

Portfolio Task 1.1

As a starting point for working on this book get a notebook or file. This will act as a record of all the activities you engage in whilst you use the book. The companion website links these activities to the NQT standards for those of you that need to evidence your learning. Now try the activity before reading on. It may take you a few minutes.

Portfolio Task 3.1

Look at this number square. Imagine you can extend it as far as you like both horizontally and vertically. You may want to sketch your own enlarged version in a notebook. What patterns do you see in the number square? Jot down anything you notice.

1	3	5	7	...
2	6	10	14	...
4	12	20	28	...
8	24	40	56	...
...

Portfolio task 3.2

Look at the number line below:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----

Look at chunks of the number line which consist of two consecutive numbers, such as 1, 2 or 6, 7 or 13, 14. Add these pairs of numbers together. What do you notice? Do you think this result is true for any two consecutive numbers? Why do you think this happens?

Now try adding together three consecutive numbers, or four. What are you noticing? What do you think is the reason for these results?

You may feel a little insecure with the openness of this task. You may not be sure if you have 'answered the question'. This isn't unusual. There is in fact no 'question to answer' – the point is to 'plan and follow lines of enquiry', which is one of the Laurinda Brown's themes. Hopefully, by trying to answer the 'why' questions you are beginning to 'communicate your mathematical thinking'.

Portfolio task 3.3

Try to prove the statement 'The sum of two consecutive numbers is always an odd number' through a drawing. I have used this problem with young children and they proved the result for me by building towers from cubes.

Here is a drawing that may get you started:

Portfolio task 3.4

Take a sheet of A3 paper and fold it in half – use a ‘portrait’ orientation. On the left hand side of the paper revisit the consecutive numbers from chapter 3. Try to recreate in as much detail as you can the thinking process you went through when you explored the problem. Now on the right hand side of the paper use the method of rubric writing to annotate your thinking. When were you stuck? Why were you stuck? Jot down your ‘aha’ moments. What did you do immediately following these thoughts? At what stages did you check back over your calculations? What did you discover? Finally, take time to reflect. What did you learn from working at the problem? How might you approach a similar problem in the future? How might you explore this problem further?

If you can, try this problem with a class you are teaching, encourage them to tell you when they are stuck, or have ‘aha’ moments. Support them in checking back over their solutions and most importantly give them time to reflect on the process.

Portfolio Activity 4.1

You will need to work with a small group of friends or colleagues. Take it in turns to pick up a number of small cubes, between 5 and 12. Drop them onto a flat surface and cover them with a piece of cloth. Remove the cloth so that your friends can see the cubes but replace it before they have chance to ‘count’ the cubes. Ask them how many cubes they saw. Then ask how they calculated. It is likely that the group will have counted in ‘2’s, or ‘3’s, or even larger groups depending on the arrangement of the cubes. Try this several times with increasing numbers of cubes to see how many cubes they can ‘count’ in this way.

Portfolio task 4.2

Can you think of examples of children who do not yet understand these principles? For example, a child who is asked to count seven multilink cubes laid out in a row and then count them again when you put them into a different arrangement to ‘check’ there are still seven would not yet understand the order irrelevance principle. Write your examples and enter this reflection in your personal portfolio.

Portfolio task 4.3

Can you think of examples of children who do not yet make the link between the numerical symbols and the results of a count? I have heard children ask how to ‘spell’ a certain number. They might count 15 ducks in a pond and ask, ‘How do you spell 15?’ Alternatively they may recognise particular numbers such as their age, the house number they live at, or the bus they catch to school, and not connect this to the numbers on a number line. Reflect on these experiences and add this to your portfolio.

Portfolio task 4.4

Take as large a sheet of paper as you can get hold of. Write $\frac{1}{2}$ in the centre. Now create a web diagram with as many different representations of $\frac{1}{2}$ as you can think of. These might be diagrams with $\frac{1}{2}$ shaded in different ways, they might be equivalent fractions, or they might be percentages. When you have exhausted this idea pick another fraction which is linked to $\frac{1}{2}$ in some way. So you might choose $\frac{1}{4}$ (which is $\frac{1}{2}$ of a $\frac{1}{2}$). Create another family of representations for a quarter. Carry on filling the paper with as many different fractions as you can think of.

Portfolio task 4.5

Write down all the errors that you can remember children making when they have named or written down fractions. For each example decide whether the children's misconception was based in a misunderstanding of the language of naming and writing fractions or a lack of clarity around what defines the numerator and denominator of a fraction. Add these notes to your portfolio.

Portfolio task 4.6

Can you write down 2.75 as a fraction and a percentage? Can you do the same for 1.5 and 4.9?

Portfolio task 4.7

Use a calculator to explore the following fractions in their decimal forms. What do you notice about the patterns that are formed?

- a. $\frac{1}{3}$, $\frac{2}{3}$, $\frac{3}{3}$
- b. $\frac{1}{6}$, $\frac{2}{6}$, $\frac{3}{6}$, $\frac{4}{6}$, $\frac{5}{6}$, $\frac{6}{6}$
- c. $\frac{1}{9}$, $\frac{2}{9}$, $\frac{3}{9}$, $\frac{4}{9}$, $\frac{5}{9}$, $\frac{6}{9}$, $\frac{7}{9}$, $\frac{8}{9}$, $\frac{9}{9}$

What other fraction families give you recurring decimals?

Portfolio task 4.8

Look back over the misconceptions you have explored in this chapter. Which of the misconceptions did you share? How do you think you developed this misconception? What might a teacher have done to support you in overcoming the misconception?

Before moving on to the case study section, try to write a convincing explanation to support a colleague in understanding why this misconception is incorrect. Add this to your portfolio.

Portfolio task 5.1

Describe the following operations on a 100 square:

- Adding 10
- Subtracting 11
- Adding 27

Try to describe the 'move' you make – for example, to add 11, 'I move down one row and one column to the right.'

Add these notes to your personal portfolio.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Portfolio task 5.2

Explore the link between square numbers and triangle numbers. If we call the square numbers S_1, S_2, S_3, S_4 , and so on, so that:

$$S_1 = 1, S_2 = 4, S_3 = 9, S_4 = 16...$$

And the triangle numbers T_1, T_2, T_3, T_4 so that:

$$T_1 = 1, T_2 = 3, T_3 = 6, T_4 = 10...$$

Try to represent any square number as the sum of two triangle numbers. Try to illustrate your answer with a picture.

Portfolio task 5.3

Use the distributive property to carry out the following calculations mentally – draw a sketch to illustrate the calculation:

$$18 \times 8$$

$$34 \times 7$$

$$29 \times 14$$

$$48 \times 6$$

Check with a calculator to convince yourself!

Portfolio task 5.4

Explore patterns in the 4 and 9 times-tables. Are there rules that you can find so that you know if a large number is divisible by 4 or by 9?

Portfolio Task 6.1

Work out $48 + 36$ and record your solution using a pencil and paper method.

Portfolio task 6.2

1. The grid method: Calculate the following using the grid method. Before you carry out the calculation, estimate the answer. Which two numbers do you think the answer should be between?

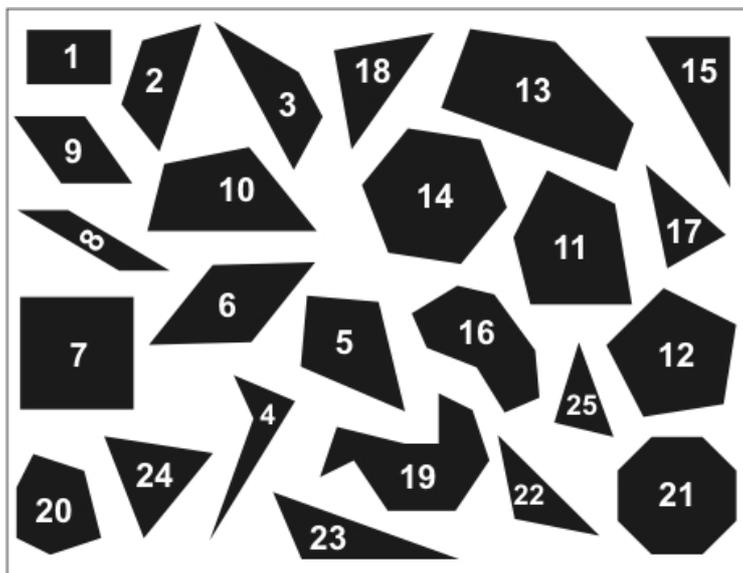
358×34

×	30	4	
300			
50			
8			

Then use the expanded method shown on page 116.

Portfolio task 7.1

Look at the polygons below:



Classify them in any way you like, into as many groups as you like. When you have completed this task explain your classification to a friend. Then classify them in a different way. Finally, name as many of the polygons as you can.

(This activity is taken from many of the free online resources provided by the National Council of Teachers of Mathematics in the USA. This activity can be found at <http://illuminations.nctm.org/LessonDetail.aspx?ID=L277>.) Source: Reprinted with permission from <http://illuminations.nctm.org>, copyright 2009 by the National Council of Teachers of Mathematics. All rights reserved.

Portfolio task 7.2

Look at the shapes you sorted earlier in the chapter. For your portfolio sort them into groups using the vocabulary you have been introduced to above – so you may sort into concave and convex, regular and irregular, and so on – and draw them.

Portfolio task 7.3

Try this activity – the folding helps you understand ideas of symmetry and the surprises when you unfold the shape support you in 'noticing' the properties of the shapes. Children find it motivating too as it develops their skills of visualisation as they have to try and 'picture' the shape that will emerge when they unfold the paper.

Take a piece of A4 paper and make one fold anywhere – you do not have to fold it in half. Make a cut so that you form two shapes out of the piece of paper. Sketch the two shapes that you have made and name them. Can you find ways to fold and cut the paper so that you make a square, a rhombus, a rectangle, a parallelogram, a trapezium and a kite?

Portfolio task 7.4

Draw the regular polygons given in the table earlier in this chapter. Find all the lines of symmetry for each shape. What do you notice about the result? Why do you think this is the case?

Portfolio Task 8.1

Write a list of the units of measurement you have a sense of as I did above. Try to complete the list below – what do you think weighs about 1 kg, has a capacity of about a litre or measures about 1 cm?

1 mm	1 g	1 ml
1 cm	1 kg	10 ml
1 m	100 kg	500 ml
1 km		1 litre
10 km		100 litres

Which measurements did you find easy and which did you find hard? Talk to your friends about it and think about how your prior experiences have informed your knowledge of measurements.

Portfolio task 8.2

Decide which of these statements are true and which are false:

- If you double the dimensions of a rectangle you double its perimeter.
- If you double the dimensions of a rectangle you double its area.
- If you double the lengths of the sides of a rectangle, but leave the width the same, you double the area.
- If you double the dimensions of a cuboid you double its volume.

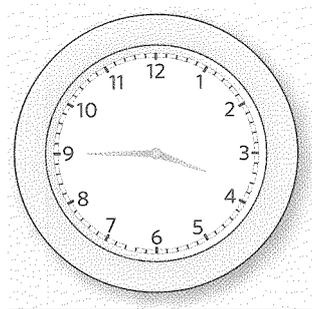
For the false statements write down an equivalent statement which is true. Try to describe why this is true.

Portfolio task 8.3

This clock is showing 3:45. Write down all the ways you could say this time.

These are some of the answers that my class gave – explain the errors the children are making:

- 45 minutes to 4
- 9 minutes to 4
- 9 minutes past 3
- 18 minutes past 9



Portfolio task 8.4

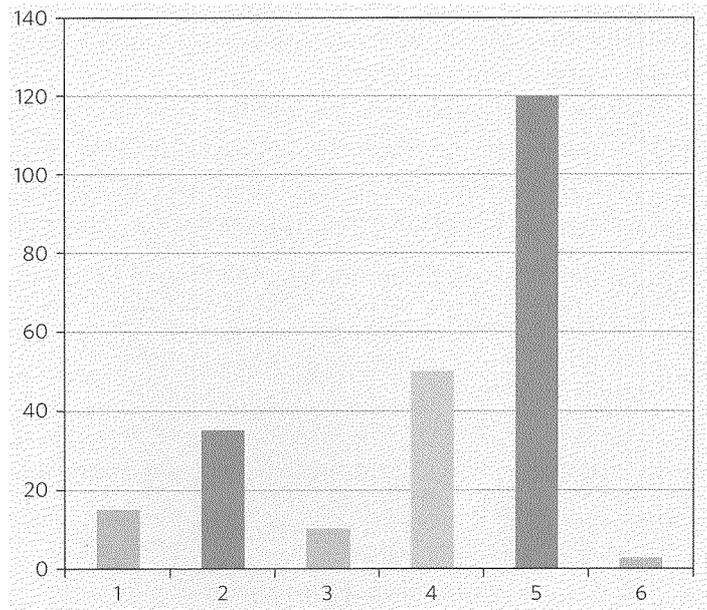
Devise a lesson plan which is appropriate for a group of learners you are working with. The focus should be an aspect of 'Measuring' that is appropriate to the age group you are working with.

Make sure you think carefully about the context and evaluate the lesson. Either incorporate the 'Scales' program or another interactive program which models a scale for weighing within your planning.

Add this lesson plan and evaluation to your subject knowledge portfolio.

Portfolio Task 9.1

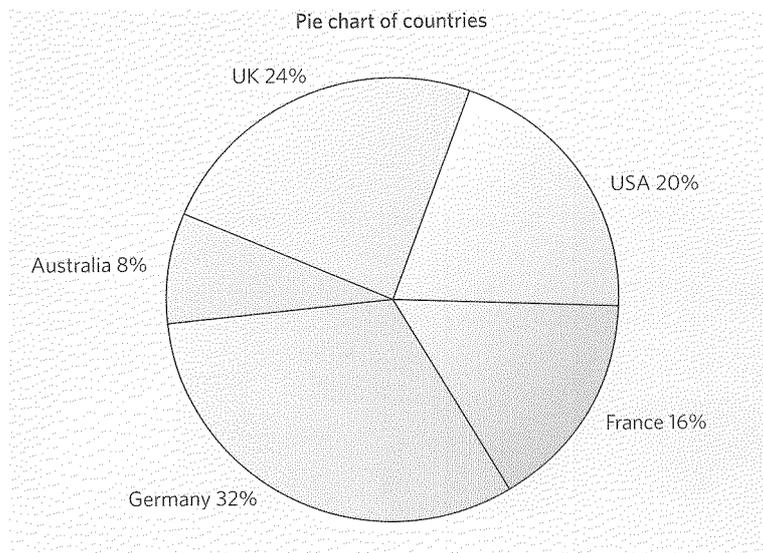
Look at this column graph:



Write down three different sets of data that the graph could be illustrating. You can define for yourself what the numbers 1–6 along the x axis (the bottom) stand for. If you work with friends on this describe how you decided on your answers.

Portfolio task 9.2

Examine this pie chart. Write down three different sets of data that it could represent. Choose one of your sets of data and write a short paragraph analysing the data. This question is deliberately open as it exemplifies how data can be interpreted in many different ways.



Portfolio task 9.3

Look at the shape sorting task and the number sorting activity from earlier in chapter 9. Carry out the tasks and then find ways of sorting the shapes using Venn diagrams. What are the advantages of using a Carroll diagram for sorting? What are the advantages of using a Venn diagram for sorting?

Portfolio task 9.4

Find a chart or graph from a newspaper or magazine which illustrates data that you are interested in. Write down your own analysis of the data, try to decide when you are 'reading the data', 'reading between the data' and 'reading beyond the data'.

Portfolio task 9.5

Try and find:

1. Six numbers with a mean of 6
2. Eight numbers with a median of 4
3. Ten numbers with a mode of 7.2

Portfolio Task 10.1

Try to work on this with a group of friends. One of you should read out this list of numbers and ask the others to draw the images they see when each number is read out:

8; 25; 6; 13; 100; 1,000,000

Portfolio task 10.2

Choose one of the books that you enjoy sharing with young learners. Jot down some notes for your portfolio about the way you can use this book to develop children's mathematical skills and understanding.

Portfolio task 11.1

Here is another NRICH problem to have a go at. I am decorating 20 biscuits for my daughter's party. I line them up and put:

- icing on every second biscuit
- a cherry on every third biscuit
- chocolate on every fourth biscuit

How many biscuits have no decoration on them? How many have icing, a cherry and chocolate?

If I ice 50 biscuits how many will have all three decorations on them?

Make notes in your portfolio about your thinking whilst you solved this problem. How do you think it would 'stretch' your high-attaining learners?

Portfolio task 12.1

Write the following fractions as decimals by using a calculator. For example, if you want to find $\frac{3}{5}$ as a decimal you key in " $3 \div 5 =$ ". You should see 0.6.

$\frac{3}{4}$

$\frac{1}{2}$

$4/5$

$1/4$

$1/5$

$2/10$

$7/10$

Convert $1/5$, $2/5$, $3/5$, $4/5$, $5/5$ to decimals.

Do the same with $1/10$, $2/10$, $3/10$, $4/10$, $5/10$, $6/10$, $7/10$, $8/10$, $9/10$, $10/10$.

What do you notice about your answers to 'fifths' and tenths'?

Now explore all the other fractions from $1/3$ s to $1/12$ s. Describe the patterns you are seeing. Can you see how this activity helped develop a sense of the value of fractions, and would have been impossible without the use of calculators?