Putting the Jigsaw Together

Practical strategies for assisting apprentices with numeracy issues

Using Percentages
A trainer’s resource
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Guide for Trainers

It is recommended that you read the Trainer's Guide for a full understanding of how to use this tool.

How to use this tool

Each tool has been designed to support vocational trainers working with apprentices to develop their numeracy skills and it focuses on a specific area of numeracy. Tools should be contextualised to match the workplace of the apprentice and the sample activities framed within a workplace context.

This tool focuses on working with percentages in the Metals industry. At the Australian Core Skills Framework (ACSF) level 2, an apprentice would be able to use simple, everyday decimals and percentages, such as 0.25, 50% and 75%. The apprentice should also be able to use a calculator to undertake familiar and predictable numerical calculations, such as calculating an increase of 25% on a set of relevant workplace values.

The tool covers basic mathematical calculations of percentages. The examples and activities within this tool can be easily contextualised to support apprentices with numeracy issues in other industries.

Topic content has been provided as background information for each numeracy task. This information can be worked through with the apprentice, or the trainer can go straight to the work examples and activities.

Apprentices may often question why they need to perform certain calculations manually rather than using a calculator. Some examples of times when it is useful to be able to perform manual calculations are:

- the battery in the calculator is flat
- the apprentice left the calculator at home
- the answer on the calculator looks ‘wrong’
- the apprentice may have entered the incorrect details/numbers
- the apprentice may be using an incorrect application on the calculator.

As a trainer, you may be able to provide other examples relevant to the apprentice’s workplace.
The numeracy examples for each task have been designed in small incremental steps to assist the apprentice to build up to the final answer. It is intended that there is no assumed knowledge. The tool may, where appropriate, point to foundation numeracy topics which can be found on the MSA website. The tool may also support numeracy units from the Foundation Skills Training Package.

Sample activities are provided as practice for the numeracy task. These can be completed either with support from the trainer or alone by the apprentice. Worked answers are provided for each activity at the rear of the tool to allow the apprentice to check their understanding and progress.

A word list has been provided to support the pre-teaching and/or review of specific numeracy terms. As the trainer, you may want to provide your own definition of these words and/or add other words as required. You may also use the word list to encourage the apprentice to develop their own definitions which will assist in demonstrating their understanding of the numerical concepts being developed.

You may use additional activities or replace the sample activities with activities relevant to the apprentice. In some instances, you may want to focus on a particular area in which the apprentice is experiencing difficulty.

For the more advanced apprentice, this tool could be provided as a self-paced learning resource.
Functions are indicated by the following icons

- **Information**
  - Information is provided that is relevant to the concepts, activities or workplace that the apprentice is engaged in.
  - ‘Why we do this’ offers the apprentice an explanation regarding the relevance of the knowledge, skill or activity to the work they are engaged in.

- **Fact**
  - A true statement.

- **Example**
  - An example of a function or calculation. Worked examples are given to assist the trainer to break down the steps involved in an activity.

- **Hint**
  - A hint that can make things easier. Hints are an important part of the learning process for apprentices as they usually are based on the trainer’s own experiences.

- **1**
  - A proposed theoretical activity for apprentices. This activity is designed to embed the underpinning mathematical concepts needed to complete a task.

- **Calculator**
  - Use a calculator.

- **No Calculator**
  - Do not use a calculator.

- **Hands-on**
  - Hands-on activity for apprentices. This activity is designed to engage the apprentice in a practical activity that consolidates conceptual learning.
Using percentages

The word list below is designed to introduce or review the words/terms commonly used when working with shapes and calculating the perimeter.

There may be other words/terms which the apprentice can add to this list.

**Word list**

<table>
<thead>
<tr>
<th>Word/term</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td></td>
</tr>
<tr>
<td>Symbol</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td></td>
</tr>
<tr>
<td>Dimension</td>
<td></td>
</tr>
<tr>
<td>Wastage</td>
<td></td>
</tr>
<tr>
<td>Stock</td>
<td></td>
</tr>
<tr>
<td>Increase</td>
<td></td>
</tr>
<tr>
<td>Decrease</td>
<td></td>
</tr>
<tr>
<td>Fraction</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td></td>
</tr>
</tbody>
</table>
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Percentages

The word per cent comes from the Latin *per centum* meaning ‘by the hundred.

The % symbol tells us that we are dealing with a portion of 100.

The percentage of an amount is the number of small parts we have of the total of 100 parts.

10% (10 out of 100)

50% (50 out of 100)

90% (90 out of 100)

100% (100 out of 100, the whole amount)

Within the ACSF, percentages begin to appear at numeracy level 2. At level 2, an apprentice would be expected to be able to work with ‘simple every day, percentages (e.g. 50%). In planning activities for an apprentice working at ACSF numeracy level 2, you should consider hands-on activities that reflect an apprentice’s workplace – activities that they are likely to come across in their daily work. Problem solving should involve only one or two familiar steps.

Percentages have a vast range of uses across the manufacturing trades. Some examples include:

- adding GST to a bill; allowing for an increase in cost for materials or labour
- calculating the extra quantities of materials needed for production runs
- calculating mix ratios of materials
- calculating wastage to allow for in a job
- finding new dimensions of a job that has a change in size.
**Converting to percentages**

In this box, 50 of the 100 squares are green.
This can be written as 0.5 or 50% of the box is green.

- Using a piece of graph paper, colour in 50% of the squares.
- Use a tape measure to work out 25% of the length of a metre of steel rod.

Look at this table:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Decimal</th>
<th>ACSF level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>0.01</td>
<td>3</td>
</tr>
<tr>
<td>10%</td>
<td>0.1</td>
<td>2</td>
</tr>
<tr>
<td>16%</td>
<td>0.16</td>
<td>3</td>
</tr>
<tr>
<td>25%</td>
<td>0.25</td>
<td>2</td>
</tr>
<tr>
<td>33.3%</td>
<td>0.333</td>
<td>3</td>
</tr>
<tr>
<td>50%</td>
<td>0.5</td>
<td>2</td>
</tr>
<tr>
<td>62.35%</td>
<td>0.6235</td>
<td>3</td>
</tr>
<tr>
<td>75%</td>
<td>0.75</td>
<td>2</td>
</tr>
<tr>
<td>90%</td>
<td>0.9</td>
<td>3</td>
</tr>
<tr>
<td>100%</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
These are different ways of writing the same amount. As you can see, where the complexity of the percentage calculation increases (unfamiliar numbers, such as 16%, 33.3% and 62.35%), the numeracy skill level increases.

Using calculators is an ACSF numeracy level 2 skill. At this level the apprentice should be able to perform a limited range of familiar and predictable calculations, such as addition, subtraction, multiplication and division with multiplication and division related to small whole numbers. However, the use of the % key is an ACSF level 3 numeracy skills.

**EXAMPLE**

**ACSF level 2**

Increase 12 by 0.25

\[
12 \times 0.25 = 3 + 12 = \underline{15}
\]

**ACSF Level 3**

Increase 12 by 25%

\[
12 + 25\% = \underline{15}
\]

The answer for the two calculations is 15; however, the first calculation needs more keys to be pressed.

**Try the following examples on your calculator.**

a. Increase 36 by 0.75

\[
\underline{x} = \underline{+} = \underline{=} \]

Increase 36 by 75%

\[
\underline{+} \% \underline{=} \underline{=} \]

Answer = __________
b. Increase 23 by 0.10

\[ \text{Increase } 23 \times 0.10 = \]

Increase 23 by 10%

\[ 23 + 10\% = \]

Answer = 25.3

c. Increase 89 by 0.12

\[ \text{Increase } 89 \times 0.12 = \]

Increase 89 by 12%

\[ 89 + 12\% = \]

Answer = 100.8
Converting decimals to percentages

Converting decimals to percentages is ACSF numeracy level 3. At this level the apprentice should be able to convert using whole numbers (e.g. 0.25 to 25%).

To multiply the decimal by 100, move the decimal point 2 places to the right.

From decimal

<table>
<thead>
<tr>
<th>Decimal</th>
<th>To percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>25%</td>
</tr>
<tr>
<td>0.05</td>
<td>5%</td>
</tr>
<tr>
<td>0.78</td>
<td>78%</td>
</tr>
<tr>
<td>0.255</td>
<td>25.5%</td>
</tr>
</tbody>
</table>

Convert these decimals to percentages:

a. 0.2  b. 0.05  c. 0.95  d. 0.654

Check your answers to this activity in the last section.
Calculating percentage amounts

Calculating percentage amounts is an ACSF level 4 activity. At this level an apprentice is able to ‘calculate with decimals and percentages and flexibly use equivalent forms’.

To find out the percentage of a known quantity or amount it is necessary to complete a calculation.

5% of 45  
This statement can be written as a calculation 45 x 5%

Step 1: 5% as a decimal = 0.05

Step 2: 45 x .05 = 2.25

From a piece of angle iron 2000 mm long, 5% will be wastage. How much is that?

Step 1: 2000 x 0.05 = 100

Step 2: The wastage is 100 mm of the angle iron.

Use the method above to calculate these:

a. An apprentice is on wages of $400 a week. He will be fully qualified next year and will gain a 20% pay increase. How much will that increase be?

\[
\frac{\text{Wages}}{\text{Percentage}} \times \frac{\text{Wages}}{\text{Percentage}} = $\text{Increase}
\]
b. A molten metal pour of 260 kg is being prepared. An error is found and another 15% is required. How many more kg of material is needed to add 15%?

\[
\frac{260}{100} \times 15 = \frac{39}{2} \text{ kg}
\]

c. A 140 kg sand mix is being prepared for a metal moulding job when an error is found in the job sheet. A further 12% is required. How many more kg of sand is needed to add 12%?

\[
\frac{140}{100} \times 12 = \frac{126}{5} \text{ kg}
\]

Check your answers to this activity in the last section

Using the calculator’s % key

What is 10% of 460?

On the calculator press these buttons

\[
\begin{align*}
4 & \ 6 \ 0 \ \times \ 1 \ 0 \ \% \\
\end{align*}
\]

Answer = 46

On most calculators there is no need to press the = key after pressing the % key.

From a piece of 3000 mm long angle iron, 8% will be wastage. How much is that?

On the calculator press

\[
\begin{align*}
3 & \ 0 \ 0 \ 0 \ \times \ 8 \ \% \\
\end{align*}
\]

Answer = 240 mm wastage of the angle iron.
Use the method on the previous page to calculate the following:

a. A manufacturer had 156 sheets of fabricated steel in stock but 25% of these were used on a job this week.

Calculate how many sheets were used.

On the calculator press

\[ \underline{x} \times \underline{\%} \]

Answer: \[ = \] _______ sheets

b. A sand mix is being prepared for a metal moulding job. A batch of 230 kg is being prepared when it is realised that 20% more is required. How many more kg of sand is needed to add 20%?

On the calculator press

\[ \underline{x} \times \underline{\%} \]

Answer: \[ = \] _______ kg

c. A batch run using 490 kg of sheet steel is being prepared. The customer now wants an extra 15%. How many more kg of sheet steel is needed to add 15%?

On the calculator press

\[ \underline{x} \times \underline{\%} \]

Answer: \[ = \] _______ kg
d. An apprentice is on wages of $364 a week. When he is fully qualified next year he will gain a 17% wage increase. How much will that increase be?

On the calculator press

\[ \text{Answer: } = \underline{\ \ \ \ \ \ \ \ \ \ \ } \]

*Check your answers to this activity in the last section*
Increasing and decreasing by a percentage

Increasing and decreasing by a percentage is a level 3 numeracy skill in the ACSF. At this level, the apprentice would be able to use a calculator to work out percentage increases and decreases in the amount of materials needed to undertake a job of work or the change in his/her pay rate following a pay increase.

Sometimes you don’t need to know the extra amount. You may just want to know the revised total amount (i.e. the new increased price or perhaps the new discounted price).

An apprentice is on wages of $400 a week. He will be fully qualified next year and will gain a 20% pay increase. How much will the apprentice’s pay be after the pay increase?

Step 1: \( \frac{400}{100} \times 0.2 = \frac{80}{100} \)

Step 2: \( 400 + 80 = 480 \)

Increasing by a percentage

Use the + and % keys on the calculator

A supervisor planned that a manufacturing job will use 27 kg of materials. A revised specification shows he will need another 10% of material to do the job. How much material is now needed?

On the calculator press:

\[ \begin{array}{c}
2 \ 7 \ + \ 1 \ 0 \ %
\end{array} \]

Answer = The job will require 29.7 kg of material.
Kim earns $640.00. This is being increased by 12%. What will he earn?

On the calculator press

6 4 0 + 1 2 %

Answer = $716.80

Use the above method to calculate these:

a. The cost of sheet metal components for a job is $11 600 and it needs to have 10% added for GST. What is the cost including GST (10%)?

Answer = $ __________________

b. A customer is quoted $12 750 for a job. They ask for some modifications. The modifications means that the cost needs to increased by 18%. What will be the new total amount for the job?

Answer = $ __________________
c. The total cost of a job is $650 and it needs to have 10% added for GST. How much will the job cost the customer?

\[
\text{Answer} = \$ \quad \text{[Blank]} + \text{[Blank]} \% \\
\]

\[
\text{Check your answers to this activity in the last section}
\]
Decreasing by a percentage

If the original amount needs to be reduced, such as a discount taken off the cost of goods, the percentage is subtracted (-) from the original amount.

Use the – and % keys on a calculator

Fabulous Fabrications account for steel this month is $2358.60. The supplier offers that if you pay by the 15th you will get a 5% discount. What will you need to pay?

On the calculator press:

2 3 5 8 . 6 0 - 5 %

Answer = $2240.67

Use the above method to complete these activities:

a. Materials are being prepared for a job. A batch of 175 kg is being prepared when it is found the order had been reduced by 10%. Calculate how much material is now needed:

Answer = ..........................
b. An employee earns a base wage of $874 per week. He takes a day's leave without reason. His employer docks a day's pay that is equal to 20%. What will be his pay this week?

\[
\text{Answer } = \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \}
Answers to activities

a. Increase 36 by 0.75
   $3 \times 0.75 = 2.7$  
   $36 + 2.7 = 38.7$

b. Increase 23 by 0.10
   $2.3 \times 0.10 = 0.23$  
   $23 + 0.23 = 23.23$

c. Increase 89 by 0.12
   $8.9 \times 0.12 = 1.068$  
   $89 + 1.068 = 90.068$

1. a) 20% b) 5% c) 95% d) 65.4%
2. a) $80$ b) 39 kg c) 16.8 kg
3. a) 39 b) 46 kg c) 73.5 kg d) $61.88$
4. a) $12760$ b) $15045$ c) $715$ d) 624
   e) 4025 f) 10.5 g) 12120
5. a) 157.5 kg b) $699.20$ c) $170.98$ d) 540 mm
   e) $12.35$ f) $320$ g) 3.2 mm