SKILLSHEET

Percentage calculations

Percentage of a quantity

A percentage is a fraction 'out of 100'. So, to find a percentage of a number or quantity, you write the percentage as a fraction (or decimal) and multiply it by the quantity.

Example 1

Find:

a 8% of 450 **b** 47% of \$287 **c** $17\frac{1}{2}$% of \$8974

Solution

Fraction method

a $8\% \text{ of } 450 = \frac{8}{100} \times 450 = 36$

b $47\% \text{ of } \$287 = \frac{47}{100} \times \$287$

$= \$134\frac{89}{100}$

$= \$134.89$ (press the $a^b/_c$ key)

c $17\frac{1}{2}\% \text{ of } \$8974 = 17\frac{1}{2} \div 100 \times \$8974$

$= \$1570\frac{9}{20}$

$= \$1570.45$ (press the $a^b/_c$ key)

Decimal method

$8\% \text{ of } 450 = 0.08 \times 450 = 36$

$47\% \text{ of } \$287 = 0.47 \times \$287$

$= \$134.89$

$17\frac{1}{2}\% \text{ of } \$8974 = 0.175 \times \$8974$

$= \$1570.45$

Exercise

1 Find:

a 88% of 400 **b** 26% of \$142 **c** 19% of 1250

d 2% of \$7043 **e** 58% of 289 **f** 30% of \$980

g $37\frac{1}{2}$% of 824 **h** 7% of \$56 **i** 93.1% of 2740

j 3.85% of \$4200 **k** $6\frac{1}{4}$% of 256 **l** 77.75% of \$3500

Expressing quantities as percentages

To express one quantity as a percentage of another quantity, we first write them as a fraction. (The first quantity, usually the smaller one, forms the numerator [top] of the fraction and the other forms the denominator.) Then we multiply the fraction by 100%. If it is not practical to express the quantities as a fraction, then we divide the first quantity by the second quantity instead.

$$\frac{\text{First quantity}}{\text{Secound quantity}} \times \mathbf{100\%} \quad \textbf{or} \quad \textbf{First quantity} \div \textbf{Second quantity} \times \textbf{100\%}$$

Example 2

a What percentage is 84 of 90?

b What percentage is 375 mL of 3 L?

c What percentage of \$135 is \$60.75?

d A bike was bought for \$120 and resold for \$145. Express the profit as a percentage (correct to one decimal place) of the cost price.

Solution

a $\frac{84}{90} \times 100\% = 93\frac{1}{3}\%$

b $3 \text{ L} = 3000 \text{ mL}$

$\frac{375}{3000} \times 100\% = 12\frac{1}{2}\%$

c $\frac{\$60.75}{\$135} \times 100\% = \$60.75 \div \$135 \times 100\%$

$= 45\%$

d $\text{Profit} = \$145 - \$120$

$= \$25$

$\text{Profit percentage} = \frac{\$25}{\$120} \times 100\%$

$= 20\frac{5}{6}\%$

$= 20.8333 \ldots\%$

$\approx 20.8\%$

Exercise

2 a Express 18 out of 40 as a percentage.

b What percentage is \$56.07 of \$126?

c What percentage is 105 minutes of 3 hours?

d What percentage of 2420 is 1694?

e Mark kicked 8 goals out of eleven attempts. Express his success rate as a percentage, correct to one decimal place.

f For Sharon's bank account with $542, the bank paid $23.30 interest. Calculate the interest rate as a percentage, correct to one decimal place.

g Henry's share price went from $4.40 to $3.75. Calculate the decrease as a percentage (correct to one decimal place) of the original price.

h Julie's wage increased from $600 to $666. Express the increase as a percentage.

Percentage increase and decrease

'Increase' means to make bigger by *adding*. To increase a number or quantity by a percentage, we can calculate that percentage of the original quantity and add it on.
'Decrease' means to make smaller by *subtracting*. To decrease a number or quantity by a percentage, we can calculate that percentage of the original quantity and take it away.
Alternatively, we can increase or decrease the *percentage* that represented the original quantity first to represent the new quantity, then find the new quantity from that adjusted percentage.

Example 3

a Increase 640 by 12%.

b Increase $125 by 7%.

c Decrease 145 by 20%.

d Decrease $2400 by 8.5%.

Solution

Two-step method

a $12\% \times 640 = 76.8$
$640 + 76.8 = 716.8$

b $7\% \times \$125 = \$8.75$
$\$125 + \$8.75 = \$133.75$

c $20\% \times 145 = 29$
$145 - 29 = 116$

d $8.5\% \times \$2400 = \$204$
$\$2400 - \$204 = \$2196$

One-step method

Think: Increase by 12% = 100% + 12% = 112%
$112\% \times 640 = 1.12 \times 640 = 716.8$

Think: Increase by 7% = 100% + 7% = 107%
$107\% \times \$125 = 1.07 \times \$125 = \$133.75$

Think: Decrease by 20% = 100% − 20% = 80%
$80\% \times 145 = 0.8 \times 145 = 116$

Think: Decrease by 8.5% = 100% − 8.5% = 91.5%
$91.5\% \times \$2400 = 0.915 \times \$2400 = \$2196$

Exercise

3 a Increase 140 by 8%.

b Decrease $244 by 22%.

c Increase 750 by 13%.

d Decrease $69 by 5%.

e Increase $330 by 15.2%.

f Decrease $86 by $12\frac{1}{2}\%$.

The unitary method: given a percentage, finding the whole or another percentage

The **unitary method** is so called because we need to find 1% first (*unit* means 'one'). If we are given a percentage of a quantity and asked to find the whole quantity, we use the unitary method to find 1% first, then multiply by 100 to find the whole (100%).

Example 4

a 18% of a number is 45. What is the number?

b 85% of Year 10 went on an excursion. If 102 students went on the excursion, how many are in Year 10?

c The price of a watch after 10% of GST was added was $92.40. What was the original price of the watch?

d At a '12% off' sale, a game system was reduced to $215.60. What was the discount?

Solution

a 18% of the number = 45
$\therefore$ 1% of the number = 45 ÷ 18 = 2.5
$\therefore$ 100% of the number = 2.5 × 100 = 250
The required number is 250. (*Check*: 18% of 250 = 45)

b 85% of Year 10 = 102
$\therefore$ 1% of Year 10 = 102 ÷ 85 = 1.2
$\therefore$ Number of Year 10 (100%) = 1.2 × 100 = 120

(*Check*: 85% of 120 = 102)

c The original price of the watch was increased by 10%.
100% + 10% = 110%
110% of original price = $92.40
$\therefore$ 1% of original price = $92.40 ÷ 110 = $0.84
$\therefore$ Original price (100%) = $0.84 × 100 = $84

(*Check*: 110% of $84 = $92.40)

d The original price of the game system was decreased by 12%.
100% − 12% = 88%
88% of original price = $215.60
$\therefore$ 1% of original price = $215.60 ÷ 88 = $2.45
Note that this question asks for the *discount* (12%), not the original price (100%).
$\therefore$ Discount (12%) = $2.45 × 12 = $29.40

(*Check*: Original price = discount price + discount
= $215.60 + $29.40
= $245
Discount price = 88% of $245
= $215.60)

Exercise

4 **a** 15% of an amount is 855. What is the amount?

b Jane pays 28% of her weekly income in tax. If she pays $161, then what is her weekly income?

c Trevor earns 6% commission on every car he sells. If he earned $1767 from the sale of a car, what was the price of the car?

d Meikle received $110.70 interest on her savings account. If the interest rate is 4.5%, how much did Meikle have in her account?

e The value of a computer fell 7% to $3250.35. Find its previous price.

f The population of Westvale increased by 4% to 75 322 this year. What was:

i the population of Westvale last year?

ii the increase?

Answers

1 **a** 352 **b** $36.92 **c** 237.5 **d** $140.86
e 167.62 **f** $294 **g** 309 **h** $3.92
i 2550.94 **j** $161.70 **k** 16 **l** $2721.25

2 **a** 45% **b** 44.5% **c** $58\frac{1}{3}\%$ **d** 70%
e 72.7% **f** 4.3% **g** 14.8% **h** 11%

3 **a** 151.2 **b** $190.32 **c** 847.5 **d** $65.55 **e** $380.16 **f** $75.25

4 **a** 5700 **b** $575 **c** $29 450 **d** $2460
e $3495 **f** **i** 72425 **ii** 2897