The see-saw

1. a) What happens when an adult goes on one side of a see-saw with a toddler on the other side?
   b) Look at the family shown below. What combinations of people would you suggest should go on the see-saw together?
Class activity 1

The human balance

1. Work in pairs. Person 1 stands with their arms outstretched to make a human balance. Person 2 places objects on the palms of Person 1’s hands. Person 1 then has to tilt to show which object they think is heavier. Repeat with different objects and take it in turns to be the human balance.

2. Direct your teacher to make a human balance with five marker pens on each palm. Students take it in turns to remove or add marker pens. After each move the teacher has to tilt to show what has happened to the scales.
The grocer

Here is a set of weighing scales.

There is nothing in the dish and there are no weights on the other side. How can you tell that these scales are balanced?

a) Look closely at these photographs and describe what you see.

b) How much flour is in the bag?
The weighing scales in the pictures date back to 1895. In those days people used to go to the grocer’s to buy food such as flour, rice, sugar, and so on. It was not available in pre-packed quantities as it is today. Nor were there digitalised weighing scales as we see in supermarkets today.

The customer would ask the grocer for a certain amount of an ingredient.

Good morning Mr Jenkins. Please could I have 10 oz of flour?

The grocer would place 10 oz in weights on the scales. They would then begin to spoon flour onto the tray side of the scales. When the scales balanced this would tell the grocer that they had the required quantity of flour.

Each set of scales came with a standard set of seven weights. These were:

\[
\begin{array}{cccc}
\frac{1}{4} \text{ oz} & \frac{1}{2} \text{ oz} & 1 \text{ oz} & 2 \text{ oz} \\
4 \text{ oz} & 8 \text{ oz} & 16 \text{ oz} (= 1 \text{ pound})
\end{array}
\]

The set of weighing scales shown in the photo above has one of the original weights missing.
Write down a statement about the weight of flour in each of the following pictures.

a) 

b) 

c) 

d) 

What is the largest quantity you could measure using the standard set of seven weights?

Now do Workbook exercise 2.1 on pages 1–2 of your workbook.
It is possible to buy antique sets of these weighing scales at auctions and online. As you might expect, the set of weights is not always complete.

Elaine purchases scales that only have the following weights:
1 oz  2 oz  4 oz  16 oz

She starts to make a list of the quantities she will and won’t be able to measure.

Elaine’s Grandma thinks she has made a mistake with her list. See if you can find it.

1 oz = 1 oz  ✓
2 oz = 2 oz  ✓
3 oz = 1 + 2 oz  ✓
4 oz = 4 oz  ✓
5 oz = 4 + 1 oz
6 oz = 4 + 2 oz
7 oz = 4 + 2 + 1 oz
8 oz  can’t do
9 oz  can’t do
Elaine’s Grandma says she knows how to measure 10 oz as well, and she draws the following picture:

![Flour measurement diagram]

Explain how you know this flour weighs 10 oz.

Turn to pages 3–4 of your workbook and do Workbook exercise 2.2.

Now do Workbook exercise 2.3 on pages 5–6 of your workbook.

Make up four weighing pictures like the ones in Workbook exercise 2.3. Work out your answers, and then give the problems to your neighbour to solve.

a) Compare the answers you found for each other’s problems.

b) How realistic were the problems you designed?

(Note: A small banana weighs roughly 4 oz and a supermarket-sized bag of sugar weighs roughly 2 pounds or 32 oz.)
Describe what you see in the two pictures below.
In the second picture a 1 oz weight has been added to the right-hand side of the scales and this has tipped the balance. Describe some ways in which you could make the scales balance again.

12 a) Describe what has happened from one picture to the next.

Peppers

\[ \text{Peppers} = 1 \text{ oz} \]

b) Do you think the scales would remain in balance at each stage? Explain your answer.
13 a) Draw your own version of the following picture:

**Oranges**

= 1 oz

b) Imagine that you are adding or removing objects from the scales shown. Draw the pictures to match your moves.

c) What is the weight of one orange?
Two Year 11 students answered **question 13** in quite different ways. 

**Gary’s method:**

![Diagram showing how Gary solved the problem](image)

- 2 oranges weigh 10 oz
- 1 orange weighs 5 oz

**Ellie’s method:**

![Diagram showing how Ellie solved the problem](image)

- I added weights and oranges to make the scales exactly the same.
- 2 oranges added must weigh 10 ounces added.
- So one orange weighs 5 ounces.

**a)** Describe what Gary has done to solve the problem.

**b)** Describe what Ellie has done to solve the problem.

**c)** How does Ellie know that 2 oranges must weigh the same as 10 ounces?

**d)** Which method do you prefer?

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**Turn to your workbook and do Workbook exercise 2.4 on pages 7–10.**

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Shorthand for balancing

When answering the questions in *Workbook exercise 2.4*, some students started to write a shorthand version of the pictures.

Look at the shorthand they wrote for questions 1 and 2F below. Does it make sense to you? Explain what they have done.

**A. Bananas**

\[ 6b + 2 = 2b + 18 \]

**F. Apples**

\[ 11a + 16 + 16 + 8 = 15a + 8 + 8 + 4 \]
Here is the shorthand for another balance problem:

\[ 16p + 14 = 10p + 44 \]

a) Draw a scales picture for this problem. Try to do this in more than one way.
b) Work out the value of \( p \).
c) What object do you think \( p \) could be?

a) Draw a scales picture for the balance problem:

\[ 8 + 6q = 20 + 3q \]

b) Work out the value of \( q \).
c) Here is a scales picture for the problem:

\[ 8r + 15 > 5r + 21 \]

Does this picture fit with the problem or not? Explain.

d) Use the picture to find out some information about \( r \).

Turn to pages 11–12 of your workbook and do Workbook exercise 2.5.
More shorthand

18 Try to make some sense of the shorthand written below by drawing a scales picture.

\[3(a + 2) = a + 12\]

Compare your ideas with the rest of your class.

19 a) Draw a scales picture for the balance problem:

\[5b + 7 = 3(b + 4)\]

b) Work out the value of \(b\).

Turn to pages 13–14 of your workbook and do Workbook exercise 2.6.
Summary

In this chapter you worked on the idea of balanced weighing scales and what this could tell you about the weight of an object. For example:

**Bananas**

Here you worked out that the weight of a banana must be around 5 ounces, i.e. $b = 5$.

**Apples**

Here you worked out that the weight of an apple must be more than 4 ounces, i.e. $a > 4$.

You developed strategies for solving weighing problems where the objects appeared on both sides of the scales. For example:

**Tangerines**
Chapter 2: Weigh it all up

Then you can figure out what an object weighs from what you have left.

\[ 6 = 2t \quad \Rightarrow \quad t = 3 \]

You developed ways of solving balance problems by drawing scales pictures.

For example, the problem \(12y + 4 = 7y + 14\) can be drawn as:

By removing objects from both sides of the scales:

You can see that:

\[ 5y = 10 \quad \Rightarrow \quad y = 2 \]