensions and allowances, and of course, to entice us to save (or spend) money with discount offers.

Since numeracy is about understanding mathematically related aspects of our world, part of numeracy teaching is to make percentages meaningful. We want students to be able to get a sense of their size or value when they arise, whether in personal situations or in relation to the wider society.

The meaning of 'percent'

Percentages are used in reporting information because they are easier to understand and compare than other types of fractions. For example, comparing 20% and 15% of the population is a lot simpler than if the same figures were presented as 1/5 and 3/20.

Percentages are simple and powerful because they always use the same base number, 100. Unfortunately, this basic understanding of the meaning of percentages has been obscured for many adults because of a common preoccupation with teaching formulae rather than meaning.

This section attempts to redress that focus and to demystify percentages for adults operating in a modern world.

Building on prior knowledge for shortcut methods

The activities draw on students' everyday understanding of common percentages, such as 50% and 100%, to boost confidence in their existing knowledge. They go on to explore the meaning of percentage as part of 100, to make links to other common fractions, and to use these as the basis of 'shortcut' or 'in the head' strategies for calculating everyday percentages.

Calculators and estimations

The section also contains activities to introduce the percentage function on the calculator, and familiarise students with its use.

Estimation techniques are also introduced in this section. They are used as a strategy for checking calculator results as well as a means of approximating complex percentage calculations which do not lend themselves to simple ‘in the head’ strategies.

Matching Percentages 1

Overview

This activity can be used in a variety of ways:

- As a non threatening introduction to percentages
- As a link between commonly used fractions and equivalent percentages (e.g. ½ = 50%, ¼ = 25%)
- As a chance to observe students' familiarity with simple percentage and fraction concepts
- As a foundation for shortcut percentage calculations
- To extend students' understanding of the concept of percentage

Skills and Knowledge

- Linking common percentages and fractions
- Explaining 'percent' as part of a hundred

Preparation and Materials

- Copy Activity Sheet 1 *Matching Percentages 1* onto stiff paper or card, cut into pieces and place in labelled envelopes (1 for each pair or small group of students).
- Cut also some blank pieces of paper or card roughly the same size as the cards in the sets.
- Copy Activity Sheet 2: *Large 100 Square Grid* (2 - 3 copies for demonstrating)
- Copy Activity Sheet 3: *100 Square Grids* cut and have ready to distribute (5 per pair or group).
- Collect some coloured pencils or textas (at least 1 per student).

Suggested Procedure

Matching the cards

Arrange students in pairs or small groups and give one envelope of *Matching Percentages* to each group.

Ask them to tip the contents on to the table and sort the cards into groups that they think will go together (say the same thing).

Circulate to observe how easy or difficult this seems to your students so you will know how far and how quickly you can proceed with the rest of the activity.

Extension for early finishers – blank set

If some groups finish while others are still absorbed in the task, give them a set of the blank cards and ask them to try and create a set of cards similar to the others but for a fraction or number that is not there yet.

If they really cannot think of one then make a suggestion e.g. 1/3, 1/5, 1/10 or even 1½ depending on their likely strengths and previous knowledge.

Compare results

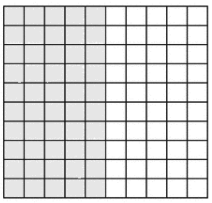
When all students have completed the first set, compare results.

When possible, for questions or disputes that arise, encourage students to explain their thinking to one another.

If any group have completed a set of their own cards, check and acknowledge their extra work. If it seems helpful, ask them to show the rest of the class what they created and ask the others if they agree.

The next section is valuable to extend students' understanding of percentages and lay foundations for shortcut calculations of percentages.

Extending understanding of percentages



Ask students to leave the sets of cards on the table.

Distribute copies of Activity Sheet 2: *Hundred Square Grids* to each student group and ask them make a diagram for each of their sets of cards by shading in some of the 100 squares in the grid.

Beginning with one half, ask:

- *How many squares did you shade in for one half?*
- *Why 50?*

Words like century, centigrade, centimetre, cents in the dollar... all of which denote 100 parts.

Explain that the word 'percent' means exactly '50 per hundred' or '50 out of 100'.

Ask students if they have seen this 'cent' in other words

If students are interested this is also a good time to consider where else they see 'per' – as in km per hour ... meaning 'in every hour'.

Explain:

- *This '50 out of a hundred' can also be written as a fraction:* $^{50}/_{100}$
- *The fraction with the line and two zeros has led to the shorthand symbol %*
- *So* $^{50}/_{100}$ *becomes 50%.*

Compare students' diagrams for the other fractions, continuing to reinforce the 'out of 100' or 'per cent' meaning.

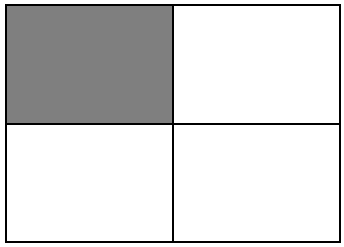
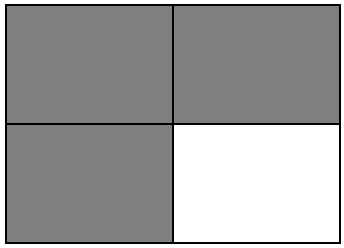
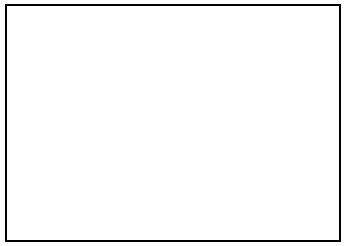
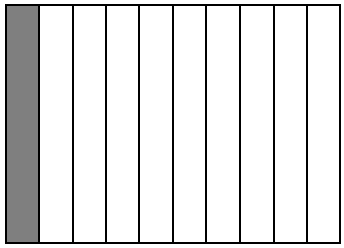
They should also be aware that it doesn't matter where on the grid the shading is done, as long as the correct number of squares is shaded.

Explain to students that understanding percentage this way helps them do lots of shortcut calculations without having to use a formula.

Matching percentages 1

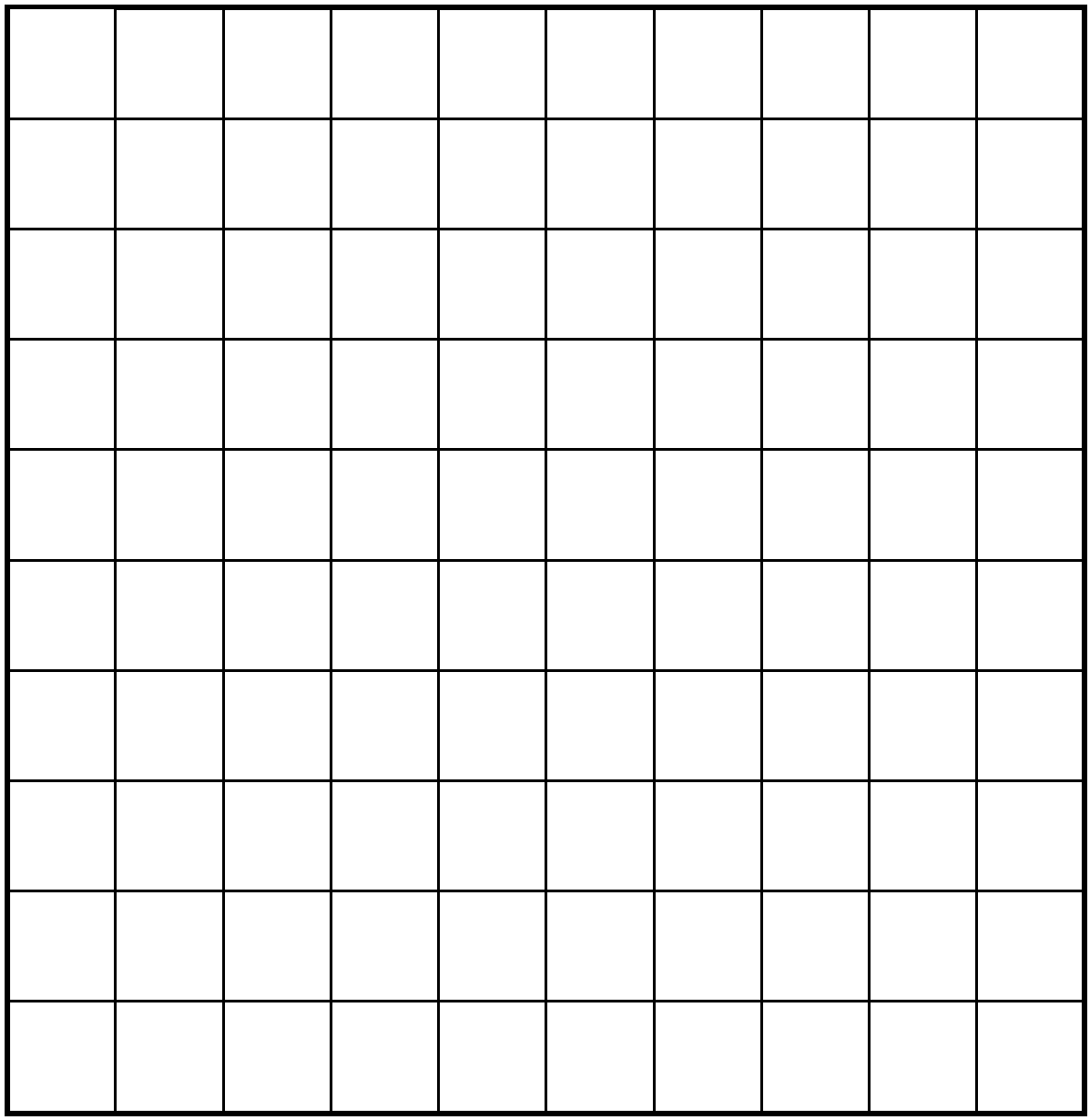
Activity Sheet 1

Copy onto card and cut.

100%	1	all	
50%	$\frac{1}{2}$	a half	
25%	$\frac{1}{4}$	a quarter	
75%	$\frac{3}{4}$	three quarters	
0%	0	nothing	
10%	$\frac{1}{10}$	one tenth	

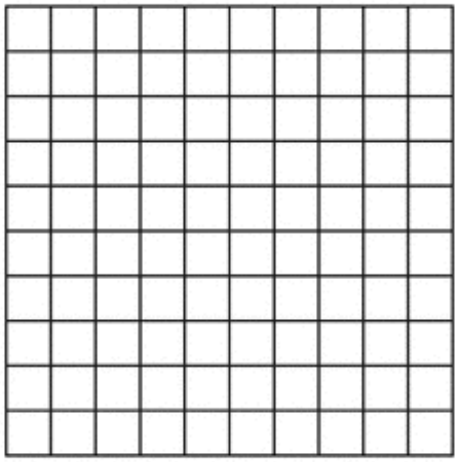
Large 100 Square Grid

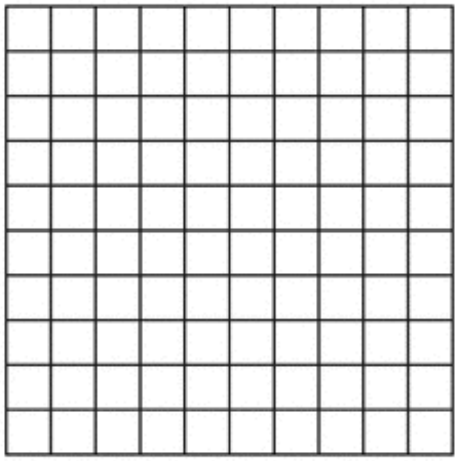
Activity Sheet 2

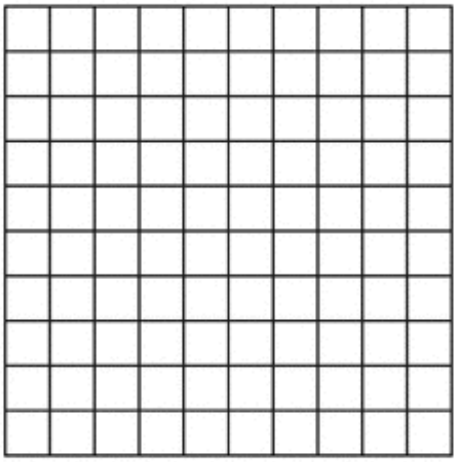


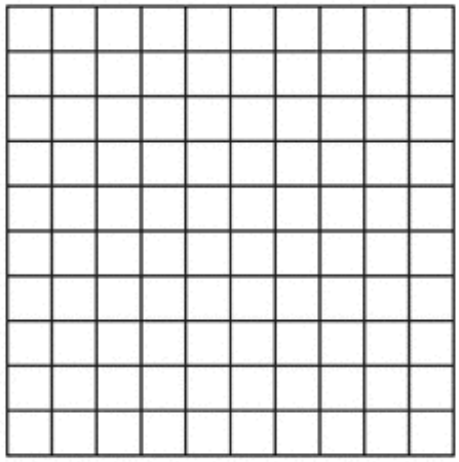
100 Square Grids

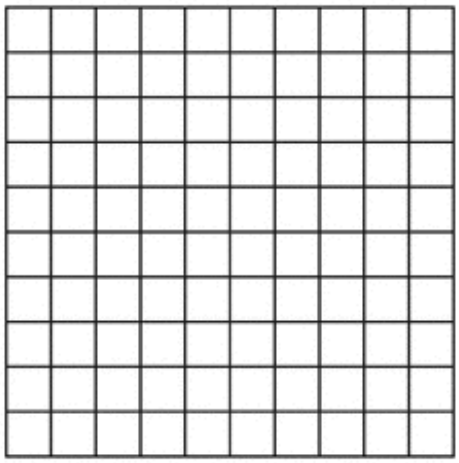
Activity Sheet 3

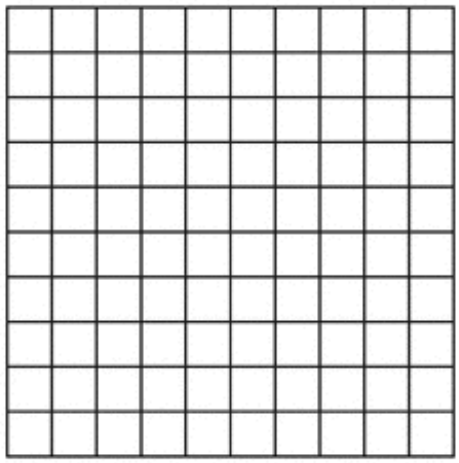












Matching Percentages 2

Overview

This activity can be used to make links between fractions and percentages commonly used in Australian society and to explore their relative sizes. It also provides an opportunity to reinforce both fraction and percentage concepts.

It is a quick, non-threatening activity which encourages student discussion and cooperation in pairs or small groups, so provides a useful variation from individual calculation exercises. The matching activities should not be done one after the other.

Skills and Knowledge

- Linking common percentages and fractions
- Comparing common fractions and percentages
- Reinforcing fraction concepts
- Reinforcing the concept of percentage as a special type of fraction

Preparation and Materials

- Copy Activity Sheet 1 'Matching Percentages 2' onto stiff paper or card, cut into pieces and place in labelled envelopes (1 for each pair or small group of students).
- Cut also some blank pieces of paper or card roughly the same size as the cards in the sets (optional).
- Have Fraction circle kits from *'The Meaning of Fractions'* available for revising fraction concepts if necessary (optional).
- Photocopy *Activity Sheet 3,* the 1 hundred square grids, from *'Matching Percentages 1'* for revising percentage concept if necessary. These will also be useful for comparing common fractions of a square.
- Coloured pencils or textas should be available for colouring the hundred square grids.

Suggested Procedure

Matching the cards

Arrange students in pairs or small groups and give one envelope of 'Matching Percentages 2' to each group.

Ask them to tip the contents on to the table and sort them into pairs that they think will go together (say the same thing).

Circulate to observe how easy or difficult this seems to your students so you will know how much revision of the fraction and percentage concepts will be necessary.

Extension for early finishers – blank set

If some groups finish while others are still absorbed in the task, give them a pair of blank cards and ask them to try and create a pair of cards similar to the others but for percentages that are not yet used.

Compare results

When all students have completed the set compare results.
When possible, for questions or disputes which arise, encourage students to explain their thinking to one another.

If there are any pairs that students are not confident about then use the diagrams and fraction kits to remind them, some suggestions provided below.

Reinforce the meaning of fraction symbols

Fractions such as a half, a quarter, a third mean one of 2, 4 or 3 equal pieces that the whole shape is cut (or divided) into. [Refer back to *The Meaning of Fractions*].

When students confidently recall these concepts with the circle pieces use the100 square grids to look at fractions of the square shape.

Use the 100 square grids to compare fraction and percentage sizes.

Students can then compare the relevant percentages by colouring in the appropriate number of squares in a different colour.

For example, 60% (60 squares out of the 100) and 40% (40 squares out of the 100) could be shaded and compared to one half (50 squares out of the 100).

If the grid is divided into 4 small squares then students will see that each is 25 out of 100 or 25%, and three of these smaller squares will be 3 x 25 or 75%.

Demonstrate one third as a percentage

The challenge of dividing the 100 square grid into three equal pieces might be interesting for some students. Otherwise you can demonstrate that 33 and 1/3 squares fit exactly 3 times into the grid and then compare that to 30% (30 squares). They are *about* the same but not exactly.

Note: Some students may find it useful to remember that 1/3 = exactly 33 1/3%

Optional exploration of 1/3

Using a calculator to divide 100 squares by 3 is another way to help students work out 1/3 as a percentage, depending on the students in your group. Some may find the decimal result of 33.3333333333333 interesting, for some it may be an unnecessary distraction at this point.

Playing with things like this is a way of exploring and reinforcing the connections between decimals, fractions and percentages, but beware of the potential to confuse and reinforce other students' anxiety about percentages and fractions.

If interested students doubt that .3333333333333 = 1/3 get them to multiply it by 3 – what happens?
Compare this to putting the three 1/3 pieces of the Fractions Circle Kit together.

Matching Percentages 2

Activity Sheet 1

✂ Copy onto card and cut.

100%	all
90%	nearly all
75%	three quarters
60%	slightly more than half
50%	half
40%	nearly half
30%	about one third
25%	a quarter
0%	none
10%	a tenth part
1%	a really small part

Shortcut Percentages:
50%, 25% & 75%

Overview

This activity explores how knowing that 50% = ½ and 25% = ¼ gives us the power to do shortcut percentage calculations without formulas.

This activity ideally follows the Matching Percentages activity.

Skills and Knowledge

- Shortcut calculations of 50% & 25% by halving
- Shortcut calculations of 75% by halving & adding

Preparation and Materials

- Photocopy *Large 100 square grid* [See *Matching Percentages:* Activity Sheet 2 (1 - 2 for teacher demonstration)
- Photocopy Practice Sheets 1, 2 and 3 (1 per student)

Suggested Procedure

If you are doing this activity soon after the Matching Percentages activity then students will have discussed the links between the common fractions ½, ¼, ¾ and percentages. If not you may have to spend a little more time on the introduction to this activity. The Activity Sheet would be useful.

Explain that it is useful to know these equal fractions and percentages because it helps us work out some percentage very easily without formulas or calculators.

Calculating 50% by Halving

Ask:

- *What fraction is the same as 50%*
- *Who knows how you could find 50% easily?*
  [It's the same as a half so you halve it]

- *For example 50% of $40*

> *50% = $\frac{1}{2}$*
> *So 50% of 40 → $\frac{1}{2}$ of $40 →$20*

- *Try the examples: 50% of $60; $28; $9; $35*
  [Answers: $30; $14; $4.50 $17.50]

[You may need to give some students further practice at halving, particularly odd numbers, see Activity]

Calculating 25% by halving again

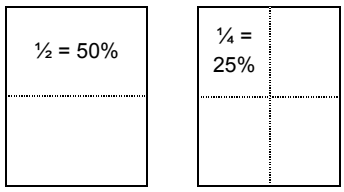
Explain:

- *We are now going to calculate 25% almost as easily as 50%*

Hold up a piece of paper and fold it in half.

Ask:

- *What fraction is this?*
- *What percentage?*



Now fold it again:

- *What fraction is this?*
- *What percentage?*

Hold up one of the 'Large 100 square grids' with one corner coloured to reinforce, or remind students, that one quarter is 25 squares out of 100.

Hopefully students will see that ¼ is obtained by halving the ½ and also that ¼ is 25%.

- *So how can we use this to find 25% of $80?*

First halve it		*Then halve again*
½ of $80 = $40	→	*½ of $40 = $20*
So 25% of $80 is $20		

Further examples to try before attempting the practice sheet are:

25% of: $40; $48; $60; $100; $300

[Answers: $10; $12; $15; $25; $75]

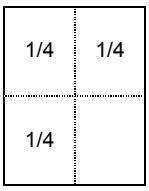
Further examples of this type are provided in Practice Sheet 1 & 2.

Note: Some students will readily see that these can be done by dividing by four. For students who can do this competently it is a simple way to go. But students who find dividing a challenge will probably prefer this method

Extension - Shortcut method for 75%

Explain to students that the quick method we have learned for 25% or ¼, can also be used to find ¾.

To reinforce the meaning of ¾ hold up the folded piece of paper you used to illustrate ¼.



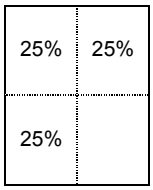
Open it out to show all of the quarters and quickly

shade three of them to indicate ¾.

Ask: *Do you remember what percentage this is?*

Indicate ¼ and remind students that this was 25%

- *So 3 of these will be 3 lots of 25% = 75%.*
  [You may have to display the paper and write 25% in each quarter to assist students to visualise this]

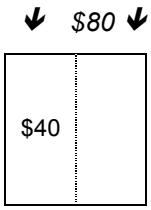


It will also be clearer with an example.

Explain that you want to find 75% of $80 without a formula.

Write $80 on top of another piece of paper, and explain:

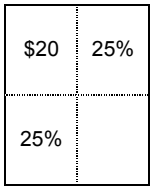
- *This piece of paper is my $80*



Fold it in half, then half again asking as you go:

- *What fraction is this?*
- *What percentage?*
- *How much money would it be?*

[First fold: ½ → 50% → $40.
Second fold: ¼ → 25% → $20]

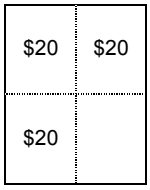


Open out the paper and, point to each of the quarters.

Ask: *How much money would this part be?*

Indicate three of the quarters. Ask:

- *How much money do we have altogether here?*
- *What did you do to get it?*
- *What percentage is this?*
- *What fraction?*



Students should realise that once they have ¼ or 25%, then to get to 75% it is a simple matter of multiplying by three, adding the amount three times or adding ½ and ¼.

75% or ¾ is 3 x $20 or $20 + $20 + $20 or $20 + $40 = $60

Ask students to work in pairs to calculate 75% of the amounts they used previously:

75% of: $40; $48; $60; $100; $300
[Answers: $30; $36; $45; $75; $225]

Encourage the students to draw their own diagrams or fold paper for themselves as they think about these calculations. This is far better for their understanding of the process than just remembering a rule. Also ask questions that encourage the students to explain how they understand what they are doing.

Further practice can be obtained by calculating 75% of the items on the previous Practice Sheet 2: *Shortcut calculations: 25%.*

Practice Sheet 3: *Sharing Taxis* provides further practice including some more challenging examples.

Shortcut calculations: 50%

Practice Sheet 1

What are the discount prices for these?

Was: $450
Discount price: $ ……..

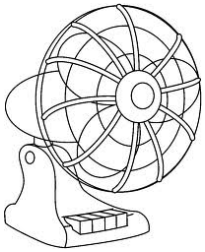
Was: $418
Discount price:
$ ……..

Were: $287
Discount price:

$ ……

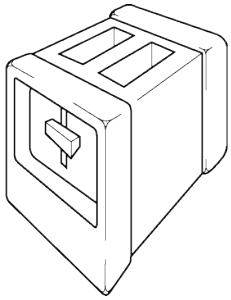
Were: $84.90
Discount price:

$ ……..



Was: $105
Discount price:

$ ……



Was $53
Discount price:

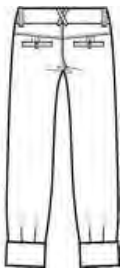
$ ……

Was: $27.30
Discount price: $ .....

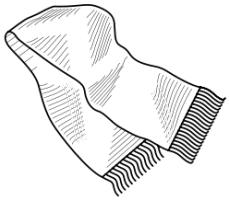
Shortcut calculations: 25%

Practice Sheet 2

What are the discount prices for these?



Were: $ 80
Discount: $ …….
New price: $ …….



Was: $12
Discount: $ …….:
New price: $ ……..

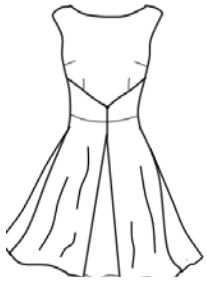
Were: $18
New price:

$ …….

Was: $84
New price: $ …….

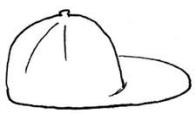
Were $112
New price:

$ …….



Was: $ 38
New price:

$ ……



Was: $17
New price: $ .....

Sharing Taxis

Practice Sheet 3

Sometimes people have to share taxis. The law says that the first person that gets out has to pay 75% of the fare showing on the meter.

What would you pay for each of these fares?

1. $28 on the meter	50% of fare = 25% of fare = 75% of fare =
2. $36 on the meter	50% of fare = 25% of fare = 75% of fare =
3. $47 on the meter	50% of fare = 25% of fare = 75% of fare =
4. $32 on the meter	
5. $ 35 on the meter	
6. $24.60 on the meter	

Some harder ones to try:

7. $18.50 8. $27.30 9. $35.70

Shortcut Percentages: 10%

Overview

This activity is designed to introduce students to the method of calculating 10% by finding a tenth (or dividing by 10). It also provides opportunity to revise the fundamental meaning of percentage and simple fraction concepts.

Ideally this activity should be done after students have been introduced to shortcut methods for 50% and 25% by halving.

Skills and Knowledge

Calculating 10% by ÷ 10

Preparation and Materials

Photocopy several copies of Activity Sheet 1: *Large 100 Square Grid*

Photocopy Practice Sheets 1 & 2 (1 per student)

Coloured pencils or textas (ideally 1 per student)

Suggested Procedure

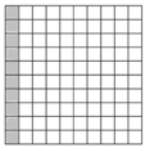
Introducing the activity

Remind students that they have so far used shortcuts to find 50% and 25% (and 75% in some cases). You are now going to look at an even more useful shortcut method.

Reinforcing the meaning of percentage

Hold up one of the 100 square grids and ask:

- *How many small squares are there in this grid?*
- *Why is it useful for thinking about percentages?*
- *So what percentage is each of the small squares?*



Introducing 10%

Quickly shade one column of 10 squares on the grid.

- *What percentage is this?*

[10% - if necessary students should count the squares together]

Write 10% on the column.

Shade another column, in a different colour and repeat the question:

- *What percentage is this?*

Write 10% on the second column and ask?

- *How many of these columns could I colour in?*

You want students to see that there are 10 columns like this all the same size – if necessary colour a few more or distribute grids so the students can try it for themselves, writing 10% on each of the columns as they go.

Note: This is not just 'busy work' physical activity like this may help some students to relate better to the underlying concepts.

If students have a foundation of fraction concepts then you want to relate 10% to $^1/_{10}$ so that they will understand that 10% of something is the same as $^1/_{10}$.

Ask:

- *If there are ten of these and they are all the same size what fraction is it?*

Write $^1/_{10}$ on each of the columns as well as 10%

If students do not have a firm understanding of fractions, then you may prefer to emphasize that the whole grid has been ***divided*** into 10 equal pieces.

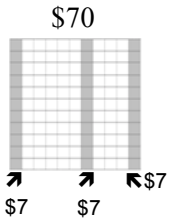
Explain:

- *You can use this to find 10% of any amount.*
- *For example let's look at $70.*

Example: 10% of $70

Use another 100 square grid with **$70** written at the top so it is clearly visible.

Draw the lines for the ten columns clearly on the paper.
[You could give students their own copy to do this with you if necessary.]

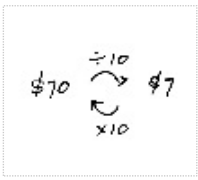


Hold up the grid.

- *How many columns are there?*
- *How much money would be in each of these ten columns?*
- *How did you work it out?*

You want students to see that they need to divide by 10 so that there will be $7 in each column. Emphasize that dividing by 10 is the same as finding one tenth.

Checking the calculation



- *So we worked out 10% of $70 = $7*
- *Does that seem right?*
- *You can check division by going backwards*

Model the checking process for students by multiplying to see that $7 times 10 will give you $70.

Why bother with 10%?

Ask:

- *Why is it so useful to be able to find 10% quickly in your head?*

Answers will vary but should include the current Australian GST rate.

Other possibilities: 10% is a common deposit when you buy something with a loan, and a common amount for tips in some restaurants or fast food deliveries.

It is also a first step to calculate lots of other percentage rates such as 20%, 30% etc.

Further Examples

Calculate 10% of: *$60; $100; $300;*
$4,000; 50 cents; 90 cents.

[Answers: $6; $10; $30; $400, 5 cents; 9 cents]

Circulate while students are doing these calculations to ensure they are using the **shortcut method for division by 10**, that is, crossing off the zeros.

If students need more practice at dividing by 10, or have not learned it before, refer to the 'in the head' Activity: *Multiplying & Dividing by tens*.

Practice Sheet 1 provides more practice at finding 10% of simple amounts as above.

Examples that don't end with '0'

Once students are confident with numbers ending in 0 ask them to:

- *Find 10% of $38*

For students who **can** divide decimals by 10 this should be straightforward, as long as they realise that they can write $38 as $38.00

$38 → $38.00 *38.00 ÷ 10 = 3.80 or 3.8*
So 10% of $38 = $3.80

If students cannot yet divide decimals by 10 these examples can be done by changing the amount into cents.

$38 →3800 cents *3800 cents ÷ 10 = 380 cents = $3.80*
So 10% of $38 = $3.80

Checking the calculations

Encourage students to check these calculations by estimation because it is easy to make mistakes with zeros and decimal calculations.

Model the process for students as follows:

$38 is almost $40
10% of $40 = $4

Our answer is $3.80, that's almost $4, so will be correct.

Ask students to try these calculations:

10% of: $92; $49; $71.20; $167 and $23.90.
Check each answer by estimation.

[Answers: $9.20; $4.90; $7.12; $16.70 and $2.39]

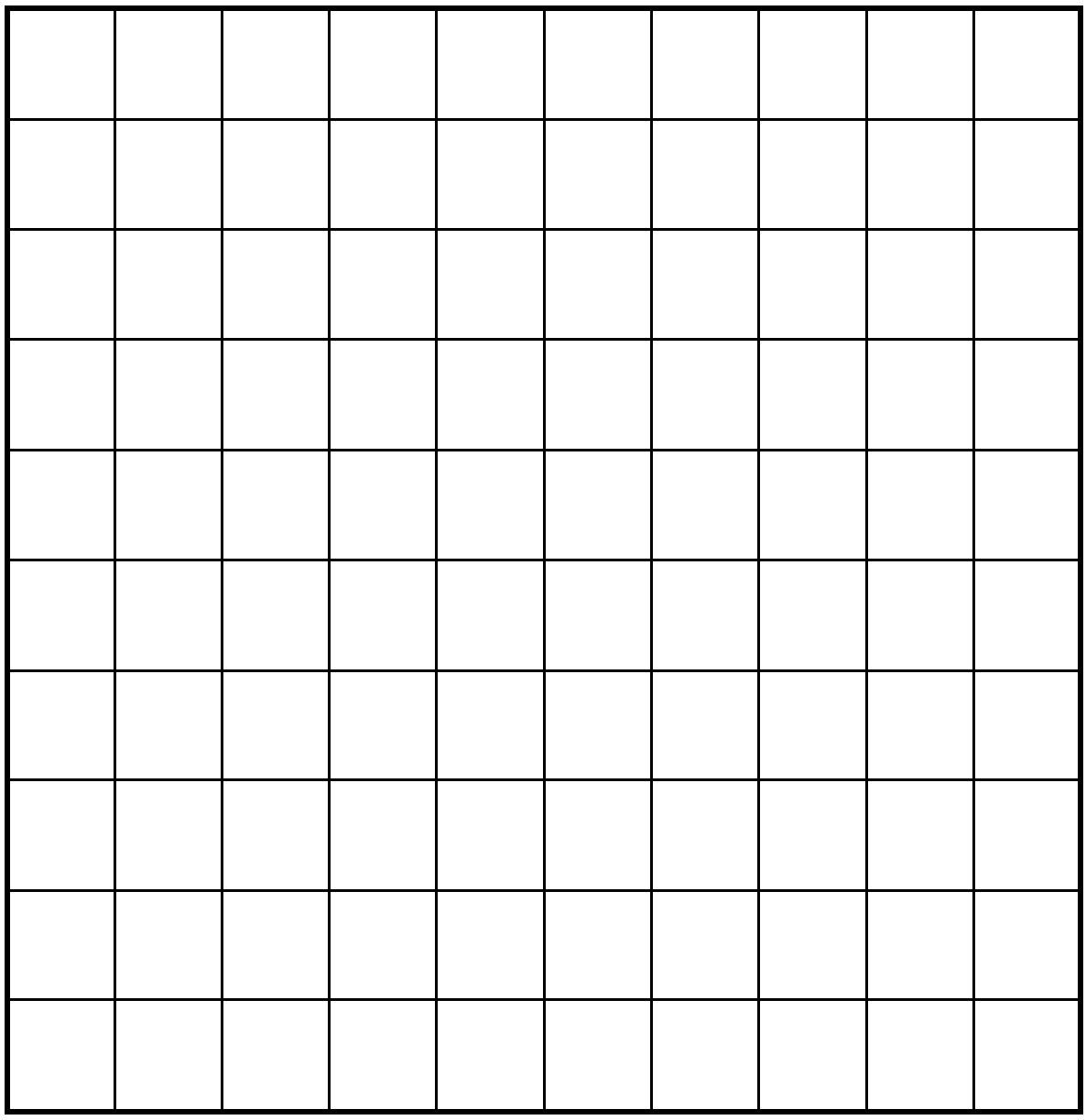
Further examples can be found in Practice Sheet 2.

Also recommended

Collect local shop or supermarket catalogues or advertising leaflets, ask students to calculate 10% discounts on a selection of items and work out what the final price would be.

Large 100 Square Grid

Activity Sheet 1



10% GST and Wastage

Practice Sheet 1

In 2012 Australia's GST (Goods and Service Tax) was 10%.
Calculate the GST that will be added to:

1. A $40 cleaning charge — GST 10% of $40 = $
2. $70 for lawn mowing — GST = $
3. $150 for washing machine repairs — GST = $
4. A $90 catering fee — GST = $
5. $380 labour fee for painting a room — GST = $.

Find the amount **after** GST is added to these charges.

6. $40 cleaning: GST = Charge with GST: + =
7. $70 lawn mowing: GST = Charge with GST: + =
8. $150 repairs:
9. $ 90 catering:
10. $380 painting:

When a builder buys things like bricks, tiles and paint he always orders 10% more to allow for 'wastage', eg damaged tiles, spilt paint.

Calculate the extra 10% for wastage when ordering:

11. 20 litres of paint for a house
12. 130 tiles for a bathroom
13. 420 bricks for an outdoor space
14. 5,000 bricks for a house
15. 6,500 bricks for a house

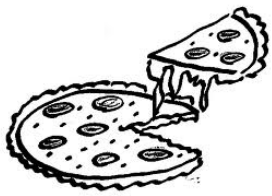
10% Tips and Service Charges

Practice Sheet 2

When Tony does home delivery for the local pizza shop he hopes for a 10% tip.

What would that be for these approximate charges?

1. $28 tip = 10% of $28 =
2. $39 tip =
3. $47 tip =
4. $52 tip =
5. $105 tip =



If people did pay these tips calculate how much they would pay:

6. $28: tip = They pay $28 + = $
7. $39: tip = They pay $ = $
8. $47:
9. $52:
10. $105:

Some restaurants add a 10% 'service' charge to every bill. They say they share this between all of the staff.

Find the service charge and the final bill for these amounts.

11. $36
12. $49
13, $78
14. $123
15. $109

Shortcut Percentages:
20%, 30% ... 5%

Overview

This activity extends the previous activity by exploring how the 10% shortcut can be used as a stepping stone for calculating percentages such as 20%, 30% ... as well as 5%, 15%.

Skills and Knowledge

- Shortcut calculations of 20%, 30% … based on 10%
- Shortcut calculations of 5%, 15% ... based on 10%

Preparation and Materials

A copy of the *Large 100 Square Grid* from the previous activity with each of the columns marked as 10%

Photocopy Practice Sheets 1 – 4 (1 per student)

Suggested Procedure

Revise the 10% process

Warm up with a few quick and simple 10% shortcut calculations to remind students of the skill they practised earlier, for example:

- *A shop is giving a 10% discount on all winter clothes*
- *What will they take off these prices: $40; $90; $200; $350*

[Answers: $4; $9; $20; $35 by dividing each amount by 10]

Extending the process

Explain a new scenario:

- *Winter is nearly over and the shop really wants to get rid of winter clothes, so they increase the discount to 20% of the original price*
- *Can you think of a quick way to work out 20% of these prices?*

Hopefully students can see readily that 20% is twice as much as, or double 10%. If not, use copies of the *Large 100 square grid* and ask learners to show you 10% then 20% so that they can see 20% as twice the size of 10%.

So for $40:	*10% was $4*
	20% → 2 x 10% → 2 x $4 → $8
OR	*20% → 10% + 10% → $4 + $4 → $8*

Ask students to calculate 20% of the other prices above.

Now suggest a few more scenarios and ask students to calculate the reductions for 30% or 40% of the marked price.

Try a couple more examples using different prices and percentages.

Encourage students to try using these short cut methods rather than just reverting to formulae that they may have learned in the past, or to their calculators.

Note: What students may find difficult is remembering the two steps in the process. You can 'scaffold' this by at first providing a cue for the 10% which you gradually remove as they become confident. Encourage quick jotting calculations rather than formal layout.

For example: 30% of $120: 10% = 30% =

Further quick examples are provided in Practice Sheets 1 & 2.

Sometimes adult students are resistant to learning alternative methods because they are proud of being able to use the formula. It is important that they are reminded that shortcuts can be a very useful adult tool and much quicker than formulae, especially if they want quick approximations.

Choosing the fastest method

Note: one of the last questions in the set asks for 50% of ...?

Ask students:

- *How did you calculate 50% of...?*
- *Did anyone remember the other shortcut for 50%?*
- *How can you work it out?*
- *Would it have been easier to halve the ... than to do the two steps?*

Calculating 5%

Present a scenario involving 5% calculations.

For example:

- *Farmers say that because of petrol price increases they have to increase all their wholesale prices by 5%*
- *Can you think of a quick way to calculate 5%?*
- *For example, 5% of $60?*

Encourage students to see that 5% is half of 10% so again it is a two step process of finding 10% then halving the result.

$60: 10% = $6 → 5% is half of $6 = $3

Try a few more examples together, for example:

5% of: $240; $600; $70; $190

Continue to remind students to use the short cut methods for these exercises.

Further practice is provided in Practice Sheet 3.

Calculating 15%

Now ask students:

- *Can think of a quick way to work out 15%?*
- *For example, 15% interest on a loan of $400?*

Encourage students to see that 15 can be broken in to two parts: 10 and 5.

So 15% is just 10% and 5% added together.

15% of $400:
10% → $400 ÷ 10 → $40
5% → half of $40 → $20
15% → $40 + $20 → $60

Note
The figures have been kept relatively simple in the early practice sheets so that students become confident with the methods without being bogged down with trickier divisions.

Further practice is provided in *Practice Sheet 4*.

30% off everything!!!

Calculate the prices after the discount:

Was $6 Discount: …… New price: …… 	 Was $9 Discount …… New price: ……
Was $7 Discount: …… New price: …… 	 Was $11 New price: ……
 Was $9.50 New price: ……	 Was $10.50 New price: ……

Shortcut Percentages: 20%, 30% ... 5% Practice Sheet 2

From the money we pay for electricity:

- 20% pays for generating the electricity
- 20% pays for energy saving programs
- About 50% pays for the network (the poles and wires)
- About 10 % pays for the carbon price

Ani's electricity bill is $320.	Kim's electricity bill is $490.
That means:	That means:
$ …….. pays for generating the electricity	$ …….. pays for generating the electricity
$ …….. pays for energy saving programs	$ …….. pays for energy saving programs
About $ ……..…. pays for the network	About $ ……..... pays for the network
About $ ……..…. pays for the carbon price.	About $ ..…….. pays for the carbon price

Fill in the spaces below:

260 people work at a car making factory.

- 10% of them own a car less than 2 years old.
  ……..…. workers own a car less than 2 years old.

- 50% have children at the local primary school.
  ……..…. workers have children at the local primary school.

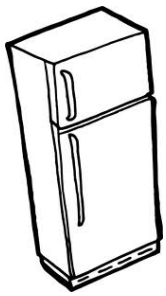
- 30% of the workers were born in Europe.
  ……..…. workers were born in Europe.

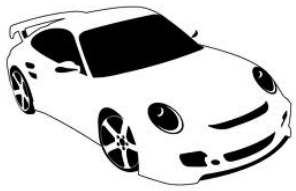
- 20% of the workers were born in Australia.
  ……..…. workers were born in Australia.

- 90% of the workers said they liked the canteen food.
  ……..…. workers liked the canteen food.

At the local homewares store the staff get a 5% discount.

Calculate the staff discount for each of these items. Then work out the final price they would pay.

 Normal price: $40 Staff discount: ……. Final price: …….	 Normal price: $480 Staff discount: ……. Final price: …….
 Normal price: $660 ……. Final price: …….	 Normal price: $270 ……. Final price: …….
 Normal price: $30 Final price: …….	 Normal price: $350 Final price: …….



1. Elisa wants to buy her first car.
It costs $3,800

She pays a 10% deposit	*Deposit*:	$ .....
She borrows the rest or the money from the bank	*Loan*:	$ .....
The interest on the loan is 15% in the first year	*Interest* (1 year)	$ .....

2. Assam also borrows $6,500 with a 15% interest rate.

He pays no deposit		
The interest on the loan in the first year	*Interest*	$ .....

Quick Easy Loans is a shopfront money lender. It charges 35% on every loan.

3. For a loan of **$400** the charge would be $ .....

Total repaid = $ .....

4. For a loan of $250 the charge would be $ .....

Total repaid = $ .....

5. How much interest would Elisa pay if she borrowed her money from *Quick Easy Loans?* $ .....

6. How much interest would Assam pay if he borrowed his money from *Quick Easy Loans?* $ .....

Percentages in Circles

Overview

This activity is a way of bringing together the shortcut percentage methods based on division by 10 and halving. It can be used to:

- Revise the methods introduced in previous activities
- Graduate the level of difficulty of calculations for individual students
- Develop individualised homework and revision exercises
- Introduce and practise estimation of percentages

Ideally it follows the activities *Shortcut Calculation: 50%, 25% & 75%* and *Shortcut Calculations: 10%*.

Skills and Knowledge

- 'In the head' calculation of percentages
- 10%, 20%, 30%
- 5%, 15% … 50%, 25%

Preparation and Materials

Photocopy Practice Sheet 1: *Shortcut Percentages in Circles* (3 or more blank copies for each student)

Alternatively, make several blank photocopies of *Shortcut Percentages in Circles*, insert chosen amounts of money in the central space (see below), and photocopy each of these (1 per student)

Suggested Procedure

If you are doing this activity after the Activities: *Shortcut 10%, Shortcut 20%, 30% ...* and *Shortcut 50%, 25%, 75%* then introducing this Activity should require only a demonstration of how to use the sheet.

As described below, work through one example with the group so they are reminded of the various shortcut methods they have used previously. You can then use the blank space in the centre to graduate the level of difficulty for individual students.

Introducing the format

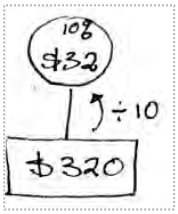
Distribute one blank sheet to each student and ask them all to write $320 in the centre square.

The following possible script explains the suggested use of the sheet.

Explain:

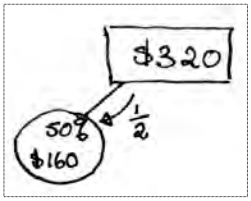
- *Starting with $320, your task is to fill in these circles with the percentages marked on them*
- *This is about using shortcuts only - no formulas allowed*
- ***On the top half** you start with the 10% circle*
- *What will we write in it?* [$32]

- *Show the path you have taken from the centre to the 10% circle with an arrow*
- *Beside the arrow you write what you did to work out 10%*
- *So what will we write here?* [÷10]



- *Now we move out from the 10% - so you choose another circle*
- *How much money will that be?*
- *What will we write on the arrow?*
- *In a minute you can finish the circles on the top yourselves [work in pairs if it helps you]*

- ***On the bottom half:*** *You should start with the 50% circle and then go from there to the others. How much will 50% be?* [$160]
- *Again draw the arrow and write what you did.*
- *What will we write on the arrow?* [÷2 or half]



Allow students to complete this example Practice Sheet at their own pace.

As they complete it give them another to try – inserting increasingly more challenging amounts in the central space (see below for suggestions).

Checking Answers

In order for students to check their answers you could:

- Ask them to compare their answers with one another
- Have pre-prepared answer sheets for students to look at as they complete each sheet
- Ask students to use the percentage function on their calculators and see if they get the same result.

Increasing the challenge

These practice sheets are ideal for providing practice to students of varying speeds and ability levels at the same time. All you have to do is put different numbers in the centre for different students.

Note: The numbers are more difficult if they are not easily halved then halved again, or if they involve cents as well as whole dollars at the 10% stage.

Some suggestions for increasingly difficult are given below but many learners may need more time than others on the simpler numbers. Don't rush them. The aim is to build confidence, not challenge them beyond their capacity.

Don't regard this as a one-off activity. You can return to these many times to keep students' skills honed.

Suggested amounts for increasing difficulty

First level: (Numbers which divide simply by 10 and 2 then 2 again)
$200; $280; $360; $480; $1200

Second level: (Numbers which divide simply by 10 and 2)
$260; $300; $380; $540

Third level: (Numbers which involve decimal amounts but divide by 2)
$64; $128; $426; $738

If you prepare plenty of these blank sheets they can be used as extension or revision at any time with increasing levels of difficulty for students who need further challenges.

Larger numbers: For some students handling larger amounts of money with differing numbers of zeros may also be a useful skill. For example $8,000; $9,000; $400,000; $85,000; $2 million.

These are the sort of rounded off amounts which arise when estimating percentages for large amounts of money.

Estimating percentage calculations

The circle percentage sheets can also be used to give students the idea of estimating for percentage calculations in real situations.

Explain:

- *Quite often it is not really necessary to calculate exact percentages*
- *For instance, if we are interested in how much interest we may have to pay on a loan or credit card*
- *We are usually only trying to get a **sense** of how much it will be, not the exact amount*

An example

Place an amount such as $789.65 in the circle.

Explain:

- *Working out percentages of this number will not be quick*
- *We don't need to know exact amounts*
- *So we choose a more friendly approximate*
- *This will be a number that is easy to work with*

Ask:

- *Can you suggest a number?*
- *It has to be close to this but easy to calculate*

When student s can appreciate why $800 is a suitable friendly approximate write it in the space and ask them to complete the sheet in pairs or individually.

Compare solutions using the language like 'approximately', 'about'.

Further Practice

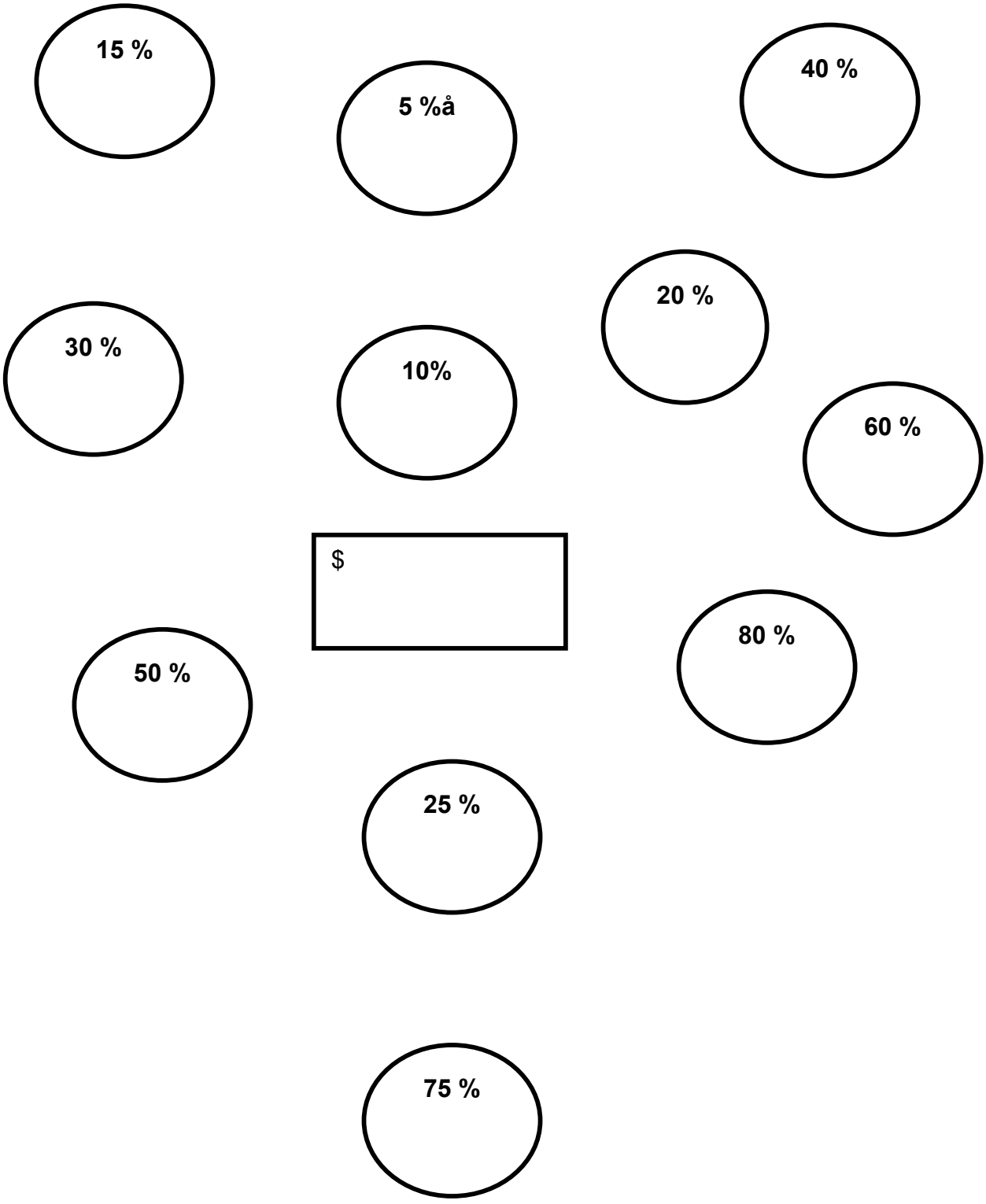
For further practice collect local ads for cars or home appliances from the papers and use the circles sheet to calculate the yearly interest which would accrue for a range of possible interest rates. The interest rate can also be approximated to a friendly number for the purpose of rough estimates, for example 17½ % could be approximated as 15% or 20%.

Encourage students to check the interest rate on any personal loans or credit cards that they have and do an approximate calculation of the interest they would accrue in the first year.

Students may want to discuss the interest payments shown on their credit card statements. Although the advertised interest rate is annual or 'per annum' (for 1 year), it is important that they realise the amount on the statement is only a monthly instalment.

Percentages in Circles

Practice Sheet 1



Shortcut Percentages: 1%, 2%, 3%...

Overview

This activity is designed to introduce students to the very useful method of calculating 1% by finding one hundredth (or dividing by 100).

1% can be used to find 2%, 3% … and these in turn can be added to 10%, 20% … to calculate other percentages such as 23%, 34%, 12%.

The activity also provides opportunity to revise the fundamental meaning of percentage and simple fraction concepts.

Ideally this activity should be done after students have been introduced to shortcut methods for 50% and 25% by halving and 10% by dividing by 10.

Skills and Knowledge

Calculating 1% by ÷ 100

Preparation and Materials

Photocopy Activity Sheet 1: *Large 100 Square Grid* (1 or 2 copies)

Photocopy Practice Sheets 1 & 2 (1 per student)

Suggested Procedure

Introducing the activity

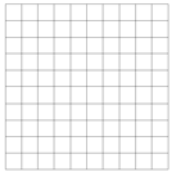
Remind students that they have so far used shortcuts to find 10%, 20%, 30% … and 50% and 25% (and 75% in some cases). Tell them you are now going to show them another useful shortcut method: the method for finding 1%.

Explain that if they can find 1% then it is easy to find 2%, 3% etc. Then these can be used in combination with these other techniques to work out nearly any percentage they need. For example: 11% is 10% + 1%, 23% is 20% + 3%.

Reinforcing the meaning of percentage

Hold up one of the 100 square grids and ask:

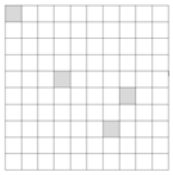
- *How many small squares are there in this grid?*
- *Why is it useful for thinking about percentages?*



Introducing 1%

Quickly shade one square on the grid.

- *What percentage is this?*



Shade other squares randomly on the grid and repeat the question:

- *What percentage is this?*
- *And this?*

If students have a foundation of fraction concepts then you want to relate 1% to $^1/_{100}$ so that they will understand that 1% of something is the same as $^1/_{100}$.

Ask:

- *If there are 100 of these and they are all the same size what fraction is it?*

Write on the board: $^1/_{100} = 1\%$

If students do not have a firm understanding of fractions, then you may prefer to emphasize that the whole grid has been ***divided*** into 100 equal pieces.

Explain:

- *You can use this to find 1% of any amount.*
- *For example let's look at $500.*

Example: 1% of $500

Use another 100 square grid with **$500** written at the top so it is clearly visible.

$500

Hold up the grid.

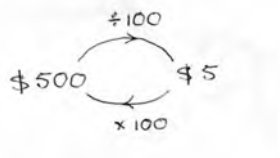
- *How many squares are there?*
- *Imagine this $500 was divided into these 100 squares*
- *How much money would be in each square?*
- *How did you work it out?*

You want students to see that they need to divide by 100 so that there will be $5 in each square. Emphasize that dividing by 100 is the same as finding one hundredth.

Checking the calculation

- *So we worked out 1% of $500 = $5*
- *Does that seem right?*
- *You can check division by going backwards*

Model the checking process for students by multiplying to see that $5 times 100 will give you $500.



Further Examples

Ask students to use the same method for some further examples:

Calculate 1% of: *$300; $100; $600; $4,000; $3,700; 400 cents*
[Answers: $3; $1; $6; $40, $37; 4 cents]

Circulate while students are doing these calculations to ensure they are using the **shortcut method for division by 100**, that is, crossing off the zeros.

If students need more practice at dividing by 100, or have not learned it before, refer to the 'in the head' Activity: *Multiplying & Dividing by Tens*.

Extending to 2%, 3% …

Ask:

- We worked out 1% of $500
- How could you use it to work out 3% of $500?

On the board write:

1% of $500 = $5
3% of $500 = 3 x $5 = $15

Further Examples

Ask students to use the same method:

Calculate 3% of: *$300; $100; $600; $4,000; $3,700; 400 cents*
[Answers: $9; $3; $18; $120, $111; 12 cents]

Ask:

- *How could you find 2 % of the same amounts?*
- *Start with the $500*

On the board write:

1% of $500 = $5
2% of $500 = 2 x $5 = $10

Ask:

Calculate 2% of: *$300; $100; $600; $4,000; $3,700; 400 cents*
[Answers: $6; $2; $12; $80, $74; 8 cents]

A closer look at 400 cents

Once students are confident with round hundreds of dollars, e.g. $200, $500 ... you can examine other dollar amounts, starting with $4 or 400 cents.

Ask:

- *What's another way of writing 400 cents?*
- *Yes it is $4*
- *You already calculated 1% of 400 cents*

- *So what is 1% of $4?*

On the board write:

$4 = 400 cents
1% of $4 = 400 c ÷ 100
= 4 c

Explain:

- *You can use the same thinking to calculate 1% for any dollar amount*
- *For example:*

Calculate 1% of: *$8; $7; $12; $48; $96; $210*
[Answers: 8c; 7c; 12c; 48c; 96c; $2.10]

Students may see the shortcut that saves them writing the whole calculation out. If they do then they should be encouraged to use it.

Students who can divide decimals by 100 may also realise that they can write $96 as $96.00

$96 → $96.00 *96.00 ÷ 100 = 0.96*
So 1% of $96 = $0.96 or 96 cents
And 2% of $96 = 2 x $0.96 = $1.92

Extending to 2%

Ask:

- *How would you calculate 2% of $4?*
- *Yes, multiply 1% by 2. So it is 2 x 4c = 8c*
- *Now calculate 2% of all of the amounts above*

[Answers: 16c; 14c; 24c; 96c; $1.92; $4.20]

Check a few more examples together using 3% & 4% of whole dollar amounts until students are confident.

Practice Sheet 1 provides more practice at finding 1%, 2%, 3% … of simple amounts as above.

Combining the shortcuts

Explain:

- *We are now going to see how our shortcut methods can be combined to work out other percentages*
- *Do you remember how to work out 50% of $60?*
- *Yes, its half of $60 = $30*

On the board: *50% of $60 → $\frac{1}{2}$ of $60 = $30*

Ask:

- *How could you use this to work out 51% of $60?*
- *What's 1% of $60 going to be?*

On the board: *1% of $60 = 60c*
51% is 50% + 1%
$30 + 60 c = $30.60

Further examples in pairs

Ask students to work in pairs to think about how they could combine short cut methods for the following:

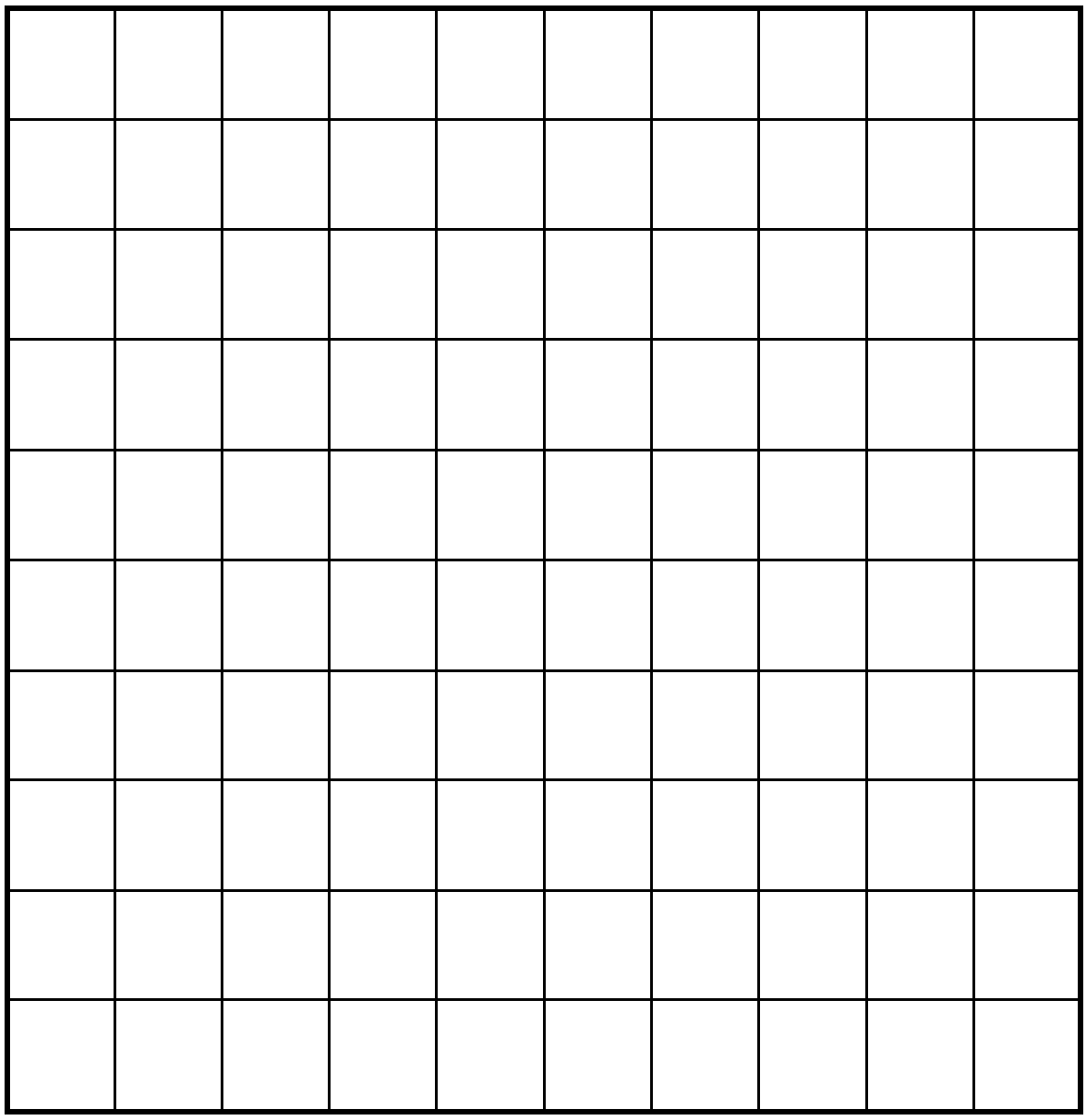
Calculate: *14% of $210*
23% of $340
26% of $680

[Answers: 14% = 10% add 4 x 1% → $29.40
23% = 2 x10% add 3 x1% →$112.20
26% = 25% (½ then ½) add 1% →$173.40]

Further examples can be found in *Practice Sheet 2.*

Large 100 Square Grid

Activity Sheet 1



Price rises

Practice Sheet 1

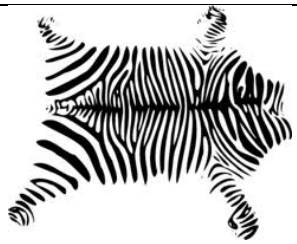
To make up for a rise in costs Charlie's Cheap as Chips Shop raised all their prices by 2%. Calculate the rise and new price for these products.

Was $9

1% =

2% =

New price =



Was $11

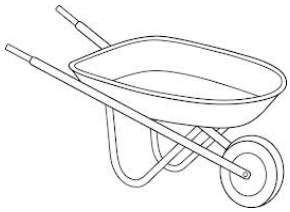
1% =

2% =

New price =

Was $27

Was $59



Was $160

Was $240

Bella's Beautiful Bags put up the prices of all their bags and luggage by 3%
Calculate the new prices.

Style	Current price	1%	3% rise	New price
Rosa	$60			
Caterina	$72			
Patrizia	$112			
Mina	$135			
Venezia	$154			

How much? How many?

Practice Sheet 2

Combine shortcut percentage strategies to calculate these the quickest way you can.

1. 11% of $300
2. 14% of $700
3. 21 % of $900
4. 51% of $1,200
5. 26% of $800
6. 32% of $420

290 people work at *Marissa's Pasta & Fine Foods*

Fill in the spaces to complete these facts about Marissa's staff.

7. 27% had worked there for more than 2 years. This is …… people.
8. 31% of them have small children. This is …… people with small children.
9. 13% said they needed to work part-time. …… people need to work part-time.
10. 76% said they like working at Marissa's. This was …… people.

Percentages of our lives

Overview

This activity introduces a range of percentages related to adult life in Australia whist exploring the meaning of 'percent' as well as common diagrams used to represent percentages. It is an activity rich in opportunities for small group and whole class discussion: a worthwhile variation from individual calculation exercises.

For higher level numeracy students or Australian workplace learners it can be an interesting, adult appropriate introduction to percentages. It provides a chance to:

- Observe learners' existing knowledge of percentage concepts
- Explore and clarify some percentages which affect students' lives
- Build a strong foundation for 'in the head' percentage calculations.

For less experienced numeracy students the activity can be used during a series of percentage activities. It provides a chance to:

- Revise and reinforce percentage concepts
- Explore percentages affecting students' lives
- Introduce common diagrams used for representing percentages.

Skills and Knowledge

- Common percentages in the community
- Meaning of percentage as per hundred
- Percentages in diagram form

Preparation and Materials

Copy Activity Sheets 1 (Set 1), 2 & 3 (Set 2) onto stiff paper or card, cut them into pieces and place Set 1 and Set 2 in separate envelopes (1 for each pair or small group of students).

Cut also some blank pieces of paper or card roughly the same size as the cards on Activity Sheet 2 (2 per pair or small group of students).

Suggested Procedure

Introducing the activity

Arrange students in small groups around flat tables (preferably 4 per group).

Explain:

- *This activity is just a way to start with what you know already about percentages*
- *I do not expect you to know all of these facts yet*
- *You may be able to share quite a bit of knowledge between you*
- *At the end of the session you will hopefully have learned something new*

Matching Set 1

Give out one of the envelope labelled '*Set 1*' to each group.
Ask them to empty the contents on the table.
Hold up an example of each type of card and explain:

- *Some cards have words and some have percentages.*
- *Your first task is to match each of the word cards with the most likely percentage.*

Circulate as they work to:

- Encourage discussion
- Observe existing knowledge about percentages in the community.

Responding to existing knowledge

If students know **over half** of the responses without help, then proceed with the steps outlined below.

If they know **less than half** of these then assist them to finish the task together. You can then use another approach to introduce percentages, such as the *Matching Percentages* activity or use a couple of the cards that they do know to explore the meaning of percentage.

Note: It is possible that with time, or in some locations, the percentages will change. This should not matter because it will promote discussion. Students could vote on the response they accept today and come back next time with accurate figures to settle any disputes.

Discussing the first set

When all groups have finished matching the cards compare responses and discuss any disagreements together.

Ask students to leave the cards laid out on the table for the next part of the activity.

Using set 2

Distribute the second set of cards to each group and ask them to match the explanatory sentences and the diagrams with the pairs already on the table.

Explain that:

- *The blank card is there on purpose*
- *There are spare diagrams that you will not use*

Note: There are spare diagrams in Set 2 to provoke discussion and thought.

Circulate and observe carefully which cards are easy for the students to place and which sets reveal misunderstandings or dilemmas that may need addressing later. Assist with hints where necessary.

Note: Students who have only been able to identify a small number in Step 1 could just look for cards which go with their items and ignore the rest.

100% - Pure new wool *Completely one thing* The main point to be made is that 100% means the whole lot.	Ask learners what other labels or advertising they have seen like this. Examples may be 100% cotton or even 100% synthetic fibre. 100% orange juice is also common, which of course means it should have nothing else in it.
150% - Time and Half Overtime Rate - $12 becomes $18 Many people are confused at the idea of more than 100% or more than the whole.	This means that you are paid all of what you are normally paid (100%) and then an extra 50% as well. The diagram should help clarify this.

.05% - Blood Alcohol Content This is one of the most familiar percentages in our society. It is best to emphasize the meaning as a very small amount – less than 1 in every 100 – because its exact meaning is more likely to confuse than help [it really means that in every litre of blood (1000 ml) there is half of a ml (.5ml) of alcohol].	What should be clear is that 1% means 1 out of 100 and .05% means only 0.05 or 5 hundredths out of every 100. This should be clear from the diagram, which shows 5 hundredths of 1 and that it is indeed a very small amount. It is worth stressing however, that even this seemingly very small amount of alcohol is enough to affect the judgement and responses of drivers.

Discussing Set 2

Compare responses as a whole class. Some ideas that may provoke discussion are:

Consolidating the meaning of 'percent' age

Make sure that the relevance of 100 in some of the explanatory sentences is made really clear at this point.

Remind students that 'per cent' means 'per 100' or 'in every 100'.

You could reinforce this by brainstorming other words that contain 'cent'.

Responses may include 'century' – 100 years, 'centigrade' – 100 degrees in the scale, centimetres – there are 100 of them in a metre, centipede – supposedly 100 legs...

Discussing the diagrams

Ask:

- *Which diagrams make the 100 meaning clearer?*
- *Which diagrams are familiar?*
- *Where do you see them?*

[The 100 square grids allow us to see the 100 meaning. The circles are similar to pie graphs that we often see in the media.]

Filling in the blank card

Ask the groups:

- *Where have you put the blank card?*

[Should be with the cards for the 4% wage rise]

- *As a group create a sentence that could go with this set*
- *Look at the other sentence cards to help you*

Ask each group to read out their sentence. Write it on the board.

Ask:

- *Look at these different responses*
- *Discuss them in your group*
- *Decide whether or not you agree with them*

Note: There is not only one correct response to this, so comparing answers can help to explore the meaning of percentages and indicate that different people come up with different ways of explaining it.

Emphasising per 100

To ensure students understand the meaning of 'per cent' emphasise any responses similar to: *'$4 extra for every $100 now'*.

Explain:

- *This is a powerful idea that helps you to calculate percentages in your head*

If no-one has put forward such a response, ask the whole class to:

- *Suggest another possible sentence that has the number 100 as part of it.*

This basis for a shortcut or 'in the head' method of calculating percentages is explored in the following activity: *Shortcut percentages: The 'per 100' method.* It is best done as soon as possible after this activity.

✂ Copy onto card and cut.

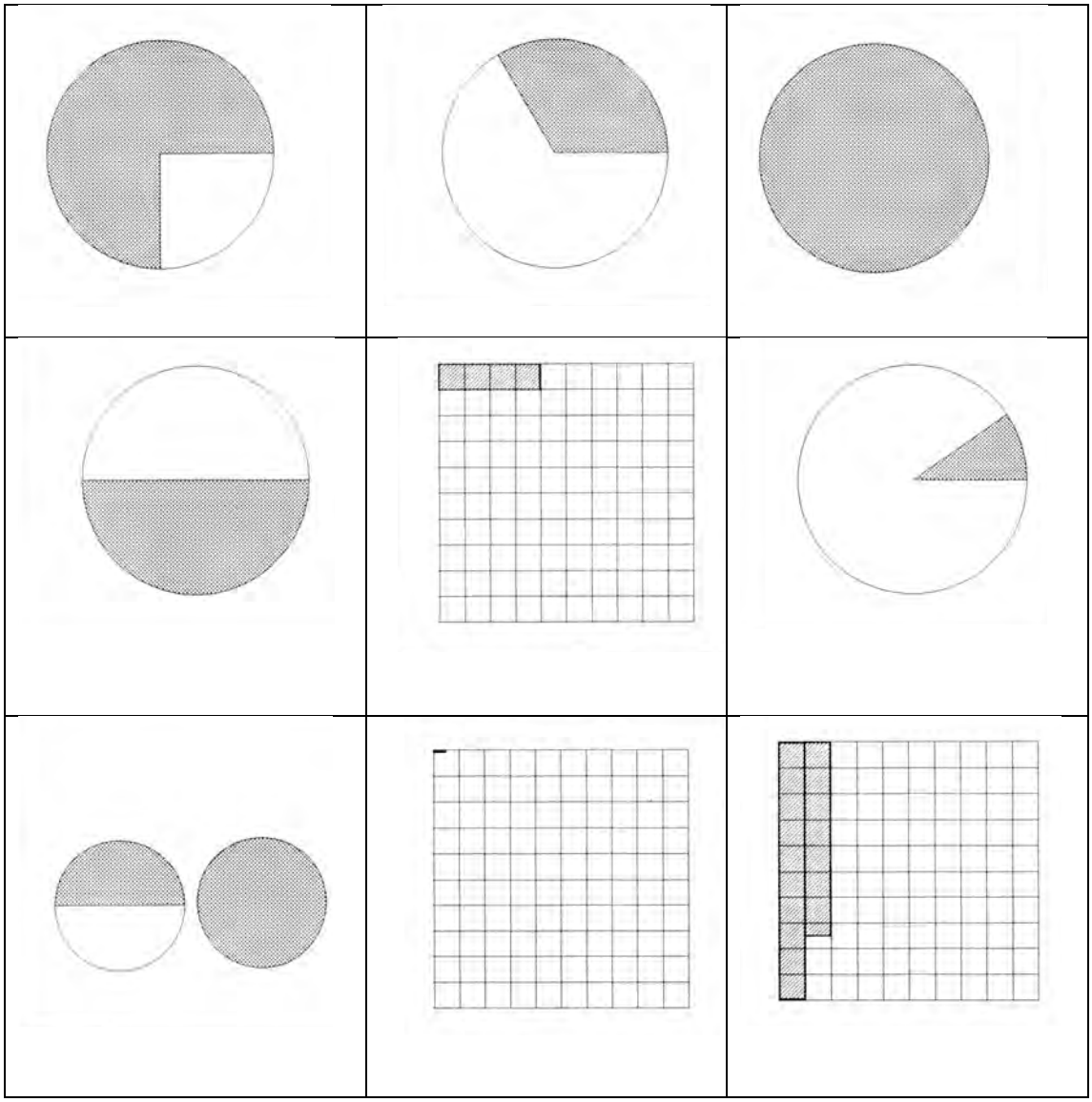
A wage or pension rise	4%
Blood alcohol content	0.05%
A personal loan interest rate	17.5%
Time and a half overtime rate	150%
Pure new wool	100%
GST in Australia	10%
Half price sale	50%

✂ Copy onto card and cut.

A pay rate of $12 per hour becomes $18 per hour
A product normally costs $60 but now costs $30
Every year you have to pay almost $18 for each $100 that you owe.
A percentage much lower than 1%
Completely one thing
10 cents tax is added to every one dollar of the actual price

Set 2 (cont.)

✂ Copy onto card and cut.



Shortcut percentages

The 'per 100' method

Overview

This activity uses the concept of a percentage rise in wages or allowances to present a **shortcut** or **'in the head'** method for calculating percentages.

Two versions of the method are introduced to cater for different levels of student ability. Both are based on understanding percentage as **'per hundred'** or **'in every hundred'**.

Ideally this activity follows *Percentages of our lives* which explores this meaning of percentage.

The activity focuses on calculating percentages of multiples of $100, such as $200, $300, $500 and amounts such as, $50, $150, $450 etc. However, it can be extended to estimating percentages for other amounts by first approximating to the nearest 50.

Skills and Knowledge

- Concept of percentage as 'per100'
- Using the 'per 100' method to calculate percentages
- Estimate percentages using the 'per 100' method

Preparation and Materials

Photocopy Practice Sheets:
Increasing Incomes 1 & 2 (1 per student)

Suggested Procedure

Introducing the activity

Note: If you are following directly from the *Percentages of our Lives* Activity the introduction will be more of a revision.

Ask students to discuss in pairs:

- *What does the word 'percent' mean?*
- *For example, what would it mean to get a 4% rise in pay or a weekly allowance?*

Discuss various responses as a whole class and if necessary assist students to arrive at the meaning of 'per hundred' or 'in every hundred'.

In the particular example, it would mean:

$4 extra for every $100 you get now

Two versions of the calculation method are described below. One is simpler to understand but can take longer to calculate, the other is shorter but may be more complex for some learners to understand at first. Choose the version you think will best suit you students or perhaps introduce the first, which for some students will lead easily into the second.

4% of $300 Version 1

First draw a table on the board as shown filling it in line by line as students answer questions such as:

- *If someone gets exactly $100 per week now, what would their rise be?*
- *If they get another $100 per week, what extra would that give them?*
- *And another $100 per week would give them an extra ... ?*
- *What is the total for each column?*

Wage	Rise
$100	$4
$100	$4
$100	$4
Total $300	$12

4% of $300 Version 2

Ask:

- *If someone gets $100 per week now, what would their rise be?*
- *If they get $200 per week now, what would the rise be?*
- *If they get $300 per week now, what would the rise be?*
- *If a supervisor gets $700 per week now, what would their rise be?*

As students answer, record on the board:

$100 ➔ $4 rise
$200 = (2 x $4) ➔ $4
$300 = (3 x $4) ➔ $4
$700 = (? X $4) ➔ $?

If students are not yet able to tell you that the last rise would be 7x $4 or $28 then try a few more examples together until they can see a pattern and the logic behind it.

Ask:

- *Can you explain the pattern or rule in your own words?*

You are looking for responses something like 'for every $100 you get $4 extra, so you have to multiply $4 by the number of hundreds.'

Further examples

Ask students to use whichever method they prefer to:
Calculate a 4% increase on incomes of:

- *$500 per week*
- *$700 per week*

4% of $50 **Both versions**

Now ask:

- *If a part timer gets $50 per week what would their 4% rise be?*
  [Since $50 is exactly half of $100, then the rise will be exactly half of $4 = $2]

- *What about $350?*

Version 1

Wage	Rise
$100	$4
$100	$4
$100	$4
$ 50	$2
Total $300	$12

Version 2

$300 ➔ 3 x $4 = $12
$50 ➔ $2
$350 ➔ $12 + $2= $14

Further examples

Calculate a 4% increase on incomes of:

- *$250*
- *$650*

[Answers: $8 + $2 = $10; $24 + $2 = $26]

Extending to other percentages

Now try some examples with a different percentage increases, for example:
Calculate a 2% 'cost of living' increase for wages or allowances of:

- *$200 per week*
- *$700 per week*
- *$450 per week*

Try a few different examples until learners seem confident to use either version 1 or 2 of this method.

Calculating the new total

Now return to the first example and ask:

- *This first person had a wage of $300 per week.*
- *They will get a 4% rise of $12.*
- *So what is their wage after the rise?*

[Answer $312]

Ensure students understand to add the extra on to the original

Ask students to repeat this calculation for each of the examples they have done already.

Further practice is available in Practice Sheet 1.

This method is applied to smaller amounts of money in the Activity: *Shortcut Percentages: Cents in the dollar.*

Extension - Estimating percentage increases

The next step is to extend this method to **estimations** of percentages when the amount is not an exact multiple of 50 or 100.

Explain:

- *This method is easy with numbers like 200, 300, 450, etc because they are exact*
- *Sometimes the amounts of money are not so neat*
- *But we can use the same method to **estimate** the increase*

Emphasise:

- *We don't always need to know the **exact** amount to know what an increase will mean for our lives.*

Ask learners to discuss in pairs:

- *How could you estimate a 4% rise on an allowance of $280?*

Use students' responses to discuss:

Step 1 — $280 is close to $300.

Step 2 — Calculate 4% as before
[3 lots of $4 = $12]

Result — The **approximate rise** is $12,
Or we could say 'The rise is **almost** $12'

So the final allowance is **approximately** $280 + $12 = **$292**

Further examples

Try a few more together. For example:

Estimate a 2% increase on: $420; $391; $219 and $263
[Answers: $8; $8; $4; $5]

Make sure that:
- *$219 is approximated by $200 not $220 (which can't be calculated easily using this method)*
- *$263 is approximated by $250 not $300 (it is closer to $250 so this will give a more accurate estimate)*

Further examples:

Estimate a 3% 'cost of living' increase on: $323, $439, $408 and $479
[Answers: $9; $13.50; $12; $15]

Further practice for students is available in Practice Sheet 2.

Other ideas

Scan newspapers for articles relating to cost of living increases, workers' claims for higher salaries, or cuts to services or allowances. Create some related case studies (e.g. a person on the current base rate salary) and get students to estimate the meaning in real terms for a week, for a month, for a year. What might this amount of money buy?

You could integrate this topic with other subjects or units of study. Encourage students to research the relevant wage information on Internet sites that provide award wages and conditions. They could also write, or give an oral presentation, about their findings.

Increasing Incomes

Practice Sheet: 1

Some typical weekly incomes in Australia are listed here.
Calculate a 2% 'cost of living' increase for each of them.

1.	Part-time cleaner	$600	2% increase:	$ ……
2.	Car mechanic	$1,400	2% increase:	$ ……
3.	Electrician	$2,700	2% increase:	$ ……
4.	Unemployment benefit	$250	2% increase:	$ ……

Sarah gets a disability support allowance of about $550 a fortnight.

5. If it is increased by 1%, how much extra would she get? $ ……

6. What would the fortnightly payment become? $ ……

7. If it was increased by 3% what would the payment become?

$ ……

Increasing Incomes

Practice Sheet: 2

Estimate the increases of all of these:

1. Sarah, a full-time cleaner earns $961 per week.

   If wages rise by 1%, her approximate rise = $ …….

2. Tibor, a car mechanic, earns $1346 per week.

   If wages rise by 3%, he will get approximately $ …… more each week.

Alisha works half time as a painter.
Each week she gets a salary of $788,

3. If her salary increases by 4% about how much more will she get? ……

4. What will her salary be after the increase? ……..

5. Simone, an accountant, is paid $2,115 a week.
   He pays 9% in expenses every week.

   Approximately how much are his expenses? …….

6. Tran is a carpenter. His weekly wage is $1538.
   He gets a bonus of 7% for the week of Tet (New Year week).

   About how much will this be? …….

Shortcut Percentages

Cents in the dollar

Overview

This activity introduces the cents in the dollar approach to calculating discounts.

Ideally it follows on from the previous activity: *Shortcut percentages: The 'per 100' method*

Skills and Knowledge

- Explaining discounts as per 100
- Calculating percentages by cents in the dollar shortcuts.

Preparation and Materials

Photocopy Practice Sheets 1 & 2 (1 per student).

Suggested Procedure

Introducing percentage discounts

Sketch a 20% discount Sale Sign on the board.
If this is following from *Shortcut percentages: The 'per 100' method*, explain to students that you will now explore how to use this same idea to calculate discounts for smaller amounts.

If not, then begin by asking the students:

- *How do you read this sign?*
- *What does the word 'percent' in the sign mean?*

You are looking for a response that indicates that it is the amount in every 100.

Calculating the discount for whole dollar amounts

Ask:

- *How many cents are there in a dollar?*
- *If we had a 20% discount on $1 how many cents is that?*
  [20 cents in 100 cents or 20 cents in $1]
- *What about 20% of $3?*
- *How would you calculate that?*
  [3 lots of 20 cents: either 20+20+20 or 3 x 20]

Some practice

Work through the following examples with the students using whichever version of the per hundred method they feel comfortable with (see below).

Example calculation for*: A 20% discount on prices of: $5.00 and $7.00*

<table>
<tr>
<td>Version 1 method
$5 = 500 cents

From the table the discount is 100 cents. That is $1

Discounts are taken <u>off</u> the price, so the final cost is: $5 - $1 = $4

<table>
<tr><td>100</td><td>20</td></tr>
<tr><td>100</td><td>20</td></tr>
<tr><td>100</td><td>20</td></tr>
<tr><td>100</td><td>20</td></tr>
<tr><td>100</td><td>20</td></tr>
<tr><td>500</td><td>100</td></tr>
</table>
</td>
<td>Version 2 method
$5

Discount:
20% is 20 cents for every $1

We have $5
so → 5 x 20 = 100 cents = $1

Final price: $5 - $1 = $4</td>
</tr>
<tr>
<td>$7 = 700 cents

From the table the discount is 140 cents. That is $1.40

Discounts are taken off the price, so the final cost is $7.00 - $1.40 = $5.60

<table>
<tr><td>100</td><td>20</td></tr>
<tr><td>100</td><td>20</td></tr>
<tr><td>100</td><td>20</td></tr>
<tr><td>100</td><td>20</td></tr>
<tr><td>100</td><td>20</td></tr>
<tr><td>100</td><td>20</td></tr>
<tr><td>100</td><td>20</td></tr>
<tr><td>700</td><td>140</td></tr>
</table>
</td>
<td>$7

Discount:
20% is 20 cents for every $1

We have $7 so → 7 x 20
= 140 cents = $1.40

Final price: $7.00 - $1.40 = $5.60</td>
</tr>
</table>

Discounts on 50 cents - both versions

Ask students:

- *How much would a 20% discount be on a 50 cent item?*
  [50 cents is half of 100 cents or $1
  so the discount would be half of 20 cents = 10 cents]

Ask students to:

- *Work in pairs to calculate these discounts:*
  20% of $2.50, $4.50 and $7.50
  [Answers: 50 cents, 90 cents, $1.50]

Then:

- *Calculate the final prices after the 20% discount*
  [Answers: $2.00, $3.60, $6.00]

Try a few examples using an odd number for the percentage to ensure that students can work out the discount amount for 50 cents, which requires them to halve the amount.
Example: 5% discount on items worth $4.50 and $7.50

Version 1 method
$4.50 = 450 cents

The discount is 22½ or almost 23 cents.

The final price is approximately:

$4.50 – 23c = $ 4.27

100	5
100	5
100	5
100	5
50	2 ½
450	**22½**

Version 2 method
$4.50

5% is 5 cents for every $1
We have $4 and 50 cents
So → 4 x 5 + (½ of 5) = 20 + 2 ½
= 22 ½ cents = almost 23 cents

Final price**:** $4.50 – 23c = $ 4.27

As a group work through a 5% discount on $7.50

Note: This method can be used for any percentage amount, even though simple numbers such as 20% and 5% were used to demonstrate the process.

Practice sheets 1 & 2 allow students to practise these types of calculations, with 5%, 7% and 12%. You could also ask students to try different variations such as 9%, 17%.

How do supermarkets work?

Discuss with students what kinds of approximations are used in supermarkets and other shops when the discount comes to half a cent. Do they give you a slightly larger discount, as we did in the examples, or do they give you less?

Encourage students to bring some sample dockets along to class to discuss the discounts and how they are shown on the dockets.

Suggestions for further practice

Bring advertisements from newspapers or junk mail and get students to calculate discount prices for items that might interest them.

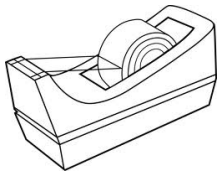
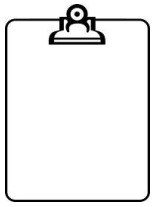
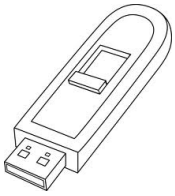
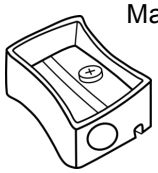
Other activities in this series describe alternative shortcut calculations for particular percentages. These include: *Shortcut Percentages 10%, Shortcut Percentages: 20%, 30% …5%, Shortcut Percentages: 50%, 25% & 75%.*

Cents in the dollar – Discounts Practice sheet 1

Tuesdays Only!!!

7 % off ALL goods

Use shortcut methods to calculate the discounts and the new price.

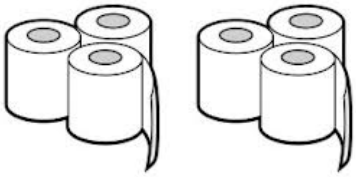
1.  Marked price $4 Discount? New price?	2.  Marked price $ 3 Discount? New price?
3.  Marked price $6 New price?	4.  Marked price $ 5 New price?
5.  Marked price $4.50 New price?	6.  Marked price $1.50 New price?

If the discount was increased to 12% what would these now cost?

1.	2.	3.
4.	5.	6.

At the local supermarket the staff get a 5% discount.

Calculate the staff discount for each of these items. Then work out the final price they would pay.

 Normal price: $10 Staff discount: Final price:	 Normal price: $2 Staff discount: Final price:
 Normal price: $5 Final price:	 Normal price: $3 Final price:
 Normal price: $6 Final price:	 Normal price: $4.50 Final price:

Percentages on the Calculator

Overview

This activity introduces students to the % button on their calculators and how to use it.

It is best done **after** students have gained confidence at some of the shortcut percentage calculation strategies.

Skills and Knowledge

Calculating percentages using calculators.

Preparation and Materials

Photocopy Practice Sheet 1: *Percentages on the Calculator* (1 for each student).

Calculators (1 per student)

Note: you cannot rely on students' mobile phone calculators for this exercise as many don't have a % functions.

Suggested Procedure

Introducing the activity

Suggest to the class that sometimes you need to be able to perform complicated percentage calculations exactly. For instance, if you are in a pay office and have to work out pay rises accurately.

The quickest, easiest and most accurate way is with a calculator.

For exact work a calculator is usually used.

There are many ways to calculate percentages using a calculator.

The % button is just one simple method, but most adults are curious about its use.

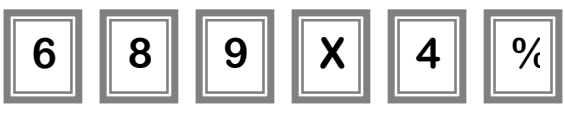
Ask:

- *How would you go about calculating exactly 4% of $689 on a calculator?*

Distribute calculators and allow a few minutes for students to try out ideas.

Briefly acknowledge any ideas which lead to correct answers but go on to highlight the particular use of the % button.

On the board write this sequence of buttons for students to follow:



Discuss whether or not the = button needs to be pressed.

It might be optional for some calculators.

Checking by estimation

Encourage students to estimate also to ensure they are using a correct method.

For example: *4% of $689:*

689 is approximately equal to 700

Either:	*Or:*
4% of 7 hundreds is *7 x 4 = $28.*	*1% of $700 = $7* *4% is 4 x 7 = $28*

Further examples

Try a few further examples together such as:

- *What would a 12% discount be on a $739 television set?*
  [Answer: $88.68]
- *What would be a 5% discount on a $139 food bill?*
  [Answer: $6.95]
- *What would a 2.5% increase on a salary of $52,650 be?*
  [Answer: $1,316.25]

Remember to model the checking by estimation process as well as the use of the calculator.

Practice Sheet 1: Percentages on the Calculator provides a few examples for students to practice.

Other practice

Bring in some authentic advertisements which offer discounts expressed as percentages. Ask students to first estimate the discount and then use their calculators to calculate the exact discounts offered.

Look for newspaper articles which mention percentage increases in wages or profits. Estimate and calculate some of these amounts to highlight the significance of the articles.

Percentages on the Calculator

Activity Sheet 1

Use the [%] on your calculator to answer these.

1. A bed priced at $575 is discounted by 12%. What is the discount?

≈ approximate:

Exact answer using a calculator:

[5] [7] [5] [X] [1] [2] [%]

_____

2. A refrigerator costs $955. How much will you save with a 17% discount?

≈ approximate:

Exact answer using a calculator:

_____

3. Mina pays about $195 for petrol each month. If petrol rises 3.5%.
   How much more will she pay?

≈ approximate:

Exact answer using a calculator:

_____

3. Gregor gets $695.30 every two weeks. If his pension rises by 2½ %
   How much extra will he get?

≈ approximate:

Exact answer using a calculator:

_____

Percentage Target Game

Overview

This activity is designed to encourage students to estimate percentages and to use the percentage function on their calculator to check these estimates. The aim of the game is to achieve the target on their calculator display in the minimum number of tries.

As a game for two students in competition, it motivates students to focus on their estimates in order to win.

As a game for one person this motivation comes from trying to improve on their previous score.

Once it has been introduced, this game can be used many times: as a class starter, as a change in pace during the class or as a means to bring students together during a class.

Skills and Knowledge

- Estimating percentages
- Percentages on a calculator

Preparation and Materials

Photocopy *Activity Sheet 1* (at least 1 per student)

Calculators (1 between 2 students)

Suggested Procedure

Introducing the game

Arrange students into pairs.
Distribute a copy of Activity Sheet 1 to each student.

Explain:

- *This is a new game for practising percentage estimations*
- *It also lets you practice using the calculator*
- *The aim of the game is to reach the target of 10 in the smallest number of tries*

Explaining the rules - the example

Ask students to look at the example on Activity Sheet 1

Explain:

- *I will explain how it works by working through the example with you*

Step 1

- The first person (Player A) chooses a number between 10 and 100
- They write the number on the grid
- *In the example, Player A has chosen 74*

Step2

- Player B estimates what percentage of the number will give 10
- Player A tests it using the calculator
- *In the example, they have estimated 60%*
- *They tried 60% of 74 and got 44.4 – too big!*
- Player B records this on the grid

Number	*%*	*Result*
74	*60%*	*44.4*
	10%	*7.4*
	11%	*8.8*
	15%	*11.1*
	14%	*10.36*
Number of tries		*5*

Step 3

- Player A deletes the first try and enters the number *(74)* again on the calculator
- Player B suggests another estimate of the percentage (still aiming at 10)
- *In the example, the second estimate is 10%*
- *10% of 74 ... 7.4 – too small!*
- Player B records this on the grid

Go through the steps one by one with the students.
For example:

- *For the next estimate Player B sees that 60% is far too big*
- *10% is quite close but it needs to be a bit higher ...*

Explain:

- *They repeat this last step until they get a 10 on the display*
- *The important thing is to do it with as few tries as possible*

Finishing the game

- *In the example, Player B finally got 10.36*
- *It doesn't matter if there are decimals after the 10*
- *Player B did it in 5 tries – so 5 is Player B's score for this round*
- *Player A will try for a lower score than 5*

Let students try one round of the game together to make sure they are clear about the procedure.

Playing the Game

Get students to continue playing in pairs, taking turns to choose different numbers.

Encourage them to vary between higher and lower numbers.

Circulate whilst students play.

Make sure that they are thinking about the numbers they choose, not just making a series of wild guesses.

If you see that one player is continually winning in a pair, suggest some numbers that will be more challenging.

More challenging numbers

When pairs or individual students gain confidence with numbers between 10 and 100, challenge them further by expanding the range below 10 and over 100.

Numbers less than 10 will require students to appreciate percentages greater than 100%. For example, if 8 is the chosen number, 125% will be the percentage needed to give 10.

The game as an individual activity

The Target Percentage Game can also be given to individuals as a challenge activity. For example, to students who finish exercises earlier than others in the class, or students who are more advanced than others and need further challenge.

In this case, the teacher should select the numbers at a suitable level of difficulty for each student and the students will try to better their own previous scores.

Percentage Target Game

Activity Sheet 1

Number	%	Result
74	60%	44.4
	10%	7.4
	11%	8.8
	15%	11.1
	14%	10.36
Number of tries		5

Number	%	Result
Number of tries		

Number	%	Result
Number of tries		

Number	%	Result
Number of tries		

Number	%	Result
Number of tries		

Number	%	Result
Number of tries		