How much do I know?

2. Ratio and proportion

**Try this first:**

To make playdough, I mix flour, salt and paint in the ratio 9:4:2.

1. If I want 135g of playdough, how much salt should I use?
2. If I have only 108g of flour but plenty of salt and paint, what is the most playdough I can make?

**Answers:**

1. 36g
2. 180g

**What is this topic?**

Ratio and proportion are terms used together, but experts argue as to whether they mean the same thing, which is very confusing. However it is generally accepted that ratio compares two or more parts of a whole, whereas proportion compares one part to the whole. [For example, ‘3 out of 4 drivers speed at some time’ is a proportion, whereas ‘3 drivers speed to every one who does not’ is a ratio.] Also the word ratio can be used for different things: we are used to the notation 3:4 to denote a ratio of 3 parts to 4 parts, but in more advanced maths it can just mean a single number, the result of dividing one number by another (e.g. in trigonometry).

We will stick to the normal definition of ratio, which is the comparison between two or more quantities. In the example above, the playdough is made of three ingredients in the ratio 9:4:2, which means for every 9 parts of flour we must have 4 parts of salt and 2 parts of paint. So we could list all possible quantities like this:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Portions of playdough** | **g of flour** | **g of salt** | **g of paint** | **Total amount of playdough** |
| 1 | 9 | 4 | 2 | 15 |
| 2 | 18 | 8 | 4 | 30 |
| 3 | 27 | 12 | 6 | 45 |
| 4 | 36 | 16 | 8 | 60 |
| 5 | 45 | 20 | 10 | 75 |
| 6 | 54 | 24 | 12 | 90 |
| 7 | 63 | 28 | 14 | 105 |
| 8 | 72 | 32 | 16 | 120 |
| 9 | 81 | 36 | 18 | 135 |
| 10 | 90 | 40 | 20 | 150 |
| 11 | 99 | 44 | 22 | 165 |
| 12 | 108 | 48 | 24 | 180 |

With this table in front of us, we can easily see the answers to the two questions. However this is a long-winded method and we can do it much more efficiently.

Start using the unitary method, e.g. finding the value of one ‘thing’ or part of the ratio. [This is the method used to find the cost of 5 pens when two cost 62p: the unit value is the cost of one pen, 62p $÷$ 2 = 31p, so 5 pens will cost 5 x 31p = 155p.]

Here we need to find the total number of parts of the ratio by adding 9 + 4 + 2 = 15, then finding out unit value by dividing 135 $÷$ 15 = 9. So our unit value (the weight of one part of our ratio) is 9g. The ingredients listed in the question go in the same order as the numbers, so salt is 4 parts, so the amount of salt is 4 x 9g = 36g.

For the second part, we need to work backwards. If we only have 108g of flour, then we can only make 108 $÷$ 9 = 12 portions of playdough, so the most we can make is 12 x 135g = 180g.

**Questions**

1. Tom and Ben have the same birthday. Tom was born in 1988 and Ben was born in 2000. The ratio of Tom’s age to Ben’s age on their birthday in 2001 was 13:1.

What was the ratio of Tom’s age to Ben’s age on their birthday in 2003? Write the ratio in its simplest form.

In what year was the ratio of Tom’s age to Ben’s age 3:1?

1. In a country dance there are 3 boys and 2 girls in every line.

42 boys take part in the dance.

How many girls take part?

1. Two letters have a total weight of 120 grams.

One letter weighs twice as much as the other.

What is the weight of the heavier letter?

**Answers**

1. In 2003 Tom will be 15 and Ben will be 3. So the ratio is 15:3, which simplifies to 5:1.

In 2004, ages will be 16 and 4.

In 2005, ages will be 17 and 5.

In 2006, ages will be 18 and 6. The ratio 18:6 simplifies to 3:1, so this is the year we want.

1. 42 $÷$ 3 = 14, 14 x 2 = 28.
2. The ratio of the weights is 1:2, so we do 120 $÷$ 3 = 40, and then 40 x 2 = 80 grams.

**Do you need more information?**

Refer to **Mathematics Explained for primary teachers** by Derek Haylock, Chapter 17, pages 207-218, and Chapter 19, pages 235-247.