

# Percentage Calculations

Solutions



Curriculum Ready



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Page 3 questions

Fractions and percentages

1 a  $\frac{3}{100} = 3\%$     b  $\frac{41}{100} = 41\%$     c  $\frac{110}{100} = 110\%$     d  $\frac{200}{100} = 200\%$

2 a  $7\% = \frac{7}{100}$     b  $89\% = \frac{89}{100}$     c  $117\% = \frac{117}{100}$     d  $336\% = \frac{336}{100}$

3 a  $20\% = \frac{20}{100} = \frac{1}{5}$  Simplified    b  $15\% = \frac{15}{100} = \frac{3}{20}$  Simplified    c  $80\% = \frac{80}{100} = \frac{4}{5}$  Simplified

d  $24\% = \frac{24}{100} = \frac{6}{25}$  Simplified    e  $42\% = \frac{42}{100} = \frac{21}{50}$  Simplified    f  $96\% = \frac{96}{100} = \frac{24}{25}$  Simplified

g  $125\% = \frac{125}{100} = \frac{5}{4}$  Simplified improper    h  $180\% = \frac{180}{100} = \frac{9}{5}$  Simplified improper    i  $350\% = \frac{350}{100} = \frac{7}{2}$  Simplified improper

4 a  $\frac{24}{300} = \frac{24 \div 3}{300 \div 3} = \frac{8}{100} = 8\%$     b  $\frac{48}{200} = \frac{48 \div 2}{200 \div 2} = \frac{24}{100} = 24\%$     c  $\frac{175}{500} = \frac{175 \div 5}{500 \div 5} = \frac{35}{100} = 35\%$

## Page 4 questions

## Fractions and percentages

$$5 \quad a \quad \frac{3}{10} = \frac{3 \times 10}{10 \times 10}$$

$$= \frac{30}{100}$$

$$= 30\%$$

$$b \quad \frac{12}{25} = \frac{12 \times 4}{25 \times 4}$$

$$= \frac{48}{100}$$

$$= 48\%$$

$$c \quad \frac{6}{5} = \frac{6 \times 20}{5 \times 20}$$

$$= \frac{120}{100}$$

$$= 120\%$$

$$6 \quad a \quad 3\frac{1}{2} = \frac{7 \times 50}{2 \times 50}$$

$$= \frac{350}{100}$$

$$= 350\%$$

$$b \quad 2\frac{1}{4} = \frac{9 \times 25}{4 \times 25}$$

$$= \frac{225}{100}$$

$$= 225\%$$

$$c \quad 1\frac{2}{5} = \frac{7 \times 20}{5 \times 20}$$

$$= \frac{140}{100}$$

$$= 140\%$$

$$7 \quad a \quad \frac{1}{2} = 50\%$$

$$b \quad \frac{1}{5} = 20\%$$

$$c \quad \frac{8}{25} = 32\%$$

$$d \quad \frac{13}{50} = 26\%$$

$$e \quad \frac{5}{2} = 250\%$$

$$f \quad \frac{15}{20} = 75\%$$

$$8 \quad a \quad 2\frac{2}{5} = \frac{12}{5} = 240\%$$

$$b \quad 3\frac{3}{4} = \frac{15}{4} = 375\%$$

$$c \quad 1\frac{7}{20} = \frac{27}{20} = 135\%$$

$$d \quad 4\frac{9}{25} = \frac{109}{25} = 436\%$$

Page 5 questions

Fractions and percentages

- 9 a  $\frac{13}{500} = \frac{2.6}{100} = 2.6\% = 2\frac{3}{5}\%$   
 Decimal      Mixed numeral
- b  $\frac{30}{800} = \frac{3.75}{100} = 3.75\% = 3\frac{3}{4}\%$   
 Decimal      Mixed numeral
- c  $\frac{17}{400} = \frac{4.25}{100} = 4.25\% = 4\frac{1}{4}\%$   
 Decimal      Mixed numeral
- d  $\frac{26}{500} = \frac{5.2}{100} = 5.2\% = 5\frac{1}{5}\%$   
 Decimal      Mixed numeral
- e  $\frac{47}{500} = \frac{9.4}{100} = 9.4\% = 9\frac{2}{5}\%$   
 Decimal      Mixed numeral
- f  $\frac{42}{400} = \frac{10.5}{100} = 10.5\% = 10\frac{1}{2}\%$   
 Decimal      Mixed numeral
- 10 a  $\frac{3}{200} = \frac{1.5}{100} = 1.5\% = \frac{3}{2}\%$   
 Decimal      Improper fraction
- b  $\frac{7}{500} = \frac{1.4}{100} = 1.4\% = \frac{7}{5}\%$   
 Decimal      Improper fraction
- c  $\frac{9}{800} = \frac{1.125}{100} = 1.125\% = \frac{9}{8}\%$   
 Decimal      Improper fraction
- d  $\frac{9}{750} = \frac{1.2}{100} = 1.2\% = \frac{5}{4}\%$   
 Decimal      Improper fraction

Page 7 questions

Decimals and percentages

- 1 a  $15\% = 0.15$     b  $20\% = 0.20$     c  $4\% = 0.04$     d  $9\% = 0.09$   
 e  $125\% = 1.25$     f  $250\% = 2.50$     g  $110\% = 1.10$     h  $305\% = 3.05$
- 2 a  $0.03 = 3\%$     b  $0.16 = 16\%$     c  $1.12 = 112\%$     d  $2.45 = 245\%$   
 e  $0.125 = 12.5\%$     f  $0.253 = 25.3\%$     g  $0.018 = 1.8\%$     h  $0.2225 = 22.25\%$
- 3 a  $0.015 = 1.5\%$   
 Decimal  
 $= \frac{3}{2}\%$   
 Improper fraction
- b  $0.185 = 18.5\%$   
 Decimal  
 $= 18 \frac{1}{2}\%$   
 Mixed numeral
- c  $0.012 = 1.2\%$   
 Decimal  
 $= \frac{6}{5}\%$   
 Improper fraction
- d  $0.458 = 45.8\%$   
 Decimal  
 $= 45 \frac{4}{5}\%$   
 Mixed numeral
- 4 a  $155\% = 1.55 = 1 \frac{11}{20} = \frac{31}{20}$   
 Decimal    Mixed numeral    Improper fraction
- b  $218\% = 2.18 = 2 \frac{9}{50} = \frac{109}{50}$   
 Decimal    Mixed numeral    Improper fraction
- c  $100.5\% = 1.005 = 1 \frac{1}{200} = \frac{201}{200}$   
 Decimal    Mixed numeral    Improper fraction
- d  $220.4\% = 2.204 = 2 \frac{51}{250} = \frac{551}{250}$   
 Decimal    Mixed numeral    Improper fraction
- e  $375.20\% = 3.752 = 3 \frac{94}{125} = \frac{469}{125}$   
 Decimal    Mixed numeral    Improper fraction
- f  $125.8\% = 1.258 = 1 \frac{129}{500} = \frac{629}{500}$   
 Decimal    Mixed numeral    Improper fraction

## Page 8 questions

## Decimals and percentages

5 a Simplified fraction =  $\frac{1}{4}$

Decimal = 0.25

c Improper fraction form =  $\frac{19}{4}\%$

Decimal form = 4.75%

Simplified fraction =  $\frac{19}{400}$

Decimal = 0.0475

e Mixed numeral form =  $112\frac{1}{2}\%$

Improper fraction form =  $\frac{225}{2}\%$

Simplified mixed numeral =  $1\frac{1}{8}$

Decimal = 1.125

g Mixed numeral form =  $17\frac{1}{4}\%$

Improper fraction form =  $\frac{69}{4}\%$

Simplified fraction =  $\frac{69}{400}$

Decimal = 0.1725

i Mixed numeral form =  $2\frac{3}{8}\%$

Improper fraction form =  $\frac{19}{8}\%$

Simplified fraction =  $\frac{19}{800}$

Decimal = 0.02375

b Mixed numeral form =  $5\frac{1}{2}\%$

Improper fraction form =  $\frac{11}{2}\%$

Simplified fraction =  $\frac{11}{200}$

Decimal = 0.055

d Improper fraction form =  $\frac{17}{8}\%$

Decimal form = 2.125%

Simplified fraction =  $\frac{17}{800}$

Decimal = 0.02125

f Mixed numeral form =  $237\frac{1}{5}\%$

Improper fraction form =  $\frac{1186}{5}\%$

Simplified mixed numeral =  $2\frac{93}{250}$

Decimal = 2.372

h Decimal form = 7.1875%

Improper fraction form =  $\frac{115}{16}\%$

Simplified fraction =  $\frac{23}{320}$

Decimal = 0.071875

j Decimal form = 100.625%

Improper fraction form =  $\frac{805}{8}\%$

Simplified mixed numeral =  $1\frac{1}{160}$

Decimal = 1.00625

Page 10 questions

Recurring decimals and percentages

1 a  $0.\dot{1}\% = \frac{1}{9}\%$     b  $0.\dot{5}\% = \frac{5}{9}\%$     c  $0.0\dot{7}\% = \frac{7}{90}\%$     d  $0.0\dot{6}\% = \frac{1}{15}\%$

2 a  $0.1\dot{3}\% = \frac{1}{10} + \frac{3}{90}\% = \frac{2}{15}\%$     b  $0.3\dot{8}\% = \frac{3}{10} + \frac{8}{90}\% = \frac{7}{18}\%$

c  $0.08\dot{3} = \frac{8}{100} + \frac{3}{900}\% = \frac{1}{12}\%$     d  $0.05\dot{7}\% = \frac{5}{100} + \frac{7}{900}\% = \frac{13}{225}\%$

3 a  $23\frac{1}{3}\% = 23.\dot{3}\%$  (Decimal form)  $= 0.\dot{2}\dot{3}$  (Equivalent decimal)  
 $= \frac{7}{30}$  (Fraction)

b  $14\frac{4}{9}\% = 14.\dot{4}\%$  (Decimal form)  $= 0.\dot{1}\dot{4}$  (Equivalent decimal)  
 $= \frac{13}{90}$  (Fraction)

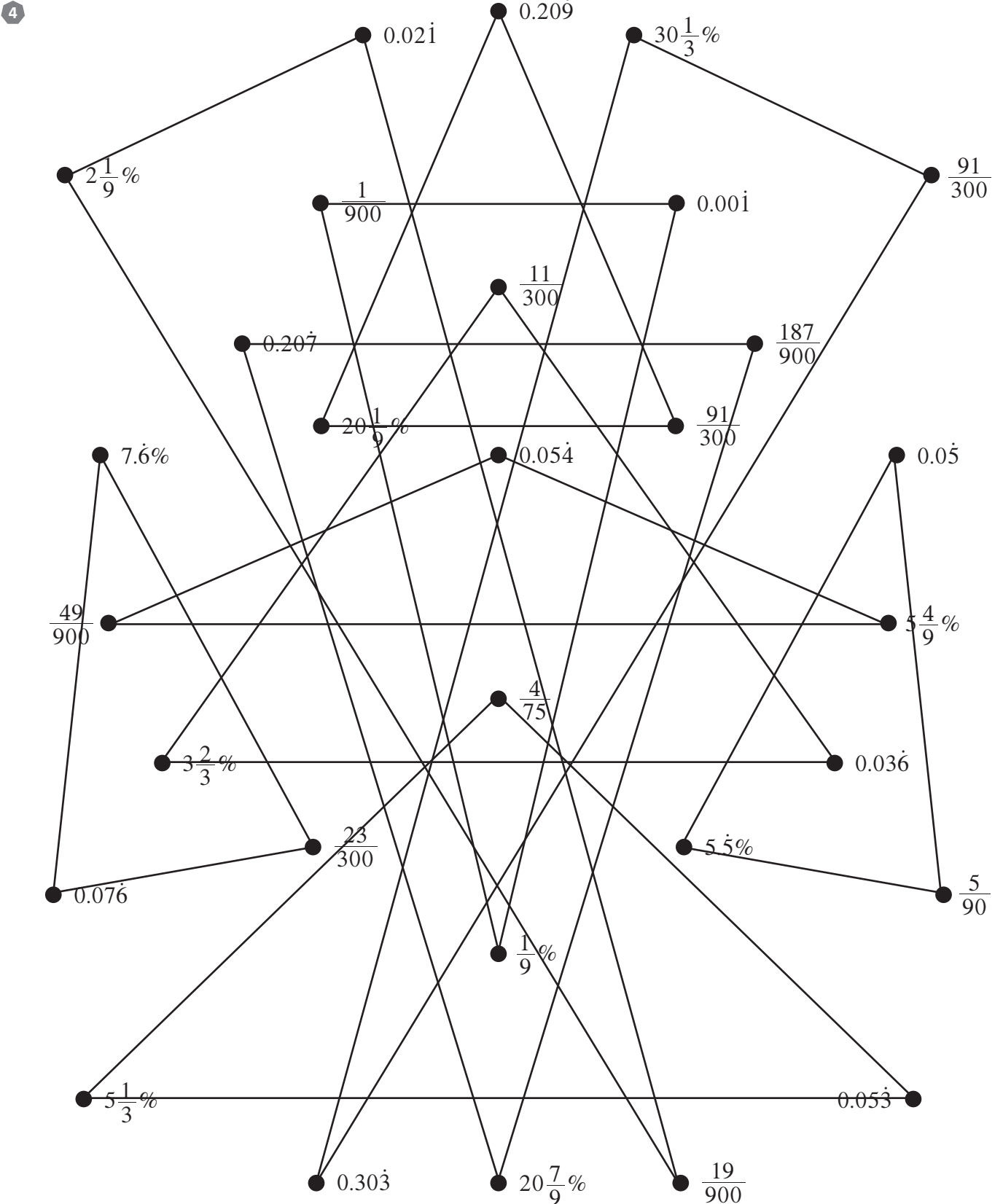
c  $5\frac{1}{9}\% = 5.\dot{1}\%$  (Decimal form)  $= 0.05\dot{1}$  (Equivalent decimal)  
 $= \frac{23}{450}$  (Fraction)

d  $9\frac{2}{3}\% = 9.\dot{6}\%$  (Decimal form)  $= 0.09\dot{6}$  (Equivalent decimal)  
 $= \frac{29}{300}$  (Fraction)



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Recurring decimals and percentages



## Page 12 questions

## Recurring decimals and percentages

$$\begin{aligned}
 \text{5 a } \frac{8}{11} &= \frac{8}{11} \div \frac{11}{11} \\
 &= 0.\dot{7}\dot{2} \text{ Recurring decimal} \\
 &= 0.\dot{7}\dot{2} \times 100 \% \\
 &= 72.7 \% \\
 &\text{Equivalent percentage to 1 d.p.}
 \end{aligned}$$

$$\begin{aligned}
 \text{b } \frac{19}{12} &= \frac{19}{12} \div \frac{12}{12} \\
 &= 1.58\dot{3} \text{ Recurring decimal} \\
 &= 1.58\dot{3} \times 100 \% \\
 &= 158.3 \% \\
 &\text{Equivalent percentage to 1 d.p.}
 \end{aligned}$$

$$\begin{aligned}
 \text{c } \frac{5}{6} &= \frac{0.8\dot{3}}{1} \\
 &\text{Recurring decimal} \\
 &= 83.3 \% \\
 &\text{Percentage to 1 d.p.}
 \end{aligned}$$

$$\begin{aligned}
 \text{d } \frac{2}{15} &= \frac{0.1\dot{3}}{1} \\
 &\text{Recurring decimal} \\
 &= 13.3 \% \\
 &\text{Percentage to 1 d.p.}
 \end{aligned}$$

$$\begin{aligned}
 \text{e } \frac{5}{18} &= \frac{0.2\dot{7}}{1} \\
 &\text{Recurring decimal} \\
 &= 27.8 \% \\
 &\text{Percentage to 1 d.p.}
 \end{aligned}$$

$$\begin{aligned}
 \text{f } \frac{9}{22} &= \frac{0.4\dot{0}\dot{9}}{1} \\
 &\text{Recurring decimal} \\
 &= 40.9 \% \\
 &\text{Percentage to 1 d.p.}
 \end{aligned}$$

$$\begin{aligned}
 \text{g } \frac{7}{12} &= \frac{0.58\dot{3}}{1} \\
 &\text{Recurring decimal} \\
 &= 58.3 \% \\
 &\text{Percentage to 1 d.p.}
 \end{aligned}$$

$$\begin{aligned}
 \text{h } \frac{13}{33} &= \frac{0.3\dot{9}}{1} \\
 &\text{Recurring decimal} \\
 &= 39.4 \% \\
 &\text{Percentage to 1 d.p.}
 \end{aligned}$$

$$\begin{aligned}
 \text{i } \frac{12}{11} &= \frac{1.0\dot{9}}{1} \\
 &\text{Recurring decimal} \\
 &= 109.1 \% \\
 &\text{Percentage to 1 d.p.}
 \end{aligned}$$

$$\begin{aligned}
 \text{j } \frac{17}{15} &= \frac{1.1\dot{3}}{1} \\
 &\text{Recurring decimal} \\
 &= 113.3 \% \\
 &\text{Percentage to 1 d.p.}
 \end{aligned}$$

$$\begin{aligned}
 \text{k } \frac{16}{12} &= \frac{1.\dot{3}}{1} \\
 &\text{Recurring decimal} \\
 &= 133.3 \% \\
 &\text{Percentage to 1 d.p.}
 \end{aligned}$$

## Page 14 questions

## Complementary percentages

- 1
- a 10%  
Complement = 90%
- b 25%  
Complement = 75%
- c 55%  
Complement = 45%
- d 37%  
Complement = 63%
- e 2%  
Complement = 98%
- f 99%  
Complement = 1%
- 2
- a 0.4  
Complement = 0.6
- b 0.8  
Complement = 0.2
- c 0.75  
Complement = 0.25
- d 0.65  
Complement = 0.35
- e 0.32  
Complement = 0.68
- f 0.07  
Complement = 0.93
- g 0.6  
Complement = 0.4
- h 0.8  
Complement = 0.2
- i 0.14  
Complement = 0.86
- 3
- a  $\frac{1}{3}$   
Complement =  $\frac{2}{3}$
- b  $\frac{3}{4}$   
Complement =  $\frac{1}{4}$
- c  $\frac{4}{5}$   
Complement =  $\frac{1}{5}$
- d  $\frac{1}{2}$   
Complement =  $\frac{1}{2}$
- e  $\frac{7}{10}$   
Complement =  $\frac{3}{10}$
- f  $\frac{13}{25}$   
Complement =  $\frac{12}{25}$
- 4
- a 65.5%  
Complement = 34.5%
- b 0.5%  
Complement = 99.5%
- c 12.75%  
Complement = 87.25%
- d 30.15%  
Complement = 69.85%
- e 73.12%  
Complement = 26.88%
- f 90.99%  
Complement = 9.01%
- g  $22\frac{1}{5}\%$   
Complement =  $77\frac{4}{5}\%$
- h  $90\frac{5}{6}\%$   
Complement =  $9\frac{1}{6}\%$
- i  $\frac{3}{20}\%$   
Complement =  $99\frac{17}{20}\%$

## Page 16 questions

## Percentages of an amount

$$\begin{aligned} 1 \quad a \quad 15\% \text{ of } 40 &= \frac{15}{100} \times 40 \\ &= 6 \end{aligned}$$

$$\begin{aligned} b \quad 28\% \text{ of } 75 &= \frac{28}{100} \times 75 \\ &= 21 \end{aligned}$$

$$\begin{aligned} c \quad 65\% \text{ of } 60 &= \left\{ \frac{65}{100} \right\} \times 60 \\ &= 0.65 \times 60 \\ &= 39 \end{aligned}$$

$$\begin{aligned} d \quad 22.5\% \text{ of } 280 &= \left\{ \frac{22.5}{100} \right\} \times 280 \\ &= 0.225 \times 280 \\ &= 63 \end{aligned}$$

$$\begin{aligned} 2 \quad a \quad \frac{20}{100} \times 65 &= 0.2 \times 65 \\ &= 13 \end{aligned}$$

$$\begin{aligned} b \quad \frac{60}{100} \times 35 &= 0.6 \times 35 \\ &= 21 \end{aligned}$$

$$\begin{aligned} c \quad \frac{22}{100} \times 25 &= 0.22 \times 25 \\ &= 5.5 \end{aligned}$$

$$\begin{aligned} d \quad \frac{15}{100} \times 30 &= 0.15 \times 30 \\ &= 4.5 \end{aligned}$$

$$\begin{aligned} e \quad \frac{67.5}{100} \times 48 &= 0.675 \times 48 \\ &= 32.4 \end{aligned}$$

$$\begin{aligned} f \quad \frac{34.5}{100} \times 14 &= 0.345 \times 14 \\ &= 4.83 \end{aligned}$$

$$\begin{aligned} g \quad \frac{125}{100} \times 12 &= 1.25 \times 12 \\ &= 15 \end{aligned}$$

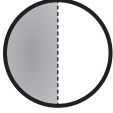
$$\begin{aligned} h \quad \frac{220}{100} \times 40 &= 2.20 \times 40 \\ &= 88 \end{aligned}$$


$$\begin{aligned} i \quad \frac{150}{100} \times 15 &= 1.5 \times 15 \\ &= 22.5 \end{aligned}$$


$$\begin{aligned} j \quad \frac{175}{100} \times 79 &= 1.75 \times 79 \\ &= 138.25 \end{aligned}$$

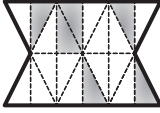
Page 17 questions

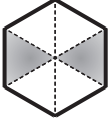
Percentages of an amount


3 a  = 50 %


b  = 25 %

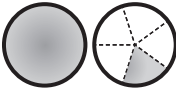
c  = 60 %


d  = 30 %

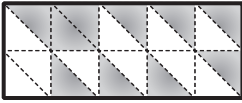
e  = 33.3 %

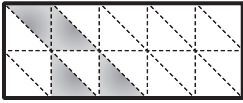
f  = 62.5 %

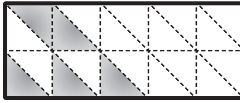
g  = 250 %

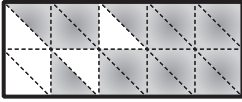
h  = 120 %

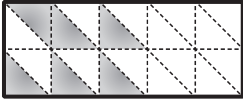
i  = 375 %

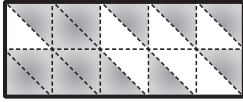
4 a 50% 

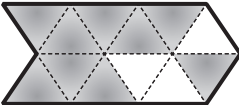
b 20% 

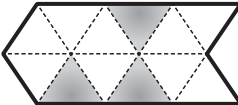
c 25% 

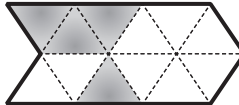
d 75% 

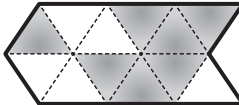
e 30% 

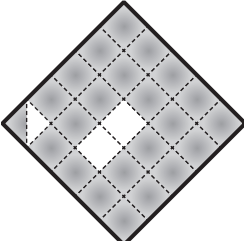
f 65% 

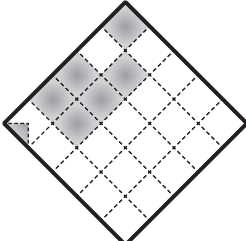
5 a 0.75 

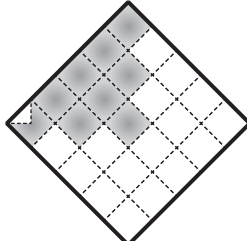
b 0.25 

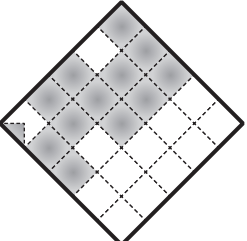
c 0.3 

d 0.583̄ 

6 a 90% 

b 25% 

c 35% 

d 49% 

## Page 18 questions

## Percentages of an amount

- 6 a 40% chose vegetarian course.  $\therefore \frac{40}{100} \times 95 = 38$   
 $\therefore$  38 of the diners chose the vegetarian course.
- b 30% of the time was in meetings.  $\therefore \frac{30}{100} \times 8 = 2.4$  hours  
 $\therefore$  Mitch spent 2 hours and 24 minutes in meetings.
- c 15.5% of the tickets still available.  $\therefore \frac{15.5}{100} \times 12\,800 = 1984$  tickets  
 $\therefore$  There are 1984 tickets available after 1 hour.
- d 42% of the time was right paddle.  $\therefore \frac{42}{100} \times 3650 = 1533$   
 $\therefore$  The right paddle entered the water 1533 times.

7 40% of 75  $\implies \frac{40}{100} \times 75 = 30$

75% of 40  $\implies \frac{75}{100} \times 40 = 30$

This is true for all percentage calculations because both are the same calculation and are examples of the commutative law ( $a \times b = b \times a$ ).

$$40\% \text{ of } 75 = \frac{40}{100} \times 75 = \frac{40}{100} \times \frac{75}{1} = \frac{40 \times 75}{100} = \frac{75 \times 40}{100} = \frac{75}{100} \times \frac{40}{1} = \frac{75}{100} \times 40 = 75\% \text{ of } 40$$

## Page 19 questions

## Percentages of an amount

- 8 25% of the 64GB left.  $\therefore \frac{25}{100} \times 64 = 16$   
 $\therefore$  There are 16GB left on the music device.
- 9 87.5% of the listed items in the shopping trolley.  $\therefore \frac{87.5}{100} \times 96 = 84$   
 $\therefore$  There 84 of the listed items are in the shopping trolley.
- 10 0.57 of the pieces are left to complete the puzzle.  $\therefore 0.57 \times 900 = 513$   
 $\therefore$  513 pieces still need to be placed to complete the jigsaw puzzle.
- 11 (i) The sled has  $1 - 0.15 = 0.85$  of the way down left to go.  
 (ii)  $0.85$  of the way down the hill left.  $\therefore 0.85 \times 450 = 382.5$

## Page 20 questions

## Percentages of an amount

$$12 \quad (i) \quad 1 - \frac{1}{3} = \frac{2}{3} = 66.\dot{6}\%$$

$\therefore 66.\dot{6}\%$  of the lightning strikes did not occur on the golf course.

$$(ii) \quad \frac{2}{3} \times 78 = 52$$

$\therefore 52$  of the lightning strikes did not occur on the golf course.

$$13 \quad 100\% - 83\frac{1}{3}\% = 16\frac{2}{3}\%$$

$$\therefore \text{Number of surveys not returned} = \frac{16.\dot{6}}{100} \times 252 = 42$$

$\therefore 42$  of the surveys posted out were not returned.

$$14 \quad \text{Total number of dots} = 6 + 5 + 4 + 3 + 2 + 1 = 21$$

$$100\% - 14\frac{2}{7}\% = 85\frac{5}{7}\%$$

$$\therefore \text{Number of other non-centred dots} = \frac{85\frac{5}{7}}{100} \times 21 = 18$$

$\therefore 18$  of the dots on a normal dice are not located at the centre of a side.

$$15 \quad (i) \quad 0.795\dot{3} \times 18 = 14.316$$

$\therefore$  The water level is 14.3m from the top of the well accurate to 1 decimal place.

$$(ii) \quad \text{Water level} = 18 - 14.316 = 3.684 \text{ m}$$

$$\therefore \text{The water level is } \frac{3.684}{18} \times 100 = 20\frac{7}{15}\% \text{ of the well is full.}$$

$\therefore < 25\%$ , so the water level indicates drought conditions.

## Page 22 questions

## One amount as a percentage of another

$$1 \quad a \quad \frac{35}{50} \times 100\% = 70\%$$

$$b \quad (3.2 \div 5) \times 100\% = 64\%$$

$$2 \quad a \quad (17 \div 22.5) \times 100\% = 75.\dot{5}\% \\ = 75\frac{5}{9}\%$$

$$b \quad \left(\frac{1}{3} \div \frac{4}{5}\right) \times 100\% = 41.\dot{6}\% \\ = 41\frac{2}{3}\%$$

$$3 \quad a \quad (10.5 \div 83.4) \times 100\% = 12.58992806\dots\% \\ \approx 12.59\% \text{ (to 2 d.p.)}$$

$$b \quad (12.2\dot{5} \div 50) \times 100\% = 24.5\dot{1}\% \\ \approx 24.51\% \text{ (to 2 d.p.)}$$

$$4 \quad a \quad (15.3 \div 22.5) \times 100\% = 68\%$$

Pencil type

HB

$$b \quad (13.05 \div 22.5) \times 100\% = 58\%$$

Pencil type

3H

$$c \quad (18.225 \div 22.5) \times 100\% = 81\%$$

Pencil type

5B

$$d \quad (16.825 \div 22.5) \times 100\% = 75\%$$

Pencil type

3B

$$5 \quad 40 - 25 = 15 \text{ vegetables do not get a nutritional report.}$$

$$\therefore (15 \div 40) \times 100\% = 37.5\%$$

$\therefore 37.5\%$  of the vegetables do not get a nutritional report written about them.



**Page 23 questions****One amount as a percentage of another**

6  $582 - 368 = 214$  birds wait for the first flock to leave.

$$\therefore (214 \div 582) \times 100\% = 36.76975945\dots\%$$

$\therefore \approx 37\%$  of the migrating birds leave as part of the second flock.

7 a  $(361130976 \div 510072000) \times 100\% = 70.8\%$

$\therefore 70.8\%$  of the Earth's surface is covered in salt water.

b  $70.8\%$  of 196 935 000 square miles =  $(70.8 \div 100) \times 196\,935\,000$   
 $= 139\,429\,980$  square miles

$\therefore 139\,429\,980$  square miles of the Earth's surface is covered in salt water.

8 First five minutes =  $(980.24 \times 60 \times 5) = 294\,072$  hits.

$$\therefore (294\,072 \div 1\,225\,300) \times 100\% = 24\%$$

$\therefore 24\%$  of the hits occurred in the first five minutes.

9 Gallons left =  $(125.75 - 70.8) = 54.95$  gallons remaining.

$$\therefore (54.95 \div 125.75) \times 100\% = 43.67981312\dots\%$$

$$\approx 43.70\% \text{ (to 2 d.p.)}$$

$\therefore$  approximately  $43.7\%$  of the water remains in the tank.

## Page 25 questions

## Percentage change

$$1 \quad a \quad 10\% \text{ increase} = 100\% + 10\%$$

$$= 110\% \text{ of initial amount}$$

$$\therefore \text{Increase of } 10\% = 1.1 \times 25 = 27.5$$

Decimal form

Other method:

Find 10% of 25 and add to 25

$$10\% \text{ of } 25 = 0.1 \times 25$$

Decimal form

$$= 2.5$$

$$\therefore \text{Increase of } 10\% = 2.5 + 25 = 27.5$$

$$b \quad 40\% \text{ decrease} = 100\% - 40\%$$

$$= 60\% \text{ of initial amount}$$

$$\therefore \text{Decrease of } 40\% = 0.6 \times 65 = 39$$

Decimal form

Other method:

Find 40% of 65 and subtract from 65

$$40\% \text{ of } 65 = 0.4 \times 65$$

Decimal form

$$= 26$$

$$\therefore \text{Decrease of } 40\% = 65 - 26 = 39$$

$$2 \quad a \quad \text{A decrease of } 30\% = 100\% - 30\%$$

$$= 70\% \text{ of original amount}$$

$$\therefore 70\% \text{ of } 50 = 0.70 \times 50$$

$$= 35$$

$$b \quad \text{An increase of } 25\% = 100\% + 25\%$$

$$= 125\% \text{ of original amount}$$

$$\therefore 125\% \text{ of } 76 = 1.25 \times 76$$

$$= 95$$

$$c \quad \text{An increase of } 5\% = 100\% + 5\%$$

$$= 105\% \text{ of original amount}$$

$$\therefore 105\% \text{ of } 6.2 = 1.05 \times 6.2$$

$$= 6.51$$

## Page 25 questions

## Percentage change

2 d A reduction of  $1.5\% = 100\% - 1.5\%$

$$= 98.5\% \text{ of original amount}$$

$$\therefore 98.5\% \text{ of } 8 = 0.985 \times 8$$

$$= 7.88$$

e An increase of  $33.\dot{3}\% = 100\% + 33.\dot{3}\%$

$$= 133.\dot{3}\% \text{ of original amount}$$

$$\therefore 133.\dot{3}\% \text{ of } 258 = 1.\dot{3} \times 258$$

$$= 344$$

f An increase of  $92\% = 100\% + 92\%$

$$= 192\% \text{ of original amount}$$

$$\therefore 192\% \text{ of } 12.8 = 1.92 \times 12.8$$

$$= 24.576$$

3 a A decrease of  $100\% = 100\% - 100\%$

$$= 0\% \text{ of original amount}$$

$$\therefore 0\% \text{ of } 50 = 0.00 \times 50$$

$$= 0 \text{ cars}$$

- b No, because a decrease of more than  $100\%$  gives you a negative number of cars. Negative amounts of a physical quantity means you finish with less than zero cars, which is not possible.

## Page 26 questions

## Percentage change

- 4 a An increase of  $100\% = 100\% + 100\%$   
 $= 200\%$  of original amount  
 $\therefore 200\%$  of 70  $= 2.00 \times 70$   
 $= 140$
- b An increase of  $100\%$  is the same as doubling. So an equivalent mathematical calculation is  $2 \times 70$ .
- c An increase of  $200\% = 100\% + 200\%$   
 $= 300\%$  of original amount  
 $\therefore 300\%$  of 70  $= 3.00 \times 70$   
 $= 210$
- d An increase of  $200\%$  is the same as tripling. So an equivalent mathematical calculation is  $3 \times 70$ .
- e Let  $n$  be any positive counting number. An increase of  $n \times 100\% = (n + 1) \times$  the original amount.
- 5 a An increase of  $50\% = 100\% + 50\%$   
 $= 150\%$  of original amount  
 $\therefore 150\%$  of £20  $= 1.50 \times £20$   
 $= £30$
- b A decrease of  $50\% = 100\% - 50\%$   
 $= 50\%$  of amount in part a  
 $\therefore 50\%$  of £30  $= 0.50 \times £30$   
 $= £15$
- c The increased amount is £30 and the original amount is £20,  $50\%$  of both values is different, so when decreasing the larger amount by a similar percentage, the actual amount it is reduced by is also larger.

**Page 26 questions**

## Percentage change

6 a An increase of  $20\% = 100\% + 20\%$   
 $= 120\%$  of original amount

$$\begin{aligned}\therefore 120\% \text{ of } 80\text{m} &= 1.20 \times 80\text{ m} \\ &= 96\text{ m}\end{aligned}$$

A further increase of  $25\% = 100\% + 25\%$   
 $= 125\%$  of new amount

$$\begin{aligned}\therefore 125\% \text{ of } 96\text{m} &= 1.25 \times 96\text{ m} \\ &= 120\text{ m}\end{aligned}$$

- b No, because the whole  $45\%$  is calculated on the smaller initial value (increasing  $80\text{m}$  by  $45\% = 116\text{ m}$ ). When split into two increases, the remaining  $25\%$  is calculated using a larger value, so therefore a larger increase.

**Page 27 questions**

## Percentage change

7 a An increase of  $33.\dot{3}\% = 100\% + 33.\dot{3}\%$   
 $= 133.\dot{3}\%$  of original amount

$$\begin{aligned}\therefore 133.\dot{3}\% \text{ of } 60 &= 1.\dot{3} \times 60 \\ &= 80\end{aligned}$$

A further decrease of  $20\% = 100\% - 20\%$   
 $= 80\%$  of new amount

$$\begin{aligned}\therefore 80\% \text{ of } 80 &= 0.80 \times 80 \\ &= 64\end{aligned}$$

## Page 27 questions

## Percentage change

7 b A reduction of  $25\% = 100\% - 25\%$   
 $= 75\%$  of original amount

$$\begin{aligned}\therefore 75\% \text{ of } 200 &= 0.75 \times 200 \\ &= 150\end{aligned}$$

A further reduction of  $70.5\% = 100\% - 70.5\%$   
 $= 29.5\%$  of new amount

$$\begin{aligned}\therefore 29.5\% \text{ of } 150 &= 0.295 \times 150 \\ &= 44.25\end{aligned}$$

c A decrease of  $12\% = 100\% - 12\%$   
 $= 88\%$  of original amount

$$\begin{aligned}\therefore 88\% \text{ of } \pounds 55 &= 0.88 \times \pounds 55 \\ &= \pounds 48.40\end{aligned}$$

A further increase of  $16\% = 100\% + 16\%$   
 $= 116\%$  of new amount

$$\begin{aligned}\therefore 116\% \text{ of } \pounds 48.40 &= 1.16 \times \pounds 48.40 \\ &= \pounds 56.14\end{aligned}$$

d An inflation of  $5.25\% = 100\% + 5.25\%$   
 $= 105.25\%$  of original amount

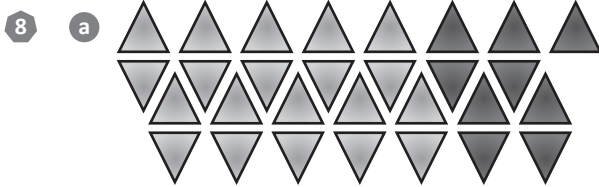
$$\begin{aligned}\therefore 105.25\% \text{ of } \pounds 90 &= 1.0525 \times \pounds 90 \\ &= \pounds 94.725\end{aligned}$$

A further reduction of  $0.6\% = 100\% - 0.6\%$   
 $= 99.4\%$  of new amount

$$\begin{aligned}\therefore 99.4\% \text{ of } \pounds 94.725 &= 0.994 \times \pounds 94.725 \\ &= \pounds 94.16\end{aligned}$$

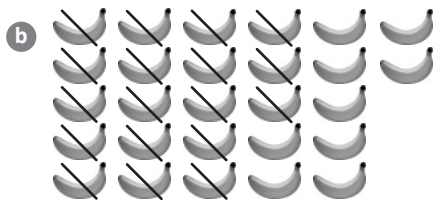
Page 27 questions

Percentage change



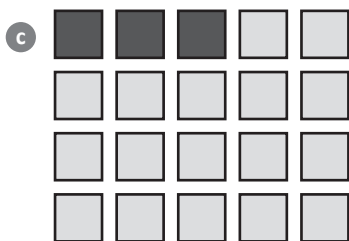
An increase of 45% = 100% + 45%  
 = 145% of original amount  
 $\therefore$  145% of 20 =  $1.45 \times 20$   
 = 29 triangles

$\therefore$  need to add 9 same-sized triangles to the diagram.



A reduction of 66.6% = 100% - 66.6%  
 = 33.3% of original amount  
 $\therefore$  33.3% of 27 =  $0.3 \times 27$   
 = 9 bananas

$\therefore$  need cross off 18 bananas to leave only 9.



60% of 20 squares =  $0.6 \times 20$   
 = 12 shaded

A decrease of 75% = 100% - 75%  
 = 25% of 12 squares











$\therefore$  25% of 12 =  $0.25 \times 12$   
 = 3 squares

$\therefore$  only 3 squares remain shaded.

Page 28 questions

Percentage change

9

Ingredients	Percentage change needed	Quantity needed for 4 people
 0.75 red onions [serves 3]	viii • 75% decrease	L • 1
 0.55 g marinated feta [serves 1]	x • 71 $\frac{1}{3}$ % decrease	D • 80 mL
 20 g Salt [serves 16]	v • 66.6% decrease	K • 3
 7.5 tomatoes [serves 10]	vi • 60% reduction	S • 60 mL
 120 mL vinegar mix [serves 8]	ix • 33 $\frac{1}{3}$ % increase	A • 225 g
 350 g olives [serves 7]	iv • 50% less	A • 200 g
 187.5 mL olive oil [serves 6]	vii • 75% more	E • 70 mL
 $\frac{3}{4}$ of a lebanese cucumber [serves 2]	iii • 33.3% decrease	A • 7.5 g
 26 $\frac{1}{4}$ g of oregano [serves 14]	i • 300% increase	E • 220 g
 225 g chopped red capsicum [serves 5]	ii • 20% removed	E • 5 g
		E • 9.5 g
		G • 125 mL
		G • 150 mL
		R • 180 g
		R • 1.5
		R • 2
		R • 4

G R E E K  
(i) (ii) (iii) (iv) (v)

S A L A D  
(vi) (vii) (viii) (ix) (x)



## Page 30 questions

## Unitary method

$$\begin{aligned}
 \text{1 a } 25\% \text{ of the amount} &= 40 \\
 \therefore 1\% \text{ of the amount} &= 40 \div 25 \\
 &= 1.6 \\
 \therefore 100\% \text{ of the amount} &= 1.6 \times 100 \\
 &= 160
 \end{aligned}$$

$$\begin{aligned}
 \text{b } 112\% \text{ of the amount} &= 84 \\
 \therefore 1\% \text{ of the amount} &= 84 \div 112 \\
 &= 0.75 \\
 \therefore 100\% \text{ of the amount} &= 0.75 \times 100 \\
 &= 75
 \end{aligned}$$

$$\begin{aligned}
 \text{2 a } 55\% &= 220 \\
 \therefore 1\% &= 220 \div 55 \\
 &= 4 \\
 \therefore 100\% &= 4 \times 100 \\
 &= 400
 \end{aligned}$$

$$\begin{aligned}
 \text{b } 325\% &= 487.5 \\
 \therefore 1\% &= 487.5 \div 325 \\
 &= 1.5 \\
 \therefore 100\% &= 1.5 \times 100 \\
 &= 150
 \end{aligned}$$

$$\begin{aligned}
 \text{c } 34.2\% &= 282.15 \\
 \therefore 1\% &= 282.15 \div 34.2 \\
 &= 8.25 \\
 \therefore 100\% &= 8.25 \times 100 \\
 &= 825
 \end{aligned}$$

$$\begin{aligned}
 \text{d } 115\frac{3}{8}\% &= 1269\frac{1}{8} \\
 \therefore 1\% &= 1269\frac{1}{8} \div 115\frac{3}{8} \\
 &= 11 \\
 \therefore 100\% &= 11 \times 100 \\
 &= 1100
 \end{aligned}$$

$$\begin{aligned}
 \text{e } 286\% &= 16\,094 \\
 \therefore 1\% &= 16\,094 \div 286 \\
 &= 56.\dot{2}\dot{7} \\
 \therefore 100\% &= 56.\dot{2}\dot{7} \times 100 \\
 &= 5627.\dot{2}\dot{7}
 \end{aligned}$$

$$\begin{aligned}
 \text{f } 14\frac{2}{3}\% &= 7.1\dot{6} \\
 \therefore 1\% &= 7.1\dot{6} \div 14\frac{2}{3} \\
 &= 0.488636363 \\
 &= 0.488\dot{6}\dot{3} \\
 \therefore 100\% &= 0.488\dot{6}\dot{3} \times 100 \\
 &= 48.8\dot{6}\dot{3}
 \end{aligned}$$

## Page 31 questions

## Unitary method

$$\begin{aligned} \text{3 a } 65\% &= 390 \\ \therefore 1\% &= 390 \div 65 \\ &= 6 \end{aligned}$$

$$\begin{aligned} \therefore 32\% &= 6 \times 32 \\ &= 192 \text{ units} \end{aligned}$$

$$\begin{aligned} \text{c } 110\% &= 5\text{kg} \\ \therefore 1\% &= 5 \div 110 \\ &= 0.04\dot{5}\text{kg} \end{aligned}$$

$$\begin{aligned} \therefore 44\% &= 0.04\dot{5} \times 44 \\ &= 2\text{kg} \end{aligned}$$

$$\begin{aligned} \text{4 a } 35\% &= 56\text{kg} \\ \therefore 1\% &= 56 \div 35 \\ &= 1.6 \end{aligned}$$

$$\begin{aligned} \therefore 100\% &= 1.6 \times 100 \\ &= 160\text{kg} \end{aligned}$$

$$\begin{aligned} \text{c } \frac{2}{5} \times 41250 &= 16\,500 \text{ people} \\ 60\% &= 16\,500 \text{ people} \\ \therefore 1\% &= 16\,500 \div 60 \\ &= 275 \text{ people} \end{aligned}$$

$$\begin{aligned} \therefore 100\% &= 275 \times 100 \\ &= 27\,500 \text{ people} \end{aligned}$$

$$\begin{aligned} \text{b } 12\% &= 46\text{g} \\ \therefore 1\% &= 46 \div 12 \\ &= 3.8\dot{3}\text{g} \end{aligned}$$

$$\begin{aligned} \therefore 30\% &= 3.8\dot{3} \times 30 \\ &= 115\text{g} \end{aligned}$$

$$\begin{aligned} \text{d } 290\% &= 4096 \\ \therefore 1\% &= 4096 \div 290 \\ &= 14.12413793\dots \end{aligned}$$

$$\begin{aligned} \therefore 72.5\% &= 14.12413793 \times 72.5 \\ &= 1024 \text{ amoeba} \end{aligned}$$

$$\begin{aligned} \text{b } 87.5\% &= 8575 \text{ termites} \\ \therefore 1\% &= 8575 \div 87.5 \\ &= 98 \text{ termites} \end{aligned}$$

$$\begin{aligned} \therefore 11.5\% &= 11.5 \times 98 \\ &= 1127 \text{ soldier termites} \end{aligned}$$

Page 32 questions

Unitary method

5 a  $\frac{100}{35} \times 16 = 45.71428571\dots$   
 $= 45.71$  (to 2 d.p.)

b  $\frac{100}{450} \times 96 = 21.\dot{3}$   
 $= 21.33$  (to 2 d.p.)

c  $\frac{45}{71} \times 121 = 76.69014085\dots$   
 $= 76.69$  (to 2 d.p.)

d  $\frac{50}{128} \times 245.8 = 96.015625\dots$   
 $= 96.02$  (to 2 d.p.)

e  $\frac{140}{30} \times \frac{5}{8} = 2.91\bar{6}$   
 $= 2.92$  (to 2 d.p.)

f  $\frac{10\frac{3}{7}}{5\frac{1}{3}} \times 2130 = 4164.910714\dots$   
 $= 4164.91$  seconds (to 2 d.p.)

6 a  $\frac{70}{2.5} \times 8 = 224$

b  $\frac{70}{2.5} \times 7 = 196$

c  $\frac{70}{2.5} \times 3.5 = 98$

Page 34 questions

Profit and loss

1 a Cost price = £25  
 Sale price = £22

$\therefore$  £3  Profit  
 Loss

b Cost price = £45.00  
 Sale price = £63.50

$\therefore$  £18.50  Profit  
 Loss

c Cost price = £104.25  
 Sale price = £140.75

$\therefore$  £36.50  Profit  
 Loss

2 a Cost price = £18.00  $\rightarrow$  £4.50  Profit  
 Sale price = £22.50  Loss

$\therefore \left( \frac{£4.50}{£18.00} \right) \times 100\%$   
 $= 25\%$   Profit of the cost price  
 Loss of the cost price

b Cost price = £5.20  $\rightarrow$  £1.04  Profit  
 Sale price = £4.16  Loss

$\therefore \left( \frac{£1.04}{£5.20} \right) \times 100\%$   
 $= 20\%$   Profit of the cost price  
 Loss of the cost price

Page 34 questions

Profit and loss

3 a Cost price = £34.56 → £8.96  Profit  
 Sale price = £25.60  Loss

$$\therefore \left( \frac{£8.96}{£25.60} \right) \times 100\%$$

≈ 35 %  Profit of the sale price  
 Loss of the sale price

b Cost price = £49.66 → £74.49  Profit  
 Sale price = £124.15  Loss

$$\therefore \left( \frac{£12.76}{£124.15} \right) \times 100\%$$

≈ 60 %  Profit of the sale price  
 Loss of the sale price

4 a Cost price = £20.50 → £9.05  Profit  
 Sale price = £11.45  Loss

= 44.1 %  Profit of the cost price  
 Loss of the cost price

= 79.0 %  Profit of the cost price  
 Loss of the cost price

b Cost price = £59.40 → £25.55  Profit  
 Sale price = £84.95  Loss

= 43.0 %  Profit of the cost price  
 Loss of the cost price

= 30.1 %  Profit of the cost price  
 Loss of the cost price

Page 35 questions

Profit and loss

5 a £24 marked up 25% = 1.25 × £24  
 = £30

Marked price = £ 30.00

b £32.50 marked up 46% = 1.46 × £32.50  
 = £47.45

Marked price = £ 47.45

c £230 marked up 12.5% = 1.125 × £230  
 = £258.75

Marked price = £ 258.75

6 a 40% discount on £157 = 0.60 × £157  
 = £94.20

Discounted price = £ 94.20

b 40% discount on £78.50 = 0.60 × £78.50  
 = £47.10

Discounted price = £ 47.10

**Page 35 questions**

**Profit and loss**

7 a £210 marked up 50% =  $1.50 \times £210$   
= £315

5 tables sold for £315 = total sales of £1575.  
5 tables cost at £210 each = £1050.

Therefore, profit =  $£1575 - £1050$   
= £525 profit.

b Profit as a percentage of the cost price:  
=  $(£525 \div £1050) \times 100\%$   
= 50% profit.

Or simply, since the markup was 50% on all of them and they were sold at this price, then the profit is 50%!

c Discount of 40% =  $0.60 \times £315$   
= £189

d Total sales of the tables:  
=  $5 \times £315 + 5 \times £189$   
= £2520

Total cost of the tables was  $10 \times £210 = £2100$   
Sale price > Cost price, so in profit  
 $\therefore$  Profit =  $£2520 - £2100 = £420$

**Page 36 questions**

**Profit and loss**

8 a Percentage discount = 30%

Discount of 30% = 70% of original value

$\therefore 70\% = £3150$

$\therefore 1\% = £3150 \div 70$

= £45

$\therefore 100\% = £45 \times 100$

= £4500

$\therefore$  Marked price = £4500

b Percentage discount = 70%

Discount of 70% = 30% of original value

$\therefore 30\% = £55.80$

$\therefore 1\% = £55.80 \div 30$

= £1.86

$\therefore 100\% = £1.86 \times 100$

= £186

$\therefore$  Marked price = £186

## Page 36 questions

## Profit and loss

$$8 \quad c \quad \text{Percentage discount} = 50\%$$

Discount of 50% = 50% of original value

$$\therefore 50\% = £97.50$$

$$\therefore 1\% = £97.50 \div 50$$

$$= £1.95$$

$$\therefore 100\% = £1.95 \times 100$$

$$= £195$$

$$\therefore \text{Marked price} = £195.00$$

$$d \quad \text{Percentage discount} = 20\%$$

Discount of 20% = 80% of original value

$$\therefore 80\% = £455.60$$

$$\therefore 1\% = £455.60 \div 80$$

$$= £5.695$$

$$\therefore 100\% = £5.695 \times 100$$

$$= £569.50$$

$$\therefore \text{Marked price} = £569.50$$

$$9 \quad \text{Markup of } 20\% = 1.2 \times £40 \\ = £48.00$$

$$\text{A following discount of } 15\% = 0.85 \times £48.00 \\ = £40.80$$

$\therefore$  sale price = £40.80, so the retailer made a profit of £0.80.

## Page 37 questions

## Profit and loss

$$10 \quad a \quad \text{Markup of } 38\% = 1.38 \times £200 \\ = £276.00$$

$$\therefore \text{marked price} = £276.00$$

$$b \quad \text{Discount} = £76$$

$$\therefore \text{Percentage discount} = (£76 \div £276) \times 100\% \\ \approx 27.5\% \text{ (to 1 d.p.)}$$

$$11 \quad a \quad \text{Cost price} = 1.125 \times £890 \\ = £1001.25$$

$$\therefore £1001.25 - £890$$

$$= £111.25 \text{ loss on the sale}$$

$$b \quad \text{Labelled price} = 1.2 \times £1001.25 \\ = £1201.50$$

$$c \quad \text{Discount} = £1201.50 - £890 \\ = £311.50$$

$$\therefore (£311.50 \div £1001.25) \times 100\% \\ = 31.1\% \text{ (to 1 d.p.)}$$

## Page 37 questions

## Profit and loss

- 12 a Marked price =  $1.36\dot{3} \times £72.50$   
 $= £98.841\dot{6}$   
 $= £98.84$  (to 2 d.p.)
- b Minimum sale price =  $1.1725 \times £72.50$   
 $= £85.00625$   
 $= £85$  (nearest whole dollar)
- c Minimum discount =  $(£98.84 - £85)$   
 $= £13.84$
- Maximum percentage discount =  $(£13.84 \div £98.84) \times 100\% = 14.00242817 \approx 14\%$

## Page 38 questions

## More applications of percentage calculations

- 1 a Protein per 100g = 8.0g  
 $\therefore 8\%$  protein
- b Protein recommended =  $(70 \times 0.8)$   
 $= 56\text{g}$
- c  $56\text{g} \div 0.4\text{g} = 140$  servings!
- d  $140 \times 3.8\text{g} = 532\text{g}$
- e For Protein, minimum daily requirement should account for 32%.  
 $\therefore 32\% = 56\text{g}$   
 $= 56\text{g}$   
 $\therefore$  recommended amount of Carbohydrates eaten =  $\frac{50}{32} \times 56\text{g} = 87.5\text{g}$   
 This is not a healthy option as it means the person consumes approximately 6 times the recommended daily intake of carbohydrates.
- 2  $24\frac{3}{4}\% = 145$  days  
 $\therefore 1\% = 145 \div 24.6$  days  
 $= 5.894308943$  days  
 $\therefore 200\% = 5.894308943 \times 200$  days  
 $= 1178.861789\dots$  days  
 $\approx 1179$  days

## Page 39 questions

## More applications of percentage calculations

3 a Tree height after 1 year =  $1.2025 \times 14$  m  
= 16.835 m

b Tree height after 2 years =  $1.2025 \times 16.835$  m  
= 20.2440875 m

$\therefore 20.2440875 - 16.835 = 3.4090875$  m  
 $\approx 3.41$  m (to 2 d.p.)

c Percentage growth after 2 years =  $(3.41 \div 14) \times 100\%$   
= 24.35714286  
= 24.4% (to 1 d.p.)

d Total growth 3 years from now =  $1.2025 \times 20.2440875$  m  
= 24.34351522 m  
< 25 m so no, the tree will not be cut down in 3 years time.

e The tree height is increasing each year, so 20.25% of the height is also increasing, so after four years it is more than a 100% increase, even though  $4 \times 20.25\%$  only = 81%.

4 Initially 50 m

After first burst of hot air, height above ground =  $1.31 \times 50 = 65.5$  m

After a further 20 minutes, height above ground =  $65.5\text{m} - 17\text{m} = 48.5$  m

After second burst of hot air, height above ground =  $1.288\dot{3} \times 48.5 = 62.48416667\dots\text{m}$

$\therefore$  Overall change in height =  $62.48416667 - 50 = 12.48$  m (to 2 d.p.)

$\therefore$  Overall percentage change =  $(12.48 \div 50) \times 100\% = 25\%$  (nearest whole percentage)











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