

# Sample topic from Y7 Headbanger

Please note: In this book, each section in a topic is meant to take ONE LESSON!

You have permission to print off this topic and try it with your class.  
Teachers' notes, worksheets, revision and assessment for this topic can be downloaded  
and printed off in the Y7 Sample Resources document.



*The Headbanger Guide  
to the*

# Y7

## FRAMEWORK

### Topic 5

#### Fractions, Decimals, Percentages and Ratio

- Section 1: Fraction review (*fractions of shapes, comparing fractions*)
- Section 2: Equivalent fraction techniques
- Section 3: Simplest form
- Section 4: Fraction applications (*one number as a fraction of another*)
- Section 5: Mixed numbers (*including improper fractions and decimals*)
- Section 6: Equivalent decimals and fractions
- Section 7: Combining fractions (*simple addition and subtraction*)
- Section 8: Percentages (*fractions  $\leftrightarrow$  % and decimals  $\leftrightarrow$  %*)
- Section 9: Equivalent fractions, decimals and percentages
- Section 10: Percentage calculations
- Section 11: Ratio and proportion
- Section 12: More ratios and percentages (*sharing in ratio and calculator %*)

Worksheets are required for p167: \*1 & \*2 Equivalent fractions search  
p172: \*8 Fraction searches

**Order a half price copy of Y7 Headbanger  
using the Special Offer form  
which can be downloaded  
from the website (page 3 of the OrderForm)  
[www.mathsisjugglers.co.uk](http://www.mathsisjugglers.co.uk)**

# Topic 5

## Mental arithmetic

1.  $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5} \dots$  of amounts (whole number answers only)
2. Make simple equivalent fractions.
3. Simplify fractions mentally and by simple cancelling
4. One number as a fraction of another [as D4.2]
5. Convert between mixed numbers and improper fractions and simple decimal mixed numbers [as D5.1, 5.2, 5.3]
6. Change decimals to fractions in simplest form [as D6.3]
7. Add and subtract common fractions [as D7.1]
8.  $1 - \frac{4}{5}$  etc.
9. Add and subtract fractions with a common denominator [as D7.2]
10.  $\frac{1}{3} + \frac{1}{6}$  [as D7.3]
11.  $\frac{2}{3}, \frac{3}{4}, \frac{4}{5} \dots$  of amounts (whole number answers only : as in Section 9)
12. Equivalent fractions, decimals and percentages (as in Section 9)
11.  $1\frac{1}{2} \times$  amounts (as in D9.3)
12. Decimals and percentages of amounts (as in Section 9)
13. 10 % of ... 5% of... 15% of, 2.5% of ... (as in Section 10)

Also continue to practice techniques developed in the previous topic.

Mental arithmetic techniques should be repeated regularly over the weeks following their review/introduction.

# Fractions, Decimals, Percentages & Ratios

## Section 1 : Fraction review

In this section you will:

- review equivalent ways of describing fractions of shapes
- use a diagram to compare fractions

### DEVELOPMENT

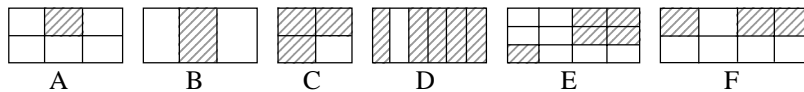
#### D1.1: Describing fractions

2 parts out of 5 have been shaded  
 $\frac{2}{5}$  has been shaded

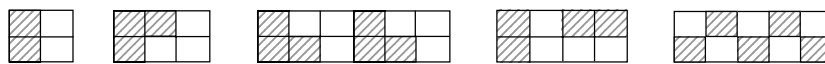
Headbanger

1. For the fraction  $\frac{3}{4}$  what is (a) the numerator (b) the denominator ?

2. What fraction of each of these has been shaded ?

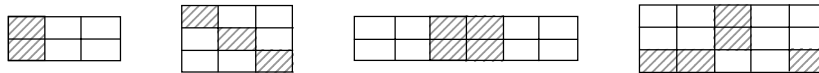


3. Each diagram below is half shaded. Each shading can also be described in a second way. Copy and complete each statement. One has been done for you.



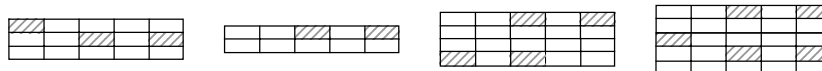
$\frac{1}{2} = \frac{2}{4}$  (a)  $\frac{1}{2} =$  (b)  $\frac{1}{2} =$  (c)  $\frac{1}{2} =$  (d)  $\frac{1}{2} =$

4. Copy and complete each statement. One has been done for you.



$\frac{1}{3} = \frac{2}{6}$  (a)  $\frac{1}{3} =$  (b)  $\frac{1}{3} =$  (c)  $\frac{1}{3} =$

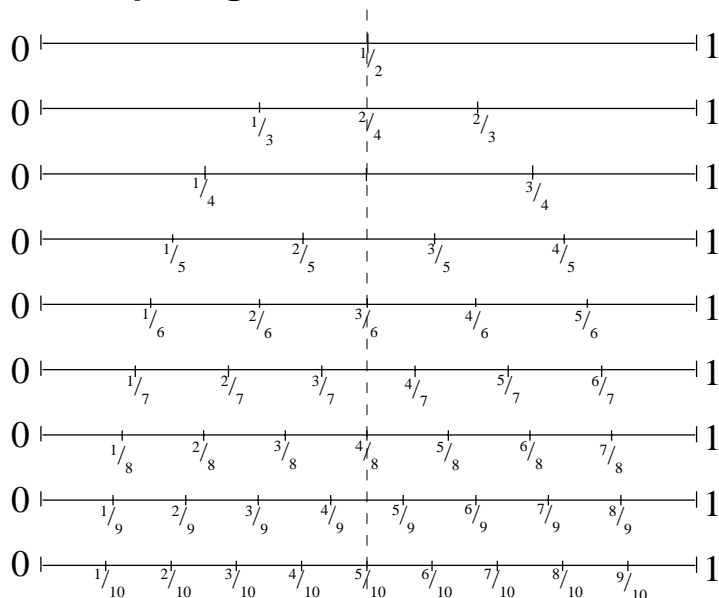
5. Copy and complete each statement. One has been done for you.



$\frac{1}{5} = \frac{3}{15}$  (a)  $\frac{1}{5} =$  (b)  $\frac{1}{5} =$  (c)  $\frac{1}{5} =$

• Check your answers.

## D1.2: Comparing fractions



1. Is  $\frac{1}{8}$  bigger or smaller than  $\frac{1}{9}$  ?
2. Is  $\frac{1}{6}$  bigger or smaller than  $\frac{1}{5}$  ?
3. Is  $\frac{2}{7}$  bigger or smaller than  $\frac{1}{5}$  ?
4. Is  $\frac{2}{3}$  bigger or smaller than  $\frac{3}{4}$  ?
5. Is  $\frac{7}{9}$  bigger or smaller than  $\frac{7}{8}$  ?
6. Is  $\frac{3}{10}$  bigger or smaller than  $\frac{1}{3}$  ?
7.  $\frac{2}{7}$   $\frac{3}{5}$   $\frac{1}{10}$   $\frac{5}{9}$   $\frac{3}{8}$   $\frac{6}{10}$   $\frac{2}{3}$   
Which fractions here are smaller than  $\frac{1}{2}$  .
8.  $\frac{5}{9}$   $\frac{4}{5}$   $\frac{9}{10}$   $\frac{7}{9}$   $\frac{5}{8}$   $\frac{7}{10}$   $\frac{5}{6}$   
Which fractions here are bigger than  $\frac{2}{3}$  .
9. Which two fractions in the diagram are equivalent to  $\frac{2}{3}$  ?
10. Which four fractions in the diagram are equivalent to  $\frac{1}{2}$  ?
11. True or false :  
(a)  $\frac{2}{7} > \frac{3}{5}$  (b)  $1\frac{5}{9} < 1\frac{3}{5}$  (c)  $7\frac{2}{3} < 7\frac{3}{5}$  (d)  $3\frac{5}{8} > 3\frac{4}{9}$
12. Write these fractions in order, with the smallest first:  
 $1\frac{2}{3}$   $3\frac{1}{11}$   $1\frac{7}{9}$   $2\frac{3}{7}$   $1\frac{8}{10}$   $2\frac{2}{5}$
13. Which of  $\frac{8}{9}$  and  $\frac{11}{9}$  is nearest to 1. Explain how you know.

• Check your answers.

**Star Challenge**



**Equivalent fraction search**

24 correct = 2 stars  
20-23 correct = 1 star

**Task 1**  $\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \dots$  The denominator is twice the numerator.

In the box, there are 12 fractions equivalent to  $\frac{1}{2}$  (including itself).  
Find 10 of them.

$\frac{1}{2}$	$\frac{2}{6}$	$\frac{8}{24}$	$\frac{15}{45}$	$\frac{48}{96}$	$\frac{6}{12}$	$\frac{9}{12}$	$\frac{100}{200}$	$\frac{15}{75}$	$\frac{19}{57}$	$\frac{43}{55}$
$\frac{12}{16}$	$\frac{2}{4}$	$\frac{6}{8}$	$\frac{47}{94}$	$\frac{5}{20}$	$\frac{1}{4}$	$\frac{50}{250}$	$\frac{7}{21}$	$\frac{8}{16}$	$\frac{3}{9}$	$\frac{2}{3}$
$\frac{150}{450}$	$\frac{6}{10}$	$\frac{3}{7}$	$\frac{17}{51}$	$\frac{23}{92}$	$\frac{7}{14}$	$\frac{10}{50}$	$\frac{6}{14}$	$\frac{15}{35}$	$\frac{5}{25}$	$\frac{3}{4}$
$\frac{2}{8}$	$\frac{6}{18}$	$\frac{123}{492}$	$\frac{4}{12}$	$\frac{10}{40}$	$\frac{30}{40}$	$\frac{10}{30}$	$\frac{1}{3}$	$\frac{3}{12}$	$\frac{7}{35}$	$\frac{5}{8}$
$\frac{13}{26}$	$\frac{50}{200}$	$\frac{11}{22}$	$\frac{3}{8}$	$\frac{4}{16}$	$\frac{17}{68}$	$\frac{4}{8}$	$\frac{31}{124}$	$\frac{5}{10}$	$\frac{20}{80}$	$\frac{13}{21}$

**Task 2**  $\frac{1}{3} = \frac{2}{6} = \frac{3}{9} = \dots$  The denominator is three times the numerator.

There are 12 fractions equivalent to  $\frac{1}{3}$  (including itself).  
Put  round 10 of them.

**Task 3**  $\frac{1}{4} = \frac{2}{8} = \frac{3}{12} = \dots$  The denominator is four times the numerator.

There are 12 fractions equivalent to  $\frac{1}{4}$  (including itself).  
Put  round 10 of them.

**Task 4**

There are 5 fractions equivalent to  $\frac{1}{5}$ .  
Put  on all of them.

• Your teacher has the answers to these.

**Star Challenge**



**Equivalent fraction challenge**

All correct = 1 star

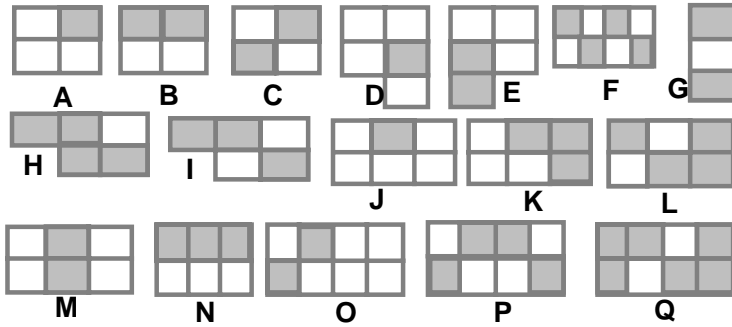
In the box, there are 5 fractions equivalent to  $\frac{3}{4}$

Put  on all of them.

• Your teacher has the answers to this.

**Star Challenge 3** Name these shapes

15 correct shapes = 2 stars  
13-14 correct shapes = 1 star



1. Name 1 shape that has  $\frac{1}{5}$  shaded.
2. Name 1 shape that has  $\frac{1}{6}$  shaded.
3. Name 1 shape that has  $\frac{3}{5}$  shaded.
4. Name 2 shapes that have  $\frac{1}{4}$  shaded.
5. Name 1 shape that has  $\frac{1}{3}$  shaded.
6. Name 1 shape that has  $\frac{3}{4}$  shaded.
7. Name 2 shapes that have  $\frac{2}{3}$  shaded.
8. Name 6 shapes that have  $\frac{1}{2}$  shaded.

• Your teacher will need to mark this.

**Star Challenge 4**

12 ways = 3 stars  
10 ways = 2 stars  
7 ways = 1 star

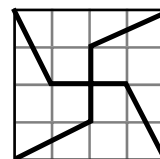
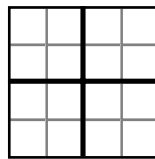
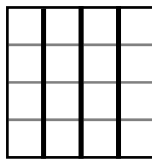
**Quartering the square**

These large squares have each been split into 4 identical quarters.

Each square is 4 x 4.

All lines must be straight.

All lines must join corners of smaller squares.



Draw 4 x 4 squares.

Divide them into quarters using these rules.

How many *different* ways can you do this ?

You may start with these three.

• Your teacher will need to mark this.

## Section 2: Equivalent fraction techniques

In this section you will meet techniques for making equivalent fractions.

### DEVELOPMENT

#### D2.1: How to make equivalent fractions

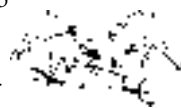
Equivalent fractions can be made by multiplying the top and bottom of a fraction by the same number.

$$\frac{1}{3} \text{ is equivalent to } \frac{5}{15}$$

$$\frac{1}{3} = \frac{5}{15}$$

Fractions that are equivalent are the same size.

Headbanger



1. Copy and complete:

(a)  $\frac{2}{5} = \frac{\boxed{x3}}{\boxed{x3}}$  (b)  $\frac{2}{5} = \frac{\boxed{x5}}{\boxed{x5}}$  (c)  $\frac{2}{5} = \frac{\boxed{x4}}{\boxed{x4}}$  (d)  $\frac{2}{5} = \frac{\boxed{x10}}{\boxed{x10}}$

2. Work out the values of  $a$ ,  $b$ ,  $c$  and  $d$ :

(a)  $\frac{3}{4} = \frac{6}{8}$  (b)  $\frac{3}{4} = \frac{15}{20}$  (c)  $\frac{3}{4} = \frac{21}{28}$  (d)  $\frac{3}{7} = \frac{30}{70}$

• Check your answers.

#### D2.2: Making equivalent fractions

Copy and complete these pairs of equivalent fractions.

Replace each ? and  $\square$  with the correct number.

1.  $\frac{1}{2} = \frac{\square}{10}$  2.  $\frac{2}{3} = \frac{10}{\square}$  3.  $\frac{4}{5} = \frac{12}{\square}$  4.  $\frac{5}{7} = \frac{\square}{14}$   
 5.  $\frac{5}{6} = \frac{\square}{18}$  6.  $\frac{3}{10} = \frac{9}{\square}$  7.  $\frac{4}{11} = \frac{\square}{22}$  8.  $\frac{2}{13} = \frac{\square}{26}$   
 9.  $\frac{1}{3} = \frac{\square}{9}$  10.  $\frac{3}{5} = \frac{\square}{10}$  11.  $\frac{4}{5} = \frac{16}{\square}$  12.  $\frac{3}{7} = \frac{6}{\square}$   
 13.  $\frac{2}{3} = \frac{20}{\square}$  14.  $\frac{5}{12} = \frac{\square}{24}$  15.  $\frac{1}{6} = \frac{\square}{30}$  16.  $\frac{3}{8} = \frac{12}{\square}$

• Check your answers.

## D2.3: Working backwards

Copy and complete these pairs of equivalent fractions.

Replace each  $\square$  with the correct number.

- |  |  |  |                                       |
|--|--|--|---------------------------------------|
| 1. $\frac{1}{\square} = \frac{8}{16}$  | 2. $\frac{\square}{3} = \frac{5}{15}$  | 3. $\frac{\square}{5} = \frac{10}{25}$ | 4. $\frac{3}{\square} = \frac{6}{20}$ |
| 5. $\frac{7}{\square} = \frac{14}{16}$ | 6. $\frac{\square}{15} = \frac{8}{30}$ | 7. $\frac{\square}{7} = \frac{6}{21}$  | 8. $\frac{4}{\square} = \frac{8}{14}$ |

• Check your answers.

### Star Challenge 5

All correct = 1 star

What do you multiply by ?

- |   |  |  |  |
|---|--|--|--|
| 1. $\frac{12}{15} = \frac{144}{180}$<br>$\xrightarrow{\times a}$    | 2. $\frac{49}{51} = \frac{343}{357}$<br>$\xrightarrow{\times b}$ | 3. $\frac{37}{73} = \frac{407}{803}$<br>$\xrightarrow{\times c}$   | 4. $\frac{57}{75} = \frac{399}{525}$<br>$\xrightarrow{\times d}$ |
| 5. $\frac{111}{120} = \frac{999}{1080}$<br>$\xrightarrow{\times e}$ | 6. $\frac{23}{35} = \frac{115}{175}$<br>$\xrightarrow{\times f}$ | 7. $\frac{151}{162} = \frac{906}{972}$<br>$\xrightarrow{\times g}$ | 8. $\frac{32}{35} = \frac{64}{70}$<br>$\xrightarrow{\times h}$   |

• Your teacher has the answers to these.

### Star Challenge 6

Without the loops

16 correct = 2 stars  
14-15 correct = 1 star

Copy and complete these pairs of equivalent fractions.

Replace each  $\square$  with the correct number.

- |   |   |   |  |
|---|---|---|--|
| 1. $\frac{3}{5} = \frac{33}{\square}$     | 2. $\frac{4}{7} = \frac{\square}{84}$     | 3. $\frac{3}{11} = \frac{\square}{121}$     | 4. $\frac{5}{8} = \frac{\square}{64}$        |
| 5. $\frac{2}{9} = \frac{\square}{45}$     | 6. $\frac{13}{15} = \frac{\square}{75}$   | 7. $\frac{11}{14} = \frac{\square}{56}$     | 8. $\frac{21}{35} = \frac{\square}{175}$     |
| 9. $\frac{13}{17} = \frac{\square}{85}$   | 10. $\frac{37}{73} = \frac{\square}{511}$ | 11. $\frac{113}{131} = \frac{\square}{655}$ | 12. $\frac{29}{41} = \frac{87}{\square}$     |
| 13. $\frac{27}{34} = \frac{216}{\square}$ | 14. $\frac{32}{49} = \frac{192}{\square}$ | 15. $\frac{53}{67} = \frac{371}{\square}$   | 16. $\frac{233}{315} = \frac{\square}{2835}$ |

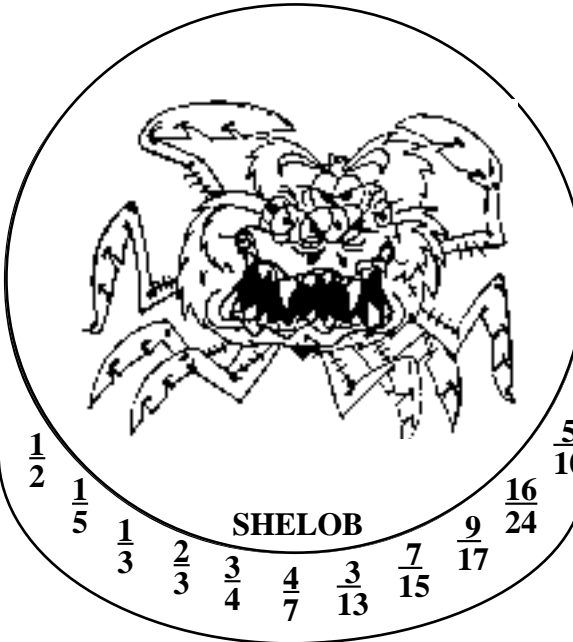
• Your teacher has the answers to these.



Star Challenge



Correct word = 2 stars  
BUT -2 stars if you tell anyone else!

<b>K</b> $\frac{10}{12}$	<b>L</b> $\frac{14}{40}$	<b>M</b> $\frac{27}{36}$	<b>N</b> $\frac{2}{9}$	<b>O</b> $\frac{63}{119}$	<b>P</b> $\frac{28}{49}$
<b>J</b> $\frac{5}{9}$	<p>Shelob is five metres high. She lurks in a cave in the Mountains of Doom and bars the way. You can only go past her if you know the magic word.</p>				<b>Q</b> $\frac{5}{12}$
<b>I</b> $\frac{77}{165}$					<b>R</b> $\frac{14}{42}$
<b>H</b> $\frac{16}{64}$	<p style="text-align: center;"><b>SHELOB</b></p>				<b>S</b> $\frac{25}{50}$
<b>G</b> $\frac{80}{165}$	$\frac{1}{2}$	$\frac{1}{5}$	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{3}{4}$
<b>F</b> $\frac{64}{120}$	$\frac{3}{4}$	$\frac{4}{7}$	$\frac{3}{13}$	$\frac{7}{15}$	$\frac{9}{17}$
<b>E</b> $\frac{10}{12}$	$\frac{5}{10}$	$\frac{16}{24}$	$\frac{5}{10}$	$\frac{9}{19}$	<b>V</b> $\frac{9}{19}$
<b>D</b> $\frac{28}{36}$	<p>Match each fraction below Shelob with an equivalent fraction from the border. Write down its letter. These letters make a word. If you get the correct word you go free. If you cannot get it, or get it wrong, you have failed ... <b>... and failures are fed to Shelob !</b> Two stars if you get the word right. BUT - two stars will be deducted if you tell anyone else the magic word.</p>				<b>W</b> $\frac{30}{70}$
<b>C</b> $\frac{15}{75}$	<p style="text-align: right;"><b>• Show your teacher the magic word !</b></p>				<b>X</b> $\frac{43}{90}$
<b>B</b> $\frac{16}{18}$					<b>Y</b> $\frac{11}{13}$
<b>A</b> $\frac{4}{9}$					<b>Z</b> $\frac{24}{29}$

Star Challenge **8** ...

1 star for each target achieved

**Fraction searches**

FRACTION SEARCH – This sheet contains fractions equivalent to one half, one quarter, three quarters, on third and two thirds. Put a loop around each of the equivalent fractions that you find.

Number found

Name.....

Fraction I am searching for:

© The 'Maths Is...' Jugglers

Draw loops round all the halves you can find.

Fill in the details at the corner of the sheet.

The fraction search can be used to look for fractions equivalent to

1 Possible 40	1 Possible 23	3 Possible 12	1 Possible 23	2 Possible 16
2 Target 37	4 Target 21	4 Target 11	3 Target 21	3 Target 14

FRACTION SEARCH – This sheet contains fractions equivalent to one half, one quarter, three quarters, on third and two thirds. Put a loop around each of the equivalent fractions that you find.

Number found

Name.....

Fraction I am searching for:

© The 'Maths Is...' Jugglers

Try the High Level Challenges at the end of this topic

## Section 3: Simplest form

In this section you will:

- understand what is meant by simplest form
- reduce fractions to simplest form

### DEVELOPMENT

#### D3.1: Simplifying fractions

The simplest form of a fraction is the equivalent fraction where the numerator and the denominator are the smallest possible whole numbers.



Big Edd

$$\frac{5}{15} = \frac{1}{3}$$

Diagram showing the simplification of  $\frac{5}{15}$  to  $\frac{1}{3}$  by dividing both numerator and denominator by 5.

$\frac{1}{3}$  is the simplest form of  $\frac{5}{15}$

Copy and complete:

1.  $\frac{4}{8} = \frac{1}{\square}$

2.  $\frac{6}{10} = \frac{\square}{5}$

3.  $\frac{6}{8} = \frac{\square}{4}$

4.  $\frac{4}{12} = \frac{\square}{3}$

5.  $\frac{9}{12} = \frac{\square}{3}$

6.  $\frac{5}{20} = \frac{1}{\square}$

What divides into both 16 and 20?

4 divides into both 16 and 20

$\frac{16}{20} = ?$



Didi

$$\frac{16}{20} = \frac{4}{5}$$

Diagram showing the simplification of  $\frac{16}{20}$  to  $\frac{4}{5}$  by dividing both numerator and denominator by 4.

$\frac{4}{5}$  is the simplest form of  $\frac{16}{20}$

Find the simplest form of each fraction.

Show your working.

7.  $\frac{20}{30}$

8.  $\frac{3}{18}$

9.  $\frac{20}{25}$

10.  $\frac{7}{21}$

11.  $\frac{12}{24}$

12.  $\frac{5}{15}$

13.  $\frac{9}{12}$

14.  $\frac{14}{21}$

15.  $\frac{8}{18}$

16.  $\frac{12}{20}$

17.  $\frac{8}{28}$

18.  $\frac{15}{20}$

• Check your answers.

### Star Challenge 9

All correct = 1 star

**Task 1:** Find the simplest form of each fraction. Show your working.

(a)  $\frac{6}{14}$

(b)  $\frac{6}{16}$

(c)  $\frac{9}{21}$

(d)  $\frac{33}{36}$

(e)  $\frac{10}{14}$

(f)  $\frac{15}{40}$

**Task 2:** Hence show which fractions are equivalent.

• Your teacher has the answers to these.

### D3.2: Multi-stage reductions

When a fraction involves larger numbers, the reduction to simplest form may be done in several stages.

$$\begin{array}{ccccccc} \xrightarrow{\div 10} & \xrightarrow{\div 6} & \xrightarrow{\div 2} & & & & \\ \frac{240}{600} = & \frac{24}{60} = & \frac{4}{10} = & \frac{2}{5} & & & \\ & \xrightarrow{\div 10} & \xrightarrow{\div 6} & \xrightarrow{\div 2} & & & \\ & & & & & & \end{array}$$

with loops

or

$$\frac{240}{600} = \frac{24}{60} = \frac{4}{10} = \frac{2}{5}$$

without loops

You may put the loops in or not – it is up to you.  
**BUT YOU MUST SHOW THE STAGES OF YOUR WORKING OUT.**

Find the simplest form of each fraction.

Show your working.

1.  $\frac{12}{36}$     2.  $\frac{24}{30}$     3.  $\frac{16}{24}$     4.  $\frac{6}{15}$     5.  $\frac{15}{25}$     6.  $\frac{20}{80}$

• Check your answers.


### D3.3: The cancelling technique

This technique is just a different way of setting out the multi-stage reductions that you have just done.

It will be widely used as you progress through school ... and beyond ...  
 and it is a very useful shortcut.

You will also meet important extensions of the 'cancelling' technique in later years.

$$\begin{array}{r} \cancel{24} \cancel{4}^2 \\ \cancel{600} \\ \hline 60 \quad \cancel{10}_5 \end{array}$$



Gizmo

The mental stages shown here are the same as in D5.2 :  $\div 10, \div 6$  &  $\div 2$

So,  $\frac{240}{600} = \frac{2}{5}$

Simplify each fraction using the cancelling method.

Show your working.

1.  $\frac{48}{60}$     2.  $\frac{125}{500}$     3.  $\frac{48}{72}$     4.  $\frac{65}{75}$     5.  $\frac{135}{180}$     6.  $\frac{75}{125}$

• Check your answers.

Star Challenge ★ 10★10 ★

6 correct = 2 stars  
 4-5 correct = 1 star

Find the simplest form of each fraction.  
 Show your working.

1.  $\frac{48}{64}$     2.  $\frac{112}{448}$     3.  $\frac{45}{180}$     4.  $\frac{98}{245}$     5.  $\frac{294}{378}$     6.  $\frac{72}{168}$

• Your teacher has the answers to these.

Try the High Level Challenges at the end of this topic

## Section 4: Fraction applications

In this section you will:

- use fractions to do division problems
- express a smaller number as a fraction of a larger one

### DEVELOPMENT

#### D4.1: Some mental division techniques

EXAMPLE Work out  $4 \div 8$

$$4 \div 8 = \frac{4}{8} = \frac{1}{2}$$



Icee

Work out these division problems :

1.  $2 \div 3$
2.  $9 \div 12$
3.  $16 \div 24$
4.  $30 \div 40$
5.  $8 \div 12$
6.  $20 \div 15$
7.  $2 \div 6$
8.  $9 \div 21$
9.  $20 \div 15$
10.  $10.5 \div 25$

• Check your answers.

#### D4.2: One number as a fraction of another

EXAMPLE What fraction of 1 m is (a) 27 cm (b) 35 cm

(a)  $\frac{27}{100}$

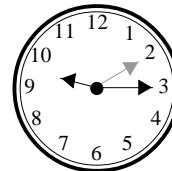
(b)  $\frac{35}{100} = \frac{7}{20}$

1. What fraction of a kilogram is 250 grams ?
2. What fraction of an hour is 45 minutes ?
3. What fraction of an hour is 25 minutes ?
4. What fraction of 30 cm is 10 cm ?
5. What fraction of 1 cm is 3 mm ?
6. What fraction of a turn is  $90^\circ$  ?
7. What fraction of a day is 6 hours ?
8. What fraction of 10 m is 2 m ?
9. What fraction of a minute is 20 seconds ?
10. What fraction of an hour is 10 minutes ?
11. What fraction of a turn does the minute hand turn through between 9.10 and 9.15 ?
12. What fraction of a turn does the minute hand turn through between 8.10 and 8.50 ?

Fraction answers should be simplified, wherever possible.



Driller

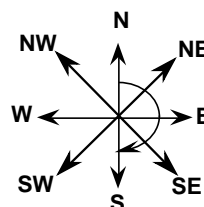


13. What fraction of a turn does the hour hand turn through between 08.00 and 12.00 ?
14. On average, I sleep 8 hours each night.  
What fraction of my life do I spend asleep ?

• Check your answers.

### D4.3: Fractions of turns

1. What fraction of a turn takes you from facing N to facing S ?
2. How many half turns take you from facing N to facing N again ?
3. What fraction of a turn takes you from facing N to facing W anticlockwise?
4. How many quarter turns take you from facing N to facing N again ?
5. What fraction of a turn takes you from S to SW ?
6. What fraction of a turn takes you from N to SE ?
7. What fraction of a turn takes you from N to SW clockwise ?
8. What fraction of a turn takes you from N to W clockwise ?



• Check your answers.

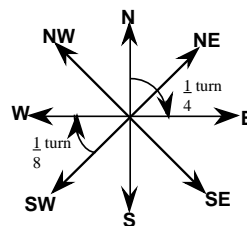
#### Star Challenge



14 correct = 2 stars  
11-13 correct = 1 star

#### Equivalent fractions of turns

1. Start facing E.  
What direction are you facing after half a turn ?
2. Start facing N.  
What direction are you facing after  $\frac{1}{8}$  of a turn ?
3. Start facing W.  
What fraction of a turn takes you to facing N ?
4. Start facing S.  
What fraction of a turn takes you to facing SW ?
5. Copy this table. Fill in the directions you would face after each turn from N:



Fraction of turn from N	$\frac{1}{4}$	$\frac{2}{4}$	$\frac{3}{4}$	$\frac{2}{8}$	$\frac{4}{8}$	$\frac{6}{8}$	$\frac{1}{2}$
Direction you would face							



Ruff

$\frac{3}{4}$  of a turn is the same as  $\frac{6}{8}$  of a turn  
We say that  $\frac{3}{4}$  is **equivalent to**  $\frac{6}{8}$  and  $\frac{3}{4} = \frac{6}{8}$

6. Which two fractions in the table are equivalent to  $\frac{1}{2}$  ?
7. Which fraction is equivalent to  $\frac{2}{8}$  ?

• Your teacher has the answers to these.

Try the High Level Challenges at the end of this topic

## Section 5: Mixed numbers

In this section you will:

- convert between mixed numbers and decimals
- convert between mixed numbers and improper fractions
- multiply a fraction by an integer

### DEVELOPMENT

#### D5.1: Mixed numbers and decimals

$0.5 = \frac{1}{2}$	$0.25 = \frac{1}{4}$	$0.75 = \frac{3}{4}$
$2.5 = 2\frac{1}{2}$	$4.25 = 4\frac{1}{4}$	$5.75 = 5\frac{3}{4}$

Copy and complete:

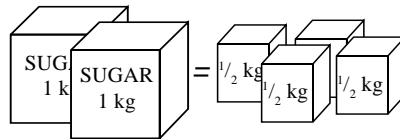
1.  $3.5 = \dots$     2.  $5.25 = \dots$     3.  $8.75 = \dots$     4.  $\dots = 3\frac{1}{4}$   
 5.  $\dots = 9\frac{1}{2}$     6.  $\dots = 7\frac{3}{4}$     7.  $10.25 = \dots$     8.  $\dots = 15.75$

Check your answers.

#### D5.2: How many ... ?

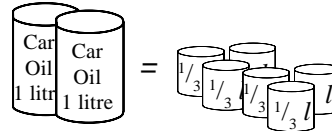
1. How many halves are there in :

- (a) 1    (b)  $1\frac{1}{2}$     (c)  $2\frac{1}{2}$   
 (d) 4    (e)  $3\frac{1}{2}$     (f)  $5\frac{1}{2}$

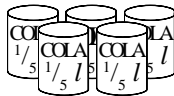


2. How many thirds are there in :

- (a) 1    (b)  $1\frac{1}{3}$     (c)  $2\frac{1}{3}$   
 (d)  $1\frac{2}{3}$     (e) 2    (f)  $2\frac{2}{3}$



3.



How many fifths are there in :

- (a) 1    (b)  $1\frac{1}{5}$     (c)  $2\frac{2}{5}$   
 (d)  $1\frac{4}{5}$     (e) 2    (f)  $3\frac{3}{5}$

• Check your answers.

#### D5.3: From mixed numbers to improper fractions



Gizmo

$$2\frac{1}{4}$$

mixed number

$$= \frac{9}{4}$$

improper fraction

Think: how many quarters in  $2\frac{1}{4}$ ?  
9 quarters of  $\frac{1}{4}$


If the numerator is larger than the denominator, it is an improper fraction.

Write as improper fractions:

1.  $2\frac{1}{3}$     2.  $3\frac{3}{4}$     3.  $2\frac{2}{5}$     4.  $3\frac{1}{2}$     5.  $1\frac{4}{5}$   
 6.  $1\frac{3}{4}$     7.  $1\frac{4}{9}$     8.  $2\frac{3}{4}$     9.  $1\frac{2}{3}$     10.  $3\frac{3}{5}$

• Check your answers.

## D5.4: Working in reverse

$\frac{5}{4} = 1\frac{1}{4}$ <p style="text-align: center;">↑                    ↑ improper fraction    mixed number</p>		Think: how many whole ones can you make from 5 quarters – and how many will be left over?
<i>Idea</i>		

Write these improper fractions as mixed numbers:

- |                   |                    |                    |                    |                    |                    |                    |
|-------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| 1. $\frac{5}{2}$  | 2. $\frac{13}{4}$  | 3. $\frac{7}{3}$   | 4. $\frac{6}{5}$   | 5. $\frac{9}{8}$   | 6. $\frac{19}{10}$ | 7. $\frac{10}{9}$  |
| 8. $\frac{19}{8}$ | 9. $\frac{23}{10}$ | 10. $\frac{19}{6}$ | 11. $\frac{21}{2}$ | 12. $\frac{11}{3}$ | 13. $\frac{25}{4}$ | 14. $\frac{19}{9}$ |

• Check your answers.

## D5.5: Multiplying a fraction by a whole number

$3 \times \frac{2}{7} = \frac{6}{7}$	$3 \times \frac{3}{4} = \frac{9}{4} = 2\frac{1}{4}$	$3 \times \frac{5}{6} = \frac{15}{6} = \frac{5}{2} = 2\frac{1}{2}$
Give answers in simplest form, as proper fractions or mixed numbers.		

Evaluate:

- |                           |                           |                           |                            |                            |                            |
|---------------------------|---------------------------|---------------------------|----------------------------|----------------------------|----------------------------|
| 1. $5 \times \frac{1}{8}$ | 2. $2 \times \frac{3}{5}$ | 3. $4 \times \frac{1}{8}$ | 4. $3 \times \frac{2}{9}$  | 5. $2 \times \frac{6}{7}$  | 6. $6 \times \frac{3}{8}$  |
| 7. $2 \times \frac{7}{9}$ | 8. $3 \times \frac{2}{3}$ | 9. $5 \times \frac{2}{9}$ | 10. $4 \times \frac{3}{8}$ | 11. $7 \times \frac{2}{5}$ | 12. $8 \times \frac{3}{4}$ |

• Check your answers.

<b>Star Challenge 12</b>	Write as improper fractions:	11-12 correct = 1 star										
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">1. <math>1\frac{1}{4}</math></td> <td style="text-align: center;">2. <math>2\frac{5}{6}</math></td> <td style="text-align: center;">3. <math>3\frac{2}{3}</math></td> <td style="text-align: center;">4. <math>2\frac{1}{5}</math></td> <td style="text-align: center;">5. <math>1\frac{3}{4}</math></td> </tr> <tr> <td style="text-align: center;">6. <math>3\frac{1}{2}</math></td> <td style="text-align: center;">7. <math>5\frac{7}{10}</math></td> <td style="text-align: center;">8. <math>2\frac{4}{9}</math></td> <td style="text-align: center;">9. <math>1\frac{2}{7}</math></td> <td style="text-align: center;">10. <math>3\frac{3}{11}</math></td> </tr> </table> <p>11. Dorothy was sent to buy 2 kg of flour. There were no 2 kg packs left. There were only <math>\frac{1}{2}</math> kg packs. How many packs should she buy?</p> <p>12. Abram needed <math>3\frac{1}{4}</math> litres of oil to do an oil change. The only cans available each held <math>\frac{1}{3}</math> of a litre. How many cans should he buy to do the oil change?</p> <p style="text-align: right;">• Your teacher has the answers to these.</p>			1. $1\frac{1}{4}$	2. $2\frac{5}{6}$	3. $3\frac{2}{3}$	4. $2\frac{1}{5}$	5. $1\frac{3}{4}$	6. $3\frac{1}{2}$	7. $5\frac{7}{10}$	8. $2\frac{4}{9}$	9. $1\frac{2}{7}$	10. $3\frac{3}{11}$
1. $1\frac{1}{4}$	2. $2\frac{5}{6}$	3. $3\frac{2}{3}$	4. $2\frac{1}{5}$	5. $1\frac{3}{4}$								
6. $3\frac{1}{2}$	7. $5\frac{7}{10}$	8. $2\frac{4}{9}$	9. $1\frac{2}{7}$	10. $3\frac{3}{11}$								
<b>Star Challenge 13</b>	Write as mixed numbers:	10 correct = 2 stars 8-9 correct = 1 star										
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">1. <math>\frac{47}{5}</math></td> <td style="text-align: center;">2. <math>\frac{13}{2}</math></td> <td style="text-align: center;">3. <math>\frac{25}{3}</math></td> <td style="text-align: center;">4. <math>\frac{17}{13}</math></td> <td style="text-align: center;">5. <math>\frac{43}{13}</math></td> </tr> <tr> <td style="text-align: center;">6. <math>\frac{100}{9}</math></td> <td style="text-align: center;">7. <math>\frac{35}{4}</math></td> <td style="text-align: center;">8. <math>\frac{47}{3}</math></td> <td style="text-align: center;">9. <math>\frac{34}{5}</math></td> <td style="text-align: center;">10. <math>\frac{57}{7}</math></td> </tr> </table> <p style="text-align: right;">• Your teacher has the answers to these.</p>			1. $\frac{47}{5}$	2. $\frac{13}{2}$	3. $\frac{25}{3}$	4. $\frac{17}{13}$	5. $\frac{43}{13}$	6. $\frac{100}{9}$	7. $\frac{35}{4}$	8. $\frac{47}{3}$	9. $\frac{34}{5}$	10. $\frac{57}{7}$
1. $\frac{47}{5}$	2. $\frac{13}{2}$	3. $\frac{25}{3}$	4. $\frac{17}{13}$	5. $\frac{43}{13}$								
6. $\frac{100}{9}$	7. $\frac{35}{4}$	8. $\frac{47}{3}$	9. $\frac{34}{5}$	10. $\frac{57}{7}$								



# Star Challenge 14 14

## The ice-breaker task

10 correct = 2 stars  
7-9 correct = 1 star

The Pan-Galactic Trainees have just arrive at the Space Academy.

They need to find which cabins they have been given.




















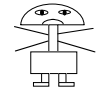





Before they are told which cabin, they are given a task to do which will get them talking to the other new trainees.

Each trainee is given a card with a number on it (and their own picture).

The trainees with the equivalent numbers on their cards will share a cabin.

Some cabins hold 3 trainees. Some hold 2 trainees. There are 10 cabins.

**Put the Pan-Galactic Trainees into their 10 cabin groups.**

 <i>Blurbl</i> $2\frac{1}{4}$	 <i>Dwork</i> 1.5	 <i>Idea</i> $3\frac{1}{3}$	 <i>Frizzbang</i> $7\frac{1}{2}$	 <i>Lubby</i> $2\frac{6}{7}$
 <i>Optymistic</i> $5\frac{3}{4}$	 <i>Mishrak</i> $1\frac{1}{9}$	 <i>Taz</i> 2.25	 <i>Zuk</i> $4\frac{2}{3}$	 <i>Plok</i> $\frac{10}{9}$
 <i>Qwerk</i> $1\frac{3}{4}$	 <i>Pow</i> $\frac{14}{3}$	 <i>Hoblin</i> $\frac{15}{2}$	 <i>Chyps</i> $1\frac{1}{2}$	 <i>Pesymistic</i> $\frac{23}{4}$
 <i>Cringo</i> $\frac{20}{7}$	 <i>Yerwat</i> 1.75	 <i>Icee</i> 5.75	 <i>Modesto</i> $\frac{33}{5}$	 <i>Do-med</i> $\frac{3}{2}$
 <i>Gorbag</i> $\frac{9}{4}$	 <i>Apul</i> $\frac{10}{3}$	 <i>Sludge</i> $6\frac{3}{5}$	 <i>Meedy Oker</i> $\frac{7}{4}$	 <i>Yusu Al</i> 7.5

• Your teacher has the answers to these.

Try the High Level Challenges at the end of this topic

## Section 6: Equivalent decimals and fractions

In this section you will:

- work with equivalent fractions and decimals
- change decimals into fractions (in simplest form)

### DEVELOPMENT

#### D6.1: Decimals and fractions

The decimal point separates the whole numbers from the bits of numbers.

Thousands	Hundreds	Tens	Units	.	tenths	hundredths	thousandths	
T	H	T	U	.	t	h	th	
			0	.	6			= $\frac{6}{10}$
			0	.	0	7		= $\frac{7}{100}$
			0	.	0	0	3	= $\frac{3}{1000}$
			1	.	9			= $1\frac{9}{10}$
			0	.	4	1		= $\frac{41}{100}$

Copy and complete this table:

Thousands	Hundreds	Tens	Units	.	tenths	hundredths	thousandths		
T	H	T	U	.	t	h	th		
			0	.	3			= .....	
			0	.	0	8		= .....	
			0	.	0	0	5	= .....	
			2	.	6			= .....	
			0	.	1	7		= .....	
			0	.				= $\frac{4}{100}$	
			0	.				= $\frac{6}{10}$	
			0	.				= $\frac{3}{1000}$	
			0	.				= $\frac{67}{100}$	
			0	.				= $\frac{31}{1000}$	
			...	.				= $1\frac{7}{10}$	
				.				= $2\frac{11}{100}$	
				.				= $4\frac{31}{1000}$	
			0	.	0	2	7	= .....	
			1	8	.	2	3	5	= .....

Just keep looking at the labels at the top of the table.



Lubbly



















**The Pan-Galactic Explorers' Dance Competition**

The Explorers have returned from a successful mission. To celebrate, a dance competition is organised. Each dancer takes a numbered card from a box.



... because the value of the numbers on their cards is the same.

The other Explorers get these numbers:



 Sludge 0.2	 Mishrak $\frac{7}{100}$	 Qwerk 0.9	 Apul $\frac{6}{10}$
 Dwork $\frac{6}{100}$	 Lubbly $\frac{4}{10}$	 Crutch 0.05	 Zuk $\frac{9}{10}$
 Yerwat 0.02	 Fission 0.7	 Cringo $\frac{2}{10}$	 Frizzbang $\frac{2}{100}$
 Chyyps $\frac{7}{10}$	 Taz 0.06	 Crumbl 0.6	 Plok 0.4
 Gorbag 0.07	 Hoblin $\frac{5}{100}$		

Who dances with whom ?  
Make a list of the pairs of dancers.

• Your teacher has the answers to these.

## D6.2: Changing decimals to fractions


**T U . t h th**

<p>EXAMPLE: Q: Write 0.7 as a fraction</p>  <p>U . t <math>0.7 = 0.7</math></p> <p><math>0.7 = \frac{7}{10}</math></p> <p>Stripee</p>	<p>EXAMPLE: Q: Write 0.71 as a fraction</p>  <p>U . t h <math>0.71 = 0.71</math></p> <p><math>0.71 = \frac{71}{100}</math></p> <p>Spottee</p>
--	--

Write these decimals as fractions:

1. **0.3**    2. **0.9**    3. **0.07**    4. **0.01**    5. **0.03**    6. **0.009**  
 7. **0.11**    8. **0.23**    9. **0.39**    10. **0.05**    11. **0.28**    12. **0.593**

EXAMPLE:  
Q: Write 1.3 as a mixed number



U . t h  
 $1.3 = 1.3$

$1.3 = 1\frac{3}{10}$

Chyps

Write these decimals as fractions or mixed numbers:

13. **1.7**    14. **2.9**    15. **3.01**    16. **0.045**    17. **0.06**    18. **0.029**  
 19. **0.13**    20. **4.5**    21. **0.001**    22. **0.12**    23. **6.1**    24. **2.05**

• Check your answers

### Star Challenge 16

13-14 correct = 1 star

#### Fraction-decimal challenge

True (T) or false (F) ?

- |                             |                              |                                |
|-----------------------------|------------------------------|--------------------------------|
| 1. $0.1 = \frac{1}{10}$     | 2. $0.003 = \frac{3}{100}$   | 3. $0.005 = \frac{5}{1000}$    |
| 4. $0.9 = \frac{9}{10}$     | 5. $2.1 = 2\frac{1}{10}$     | 6. $3.2 = 3\frac{2}{100}$      |
| 7. $0.04 = \frac{4}{100}$   | 8. $3.003 = 3\frac{3}{1000}$ | 9. $0.15 = \frac{15}{10}$      |
| 10. $0.16 = \frac{16}{100}$ | 11. $0.45 = \frac{45}{100}$  | 12. $0.103 = \frac{103}{1000}$ |
13. Does  $0.73 = \frac{73}{100}$  or  $\frac{73}{10}$  ?
14.  $0.04$  does not equal  $\frac{4}{10}$  Explain why.

• Your teacher has the answers to these.

## D6.3: Decimals to fractions in simplest form

You know how to:

- change decimals into fractions;
- simplify fractions.

You are now going to apply both of these techniques.

$0.35$	$=$	$\frac{35}{100}$	$=$	$\frac{7}{20}$
decimal		fraction		simplest form of fraction

Copy and complete:

1. $0.45 = \frac{\dots}{100} = \frac{\dots}{20}$
2. $0.18 = \frac{\dots}{100} = \frac{\dots}{50}$
3. $0.16 = \frac{\dots}{100} = \frac{\dots}{25}$
4. $0.65 = \frac{\dots}{100} = \frac{\dots}{20}$

5. $0.25 = \frac{\dots}{100} = \frac{\dots}{\dots}$
6. $0.12 = \frac{\dots}{\dots} = \frac{\dots}{\dots}$
7. $0.75 = \frac{\dots}{\dots} = \frac{\dots}{\dots}$
8. $0.004 = \frac{\dots}{\dots} = \frac{\dots}{\dots}$

• Check your answers.

### PRACTICE

## P6.4: Decimal to fraction practice

*Write each decimal as a fraction in its simplest form.*

**CHECK YOUR ANSWERS AT THE END OF EACH BATCH.**

<b>Batch A:</b>					
1. <b>0.8</b>	2. <b>0.2</b>	3. <b>0.04</b>	4. <b>0.24</b>	5. <b>0.08</b>	6. <b>0.55</b>

<b>Batch B:</b>					
1. <b>0.4</b>	2. <b>0.02</b>	3. <b>0.25</b>	4. <b>0.48</b>	5. <b>0.6</b>	6. <b>0.36</b>

### Star Challenge













All correct = 1 star

*Write each decimal as a fraction in its simplest form.*

- |                |                |                 |                |                |                |
|----------------|----------------|-----------------|----------------|----------------|----------------|
| 1. <b>0.06</b> | 2. <b>0.08</b> | 3. <b>0.404</b> | 4. <b>0.52</b> | 5. <b>0.32</b> | 6. <b>0.64</b> |
|----------------|----------------|-----------------|----------------|----------------|----------------|

• Your teacher has the answers to these.

At the Space Academy, each trainee explorer was given a locker.  
 Each explorer was also given a number.  
 Plok had  $\frac{1}{2}$ . This means that he is in Company Number 1 and his number is 2.  
 But the painter who was painting numbers on the lockers didn't understand.  
 He thought that  $\frac{1}{2}$  was a half – and he gave Plok's locker the number 0.5  
 (the decimal for a half).

Explorers and their Company Numbers				Locker Numbers
 Taz $\frac{4}{100}$	 Dwork $\frac{2}{100}$	 Crumb $\frac{4}{10}$	 Qwerk $\frac{12}{100}$	0.5
 Chyps $\frac{1}{10}$	 Plok $\frac{1}{2}$	 Yerwat $\frac{3}{1000}$	 Fission $\frac{1}{4}$	0.25
 Apul $\frac{3}{4}$	 Lubbly $\frac{1}{100}$	 Zuk $\frac{9}{10}$	 Cringo $\frac{19}{100}$	0.1
				0.4
				0.09
				0.04
				0.75
				0.9
				0.01
				0.12
				0.19
				0.003

Copy and complete this table:

Locker number	0.5	0.25	0.1	0.4	0.09	0.04
Fraction	$\frac{1}{2}$					
Explorer	Plok					
Locker number	0.75	0.9	0.01	0.12	0.19	0.003
Fraction						
Explorer						

• Your teacher has the answers to these.

## Section 7: Combining fractions

In this section you will:

- add and subtract common fractions
- add and subtract fractions with the same denominator

### DEVELOPMENT

#### D7.1: Adding and subtracting common fractions

Evaluate :

- $\frac{1}{2} + \frac{1}{2}$
- $\frac{1}{2} + \frac{1}{4}$
- $\frac{3}{4} - \frac{1}{2}$
- $\frac{3}{4} + \frac{1}{4}$
- $\frac{3}{4} + \frac{1}{2}$
- $1\frac{1}{4} - \frac{1}{4}$
- $1\frac{1}{4} - \frac{1}{2}$
- $1\frac{1}{4} - \frac{3}{4}$
- $2\frac{1}{2} - \frac{3}{4}$
- $1\frac{1}{2} + 1\frac{1}{2}$
- $1\frac{1}{2} + 2\frac{3}{4}$
- $2\frac{1}{4} - 1\frac{1}{2}$

• Check your answers.

#### D7.2: Fractions with the same denominator

$$\frac{3}{7} + \frac{5}{7} = \frac{8}{7} = 1\frac{1}{7}$$

$$\frac{1}{9} + \frac{2}{9} = \frac{3}{9} = \frac{1}{3}$$

When the denominators are the same, you just add or subtract the numerators.

Answers should be given in simplest form.

Improper fractions should be changed to mixed numbers.

Evaluate :

- $\frac{1}{3} + \frac{1}{3}$
- $\frac{2}{3} + \frac{2}{3}$
- $\frac{5}{8} - \frac{3}{8}$
- $\frac{7}{8} + \frac{3}{8}$
- $\frac{2}{5} + \frac{3}{5}$
- $\frac{4}{5} - \frac{1}{5}$
- $\frac{7}{10} - \frac{3}{10}$
- $\frac{5}{6} - \frac{1}{6}$
- $\frac{7}{9} + \frac{2}{9} - \frac{4}{9}$
- $\frac{5}{8} - \frac{3}{8} + \frac{2}{8}$

• Check your answers.

#### D7.3: Simple related fractions

$$\frac{1}{4} + \frac{1}{8} = \frac{2}{8} + \frac{1}{8} = \frac{3}{8}$$

$$\frac{1}{4} = \frac{2}{8}$$



Evaluate, simplifying answers where possible :

- $\frac{1}{5} + \frac{1}{10}$
- $\frac{1}{4} - \frac{1}{8}$
- $\frac{1}{3} - \frac{1}{6}$
- $\frac{1}{7} + \frac{3}{14}$
- $\frac{1}{2} - \frac{1}{8}$
- $\frac{2}{5} - \frac{1}{10}$
- $\frac{1}{3} + \frac{1}{6}$
- $\frac{2}{5} + \frac{1}{10}$

• Check your answers.

The rest of this section should be done using only the information given in the boxes.

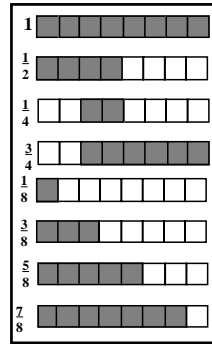
### D7.4: Halves, quarters and eighths

Copy and complete these statements.

Replace each  with one of the fractions from the list.

You may use a fraction more than once.

- |  |  |
|--|--|
| 1. one quarter = <input type="checkbox"/>                    | 6. $\frac{1}{2}$ of $\frac{1}{4}$ = <input type="checkbox"/> |
| 2. three eighths = <input type="checkbox"/>                  | 7. $3 \times$ <input type="checkbox"/> = $\frac{3}{8}$       |
| 3. $2 \times$ <input type="checkbox"/> = 1                   | 8. $\frac{1}{2}$ of $\frac{3}{4}$ = <input type="checkbox"/> |
| 4. $3 \times \frac{1}{4}$ = <input type="checkbox"/>         | 9. $\frac{1}{2} +$ <input type="checkbox"/> = 1              |
| 5. $\frac{1}{2}$ of $\frac{1}{2}$ = <input type="checkbox"/> | 10. $\frac{1}{2} + \frac{1}{4}$ = <input type="checkbox"/>   |

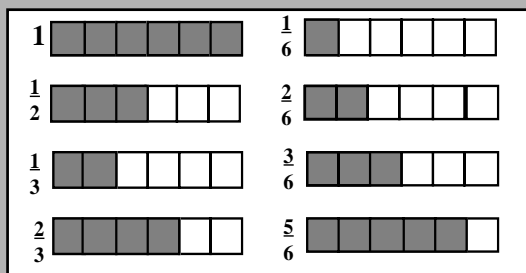


• Check your answers.

### Star Challenge 19

12 correct = 2 stars  
9-11 correct = 1 star

#### Halves, thirds and sixths



$\frac{1}{2} \times \frac{1}{3}$   
means the same  
as  $\frac{1}{2}$  of  $\frac{1}{3}$

Copy and complete these statements.

Replace each  with one of the fractions from the list above.

You may use a fraction more than once.

- |   |  |   |
|---|--|---|
| 1. two thirds = <input type="checkbox"/>        | 5. $\frac{1}{2}$ of $\frac{1}{3}$ = <input type="checkbox"/>   | 9. $\frac{2}{6} + \frac{3}{6}$ = <input type="checkbox"/>       |
| 2. five sixths = <input type="checkbox"/>       | 6. $\frac{1}{2} \times \frac{1}{3}$ = <input type="checkbox"/> | 10. $\frac{1}{3} \times \frac{3}{6}$ = <input type="checkbox"/> |
| 3. $3 \times$ <input type="checkbox"/> = 1      | 7. $\frac{1}{3} \times \frac{1}{2}$ = <input type="checkbox"/> | 11. $\frac{3}{6}$ = <input type="checkbox"/>                    |
| 4. $\frac{1}{3} +$ <input type="checkbox"/> = 1 | 8. $\frac{1}{2} \times \frac{2}{3}$ = <input type="checkbox"/> | 12. $\frac{2}{6}$ = <input type="checkbox"/>                    |

• Your teacher has the answers to these.

Try the High Level Challenges at the end of this topic



## Section 8: Percentages

In this section you will:


- work with percentages
- convert between percentages and fractions or decimals

### DEVELOPMENT

#### D8.1: Connecting fractions and percentages

Fractions, decimals and percentages are three ways of describing numbers which are not whole numbers.

$$\frac{37}{100} = 0.37 = 37\%$$

Read as "37 per cent" 

"per cent" means "out of every 100"

37 parts out of every 100

Changing percentages into fractions :  $60\% = \frac{60}{100} = \frac{6}{10} = \frac{3}{5}$

Change to fractions, simplifying the answers where possible:

- 50%
- 75%
- 10%
- 20%
- 15%
- 200%
- 150%
- 125%
- 35%
- 36%

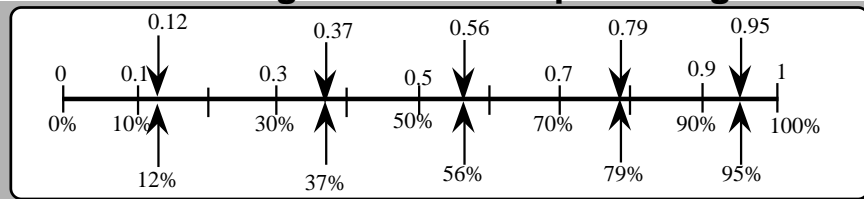
Changing fractions into percentages :  $\frac{3}{5} = \frac{80}{100} = 80\%$

Change to percentages:

- $\frac{1}{4}$
- $\frac{2}{5}$
- $\frac{3}{10}$
- 1
- 2
- $2\frac{1}{2}$
- $\frac{9}{20}$
- $\frac{43}{50}$
- $\frac{7}{25}$
- $1\frac{3}{50}$

• Check your answers.

#### D8.2: Connecting decimals and percentages



Copy and complete this table of equivalent decimals and percentages.

Decimal	0.1	0.4	0.56				0.25	0.87		
Percentage				79%	100%	83%			14%	27%

Decimal			0.99	0.42		1.5	0.795			0.125
Percentage	56%	80%			31%		79.5%	53.5%	22.5%	

• Check your answers.

### D8.3: Percentage test marks

The Pan-Galactic Explorer Trainees are taking their final set of tests.  
Test D is marked out of 100.



This is Plok's test paper.  
Plok scored 37 out of 100.  
Plok got 37%.

Plok

**PAN-GALACTIC ACADEMY  
FINAL TEST D**  
Name: Plok Mark :  $\frac{37}{100} = 37\%$

**PAN-GALACTIC ACADEMY  
FINAL TEST D**  
Name: Sludge Mark :  $\frac{50}{100} = 50\%$

Sludge



1. What fraction of the test did Sludge get right ?

2. (a) What percentage mark did Taz get ?



- (b) What fraction of the test did Taz get right ?

Taz

**PAN-GALACTIC ACADEMY  
FINAL TEST D**  
Name: Taz Mark :  $\frac{25}{100} = \bigcirc$

3. Dwork got 95%.  
How many marks did Dwork get out of 100 ?



Dwork

4. Kooldood scored 45 marks out of 100.  
What percentage mark did Kooldood get ?



Kooldood



Gizmo got  $\frac{3}{4}$  of the test right.

Gizmo

5. How many marks did Gizmo get out of 100 ?  
6. What percentage mark did Gizmo get ?

7. Crumbl falls apart in tests.  
Crumbl only got one fifth of this test right.  
What percentage mark did Crumbl get ?



Crumbl

8. Youslas is useless.  
Youslas got one tenth of the test right.  
What percentage mark did Youslas get ?



Youslas

• Check your answers.

**Star Challenge 20**

**More test marks**

All correct = 1 star

Test B was marked out of 200



I got  $\frac{100}{200}$  (100 out of 200)

That's the same as  $\frac{50}{100}$  (50 out of 100)

So I got 50%

**Task 1:** Work out the percentage mark that each trainee got for Test B.



I got  $\frac{50}{200}$

Sludge



I got  $\frac{200}{200}$

Gizmo



I got  $\frac{160}{200}$

Ruff



I got  $\frac{18}{200}$

Crumbl

Test C was marked out of 50

**Task 2:** Work out the mark (out of 50) that each trainee got for Test C.



I got 30%

Meedy Oker



I got 80%

Cringo



I got 100%

Letmewin



I got 28%

Youslas

• Your teacher needs to check these.

**Star Challenge 21**

**Related percentages**

14-15 correct = 2 stars

11-13 correct = 1 star

1.  $\frac{1}{10} = 10\%$  Write as percentages:

- (a)  $\frac{3}{10}$  (b)  $\frac{7}{10}$  (c)  $\frac{5}{10}$  (d)  $\frac{11}{10}$

$\frac{1}{20}$  is half of  $\frac{1}{10}$   $\frac{1}{10} = 10\%$

2. Write as percentages:

- (a)  $\frac{1}{20}$  (b)  $\frac{3}{20}$  (c)  $\frac{1}{40}$  (d)  $\frac{3}{40}$  (e)  $\frac{7}{40}$

$\frac{1}{8}$  is half of  $\frac{1}{4}$   $\frac{1}{4} = 25\%$



Modesto

3. Write as percentages:

- (a)  $\frac{1}{8}$  (b)  $\frac{3}{8}$  (c)  $\frac{5}{8}$  (d)  $\frac{7}{8}$  (e)  $\frac{1}{16}$  (f)  $\frac{3}{16}$

• Your teacher needs to check these.

Try the High Level Challenges at the end of this topic

## Section 9: Equivalent fractions, decimals, %

In this section you will:

- use equivalent fractions, decimals and percentages
- work out fractions, decimals and percentages of amounts mentally and/or using written techniques



### DEVELOPMENT

#### D9.1: Review of division techniques

**Division using related number facts**

$$24 \div 8 = ? \quad \text{We know that } 8 \times 3 = 24 \quad \text{so} \quad 24 \div 8 = 3$$

Work out:

1.  $36 \div 4$       2.  $30 \div 5$       3.  $28 \div 4$       4.  $55 \div 5$

**Division in disguise**

$$12 \div 4 \quad \frac{1}{4} \text{ of } 12 \quad \frac{1}{4} \times 12 \quad 12 \times \frac{1}{4}$$

24 divided by 4      share 24 between 4

These all mean  
"How many 4s are there in 12?"

Work out:

5.  $\frac{1}{5}$  of 15      6.  $20 \times \frac{1}{4}$       7.  $\frac{1}{3} \times 21$       8. 18 divided by 3  
9.  $\frac{1}{5} \times 35$       10.  $42 \div 6$       11.  $26 \times \frac{1}{2}$       12. share 16 between 2

• Check your answers.

#### D9.2: Finding fractions of amounts mentally

How many minutes are there in ...

1. ...  $\frac{1}{2}$  hour      2. ...  $\frac{1}{4}$  hour      3. ...  $\frac{1}{3}$  hour      4. ...  $\frac{1}{10}$  hour ?

How many hours are there in ...

5. ...  $\frac{1}{2}$  day      6. ...  $\frac{1}{4}$  day      7. ...  $\frac{1}{3}$  day      8. ...  $\frac{1}{6}$  day ?

**EXAMPLE** Find  $\frac{2}{3}$  of 15 cm.

$$\frac{1}{3} \text{ of } 15 \text{ cm} = 5 \text{ cm} \quad \text{so} \quad \frac{2}{3} \text{ of } 15 \text{ cm} = 10 \text{ cm}$$

$$\frac{2}{3} = 2 \times \frac{1}{3}$$

Work out:

9.  $\frac{1}{3}$  of £6      10.  $\frac{2}{3}$  of £6      11.  $\frac{1}{5}$  of 20 cm      12.  $\frac{2}{5}$  of 20 cm  
13.  $\frac{3}{4}$  of £12      14.  $\frac{3}{5}$  of 10p      15.  $\frac{2}{7}$  of £21      16.  $\frac{3}{8}$  of 40 m  
17.  $\frac{3}{10}$  of £50      18.  $\frac{5}{7}$  of 14 cm      19.  $\frac{7}{8}$  of 24 l      20.  $\frac{2}{9}$  of £45

21. Billy waited three quarters of an hour for the bus. How many minutes did he wait ?  
22. The bottle contains 75 cl when full. It is two-thirds full. How many cl are in the bottle ?  
23. Adi needed £80 to buy a bike. He saved a quarter of this. His mother gave him half of the rest. How much more does he still need ?

• Check your answers.

### D9.3: More mental fractions

**EXAMPLE** Find  $1\frac{1}{4} \times \text{£}20$

Headbanger

$1 \times \text{£}20 = \text{£}20$

$\frac{1}{4} \times \text{£}20 = \text{£}5$

So,  $1\frac{1}{4} \times \text{£}20 = \text{£}20 + \text{£}5 = \text{£}25$

Work out:

- $1\frac{1}{2} \times \text{£}10$
- $2\frac{1}{4} \times 40 \text{ cm}$
- $1\frac{3}{4} \times \text{£}60$
- $3\frac{1}{10} \times \text{£}50$

• Check your answers.

### D9.4: Equivalents you need to know and use

$\frac{1}{2} = 0.5 = 50\%$	$\frac{1}{4} = 0.25 = 25\%$	$\frac{3}{4} = 0.75 = 75\%$
$\frac{1}{3} = 0.333\dots = 33\frac{1}{3}\%$	$\frac{2}{3} = 0.666\dots = 66\frac{2}{3}\%$	
$\frac{1}{10} = 0.1 = 10\%$	$\frac{1}{5} = 0.2 = 20\%$	$\frac{1}{8} = 0.125 = 12.5\%$

**EXAMPLE** Work out (a) 75% of £120 (b) 0.5 of 40 m

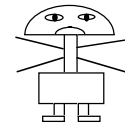
(a) 75% of £120 =  $\frac{3}{4}$  of £120 = £90

(b) 0.5 of 40 m =  $\frac{1}{2}$  of 40 m = 20 m

Work out:

- 25% of 12 sweets
- 0.5 of £8
- $33\frac{1}{3}\%$  of £60
- $1.5 \times 40\text{p}$
- 20% of 100 cm
- $66\frac{2}{3}\%$  of 24p
- 0.25 of 20 kg
- 12.5% of 40 km
- 0.1 of 9 cm
- There are 28 children in a maths class. On the day of the test, 25% were absent with 'flu'.  
How many missed the test ?
- $66\frac{2}{3}\%$  of a tutor group watched the England beat Argentina in the World Cup.  
There are 30 children in this tutor group. How many of them watched the match ?
- There are 40 teachers at Bestever High School. At 5 pm on Thursday night, 50% of them were at a meeting and 25% were at a rehearsal. The rest had gone home.  
How many had gone home ? Show how you work it out.
- A box of detergent used to cost £4.20 before the price rise. The new price is 125% of the old price.  
How much is the new price ?

8YZ is a big class. There are 36 pupils in it.  
The following questions are about 8YZ.



Do-med

- 75% are right-handed. How many are right-handed ?
- $33\frac{1}{3}\%$  own a dog. How many own a dog ?
- $66\frac{2}{3}\%$  have at least one brother or sister.  
How many do not have any brothers or sisters ?
- On one Monday in January, 50% were off with 'flu'. Of those who were in school,  $66\frac{2}{3}\%$  had the snuffles. The rest were OK. How many were OK ?

• Check your answers.

**Star Challenge 22** **Quarters and eighths**

$\frac{1}{4} = 25\%$     $\frac{1}{8} = 12.5\%$     $\frac{3}{8} = 37.5\%$     $\frac{5}{8} = 62.5\%$     $\frac{7}{8} = 87.5\%$

(There are 32 pupils in GAB. Questions 1-6 are all about GAB.)

1.  $\frac{1}{4}$  of GAB were away on Friday.      How many were away ?
2.  $\frac{1}{8}$  of them have a hamster.              How many have a hamster ?
3.  $\frac{3}{8}$  of them have a dog.                      How many have a dog ?
4.  $\frac{5}{8}$  of them have a cat.                      How many have a cat ?
5.  $\frac{7}{8}$  of them have at least one brother or sister.      How many of them have brothers or sisters?
6.  $\frac{3}{4}$  of them have bikes.                      How many of them have bikes ?

(The Youth Club has 40 members. Q7-12 are all about this Youth Club.)

How many are in each of these groups ?

7. 25% are 11 years old.
8. 75% like Cola.
9. 62.5% like Heavy Metal music.
10. 62.5% like all girl pop groups.
11. 37.5% play table tennis.
12. 87.5% like swimming.

• Your teacher has the answers to these.

**Star Challenge 23**

Work out:

1. 50% of 20 m
2. 75% of 8 cm
3. 10% of £200
4.  $33\frac{1}{3}\%$  of 15 cm
5. 25% of 16 kg
6. 70% of £30
7.  $66\frac{2}{3}\%$  of 15 tonnes
8. 12.5% of 16 miles
9. 37.5% of £16

• Your teacher has the answers to these.

**Star Challenge 24**

**BIG BLOW TO PARK'S TREES**  
70% blown down by hurricane winds

Yesterday there were 300 trees in Easton Park. Today there are only

1. How many were blown down ?  
How many trees are there in Easton Park today ?
2. There were 50 goldfish in Tom's pond. The heron ate 20% of them.  
How many did the heron eat ?
3. Mark planted 500 marigold seeds. 80% of them grew into plants big enough to sell.  
How many plants did he have to sell ?
4. Sara saved £90. She had  $66\frac{2}{3}\%$  of her savings in a Savings Account.  
How much did she have in the account ?
5. Kate planted 24 sunflower seeds. 62.5% of the seeds grew.  
How many sunflower plants did she have ?
6. 87.5% of pupils in 8BY were in school on Monday. There are 32 pupils in 8BY.  
How many of them were in school on Monday ?
7. There are 60 coloured beads in a bag. 30% of the beads are red. 15% of the beads are blue. How many red beads are there ? How many blue beads are there ?
8. Martin's two cats had 12 kittens between them. He found homes for 75% of the kittens.  
How many kittens did he have left ?

• Your teacher has the answers to these.

Try the High Level Challenges at the end of this topic

## Section 10: Percentage calculations

In this section you will:

- meet some techniques for working with percentages
- use percentage techniques to solve a variety of problems

### DEVELOPMENT

#### D10.1: Multiples of tenths are easy

$$\frac{1}{10} \text{ of } \pounds 60 = \pounds 60 \div 10 = \pounds 6$$

$$\frac{3}{10} \text{ of } \pounds 60 = 3 \times \pounds 6 = \pounds 18$$

$$\boxed{10\% = \frac{1}{10} = 0.1}$$



Idea

Similarly:

$$10\% \text{ of } 20 \text{ cm} = \frac{1}{10} \text{ of } 20 \text{ cm} = 2 \text{ cm}$$

$$70\% \text{ of } 20 \text{ cm} = 7 \times 2 \text{ cm} = 14 \text{ cm}$$

Work out mentally:

- |                            |                            |                |                  |
|----------------------------|----------------------------|----------------|------------------|
| 1. $\frac{1}{10}$ of 70 cm | 2. $\frac{3}{10}$ of 70 cm | 3. 10% of 90p  | 4. 40% of 90p    |
| 5. 90% of 90p              | 6. 10% of 300              | 7. 30% of 300  | 8. 30% of 50     |
| 9. $\frac{7}{10}$ of 40p   | 10. 0.3 x 40p              | 11. 90% of 120 | 12. 0.8 of 50 cm |

$$10\% = \frac{1}{10} = 0.1 \quad 5\% = \text{half of } 10\% \quad 15\% = 10\% + 5\%$$

Work out mentally:

- |               |                 |                |                            |
|---------------|-----------------|----------------|----------------------------|
| 13. 10% of £5 | 14. 5% of £5    | 15. 15% of £5  | 16. $2\frac{1}{2}\%$ of £5 |
| 17. 5% of 40p | 18. 5% of 60 cm | 19. 15% of £48 | 20. 5% of 2.4 m            |

• Check your answers.

#### D10.2: Some useful written techniques

EXAMPLES	Work out (a) 12% of 3400	(b) 70% of 180 kg
(a) 12% of 3400	$10\% = 340$ $2\% = 34 \times 2 = 68$	$12\% = 340 + 68 = 408$
(b) 60% of 180 kg	$\xrightarrow{10\%} 18 \text{ kg} \xrightarrow{\times 6} 60 + 48 = 108 \text{ kg}$ or $50\% = 90 \text{ kg}$ $+ 10\% = 18 \text{ kg}$	$60\% = 90 + 18 = 108 \text{ kg}$

Evaluate, choosing your own method and showing your working:

- |                 |                |                  |                 |
|-----------------|----------------|------------------|-----------------|
| 1. 11% of £1300 | 2. 13% of 3400 | 3. 70% of 40 m   | 4. 16% of £300  |
| 5. 90% of 80 cl | 6. 110% of 35  | 7. 200% of £4.50 | 8. 150% of 90 g |
| 9. 60% of £12   | 10. 15% of 40  |                  |                 |
- Check your answers.

### D10.3: Football percentages

- At a football match, 70% of the crowd supported the home team.  
What percentage of the crowd supported the away team ?
- At the match, the hot dog seller sold 95% of his hot dogs.  
What percentage of the hot dogs did he have left ?
- 83% of the crowd was male. What percentage of the crowd was female ?
- 35% of the crowd were children. What percentage of the crowd were adults ?
- At the end of the match, 75% of the supporters wanted to sack the manager.  
What percentage of the supporters did NOT want to sack the manager ?
- What fraction of the supporters wanted to sack the manager ?
- The team has won 15% of its matches and drawn 18%.  
What percentage of its matches has the team lost ?



• Check your answers.

#### Star Challenge 25♦25

#### Percentage problems

14-15 marks = 2 stars  
11-13 marks = 1 star

- What percentage of the garment is polyester ? [1 mark]
- Estimate the percentage of each shape that is shaded. [2 marks]
 

(a) 	(b) 
---	---
- The old pack held 200 g of shampoo.  
The new pack holds 25% more. [2 marks]
 

Cotton 38%
Lycra 5%
Polyester ??

  - How much shampoo is in the new pack ?
  - How much bigger is the new pack than the old one ?
- 14% of the 120 g pot of yoghurt is fruit. [2 marks]  
How many grams are NOT fruit ?
- 48% of pupils at Whynot Primary School are girls. [2 marks]  
25% of the girls and 50% of the boys like to play football.  
What percentage of Whynot Primary School pupils like to play football ?
- Whynot Youth Club

	boys	girls
live in the village	18	26
do not live in the village	2	4

  - How many boys are there in the Youth Club ?
  - How many girls are there in the Youth Club ?
  - How many members does the Youth Club have ?
  - What percentage of the Youth Club are girls ?
  - What percentage of the boys live in the village ?
  - What percentage of the Youth Club live in the village ? [6 marks]

• Your teacher has the answers to these.

Try the High Level Challenges at the end of this topic



## Section 11: Ratio and proportion

In this section you will work with ratios.

### DEVELOPMENT

#### D11.1: ...in every ... and ...for every...

1.  \_ \_ \_ \_


In this pattern, 1 in every 3 squares is black.

Copy and complete:

In every 6 squares ..... are black.

In every 12 squares ..... are black. In every ..... squares 3 are black.

In every ..... squares 7 are black. In every ..... squares 10 are black.

2.  \_ \_ \_ \_ 1 in every 3 squares is black

Copy and complete this table:

Number of black squares	Number of white squares
1	2
2	4
3	.....
4	.....
.....	10
.....	14
.....	20

3. In another pattern, 1 in every 4 squares is black.

Copy and complete this table:

Number of black squares	Number of white squares
1	3
2	6
3	.....
5	.....
.....	21
.....	33

4. In Hope Badminton Club, there are 3 girl members for every 1 boy member.  
There are 5 boy members. How many girl members are there ?  
How many members are there altogether ?

5. In Hope Snooker Club, there are 3 boy members for every 2 girl members.  
There are 20 girl members. How many boy members are there ?  
How many members are there altogether ?

• Check your answers.

## D11.2: Ratio and the words that go with it



For every 1 red bead, there are 2 blue beads.

The number of blue beads is twice the number of red beads.

The number of red beads is half the number of blue beads.

The ratio of red to blue is 1 to 2.

SHORTHAND: red : blue = 1 : 2

Read this as "red to blue = 1 to 2"

1. Ratio 1 : 3

Copy and complete:

Green beads	Yellow beads	Total number of beads
1	3	4
2	.....	.....
3	.....	.....
.....	15	.....
.....	21	.....

For every green bead there are ..... yellow beads.

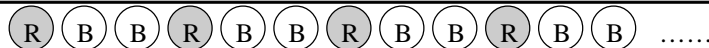
The number of green beads is ..... the number of yellow beads.

The ratio of green beads to yellow beads is ... : ...

The ratio of yellow beads to green beads is ... : ...

• Check your answers.

## D11.3: Equivalent ratios



For every 3 red beads, there are 6 blue beads. Red : blue = 3 : 6

For every 2 red beads, there are 4 blue beads. Red : blue = 2 : 4

For every 1 red bead, there are 2 blue beads. Red : blue = 1 : 2 simplest form of the ratio

To simplify a fraction, both numerator and denominator are divided by the same number.  
To simplify a ratio, both parts of the ratio are divided by the same number.

Write each ratio in its simplest form:

- 1) 4 : 8    2) 3 : 15    3) 15 : 10    4) 7 : 28    5) 20 : 50

6. Pink paint is made by mixing 8 tins of red paint with 2 tins of white paint.

(a) Write the ratio red : white in its simplest form.

(b) Write the ratio white : red in its simplest form.

7. Pale green paint is made by mixing green and white paint in the ratio 2 : 5

(a) How many cans of green should you mix with 10 cans of white ?

(b) How many cans of white should you mix with 10 cans of green ?

• Check answers.

## D11.4: Proportion

1.  $\textcircled{R} \textcircled{B} \textcircled{B} \textcircled{R} \textcircled{B} \textcircled{B} \textcircled{R} \textcircled{B} \textcircled{B} \textcircled{R} \textcircled{B} \textcircled{B} \textcircled{B} \dots$  In a necklace like this, there is 1 red bead for every 2 blue beads.

1. Copy and complete:

Red beads	Blue beads	Total number of beads
1	2	3
10	.....	.....
15	.....	.....
.....	40	.....

The ratio of red : blue is 1 : 2  
 The proportion of blue beads is  $\frac{2}{3}$   
 The proportion of red beads is  $\frac{1}{3}$

2. You are told the number of red beads.  
 How do you work out the number of blue beads ?
3. You are told the number of blue beads.  
 How do you work out the number of red beads ?



4. Copy and complete:

Red beads	Blue beads	Total number of beads
1	2	3
.....	.....	9
.....	.....	15
.....	.....	24

5. What proportion of the beads are red ?
6. What proportion of the beads are blue ?

• Check your answers.

### Star Challenge 26

All correct = 1 star

#### Ratio and proportion problems

1.  $\textcircled{R} \textcircled{B} \textcircled{B} \textcircled{B} \textcircled{R} \textcircled{B} \textcircled{B} \textcircled{B} \textcircled{R} \textcircled{B} \textcircled{B} \textcircled{B} \dots$  In a necklace like this, 1 in every 4 beads is red or  $\frac{1}{4}$  are red.

(a) Copy and complete:

Red beads	Blue beads	Total number of beads
1	3	4
2	6	8
.....	.....	16
.....	.....	20

- (b) What proportion of the beads are red ?
- (c) What proportion of the beads are blue ?

2. Mike is saving up to go ski-ing. Mike's father gives him £4 for every £1 Mike earns.

(a) Copy and complete:

Mike's money	Father's money	Total money
£1	£4	£5
£2	£8	£10
£5	.....	.....
.....	£40	.....
.....	.....	£100

- (b) What proportion of the total money is what Mike earns ?

(c) The amount his father gives Mike is  $k$  times the amount Mike earns. What is the value of  $k$  ?

(d) What is the ratio of father's money to Mike's earnings ?

Try the High Level Challenges at the end of this topic

## Section 12: More ratios and percentages

In this section you will:

- use a calculator to find percentages
- share amounts in a given ratio
- solve problems involving ratio

### DEVELOPMENT

#### D12.1: Calculator percentages



$$14\% \text{ of } £20 = ? \quad \boxed{0.14} \times \boxed{20} = \boxed{2.8}$$

change % to a decimal

of

Since the answer is an amount of money, the calculator answer of 2.8 should be interpreted as £2.80

So, 14% of £20 = £2.80

Use this method to work out:

- |               |               |              |
|---------------|---------------|--------------|
| 1. 10% of £50 | 2. 3% of £60  | 3. 5% of £16 |
| 4. 23% of £10 | 5. 80% of £72 | 6. 2% of £63 |
| 7. 52% of £90 | 8. 17% of £30 | 9. 9% of £13 |
| 10. 4% of £81 |               |              |

$$\begin{aligned} 14\% &= 0.14 \\ 3\% &= 0.03 \\ 10\% &= 0.1 \end{aligned}$$



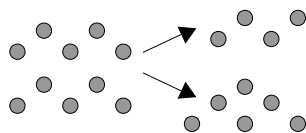
Headbanger

• Check your answers.

#### D12.2: Sharing in ratio



**EXAMPLE** Sol and Rio share £10 in the ratio 2 : 3  
How much do they each get ?



Sol gets £4 and Rio gets £6

For every £2 Sol gets, Rio gets £3  
 $£2 + £3 = £5$   
So, you divide the money into £5s and, for each £5, you give £2 to Sol and £3 to Rio.

- Share £35 in the ratio 2 : 3
- Share £40 in the ratio 1 : 4
- Share £21 in the ratio 2 : 5
- Share £80 in the ratio 3 : 7
- Eddie and Salif get paid £60 for clearing a garden. They share the money in the ratio 5 : 7.
  - Does Eddie get five twelfths of the money or five sevenths?
  - How much does Salif get ?
- (a) Meera and Dan buy a car. Meera pays two thirds of the price. Dan pays the rest.  
What is the ratio of what they each pay for the car ?  
(b) They later sell the car for £600. They share the money in the same ratio as they paid for it.  
How much does Meera get ?

• Check your answers.

**Star Challenge 27** **Ratio problems** 8 correct = 2 stars  
6-7 correct = 1 star

**EXAMPLE** Sol's and Rio's ages are in the ratio 3 : 4  
Rio is 24. How old is Sol ?

$$= \begin{array}{l} x? \downarrow 3 : 4 \downarrow x? \\ S : 24 \end{array}$$

Sol is 18

? = 6



Idea

So, 5 = 18

1. The lengths of two pencils are in the ratio 2 : 3. The larger pencil is 15 cm long.  
**How long is the smaller pencil ?**
2. Alan's age and his father's age are in the ratio 3 : 5. Alan is 36.  
**How old is Alan's father ?**
3. A piece of string 80 cm long. It is cut into two pieces in the ratio 3 : 5.  
(a) **What fraction of the original piece of string is the shorter piece ?**  
(b) **How long is the longer piece ?**
4. In one class, the ratio of boys to girls is 5 : 4.  
**What fraction of the class is boys ?**
5. In another class, four sevenths of the class are boys.  
**What is the ratio of boys to girls ?**
6. The concrete mix for foundations is cement : sand : aggregate (small stones) = 2 : 5 : 7  
(a) A load of concrete is made using 10 buckets of sand.  
**How much cement and aggregate would be needed ?**  
(b) Another load of concrete is made using 10 buckets of cement.  
**How much sand and aggregate would be needed ?**

• Your teacher has the answers to these.

**Star Challenge 28** **VAT is not included in the basic price** All correct = 1 star

Value added tax (VAT) is added to the purchase price of many goods.

VAT varies from one European country to another.

VAT is sometimes charged at different rates for certain commodities.

The prices of most goods include VAT, but sometimes the price is quoted 'before VAT' and VAT needs to be added to get the final price.

1. In Britain, VAT is charged at 5% on electricity.  
Mrs. Brown's latest electricity bill was £118.92 before VAT is added.  
**Calculate the cost of Mrs. Brown's bill including VAT.**
2. In Spain, IVA (VAT) is charged at 7% on hotel and restaurant prices.  
The holiday bill was 1219.50 euros before VAT was added. 1 euro = 100 cents.  
**What was the final bill (including VAT) ?**
3. At a U.K. discount electrical store, the price of a CD player was £235.50 + 17.5% VAT.  
**Work out the full price of the CD player.**
4. A digital camera, bought from France over the internet, cost 315 euros + 19.6 EVA (VAT).  
**Work out the full price of the camera.**

Try the High Level Challenges at the end of this topic

## High Level Challenge Section

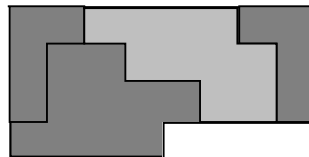
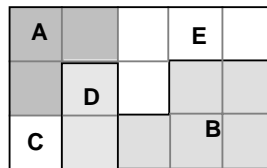
### EXTENSIONS

*YOUR TEACHER HAS THE ANSWERS TO THESE.*

#### Ch 1: Rectangle fractions (SECTION 1)

All correct = 1 star

1. What is the area of this rectangle ?
  2. What fraction of the area does tile C cover ?
  3. What fraction of the area does tile E cover ?
  4. Which tile covers  $\frac{3}{15}$  of the area ?
  5. Which tile covers  $\frac{5}{15}$  of the area ?
  6. Which tile covers  $\frac{1}{3}$  of the area ?
- What fraction of the second rectangle is...
7. ...white
  8. ... grey
  9. ... chequered
  10. ... striped.

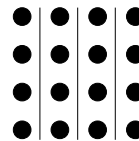


#### Ch 2: Dotty problems (SECTION 1)

4 correct diagrams = 2 stars  
3 correct diagrams = 1 star

##### Problem 1

This set of 4 x 4 dots has been split into four groups using straight lines. Each group contains one quarter of the dots.



Split sets of 4 x 4 dots into four groups each containing one quarter of the dots, in 3 more different ways.

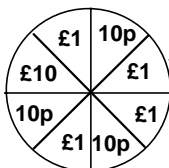
##### Problem 2

Split another set of 4 x 4 dots into 5 groups that contain  $\frac{1}{8}, \frac{1}{4}, \frac{1}{16}, \frac{3}{16}, \frac{3}{8}$  of the dots. You can use any kinds of lines.

#### Ch 3: Wheel of fortune (SECTION 1)

All correct = 1 star

1.



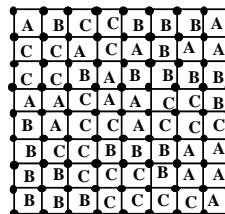
In this game, the wheel is spun and allowed to come to rest. The money that is paid out is the amount that the pointer faces when the wheel stops. You can assume that the wheel is equally likely to stop at each of the sectors.

What fraction of spins do you think would win you  
(a) £10 (b) £1 (c) 10p ?

2. A game of 'Join Up the Dots' was played by three players. At the end, the position was as shown. Player A has won all the squares with A in them, player B has won all the squares with B in them and player C has won all the squares with C in them.

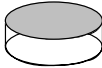
Which player had won

(a)  $\frac{3}{8}$  of the squares (b)  $\frac{9}{32}$  of the squares ?



### Ch 4: The magic cake conundrum SECTION 1

All correct = 1 star

1.  The king has a magic cake. He has been told that, provided the cake is shared out equally, everyone who eats it will have perfect health for a year. The magic knife which he must use will make only three straight cuts before it vanishes.

How should he make the three cuts in the cake so that he and his seven sons, a total of eight people, all get exactly one eighth of the cake ?

2. His wizard offers him a better magic knife which makes seven cuts before it vanishes. He does this on condition that the king cuts the cake into thirty two equal pieces. These will be shared between the king and his seven sons, and the wizard and his 23 daughters.

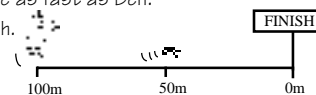
How can this be done ?

### Ch 5: Achilles and the Tortoise SECTION 1

All correct = 1 star

Achilles the rabbit and Ben the tortoise entered the Animalympics. They were both in the 100 m sprint. Achilles could run twice as fast as Ben. To make things fair, Ben was to start half way to the finish.

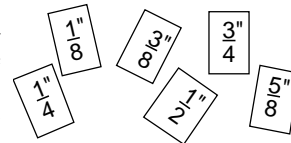
Who should win the race ?



### Ch 6: Replacing the labels SECTION 2

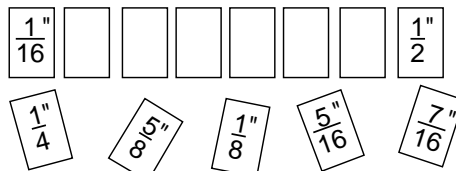
10-12 correct = 1 star

In a workshop, there is a rack which holds drill bits. The bits fit on the rack in order of size. The smallest bit goes on the left and the largest on the right. The size labels had faded so that they could no longer be read. The foreman gave an apprentice a new set of labels to go on the rack.



The symbol for an inch is " so a half inch drill bit has the label  $\frac{1}{2}$ "

- Put the drill bit labels in order of size with the smallest first.
- How many eighths are there in a quarter ?  
Put each of these sizes in terms of eighths.  
Now put the labels in order of size.  
Do you get the same order as in question 1 ? (6 marks)
- Another rack already has two labels in place:



One of the labels lying on the table does not belong on this rack.

Two of the labels for this rack have been lost.

Put *all* the correct labels onto this rack.

(6 marks)

### Ch 7: Have you spotted the pattern ? (SECTION 2)

All correct = 1 star

Complete these sets of equivalent fractions:

- $\frac{16}{20} = \frac{?}{5}$
- $\frac{8}{18} = \frac{?}{9} = \frac{?}{27}$
- $\frac{30}{50} = \frac{15}{?} = \frac{?}{10} = \frac{?}{5}$
- $\frac{49}{98} = \frac{7}{?} = \frac{1}{?} = \frac{?}{12}$
- $\frac{75}{125} = \frac{?}{5} = \frac{?}{100}$
- $\frac{21}{84} = \frac{3}{?} = \frac{?}{4}$
- $\frac{74}{111} = \frac{2}{?} = \frac{?}{117}$

### Ch 8: Sets of equivalent fractions (SECTION 3)

All 22 correct = 2 stars  
18-20 correct = 1 star

$\frac{26}{39}$	$\frac{27}{36}$	$\frac{45}{60}$	$\frac{6}{10}$	$\frac{3}{5}$	$\frac{3}{4}$	$\frac{9}{15}$	$\frac{36}{48}$	$\frac{2}{3}$	$\frac{9}{12}$
$\frac{4}{6}$	$\frac{12}{20}$	$\frac{6}{9}$	$\frac{60}{80}$	$\frac{8}{12}$	$\frac{30}{45}$	$\frac{60}{100}$	$\frac{15}{25}$	$\frac{6}{8}$	$\frac{40}{60}$

There are three sets of equivalent fractions here.  
Sort them into the three sets.

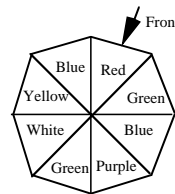
### Ch 9: Give it a twirl (SECTION 4)

All correct = 1 star

This is a coloured golf umbrella looked down on from above.

A quarter turn can also be called a **right angle**

For each question start with the red at the front.



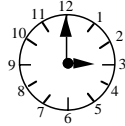
- Twirl it through a quarter turn.  
Which two colours could now be at the front ?
- Twirl it through one eighth of a turn.  
Which colours could now be at the front ?
- Twirl it through three eighths of a turn.  
Which colours could be at the front ?
- At the end of a twirl, purple is at the front. Give two possible single twirls.
- Twirl it through three eighths of a turn clockwise and then a quarter turn clockwise. What colour will now be at the front ?
- Twirl it through half a turn clockwise and then one eighth of a turn anti-clockwise. What colour will be at the front ?



## Ch 10: Toy clocks (SECTION 4)

16 correct = 2 stars  
14-15 correct = 1 star

On a clock the numbers are equally spaced.

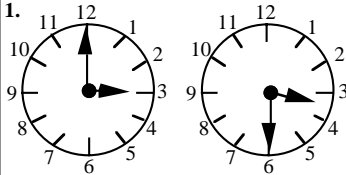


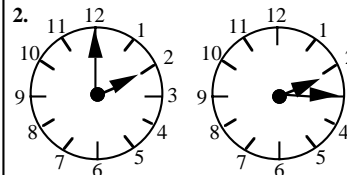
The minute hand has turned through  $\frac{1}{12}$  of a turn, between these two times.

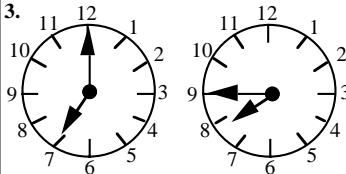
What fraction of a turn does the *minute hand* make between each pair of times ?

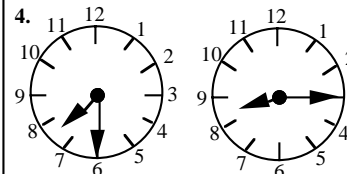
Give each answer in its simplest form.

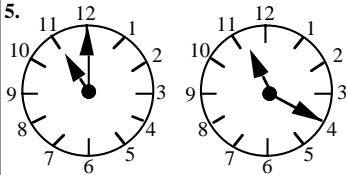
How many degrees does the minute hand turn through ?

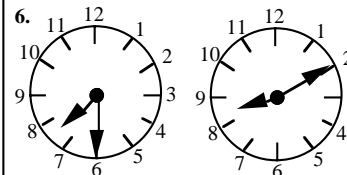
1.   
from 3 o'clock to 3.30

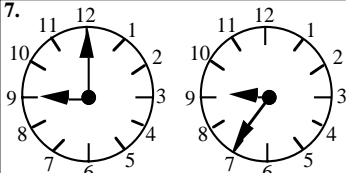
2.   
from 2 o'clock to 2.15

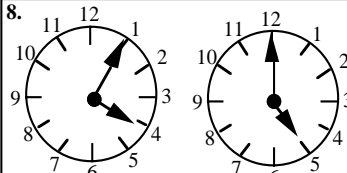
3.   
from 7 o'clock to 7.45

4.   
from 7.30 to 8.15

5.   
from 11 o'clock to 11.20

6.   
from 7.30 to 8.10

7.   
from 9 o'clock to 9.35

8.   
from 4.05 to 5 o'clock

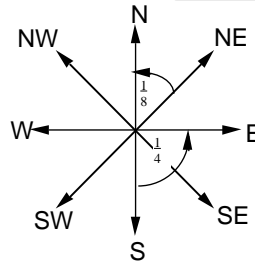
### Ch 11: Following turning instructions (SECTION 4)

8 correct = 2 stars  
6-7 correct = 1 star

The arms of this compass rose are equally spaced.

From NE to N is  $\frac{1}{8}$  of a turn

From S to E is  $\frac{1}{4}$  of a turn

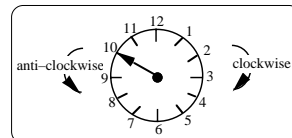


1. Start facing North. Turn  $\frac{1}{8}$  clockwise.  
Where are you facing ?
2. Start facing SW. Turn  $\frac{3}{8}$  clockwise.  
Where are you facing ?
3. Start facing S.  
Turn  $\frac{1}{8}$  clockwise, then  $\frac{1}{2}$  clockwise, then  $\frac{1}{8}$  clockwise.  
Where are you facing ?
4. Start facing NE. Turn  $\frac{1}{8}$  anti-clockwise, then  $\frac{3}{8}$  clockwise.  
Where are you facing now ?
5. You turn  $\frac{3}{8}$  clockwise. You end up facing E.  
Where were you facing at the start ?
6. Start facing E. Turn  $\frac{5}{8}$  clockwise, then  $\frac{1}{2}$  anti-clockwise, then  $\frac{1}{4}$  clockwise. Where are you facing now ?
7. You turn  $\frac{1}{8}$  clockwise, then  $\frac{1}{4}$  clockwise. You end up facing W.  
Where were you facing at the start ?
8. You turn  $\frac{1}{8}$  anti-clockwise, then  $\frac{1}{4}$  anti-clockwise. You end up facing NW.  
Where were you facing at the start ?

### Ch 12: Equivalent turns (SECTION 4)

All correct = 1 star

1. Start with the hand pointing to the 10.
  - (a) Turn  $\frac{7}{12}$  clockwise.  
What number is it now pointing to ?
  - (b) What fraction of a turn in the opposite direction is the same as  $\frac{7}{12}$  clockwise ?
2. Start with the hand pointing to the 8.
  - (a) Turn  $\frac{5}{12}$  anti-clockwise.  
What number is it now pointing to ?
  - (b) What fraction of a turn clockwise would take it to the same number ?
3. Start with the hand pointing to the 4.
  - (a) Turn  $\frac{11}{12}$  anti-clockwise.  
What number is it now pointing to ?
  - (b) What fraction of a turn anti-clockwise would take it to the same number ?
4. Start with the hand pointing to the 1.
  - (a) Turn  $\frac{7}{12}$  clockwise then  $\frac{5}{12}$  anticlockwise.  
What number is it now pointing to ?
  - (b) What single turn would take it to this number ?



**Did you know** that before clocks were invented ...  
... the term used for the clockwise direction was **sun wise**  
... the term used for anticlockwise was **contrariwise** or **widdershins**

### Ch 13: Three-digit fractions (SECTION 5)

6 correct = 2 stars  
5 correct = 1 star

- The fraction  $\frac{8}{16}$  is a three-digit fraction.  $\frac{8}{16}$  is equivalent to  $\frac{1}{2}$ .  
Kumar found four three-digit fractions equivalent to  $\frac{1}{2}$ .  
How many can you find? What are they?
- Mark found six three-digit fractions equivalent to  $\frac{1}{3}$ .  
How many can you find? What are they?
- Ellie says that there is only one three-digit fraction equivalent to  $1\frac{1}{2}$ .  
What is it?
- Find all the three-digit fractions equivalent to  $2\frac{1}{2}$ .
- Find all the three-digit fractions equivalent to  $3\frac{1}{4}$ .
- Find all the three-digit fractions equivalent to  $1\frac{2}{3}$ .

### Ch 14: Related fraction challenge (SECTION 7)

9-10 correct = 1 star

Copy and complete these statements using the information given in the diagram.

- $\frac{1}{2} + \frac{1}{4} = \dots$
- $\frac{1}{3} + \frac{1}{6} = \dots$
- $1 - \frac{1}{6} = \dots$
- $\frac{1}{2} + \frac{1}{3} = \dots$
- $1 - \frac{2}{3} = \dots$
- $\frac{1}{8} + \frac{3}{8} = \dots$
- $1 - \frac{1}{8} = \dots$
- $\frac{1}{2} + \frac{1}{8} = \dots$
- $\frac{1}{4} + \frac{1}{8} = \dots$
- $\frac{1}{2} + \frac{3}{8} = \dots$

### Ch 15: Addition and subtraction challenge (SECTION 7)

15-16 correct = 2 stars  
13-14 correct = 1 star

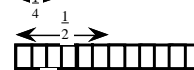
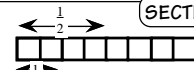
Copy and complete these statements :

- $\frac{2}{3} - \frac{1}{6} = \dots$
- $\frac{2}{3} + \frac{1}{6} = \dots$
- $\frac{5}{8} - \frac{1}{2} = \dots$
- $\frac{5}{6} - \frac{2}{3} = \dots$
- $\frac{3}{4} + \frac{1}{8} = \dots$
- $\frac{3}{4} - \frac{1}{8} = \dots$
- $\frac{2}{3} + \frac{1}{6} - \frac{1}{2} = \dots$
- $\frac{1}{6} + \frac{1}{2} + \frac{1}{3} = \dots$
- $\frac{1}{4} + \frac{1}{4} + \frac{1}{8} = \dots$
- $\frac{3}{8} + \frac{1}{4} + \frac{1}{8} = \dots$
- $\frac{3}{5} - \frac{1}{10} = \dots$
- $\frac{4}{5} + \frac{1}{10} = \dots$
- $\frac{1}{2} + \frac{1}{5} + \frac{1}{10} = \dots$
- $\frac{1}{3} + \frac{1}{9} = \dots$
- $\frac{5}{9} + \frac{1}{3} - \frac{2}{3} = \dots$
- $\frac{1}{6} + \frac{4}{9} = \dots$

### Ch 16: Halfway fractions (SECTION 7)

10 correct = 3 stars 8-9 correct = 2 stars  
6-7 correct = 1 star

- What fraction lies halfway between  $\frac{1}{4}$  and  $\frac{1}{2}$ ?
- What fraction lies halfway between  $\frac{1}{3}$  and  $\frac{1}{2}$ ?



Find the fractions that are halfway between :

- $\frac{1}{2}$  and  $\frac{3}{4}$
- $\frac{3}{4}$  and 1
- $\frac{1}{8}$  and  $\frac{1}{4}$
- $\frac{13}{4}$  and  $\frac{3}{8}$
- $\frac{1}{2}$  and  $\frac{2}{3}$
- $\frac{1}{2}$  and  $\frac{3}{5}$
- $\frac{1}{3}$  and  $\frac{1}{5}$
- $\frac{1}{10}$  and  $\frac{2}{5}$

### Ch 17: Challenging fractions of ...

23-24 correct = 2 stars  
20-22 correct = 1 star

Evaluate :

SECTION 9

- $\frac{2}{3}$  of £12
- $\frac{3}{4}$  of 16 cm
- $\frac{3}{8}$  of 80 l
- $\frac{3}{10}$  of 20 p
- $\frac{4}{9}$  of £18
- $\frac{7}{10}$  of 30p
- $\frac{3}{11}$  of 44 km
- $\frac{3}{5}$  of 10p
- $\frac{4}{5}$  of £20
- $\frac{5}{7} \times 21p$
- $\frac{2}{3}$  of 18 sweets
- $\frac{3}{5}$  of 20 mm
- $\frac{5}{6}$  of 30p
- $\frac{5}{8}$  of £40
- $\frac{2}{9}$  of 99p
- $\frac{4}{3}$  of £30
- $\frac{2}{3}$  of £297
- $\frac{3}{5} \times £4355$
- $\frac{7}{10}$  of £3690
- $\frac{4}{13}$  of £65
- $\frac{2}{7}$  of £392
- $\frac{3}{8} \times £7192$
- $\frac{2}{11}$  of £6193
- $\frac{4}{13}$  of £4823

18 correct = 3 stars  
14-17 correct = 2 stars  
10-13 correct = 1 star

### Ch 18: Fractions of fractions

SECTION 9

$\frac{1}{2}$  of [ $\frac{1}{4}$  of 20] is the same as  $\frac{1}{2} \times [\frac{1}{4} \times 20]$  Work out the bracket first.

- Evaluate :
- $\frac{1}{2} \times [\frac{1}{4} \times 16]$
  - $\frac{1}{3} \times [\frac{1}{5} \times 60]$
  - $\frac{1}{10} \times [\frac{1}{3} \times 90]$
  - $\frac{1}{20} \times [\frac{1}{2} \times 240]$
  - $\frac{1}{11} \times [\frac{1}{3} \times 99]$
  - $\frac{2}{3} \times [\frac{1}{4} \times 24]$
  - $\frac{1}{5} \times [\frac{1}{3} \times [\frac{1}{4} \times 180]]$
  - $\frac{3}{4} \times [\frac{2}{3} \times 72]$

*N* is an unknown number. Work out the value of *N*.

- $\frac{1}{3} \times N = 12$
- $\frac{1}{5} \times N = 10$
- $\frac{2}{3} \times N = 8$
- $\frac{1}{2} \times [\frac{1}{3} \text{ of } N] = 12$
- $\frac{1}{3} \times [\frac{1}{5} \text{ of } N] = 3$
- $\frac{1}{4} \times [\frac{1}{10} \text{ of } N] = 4$
- $\frac{2}{3} \times [\frac{1}{4} \text{ of } N] = 4$
- $\frac{4}{5} \times [\frac{3}{4} \text{ of } N] = 12$
- $\frac{3}{4} \times [\frac{2}{3} \text{ of } N] = 3$
- $\frac{3}{7} \times [\frac{3}{10} \text{ of } N] = 9$

25-26 correct = 2 stars  
21-24 correct = 1 star

### Ch 19: Fractions, decimals & percentages

SECTION 9

Work out:

- 25% of 40 kg
- $33\frac{1}{3}\%$  of 60 p
- 10% of 15 m
- 40% of 25 kg
- 90% of 40 l
- 80% of 50 p
- 12.5% of 80 m
- 62.5% of 16 p
- 75% of 44 mm
- $33\frac{1}{3}\%$  of £12
- 20% of 55p
- $66\frac{2}{3}\%$  of 15 km

Work out, correct to 2 d.p.:

- $33\frac{1}{3}\%$  of 7m
- 25% of 5 l
- 75% of 6 kg
- $66\frac{2}{3}\%$  of £4.25
- 12.5 % of £12
- 37.5% of £3.20
- 87.5% of 4 m
- 20% of 6 cm
- 70% of 3 l
- 90% of £6.50
- 20% of £9.40
- 40% of 65 m

40 children were asked their favourite colour.

Green	Blue	Orange	Red	Black	Yellow
12.5%	20%	10%	37.5%	5%	?

25. How many chose each colour ?

26. What percentage chose yellow ?

All correct = 1 star

### Ch 20: What percentage ?

SECTION 9

1. You score 16 out of 25 in a mental arithmetic test.  
What percentage mark do you get ?
2. 5 out of 8 babies are born at night between 6 pm and 6 am.  
What percentage of births is this ?
3. 80 women were asked to choose between two magazines.  
72 preferred Gossip to Garbage. What percentage preferred Gossip ?
4. 40 cats were asked which food they preferred. 35 of them said 'Miaow'.  
The rest did not answer. What percentage preferred 'Miaow' ?
5. On one day during a 'flu' epidemic, there were only 6 children in  
school out of a tutor group of 30. What percentage were absent ?

13-15 marks = 2 stars

10-12 marks = 1 star

### Ch 21: 10% questions

SECTION 9

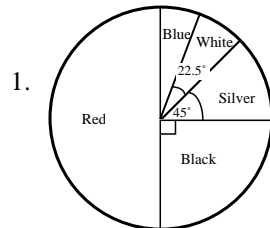
*For each question, there are marks for answers AND for working out.*

1. From January to February, production of Easter eggs at one factory went up by 10%.  
They made 1800 in January.  
How many did they make in February ? [2 marks]
2. The workers at a factory received a 10% pay rise one year.  
What was the new pay for :
  - a production line worker earning £140 per week
  - a wages clerk earning £620 per month
  - a driver earning £7 400 per year [6 marks]
3. Which of the three workers in the last question earned the most in a year. [2 marks]
4. The workers in a car factory agreed on a 2-year pay deal. They were to get a pay rise of 10%  
in the first year and another rise of 10% in the second year. Bob earned £250 per week before  
the agreement. He worked out that he would get £275 in the first year and £300 in the  
second year.  
He was right about the first year, but found that he would get £302.50 per  
week in the second year. Explain why. [2 marks]
5. During a recession, the workers in a small factory took a 10% pay cut. When things got  
better, they received a 10% pay rise. A worker earning £100 before the pay cut got £99 after  
the pay rise.  
Explain why. [1 mark]  
What percentage pay rise should they have got, to go back to their original  
pay levels ? [2 marks]

## Ch 22: Percentages in action

SECTION 10

23-24 marks = 2 stars  
18-22 marks = 1 star



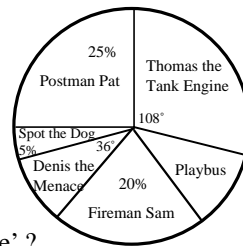
1 complete revolution =  $360^\circ$

A group of people were shown pictures of the same car in five different colours. They were asked to say which colour they preferred.

What percentage chose each colour ? [5 marks]

2. This pie chart shows the favourite TV programmes of a group of children at a playgroup.

- What angle is in the 'Postman Pat' sector ?
- What angle is in the 'Spot the Dog' sector ?
- What percentage chose 'Denis the Menace' ?
- What percentage chose 'Thomas the Tank Engine' ?
- What angle was in the 'Fireman Sam' sector ?
- What percentage chose 'Playbus' ? [6 marks]



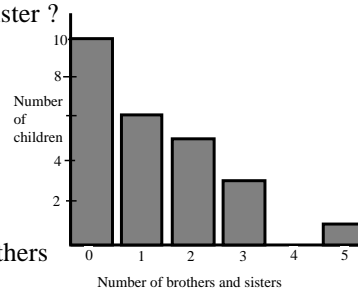
3. 500 children in one school were asked to choose their favourite football team.

Team	Man Utd	Man City	Liverpool	Everton	Other team
Number	125	50	225	75	25
Percentage					

- Copy and complete the table. [5 marks]
- In what part of the country do you think the school was ? [1 mark]

4. A survey was made of how many brothers or sisters the children in a Y7 class had.

- How many children had no brothers or sisters ?
- How many children had 1 brother or sister ?
- How many children were there in this class ?
- What percentage of the class had no brothers or sisters ?
- What percentage of the class had 2 brothers or sisters ?
- What percentage of the class had 5 brothers or sisters ?
- What percentage of the class had more than 2 brothers or sisters ? [7 marks]



### Ch 23: Percentages to 2 d.p.

14-15 correct = 1 star

$$7\% \text{ of } £15.20 = 0.07 \times £15.20 = £1.064 = £1.06 \text{ to 2 d.p.}$$

SECTION 12



Give all answers to 2 d.p. Find :

- |                      |                   |                    |
|----------------------|-------------------|--------------------|
| 1. 37% of £45.32     | 6. 14% of £24     | 11. 11% of £13.20  |
| 2. 13% of 12 cm      | 7. 12% of 3.4 l   | 12. 3% of 4.3 cm   |
| 3. 7% of £109        | 8. 70% of £16.45  | 13. 35% of 15.7 kg |
| 4. 14% of 4.5 tonnes | 9. 43% of £13.40  | 14. 27% of 14 l    |
| 5. 8% of 3.6 m       | 10. 88% of £56.43 | 15. 95% of 473 km  |

### Ch 24: Prices to the nearest penny

15-16 correct = 2 stars

13-14 correct = 1 star

Give the answers to each of these questions to the nearest penny.

SECTION 12



- Work out **the reduction** on each of these :  
(a) King size sheets £19.92 each (b) Pillowcases £4.95 each  
(c) Duvets £27.99 each (d) Valances £10.45 each
- Work out **the prices**, after the reductions, of each item :  
(a) Shirt £15.00 (b) Jumper £22.50  
(c) Jacket £23.45 (d) Trousers £14.75

**25% off  
all items**

**All prices  
reduced by  
 $33\frac{1}{3}\%$**

- Announcing a price increase of 5%  
on every item in our gardening catalogue*

Work out the **new prices** of each of the items whose old prices are given here:

- |                             |                                |
|-----------------------------|--------------------------------|
| (a) packet of seeds 50p     | (b) hand fork £3               |
| (c) pack of plantpots £1.45 | (d) watering can £6.50         |
| (e) 'Growmore' £2.30        | (f) pack of 12 seedtrays £3.34 |

- VAT is Value Added Tax. It used to be charged at 15%. It is now 17.5%  
It a government tax, added onto the cost of goods and services.  
A restaurant bill comes to £76.34 without VAT.  
The service charge is 10% and it is charged after the VAT has been added on.

Calculate the final bill under both VAT rates. (two answers required)

All correct = 1 star

### Ch 25: A proper headscratcher

SECTION 12



In July, Mary had the choice of three very similar jobs. The pay for all three jobs was due to go up in the following September. But the information on the rates of pay was very confusing.

First job:	present pay £520 per month + rise of 12%
Second job:	present pay £550 per month + rise of 8%
Third job:	present pay £560 per month + rise of one twentieth.

Sort out the information and tell Mary which will be the best paid job from September. Explain why.

# Unit 5: Fractions, Decimals, Percentages, Ratios

## Section 1: Fraction review p 162

### D1.1: Describing fractions

1. (a) 3 (b)  $\frac{4}{4}$   
 2. A:  $\frac{1}{6}$  B:  $\frac{1}{3}$  C:  $\frac{3}{4}$  D:  $\frac{5}{6}$  E:  $\frac{5}{6}$  F:  $\frac{3}{8}$   
 3. (a)  $\frac{1}{2} = \frac{3}{6}$  (b)  $\frac{1}{2} = \frac{6}{12}$  (c)  $\frac{1}{2} = \frac{4}{8}$  (d)  $\frac{1}{2} = \frac{5}{10}$   
 4. (a)  $\frac{1}{3} = \frac{2}{6}$  (b)  $\frac{1}{3} = \frac{4}{12}$  (c)  $\frac{1}{3} = \frac{5}{15}$   
 5. (a)  $\frac{1}{5} = \frac{2}{10}$  (b)  $\frac{1}{5} = \frac{4}{20}$  (c)  $\frac{1}{5} = \frac{5}{25}$

### D1.2: Comparing fractions

1. bigger 2. smaller 3. bigger 4. smaller  
 5. smaller 6. smaller 7.  $\frac{2}{7} > \frac{1}{10} > \frac{3}{8}$   
 8.  $\frac{4}{5} > \frac{9}{10} > \frac{7}{9}$  9.  $\frac{7}{10} > \frac{5}{6}$  10.  $\frac{4}{5} > \frac{3}{6} > \frac{4}{8} > \frac{5}{10}$  11. (a) F (b) T (c) F (d) T  
 12.  $1\frac{2}{3} > 1\frac{7}{9} > 1\frac{8}{10} > 2\frac{2}{5} > 2\frac{3}{7} > 3\frac{1}{11}$   
 13.  $\frac{8}{9}$  is  $\frac{1}{9}$  away from 1 and  $\frac{11}{9}$  is  $\frac{2}{9}$  away from 1 so  $\frac{8}{9}$  is closer to 1

## Section 2: Equivalent fraction ... p 169

### D2.1: How to make equivalent fractions

1. (a)  $\frac{6}{15}$  (b)  $\frac{10}{25}$  (c)  $\frac{8}{20}$  (d)  $\frac{20}{50}$   
 2. (a) 2 (b) 5 (c) 7 (d) 10

### D2.2: Making equivalent fractions

1. $\frac{1}{2} = \frac{5}{10}$	2. $\frac{2}{3} = \frac{10}{15}$	3. $\frac{4}{5} = \frac{12}{15}$	4. $\frac{5}{7} = \frac{10}{14}$
5. $\frac{5}{6} = \frac{15}{18}$	6. $\frac{3}{10} = \frac{9}{30}$	7. $\frac{4}{11} = \frac{8}{22}$	8. $\frac{2}{13} = \frac{4}{26}$
9. $\frac{1}{3} = \frac{3}{9}$	10. $\frac{3}{5} = \frac{6}{10}$	11. $\frac{4}{5} = \frac{16}{20}$	12. $\frac{3}{7} = \frac{6}{14}$
13. $\frac{2}{3} = \frac{20}{30}$	14. $\frac{5}{12} = \frac{10}{24}$	15. $\frac{1}{6} = \frac{5}{30}$	16. $\frac{3}{8} = \frac{12}{32}$

### D2.3: Working backwards

1.  $\frac{1}{2}$  2.  $\frac{1}{3}$  3.  $\frac{2}{5}$  4.  $\frac{3}{10}$   
 5.  $\frac{7}{8}$  6.  $\frac{4}{15}$  7.  $\frac{2}{7}$  8.  $\frac{4}{7}$

## Section 3: Simplest form p 173

### D3.1: Simplifying fractions

1.  $\frac{1}{2}$  2.  $\frac{3}{5}$  3.  $\frac{3}{4}$  4.  $\frac{1}{4}$  5.  $\frac{3}{4}$  6.  $\frac{1}{4}$   
 7.  $\frac{2}{3}$  8.  $\frac{1}{6}$  9.  $\frac{4}{5}$  10.  $\frac{1}{3}$  11.  $\frac{1}{2}$  12.  $\frac{1}{3}$

### D3.2: Multistage reductions

1.  $\frac{1}{3}$  2.  $\frac{4}{5}$  3.  $\frac{2}{3}$  4.  $\frac{2}{5}$  5.  $\frac{3}{5}$  6.  $\frac{1}{4}$

### D3.3: The cancelling technique

1.  $\frac{4}{5}$  2.  $\frac{1}{4}$  3.  $\frac{2}{3}$  4.  $\frac{13}{15}$  5.  $\frac{3}{4}$  6.  $\frac{3}{5}$

## Section 4: Fraction applications p 175

### D4.1: Some mental division techniques

1.  $\frac{2}{3}$  2.  $\frac{3}{4}$  3.  $\frac{2}{3}$  4.  $\frac{3}{4}$  5.  $\frac{2}{3}$   
 6.  $1\frac{1}{3}$  7.  $\frac{1}{3}$  8.  $\frac{3}{7}$  9.  $1\frac{1}{3}$  10.  $\frac{1}{5}$

### D4.2: One number as a fraction of another

1.  $\frac{1}{4}$  2.  $\frac{3}{4}$  3.  $\frac{5}{12}$  4.  $\frac{1}{3}$  5.  $\frac{1}{4}$  6.  $\frac{1}{4}$   
 7.  $\frac{1}{4}$  8.  $\frac{1}{5}$  9.  $\frac{1}{12}$  10.  $\frac{1}{6}$  11.  $\frac{1}{12}$  12.  $\frac{2}{3}$   
 13.  $\frac{1}{3}$  14.  $\frac{1}{3}$

### D4.3: Fractions of turns

1.  $\frac{1}{2}$  2. 2 3.  $\frac{1}{4}$  4. 4 5.  $\frac{1}{8}$  6.  $\frac{3}{8}$   
 7.  $\frac{5}{8}$  8.  $\frac{3}{4}$

## Section 5: Mixed numbers p 177

### D5.1: Mixed numbers and decimals

1.  $3\frac{1}{2}$  2.  $5\frac{1}{4}$  3.  $8\frac{3}{4}$  4. 3.25  
 5. 9.5 6. 7.75 7.  $10\frac{1}{4}$  8.  $15\frac{3}{4}$

### D5.2: How many ... ?

1. (a) 2 (b) 3 (c) 5 (d) 8 (e) 7 (f) 11  
 2. (a) 3 (b) 4 (c) 7 (d) 5 (e) 6 (f) 8  
 3. (a) 5 (b) 6 (c) 12 (d) 9 (e) 10 (f) 18

### D5.3: From mixed numbers to improper fractions

1.  $\frac{7}{3}$  2.  $\frac{15}{4}$  3.  $\frac{12}{5}$  4.  $\frac{7}{2}$  5.  $\frac{9}{5}$   
 6.  $\frac{7}{4}$  7.  $\frac{13}{9}$  8.  $\frac{11}{4}$  9.  $\frac{5}{3}$  10.  $\frac{18}{5}$

### D5.4: Working in reverse

1.  $2\frac{1}{2}$  2.  $3\frac{3}{4}$  3.  $2\frac{1}{3}$  4.  $1\frac{1}{5}$  5.  $1\frac{1}{8}$   
 6.  $1\frac{9}{10}$  7.  $1\frac{1}{9}$  8.  $2\frac{3}{8}$  9.  $2\frac{3}{10}$  10.  $3\frac{1}{6}$   
 11.  $10\frac{1}{2}$  12.  $3\frac{2}{3}$  13.  $6\frac{1}{4}$  14.  $2\frac{1}{9}$

### D5.5: Multiplying a fraction by a whole number

1.  $\frac{5}{8}$  2.  $1\frac{1}{5}$  3.  $\frac{1}{2}$  4.  $\frac{2}{3}$  5.  $1\frac{5}{7}$  6.  $2\frac{1}{4}$   
 7.  $1\frac{5}{9}$  8. 2 9.  $1\frac{1}{9}$  10.  $1\frac{1}{3}$  11.  $2\frac{1}{5}$  12. 6

## Section 6: Equivalent decimals & p 180

### D6.1: Decimals and fractions

- 0.7 =  $\frac{7}{10}$  0.01 =  $\frac{1}{100}$  0.003 =  $\frac{3}{1000}$  2.1 =  $2\frac{1}{10}$   
 0.13 =  $\frac{13}{100}$  0.05 =  $\frac{5}{100}$  0.2 =  $\frac{2}{10}$  0.002 =  $\frac{2}{1000}$   
 0.71 =  $\frac{71}{100}$  0.042 =  $\frac{42}{1000}$  1.3 =  $1\frac{3}{10}$  3.13 =  $3\frac{13}{100}$   
 5.041 =  $5\frac{41}{1000}$  0.024 =  $\frac{24}{1000}$  15.123 =  $15\frac{123}{1000}$

### D6.2: Changing decimals to fractions

1.  $\frac{3}{10}$  2.  $\frac{9}{10}$  3.  $\frac{7}{100}$  4.  $\frac{1}{100}$  5.  $\frac{3}{100}$  6.  $\frac{9}{1000}$   
 7.  $\frac{11}{100}$  8.  $\frac{23}{100}$  9.  $\frac{39}{100}$  10.  $\frac{5}{100}$  11.  $\frac{28}{100}$  12.  $\frac{597}{1000}$   
 13.  $\frac{17}{10}$  14.  $2\frac{9}{10}$  15.  $3\frac{1}{100}$  16.  $\frac{45}{100}$  17.  $\frac{6}{100}$  18.  $\frac{29}{1000}$   
 19.  $\frac{13}{100}$  20.  $4\frac{1}{2}$  21.  $\frac{1}{1000}$  22.  $\frac{12}{100}$  23.  $6\frac{1}{10}$  24.  $2\frac{7}{100}$

### D6.3: Decimals to fractions in simplest form

1. 0.45 =  $\frac{45}{100} = \frac{9}{20}$  2. 0.18 =  $\frac{18}{100} = \frac{9}{50}$   
 3. 0.16 =  $\frac{16}{100} = \frac{4}{25}$  4. 0.65 =  $\frac{65}{100} = \frac{13}{20}$   
 5. 0.25 =  $\frac{25}{100} = \frac{1}{4}$  6. 0.12 =  $\frac{12}{100} = \frac{3}{25}$   
 7. 0.75 =  $\frac{75}{100} = \frac{3}{4}$  8. 0.004 =  $\frac{4}{1000} = \frac{1}{250}$

### D6.4: Decimals to fraction practice

- Batch A: 1.  $\frac{4}{5}$  2.  $\frac{1}{5}$  3.  $\frac{1}{25}$  4.  $\frac{6}{25}$  5.  $\frac{2}{25}$  6.  $11\frac{1}{20}$   
 Batch B: 1.  $\frac{2}{5}$  2.  $\frac{1}{50}$  3.  $\frac{1}{4}$  4.  $\frac{12}{25}$  5.  $\frac{3}{5}$  6.  $\frac{9}{25}$

## Section 7: Combining fractions p 185

### D7.1: Adding and subtracting common fractions

1. 1 2.  $\frac{3}{4}$  3.  $\frac{1}{4}$  4. 1 5.  $1\frac{1}{4}$  6. 1  
 7.  $\frac{3}{4}$  8.  $\frac{1}{2}$  9.  $1\frac{3}{4}$  10. 3 11.  $4\frac{1}{4}$  12.  $\frac{3}{4}$

### D7.2: Fractions with the same denominator

1.  $\frac{2}{3}$  2.  $1\frac{1}{3}$  3.  $\frac{1}{4}$  4.  $1\frac{1}{4}$  5. 1 6.  $\frac{3}{5}$   
 7.  $\frac{2}{5}$  8.  $\frac{2}{3}$  9.  $\frac{5}{9}$  10.  $\frac{1}{2}$

### D7.3: Simple related fractions

1.  $\frac{3}{5}$  2.  $\frac{1}{8}$  3.  $\frac{1}{6}$  4.  $\frac{5}{14}$  5.  $\frac{3}{8}$  6.  $\frac{3}{10}$   
 7.  $\frac{1}{2}$  8.  $\frac{1}{2}$

### D7.4: Halves, quarters and eighths

1.  $\frac{1}{4}$  2.  $\frac{3}{8}$  3.  $\frac{1}{2}$  4.  $\frac{3}{4}$  5.  $\frac{1}{4}$  6.  $\frac{1}{8}$   
 7.  $\frac{1}{8}$  8.  $\frac{3}{8}$  9.  $\frac{1}{2}$  10.  $\frac{3}{4}$

## Section 8: Percentages p 187

### D8.1: Connecting fractions and percentages

1.  $\frac{1}{2}$  2.  $\frac{3}{4}$  3.  $\frac{1}{10}$  4.  $\frac{1}{5}$  5.  $\frac{3}{20}$   
 6. 2 7.  $1\frac{1}{2}$  8.  $1\frac{1}{4}$  9.  $\frac{7}{20}$  10.  $\frac{9}{25}$   
 11. 25% 12. 40% 13. 30% 14. 100% 15. 200%  
 16. 250% 17. 45% 18. 86% 19. 28% 20. 106%

### D8.2: Connecting decimals and percentages

Dec:	0.1	0.4	0.56	0.79	1	0.83	0.25	0.87	0.14	0.27
%:	10%	40%	56%	79%	100%	83%	25%	87%	14%	27%
Dec:	0.56	0.8	0.99	0.42	0.31	1.5	0.795	0.535	0.225	0.125
%:	56%	80%	99%	42%	31%	150%	79.5%	53.5%	22.5%	12.5%

### D8.3: Percentage test marks

1.  $\frac{1}{2}$  2. (a) 25% (b)  $\frac{1}{4}$  3. 95% 4. 45%  
 5.  $\frac{7}{5}$  6. 75% 7. 20% 8. 10%

## Section 9: Equivalent F,D,P p 190

### D9.1: Review of division techniques

1. 9 2. 6 3. 7 4. 11 5. 3 6. 5 7. 7 8. 6  
 9. 7 10. 7 11. 13 12. 8

### D9.2: Finding fractions of amounts mentally

1. 30 2. 15 3. 20 4. 6 5. 12 6. 6 7. 8 8. 4  
 9. £2 10. £4 11. 4 cm 12. 8 cm 13. £9 14. 6p 15. £6 16. 15 cm  
 17. £15 18. 10 cm 19. 21/ 20. £10 21. 45 minutes 22. 50 cl 23. £30

### D9.3: More mental fractions

1. £15 2. 90 cm 3. £105 4. £155

### D9.4: Equivalents you need to know and use

1. 3 sweets 2. £4 3. £20 4. 60p 5. 20 cm 6. 16p 7. 5 kg  
 8. 5 km 9. 0.9 cm 10. 7 11. 20 12. 25  
 13. £5.25 14. 27 15. 12 16. 12 17. 6

## Section 10: Percentage calculations p 193

### D10.1: Multiples of tenths are easy

1. 7 cm 2. 21 cm 3. 9p 4. 36p  
 5. 81p 6. 30 7. 90 8. 15  
 9. 28 10. 12p 11. 108 12. 40 cm  
 13. 50p 14. 25p 15. 75p 16. 12.5p  
 17. 2p 18. 3 cm 19. £7.20 20. 0.12 m

### D10.2: Some useful written techniques

1. £143 2. 442 3. 28 m 4. £48 5. 72 cl  
 6. 38.5 7. £9 8. 135 g 9. £7.20 10. 6

### D10.3: Football percentages

1. 30% 2. 5% 3. 17% 4. 65% 5. 25% 6.  $\frac{3}{4}$  7. 67%

## Section 11: Ratio and proportion p 195

### D11.1: ...in every... and ... for every ...

1. In every 6 squares 2 are black  
 In every 12 squares 4 are black  
 In every 9 squares 3 are black  
 In every 21 squares 7 are black  
 In every 30 squares 10 are black

2.	Black	White	3.	Black	White
	1	2		1	3
	2	4		2	6
	3	6		3	9
	4	8		4	15
	5	10		5	21
	7	14		7	33
	10	20			

4. 15 20

5. 30 50



**D11.2: Ratio and the words that go with it**

Green	Yellow	Total
1	3	4
2	6	8
3	9	12
5	15	20
7	21	28

For every green bead there are 3 yellow beads.

The number of green beads is one third the number of yellow beads.

The ratio of green beads to yellow beads is 1 : 3

The ratio of yellow beads to green beads is 3 : 1

**D11.3: Equivalent ratios**

- 1) 1 : 2   2) 1 : 5   3) 3 : 2   4) 1 : 4   5) 2 : 5  
 6. (a) 4 : 1   (b) 1 : 4   7.(a) 4   (b) 25

**D11.4: Proportion**

Red	Blue	Total
1	2	3
2	4	6
10	20	30
15	30	45
20	40	60

Red	Blue	Total
1	2	3
2	4	9
5	10	15
8	16	24

**Section 12: More ratios and % p199**

**D12.1: Calculator percentages**

1. £5   2. £1.80   3. 80p   4. £2.30   5. £57.60  
 6. £1.26   7. £46.80   8. £5.10   9. £1.17

**D12.2: Sharing in ratio**

1. £14 : £21   2.   £8 : £32   3.   £6 : £15  
 4. £24 : £56   5. (a) five twelfths (b) £35  
 6. (a) 2 : 1   (b) £400