



The Heys School

# Maths

### 3.10 Dividing 3-digit numbers by 1- or 2-digit numbers

Divisions are easy to do with pencil and paper.  
To work out  $785 \div 4$ , set it out like this:

Divide 7 hundreds  
by 4:  $7 \div 4 = 1$   
remainder 3 hundreds

$$\begin{array}{r} 1 \\ 4 \overline{)7385} \end{array}$$

change the 3 hundreds  
to 30 tens to give  
38 tens

Divide 38 tens by 4:  
 $38 \div 4 = 9$  remainder  
2 tens

$$\begin{array}{r} 19 \\ 4 \overline{)73825} \end{array}$$

change the 2 tens to  
20 units to give  
25 units

Divide 25 units by 4:  
 $25 \div 4 = 6$   
remainder 1

$$\begin{array}{r} 196 \text{ remainder } 1 \\ 4 \overline{)73825} \end{array}$$

So  $785 \div 4 = 196$  remainder 1.

#### Example 11

Calculate  $87 \div 5$

$$8 \div 5 = 1 \text{ remainder } 3$$

$$37 \div 5 = 7 \text{ remainder } 2$$

$$\begin{array}{r} 17 \text{ remainder } 2 \\ 5 \overline{)87} \end{array}$$

#### Exercise 3K

Calculate:

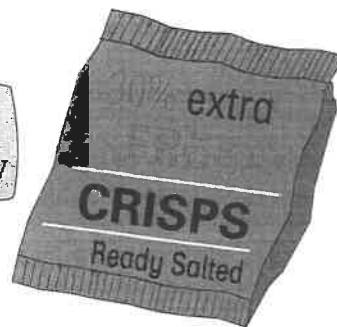
- |   |                  |                  |
|---|------------------|------------------|
| 1 | (a) $95 \div 4$  | (b) $85 \div 6$  |
|   | (c) $97 \div 4$  | (d) $947 \div 4$ |
|   | (e) $78 \div 5$  | (f) $867 \div 6$ |
|   | (g) $798 \div 7$ | (h) $944 \div 8$ |
|   | (i) $825 \div 5$ | (j) $89 \div 3$  |
|   | (k) $938 \div 8$ | (l) $653 \div 5$ |
| 2 | (a) $467 \div 3$ | (b) $637 \div 7$ |
|   | (c) $479 \div 4$ | (d) $296 \div 4$ |
|   | (e) $407 \div 6$ | (f) $999 \div 8$ |
|   | (g) $203 \div 3$ | (h) $400 \div 7$ |
|   | (i) $507 \div 7$ | (j) $111 \div 6$ |
|   | (k) $753 \div 9$ | (l) $748 \div 7$ |

# 16 Percentages

## 16.1 Understanding percentages



15% of schools  
closed due to heavy  
snow



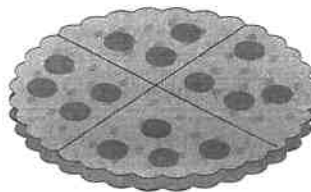
The symbol % means 'per cent'.  
Per cent means 'in every 100'.

3% means 3 in every 100.  
3% is called a **percentage**.

100% of something is all of it.



There are 5 pieces of  
chocolate in this bar.  
Each piece is  $100 \div 5 = 20\%$   
of the whole.

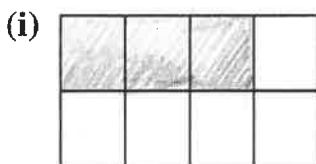
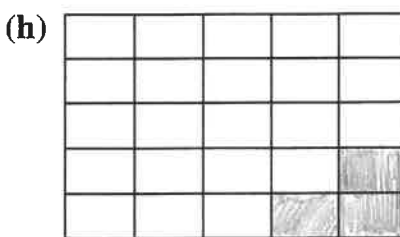
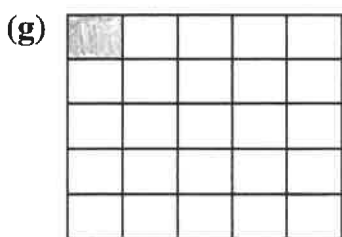
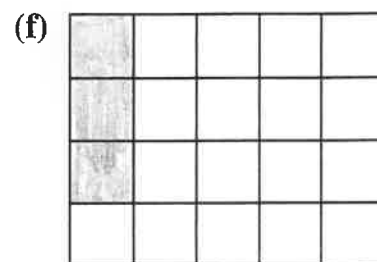
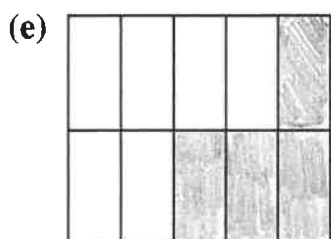
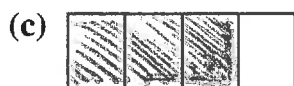


There are 4 slices of pizza.  
Each slice is  $100 \div 4 = 25\%$ .  
3 slices will be  $3 \times 25\% = 75\%$

### Exercise 16A

- 1 A rod is cut into five equal pieces. What percentage of the rod is each piece?
- 2 A pie is cut into ten equal pieces. What percentage of the pie is each piece?

3 What percentage of each shape is shaded?



## 16.2 Writing percentages as fractions

You can write a percentage as a fraction.

3% means 3 out of 100. As a fraction this is  $\frac{3}{100}$

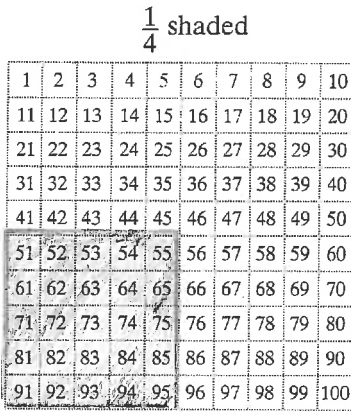
Notice that the denominator is 100

3% and  $\frac{3}{100}$  represent the same amount.

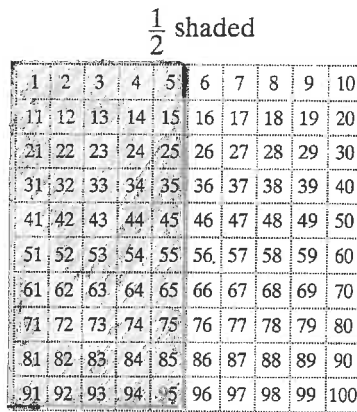
■ You can write a percentage as a fraction with the denominator 100. For example:

$$23\% = \frac{23}{100}$$

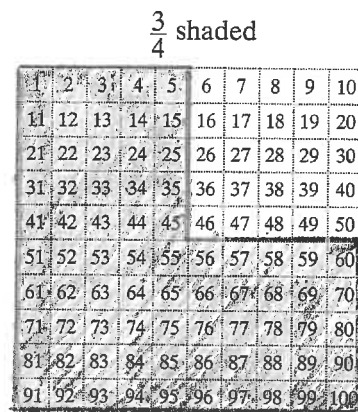
These hundred squares show some more fractions and percentages:



25 parts shaded.  
25% shaded.



50 parts shaded.  
50% shaded.



75 parts shaded.  
75% shaded.

**Example 1**

Write these percentages as fractions in their simplest form:

- (a) 20%                      (b) 5%                      (c) 40%

- (a) 20% means  $\frac{20}{100}$     (b) 5% means  $\frac{5}{100}$     (c) 40% means  $\frac{40}{100}$

$$\frac{20}{100} = \frac{1}{5}$$

(Diagram showing division by 20:  $\frac{20 \div 20}{100 \div 20} = \frac{1}{5}$ )

$$\frac{5}{100} = \frac{1}{20}$$

(Diagram showing division by 5:  $\frac{5 \div 5}{100 \div 5} = \frac{1}{20}$ )

$$\frac{40}{100} = \frac{2}{5}$$

(Diagram showing division by 20:  $\frac{40 \div 20}{100 \div 20} = \frac{2}{5}$ )

**Remember:** to find the simplest form, you divide the top and the bottom by the same number.

■ Remember these percentages and their equivalent fractions:

$$50\% = \frac{1}{2} \quad 25\% = \frac{1}{4} \quad 75\% = \frac{3}{4}$$

Equivalent means they represent the same amount.

### Exercise 16B

1 For each hundred square, write down

- the fraction shaded
- the percentage shaded

(a)

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

(b)

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

(c)

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

2 Write these percentages as fractions.

Write the fractions in their simplest form.

- (a) 1%      (b) 29%      (c) 26%      (d) 40%  
 (e) 42%      (f) 48%      (g) 44%      (h) 60%  
 (i) 12%      (j) 10%      (k) 8%      (l) 28%  
 (m) 55%      (n) 90%      (o) 45%      (p) 25%

### 16.3 Writing percentages as decimals

You can also write a percentage as a decimal:

$$3\% \text{ means } \frac{3}{100} \text{ means } 3 \div 100 = 0.03$$

■ To change a percentage to a decimal divide by 100.

For example:  $23\%$  means  $23 \div 100 = 0.23$

Remember: to divide by 100 move every digit 2 places to the right.

#### Example 2

Write these percentages as decimals:

- (a) 37%      (b) 70%

(a)  $37\% = 37 \div 100 = 0.37$

(b)  $70\% = 70 \div 100 = 0.70 = 0.7$

### Exercise 16C

Change these percentages to decimals:

- 1 12%      2 29%      3 66%      4 25%
- 5 8%      6 35%      7 42%      8 3%
- 9 17%      10 1%      11 5%      12 82%
- 13 99%      14 7%      15 16%      16 80%

17 Copy and complete this table of equivalent percentages, fractions and decimals.

Percentage	Fraction	Decimal
80%	$\frac{4}{5}$	0.8
70%		
10%		
	$\frac{1}{100}$	
	$\frac{1}{2}$	
		0.25
	$\frac{3}{4}$	
100%		

Hint: to change a fraction to a decimal you divide the top by the bottom, for example  
 $\frac{3}{5} = 3 \div 5 = 0.6$

## 16.4 Writing fractions and decimals as percentages

### From decimal to percentage

To change a percentage to a decimal divide by 100.

$$\begin{array}{c}
 \div 100 \\
 \curvearrowright \\
 22\% = 0.22 \\
 \curvearrowleft \\
 \times 100
 \end{array}$$

Notice that  $\div 100$  and  $\times 100$  are inverse operations. There is more about inverses on page 231.

- To change a decimal to a percentage multiply by 100.

**From fraction to percentage**

## ■ To change a fraction to a percentage:

- find an equivalent fraction with denominator 100
- multiply the fraction by 100%

$$\frac{11}{50} \xrightarrow{\times 2} \frac{22}{100} = 22\%$$

## ■ If you can't find an equivalent fraction with denominator 100:

- change the fraction to a decimal
- change the decimal to a percentage

$$\frac{6}{15} = 0.4$$

$$0.4 \times 100 = 40\%$$

**Exercise 16D**

## 1 Change each of these decimals to percentages:

- (a) 0.25   (b) 0.75   (c) 0.16   (d) 0.5   (e) 1.25  
 (f) 0.05   (g) 0.01   (h) 1.01   (i) 2.25   (j) 1.32

Remember: a percentage can be greater than 100%.

## 2 Change each of these fractions to percentages:

- (a)  $\frac{50}{100}$    (b)  $\frac{33}{100}$    (c)  $\frac{1}{100}$    (d)  $\frac{4}{100}$    (e)  $\frac{22}{50}$   
 (f)  $\frac{7}{25}$    (g)  $\frac{3}{10}$    (h)  $\frac{3}{2}$    (i)  $\frac{3}{20}$    (j)  $\frac{1}{8}$

## 3 Write each of these as:

- a fraction in its simplest form
- a percentage

- (a) 0.2   (b) 0.11   (c) 0.03   (d) 1.6   (e) 0.003

## 4 Convert these fractions to percentages and mark them on this number line:

- (a)  $\frac{6}{8}$    (b)  $\frac{10}{200}$    (c)  $\frac{50}{40}$    (d)  $\frac{7}{20}$    (e)  $\frac{3}{5}$

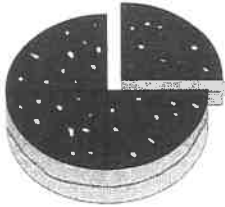




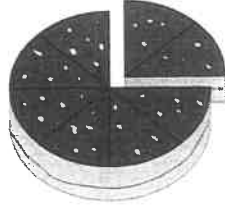
## 6.2 Equivalent fractions

Ayana, Louise and Adam are eating cake:

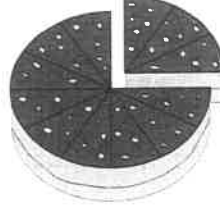
Ayana eats  $\frac{1}{4}$   
of her cake ...



Louise eats  $\frac{2}{8}$   
of hers ...



Adam eats  $\frac{3}{12}$   
of his ...



The fractions  $\frac{1}{4}$ ,  $\frac{2}{8}$  and  $\frac{3}{12}$  all represent the same amount of cake.

■ **Fractions that have the same value are called equivalent fractions.**

For example,  $\frac{1}{4} = \frac{2}{8} = \frac{3}{12}$

Equivalent fractions can be found by multiplying or dividing the numerator and denominator by the same number.

For example:

$$\frac{1}{3} \begin{array}{l} \xrightarrow{\text{1 multiplied by 2 is 2}} \frac{2}{6} \\ \xrightarrow{\text{3 multiplied by 2 is 6}} \end{array} \begin{array}{l} \xrightarrow{\text{2 multiplied by 3 is 6}} \frac{6}{18} \\ \xrightarrow{\text{6 multiplied by 3 is 18}} \end{array}$$

$$\text{or } \frac{1}{3} \begin{array}{l} \xrightarrow{\text{1 multiplied by 7 is 7}} \frac{7}{21} \\ \xrightarrow{\text{3 multiplied by 7 is 21}} \end{array}$$

so  $\frac{1}{3} = \frac{2}{6} = \frac{6}{18} = \frac{7}{21}$  are equivalent fractions

Notice that  $\frac{3}{4}$  is the **simplest form** of the fraction  $\frac{30}{40}$ .

There is no equivalent fraction with smaller numbers on the top and bottom.

Also:

$$\frac{30}{40} \begin{array}{l} \xrightarrow{\text{30 divided by 2 is 15}} \frac{15}{20} \\ \xrightarrow{\text{40 divided by 2 is 20}} \end{array} \begin{array}{l} \xrightarrow{\text{15 divided by 5 is 3}} \frac{3}{4} \\ \xrightarrow{\text{20 divided by 5 is 4}} \end{array}$$

**Example 3**

Complete this set of equivalent fractions.

(a)  $\frac{1}{2} = \frac{\quad}{4} = \frac{\quad}{10}$

(b)  $\frac{24}{32} = \frac{\quad}{16} = \frac{\quad}{4}$

(a) Multiply the numerator and denominator by 2:

$$\begin{array}{ccc} & \times 2 & \\ \text{↖} & & \text{↗} \\ \frac{1}{2} & = & \frac{2}{4} \\ \text{↘} & & \text{↙} \\ & \times 2 & \end{array}$$

Multiply the numerator and denominator by 5:

$$\begin{array}{ccc} & \times 5 & \\ \text{↖} & & \text{↗} \\ \frac{1}{2} & = & \frac{5}{10} \\ \text{↘} & & \text{↙} \\ & \times 5 & \end{array}$$

So the set of equivalent fractions is:

$$\frac{1}{2} = \frac{2}{4} = \frac{5}{10}$$

(b) Divide the numerator and denominator by 2 ...

$$\begin{array}{ccc} \div 2 & & \div 4 \\ \text{↖} & & \text{↗} \\ \frac{24}{32} & = & \frac{12}{16} = \frac{3}{4} \\ \text{↘} & & \text{↙} \\ \div 2 & & \div 4 \end{array}$$

Dividing top and bottom by the same number is called **cancelling**.

... and then divide again by 4

**Exercise 6B**

1 Copy these sets of fractions. Fill in the missing numbers to make the fractions equivalent.

(a)  $\frac{1}{4} = \frac{?}{8} = \frac{6}{?} = \frac{3}{?}$

(b)  $\frac{2}{5} = \frac{4}{?} = \frac{?}{15} = \frac{10}{?}$

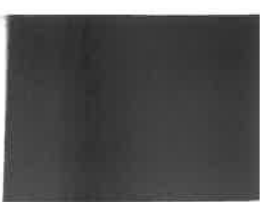
(c)  $\frac{3}{10} = \frac{6}{?} = \frac{9}{?} = \frac{?}{100}$

- 2 Nick and Harry each have the same amount of pocket money. Harry spends two tenths of his money. Nick spends four twentieths of his. Does Nick spend more than Harry? Explain your answer.
- 3 Which of these fractions are the same?

$\frac{1}{4}$	$\frac{6}{10}$	$\frac{4}{9}$	$\frac{7}{12}$	$\frac{35}{50}$	
$\frac{5}{6}$	$\frac{7}{10}$	$\frac{2}{3}$	$\frac{3}{5}$	$\frac{16}{36}$	$\frac{15}{18}$

- 4 Find all the sets of equivalent fractions.

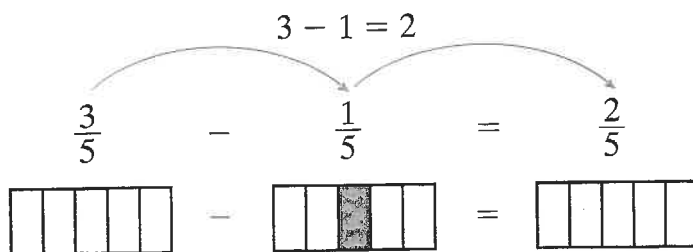
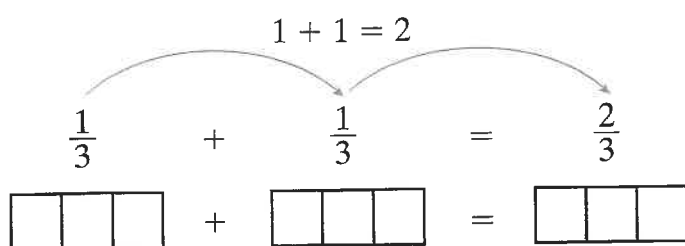
$\frac{6}{21}$	$\frac{18}{24}$	$\frac{1}{5}$	$\frac{25}{40}$	$\frac{14}{49}$	$\frac{10}{16}$
$\frac{3}{15}$	$\frac{10}{50}$	$\frac{5}{8}$	$\frac{12}{16}$	$\frac{2}{7}$	$\frac{3}{4}$



Exa  
Wo:  
(a)  
(a)  
  
(b)  
.

## 6.5 Adding and subtracting fractions

It is easy to add or subtract fractions if they belong to the same fraction family.



Remember:  
The denominator of  
a fraction tells you  
the fraction family:

$$\frac{5}{7}$$

The fraction family  
is sevenths.

The answer is in the  
same fraction  
family, thirds.

Keep the same  
denominator

- To add or subtract fractions with the same denominator add or subtract the numerators and write the result over the same denominator.

Ad  
Do  
Sh  
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To  
wit

**Example 5**

Work out:

(a)  $\frac{1}{10} + \frac{2}{10}$

(b)  $\frac{7}{8} - \frac{3}{8}$

(a) The fraction family is the same so just add:

$$\frac{1}{10} + \frac{2}{10} = \frac{3}{10}$$

1 + 2 = 3

Denominator is 10

(b) Both denominators are the same so just subtract:

$$\frac{7}{8} - \frac{3}{8} = \frac{4}{8}$$

7 - 3 = 4

Fraction family is eighths

**Adding and subtracting fractions with different denominators**

Donna gets  $\frac{1}{3}$  of her homework done at school.

She does  $\frac{1}{4}$  of it before dinner.

How much of her homework has she done?

To add the fractions find equivalent fractions with the same denominators:



$$\frac{1}{3} = \frac{4}{12}$$

×4

$$\frac{1}{4} = \frac{3}{12}$$

×3

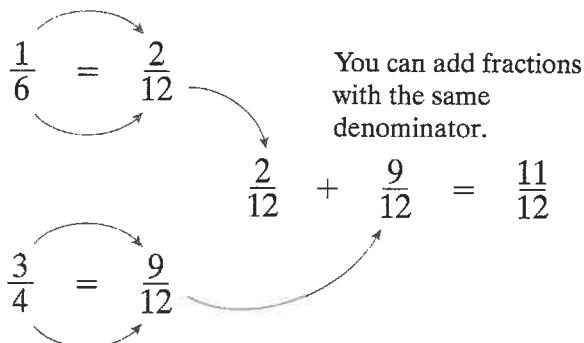
Same denominators:  
easy to add.

$$\frac{4}{12} + \frac{3}{12} = \frac{7}{12}$$

so  $\frac{1}{3} + \frac{1}{4} = \frac{4}{12} + \frac{3}{12} = \frac{7}{12}$

**Example 6**Work out  $\frac{1}{6} + \frac{3}{4}$ 

Find equivalent fractions with the same denominator:



You can add fractions with the same denominator.

$$\frac{2}{12} + \frac{9}{12} = \frac{11}{12}$$

- To add (or subtract) fractions with different denominators find equivalent fractions with the same denominators.

**Exercise 6E**

- Add the following fractions:
 

(a)  $\frac{1}{9} + \frac{2}{9}$    (b)  $\frac{3}{7} + \frac{1}{7}$    (c)  $\frac{2}{11} + \frac{5}{11}$    (d)  $\frac{1}{8} + \frac{2}{8}$

(e) Find an equivalent fraction for each of your answers.
- Subtract the following fractions:
 

(a)  $\frac{4}{10} - \frac{1}{10}$    (b)  $\frac{3}{13} - \frac{2}{13}$    (c)  $\frac{11}{12} - \frac{2}{12}$

(d) Find an equivalent fraction for each of your answers.
- Erin had  $\frac{3}{8}$  m of a roll of paper, she gave  $\frac{1}{8}$  m to Marie. How much did she have left?
- James cycles  $\frac{4}{8}$  of the way to school. He gets a flat tyre and has to walk for  $\frac{3}{8}$  of the journey to a garage to be able to fix his bike. How far had he still to go to school?
- Add the following fractions:
 

(a)  $\frac{2}{5} + \frac{1}{8}$    (b)  $\frac{7}{10} + \frac{1}{20}$    (c)  $\frac{3}{4} + \frac{1}{9}$

(d)  $\frac{4}{15} + \frac{1}{30}$    (e)  $\frac{5}{9} + \frac{2}{3}$    (f)  $\frac{7}{12} + \frac{5}{8}$

- 6 Morgan is listening to the radio in his car. He listens to jazz for half the journey and the news for a third of his journey. He then turns the radio off. For what fraction of the journey does he listen to the radio?

- 7 Subtract the following fractions:

(a)  $\frac{9}{10} - \frac{2}{5}$

(b)  $\frac{3}{4} - \frac{7}{20}$

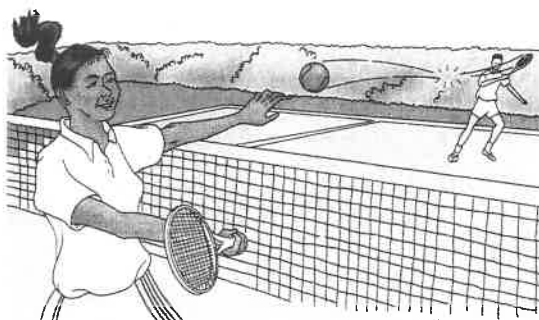
(c)  $\frac{7}{8} - \frac{5}{6}$

(d)  $\frac{9}{10} - \frac{4}{15}$

(e)  $\frac{3}{4} - \frac{3}{20}$

(f)  $\frac{8}{12} - \frac{1}{4}$

- 8 Gina and Paul went on holiday to France. They spent  $\frac{3}{10}$  of the day playing sport.  $\frac{1}{5}$  was spent on swimming, how much of their time was left for other sports?



## Summary of key points

- Fractions that have the same value are called equivalent fractions.
- A mixed number is a mixture of a whole number and a fraction.  
 $1\frac{1}{2}$ ,  $2\frac{1}{3}$ ,  $10\frac{4}{7}$ ,  $9\frac{2}{5}$ , are all mixed numbers.
- An improper fraction has a numerator that is larger than the denominator.  
 $\frac{3}{2}$ ,  $\frac{9}{5}$ ,  $\frac{4}{3}$ ,  $\frac{17}{4}$ , are all improper fractions.
- To add or subtract fractions with the same denominator add or subtract the numerators and write the result over the same denominator.
- To add (or subtract) fractions with different denominators find equivalent fractions with the same denominators.