Calculations with fractions

- Adding and subtracting fractions with different denominators
- Multiplying and dividing whole numbers by fractions
- Multiplying and dividing fractions by fractions
- Cancelling common factors before multiplying and dividing fractions

Keywords

You should know

explanation 1

1 Work these out, giving each answer in its simplest form.

a $\dfrac{4}{7} + \dfrac{2}{7}$　　b $\dfrac{3}{5} - \dfrac{1}{5}$　　c $\dfrac{2}{13} + \dfrac{5}{13}$　　d $\dfrac{3}{16} + \dfrac{5}{16}$

e $\dfrac{7}{18} - \dfrac{1}{18}$　　f $\dfrac{8}{21} - \dfrac{5}{21}$　　g $\dfrac{7}{25} + \dfrac{14}{25}$　　h $\dfrac{19}{30} - \dfrac{11}{30}$

2 Copy and complete.

$$\dfrac{2}{3} + \dfrac{1}{4} = \dfrac{\square}{12} + \dfrac{\square}{12} = \dfrac{\square + \square}{12} = \dfrac{\square}{12}$$

3 Work these out, giving each answer in its simplest form.

a $\dfrac{1}{5} + \dfrac{7}{10}$　　b $\dfrac{3}{8} + \dfrac{1}{4}$　　c $\dfrac{3}{7} + \dfrac{5}{14}$　　d $\dfrac{7}{12} + \dfrac{1}{6}$

e $\dfrac{4}{14} + \dfrac{1}{42}$　　f $\dfrac{16}{32} + \dfrac{4}{8}$　　g $\dfrac{3}{13} + \dfrac{5}{39}$　　h $\dfrac{7}{9} + \dfrac{1}{81}$

4 Work these out, giving each answer in its simplest form.

a $\dfrac{2}{3} + \dfrac{3}{4}$　　b $\dfrac{3}{4} + \dfrac{4}{5}$　　c $\dfrac{5}{6} + \dfrac{4}{9}$　　d $\dfrac{2}{3} + \dfrac{5}{7}$

e $\dfrac{4}{11} + \dfrac{1}{5}$　　f $\dfrac{6}{13} + \dfrac{1}{2}$　　g $\dfrac{2}{3} + \dfrac{5}{8}$　　h $\dfrac{7}{11} + \dfrac{1}{8}$

5 Copy and complete.

$$\dfrac{3}{4} - \dfrac{2}{5} = \dfrac{\square}{20} - \dfrac{\square}{20} = \dfrac{\square - \square}{20} = \dfrac{\square}{20}$$

6 Work these out, giving each answer in its simplest form.

a $\dfrac{3}{4} - \dfrac{5}{8}$ b $\dfrac{7}{8} - \dfrac{1}{4}$ c $\dfrac{7}{15} - \dfrac{1}{5}$ d $\dfrac{13}{18} - \dfrac{1}{3}$

e $\dfrac{17}{18} - \dfrac{5}{6}$ f $\dfrac{11}{32} - \dfrac{1}{8}$ g $\dfrac{19}{24} - \dfrac{3}{8}$ h $\dfrac{4}{21} - \dfrac{1}{7}$

7 Work these out, giving each answer in its simplest form.

a $\dfrac{8}{9} - \dfrac{1}{2}$ b $\dfrac{3}{5} - \dfrac{1}{4}$ c $\dfrac{7}{8} - \dfrac{2}{3}$ d $\dfrac{5}{6} - \dfrac{3}{4}$

e $\dfrac{11}{18} - \dfrac{5}{12}$ f $\dfrac{6}{7} - \dfrac{2}{5}$ g $\dfrac{4}{9} - \dfrac{2}{7}$ h $\dfrac{11}{19} - \dfrac{1}{3}$

8 Copy and complete this fraction addition square.

+	$\dfrac{1}{2}$	$\dfrac{2}{3}$	
$\dfrac{1}{5}$			
	$\dfrac{3}{4}$		
$\dfrac{2}{7}$			$\dfrac{37}{56}$

> explanation 2

9 Copy and complete this fraction addition square.
Remember to simplify your answers.

+	$1\dfrac{1}{3}$	$2\dfrac{1}{3}$	
$\dfrac{2}{5}$			$1\dfrac{1}{3}$
		$\dfrac{1}{2}$	
$2\dfrac{1}{4}$			

10 Although early Egyptians used fractions like $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$, they did not have notation to write fractions such as $\frac{2}{3}, \frac{4}{5}$ or $\frac{2}{11}$ (though later they used a special symbol for $\frac{2}{3}$).
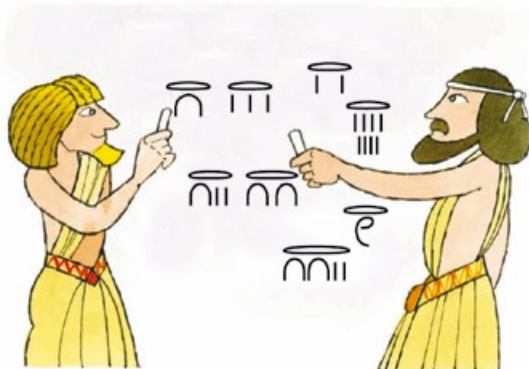
The fractions they used all had a numerator of one and are called unit fractions. The Egyptians were able to write any fraction as a sum of unit fractions.

For example, $\frac{3}{8} = \frac{1}{4} + \frac{1}{8}$ $\frac{5}{12} = \frac{1}{4} + \frac{1}{6}$ $\frac{7}{9} = \frac{1}{2} + \frac{1}{4} + \frac{1}{36}$

Write these fractions as Egyptian fractions (do not use the same denominator for all your Egyptian fractions).

Some can be done in more than one way!

a $\frac{5}{8}$ **b** $\frac{7}{12}$ **c** $\frac{13}{15}$

d $\frac{9}{20}$ **e** $\frac{17}{30}$

explanation 3a   explanation 3b

11 Work these out.

a $\frac{2}{3}$ of 16   **b** $\frac{2}{5}$ of £240   **c** $\frac{3}{8}$ of 150 g

d $\frac{4}{7}$ of 50 kg   **e** three quarters of 75   **f** five ninths of 30

g $\frac{5}{12}$ of 100 cm   **h** $\frac{5}{6}$ of 40p   **i** $\frac{7}{8}$ of 140 m

12 Two of the answers in each set will be the same. Find each odd one out.

a i $\frac{3}{4}$ of 64   **ii** $\frac{7}{11} \times 77$ **iii** $\frac{3}{5}$ of 80

b i $\frac{5}{8}$ of 48   **ii** $\frac{4}{7}$ of 56   **iii** one third of 96

13 This pie chart shows the colours of 80 cars in a car park.

a $\frac{1}{4}$ of the cars are silver.

How many silver cars are there?

b $\frac{3}{8}$ of the cars are red.

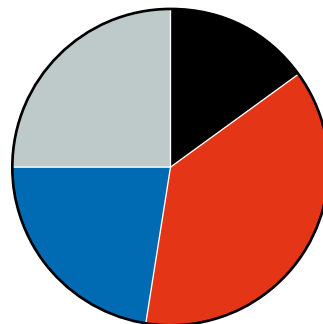How many red cars are there?

c   There are 12 black cars.

What fraction of the total number of cars is this?

d   How many blue cars are there?

e   What fraction of the cars are blue?

f   The sum of the angles at the centre of the pie chart is 360°.

Find the angle for each sector.

14 Work these out.

a $\frac{2}{5} \times 14$ b $\frac{4}{9} \times 24$ c $\frac{3}{5} \times 16$ d $\frac{4}{6} \times 32$

e $\frac{3}{8} \times 14$ f $\frac{5}{16} \times 9$ g $\frac{7}{9} \times 36$ h $\frac{1}{35} \times 14$

15 Work these out.

a $\frac{5}{6} \times 42 \, \text{kg}$ b $\frac{7}{12} \times 11 \, \text{kg}$ c $\frac{5}{3} \times 26 \, \text{cm}$ d $\frac{9}{5} \times 120 \, \text{g}$

e $\frac{6}{7} \times 15 \, \text{m}$ f $\frac{7}{9} \times 21 \, \text{seconds}$ g $\frac{3}{11} \times 17 \, \text{ml}$ h $\frac{4}{5} \times £84$

16 Copy and complete this grid.

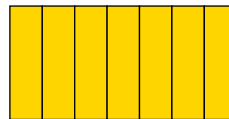| $\frac{2}{5}$	×	80	=	
×	■	×	■	×
105	×	$\frac{3}{10}$	=	
=	■	=	■	=
	×		=	

explanation 4a   explanation 4b

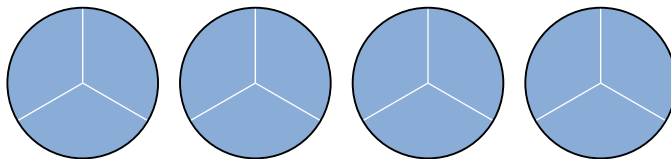**17** Write the reciprocal of each number.

a 5   **b** 7   **c** 10   **d** $\frac{1}{4}$ **e** $\frac{1}{8}$ **f** $\frac{1}{25}$
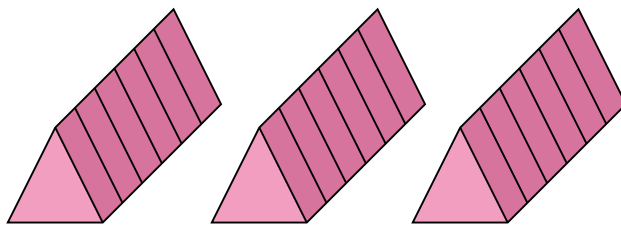
18 a How many sevenths are there in this rectangle?

b How many thirds of a circle are there in these four circles?

c How many sixths of a prism are there in these three prisms?

19 Copy and complete this sentence.

Dividing by $\frac{1}{5}$ is the same as multiplying by $\square$.

20 Work these out.

a $10 \div \frac{1}{2}$ **b** $9 \div \frac{1}{3}$ **c** $12 \div \frac{1}{5}$ **d** $20 \div \frac{1}{7}$

e $8 \div \frac{1}{4}$ **f** $15 \div \frac{1}{6}$ **g** $3 \div \frac{1}{10}$ **h** $1 \div \frac{1}{12}$

21 Copy and complete these number sentences.

a $30 \times \frac{1}{5} = \square$ therefore $\square \div \frac{1}{5} = 30$ and $\square \div 30 = \frac{1}{5}$

b $15 \times \frac{2}{5} = \square$ therefore $\square \div \frac{2}{5} = 15$ and $\square \div 15 = \frac{2}{5}$

c $\square \times \frac{3}{5} = 6$ therefore $6 \div \frac{3}{5} = \square$ and $6 \div \square = \frac{3}{5}$

d $\square \times \frac{4}{5} = 6$ therefore $6 \div \frac{4}{5} = \square$ and $6 \div \square = \frac{4}{5}$

22 Your answers to question **21** will help you answer these questions.

    a When you multiply a positive number by a fraction less than one is the answer a smaller or larger number than the first one?

    b When you divide a positive number by a fraction less than one is the answer a smaller or larger number than the first one?

> explanation 5

23 The diagram shows a 4 × 7 grid of squares.

    a What fraction of the diagram is coloured blue?

       Give your answer in its simplest form.

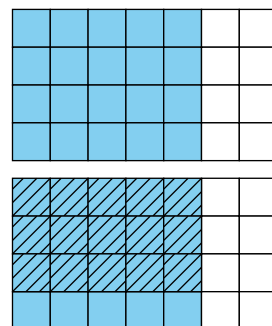   **b** What fraction of the blue squares are now shaded?

       Give your answer in its simplest form.

    c What fraction of the whole diagram is shaded?

    d Use your answers to parts **a**, **b** and **c** to complete

$$\frac{\square}{\square} \times \frac{\square}{\square} = \frac{\square}{\square}$$

24 Work these out.

    a $\dfrac{3}{8} \times \dfrac{7}{10}$ **b** $\dfrac{9}{11} \times \dfrac{4}{5}$ **c** $\dfrac{8}{15} \times \dfrac{2}{3}$

25 Work these out.

   **a** $\dfrac{9}{16} \times \dfrac{24}{25}$ **b** $\dfrac{11}{12} \times \dfrac{8}{33}$ **c** $\dfrac{21}{25} \times \dfrac{5}{14}$

26 In a survey, three-quarters of pupils said that they walk to school and two-thirds of these said that they regularly have a school dinner.

    a What fraction of the pupils in the survey walk to school and regularly have a school dinner? Show your calculation.

    b Which pupils are represented by the calculation $\dfrac{3}{4} \times \dfrac{1}{3}$?

27 For any input value these two function machines give the same output value.

$$\rightarrow \boxed{\times \frac{8}{9}} \rightarrow \boxed{\times \frac{15}{16}} \rightarrow$$

$$\rightarrow \boxed{\times F} \rightarrow$$
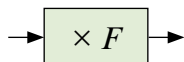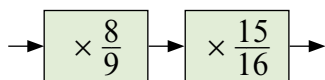
   a Write F as a fraction in its lowest terms.

   b What is the output when the input value is $\frac{4}{15}$?

explanation 6

28 Copy and complete.

$$24 \div \frac{12}{25} = 24 \times \frac{\square}{\square}$$
$$= \square$$

29 Work these out.

   a $32 \div \frac{8}{9}$ **b** $24 \div \frac{16}{3}$ **c** $12 \div \frac{18}{5}$

30 A large drill rotates once every $\frac{3}{4}$ second.

How many times will the drill rotate in one minute?

31 Work these out.

   a $\frac{2}{9} \div \frac{3}{4}$ **b** $\frac{1}{4} \div \frac{7}{8}$ **c** $\frac{5}{12} \div \frac{25}{24}$

32 A contractor has a budget of £$\frac{3}{4}$ million to cover all production costs on a project.

The production costs work out at £50 000 per month.

   a Write £50 000 as a fraction of £$\frac{3}{4}$ million.

   b How many months production can be paid for from the budget?