

6. [Percentages]

Skill 6.1 Estimating a percentage.

MM5.2 1 2 2 3 3 4 4
MM6.1 1 1 2 2 3 3 4 4

- Picture the amount shaded as out of 100.
- Count the known parts.
- Compare to common parts like one half equals 50%.

Q. What percentage is shown on the bar?



A. 65%



6 out of 10 parts are shaded.
That much is 60%



Plus half of another part.
So add another 5%.

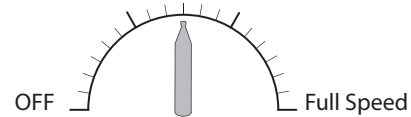
a) Estimate the percentage of the line between the arrows.



2 out of 5 parts

40%

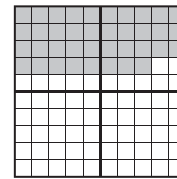
b) What percentage of full speed has been reached?



c) What percentage of the file has been transferred?



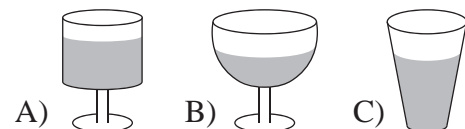
d) What percentage of the grid is shaded?



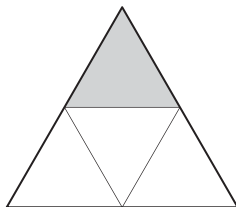
e) What percentage of data has been sent?



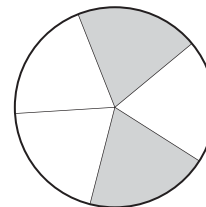
f) Which glass is 75% full?



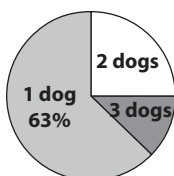
g) What percentage of the diagram is shaded?



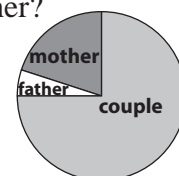
h) What percentage of the diagram is shaded?



i) What percentage of dog owners own 3 dogs?



j) In Australia 5% of adolescents live with their father. What percentage of adolescents live with their mother?



Skill 6.2 Finding the remaining percentage.

MM5.2 1 1 2 2 3 3 4 4
MM6.1 1 1 2 2 3 3 4 4

- Subtract the given percentages from one whole or 100% to find the remaining percentage.

Q. An aluminium solder is made up of 65% zinc, 20% aluminium and the rest copper. What percentage is copper?

$$\begin{aligned} \text{A. } & 100\% - 65\% - 20\% \\ & = 15\% \end{aligned}$$

a) A lingerie item was made up of 67% polyamide, 14% elastane and cotton. What percentage was cotton?

$$100\% - 67\% - 14\% = \boxed{19\%}$$

b) German silver is made up of 55% copper, 25% zinc and the rest nickel. What percentage is nickel?

$$\dots\dots\dots = \boxed{}$$

c) The energy in walnuts comes from proteins, carbohydrates and fats. If 5% comes from proteins and 5% from carbohydrates, how much energy is supplied by fats?

$$\dots\dots\dots = \boxed{}$$

d) Australia's water use is divided between 16% urban/industrial, 77% irrigation and the rest, "other rural". What percentage is "other rural"?

$$\dots\dots\dots = \boxed{}$$

e) Lou's coat is made up of 3% spandex, 21% nylon and the rest rayon. How much rayon is in the coat?

$$\dots\dots\dots = \boxed{}$$

f) A cafe latte is made up of 30% coffee, 5% froth and the rest is milk. What percentage of a cafe latte is milk?

$$\dots\dots\dots = \boxed{}$$

g) The eastern states and territories of Australia make up 37% of Australia's area. If the central region makes up for another 30%, what percentage does Western Australia cover?

$$\dots\dots\dots = \boxed{}$$

h) People of European descent make up 69% of New Zealand's population. If Islanders and Maoris make up 22% and the rest are of Asian ancestry, what percentage of New Zealand's population is of Asian ancestry?

$$\dots\dots\dots = \boxed{}$$

i) 1% of the earth's atmosphere is a mixture of gases, 78% is nitrogen, and the rest is oxygen. How much of our atmosphere is oxygen?

$$\dots\dots\dots = \boxed{}$$

j) Normann Stadler, winner of the 2006 World Triathlon Championships, spent 11% of his time swimming, 53% riding and the rest running. What percentage of time did he run?

$$\dots\dots\dots = \boxed{}$$

Skill 6.3 Finding a percentage of a multiple of 100.

MM5.2 1 1 2 2 3 3 4 4
MM6.1 1 1 2 2 3 3 4 4

EITHER

- Change the percentage to a fraction out of 100.

Example: $40\% = \frac{40}{100}$

- Rewrite the question as a multiplication (change "of" to "x").
- Change the whole number to a fraction over 1.

Example: $7 = \frac{7}{1}$

- Cross simplify the fractions before multiplying. (see skill 5.2, page 51)

OR

- First find 10%.
- Then multiply by the amount needed to make the required percentage.

To find $10\% = \frac{1}{10} \Rightarrow$ divide by 10
 $5\% \Rightarrow$ half of 10%
 $20\% = \frac{1}{5} \Rightarrow$ divide by 5
 $25\% = \frac{1}{4} \Rightarrow$ divide by 4
 $50\% = \frac{1}{2} \Rightarrow$ divide by 2

Q. 60% of $300 =$

A. $\frac{60}{100} \times \frac{300}{1} =$ *Simplify: $\div 100$* **OR** **A.** $\frac{1}{10} \times \frac{300}{1} =$ *Find 10%*
 $= 60 \times 3$ $= 30$
 $= \mathbf{180}$ *Multiply by 6 to get 60%*
 $= \mathbf{180}$

a) 40% of $200 =$ *Divide by 100*
 $\frac{40}{100} \times \frac{200}{1}$
 $= \mathbf{80}$

b) 10% of $500 =$
 $\frac{10}{100} \times \frac{500}{1}$
 $=$

c) 20% of $300 =$ *First find 10%*
 $=$

d) 3% of $700 =$
 $=$

e) 25% of $300 =$
 $=$

f) 8% of $400 =$
 $=$

g) 70% of $\$600 =$
 $=$

h) 2% of $\$700 =$
 $=$

i) 5% of $\$300 =$
 $=$

j) 55% of $\$10.00 =$
 $=$

k) 75% of $\$20.00 =$
 $=$

l) 6% of $\$30.00 =$
 $=$

m) 45% of $\$20.00 =$
 $=$

n) 25% of $\$900 =$
 $=$

o) 8% of $\$5.00 =$
 $=$

Skill 6.4 Finding a percentage of any number (1).

MM5.2 1 1 2 2 3 3 4 4
MM6.1 1 1 2 2 3 3 4 4

- Change the percentage to a fraction out of 100.

Example: $60\% = \frac{60}{100}$

- Rewrite the question as a multiplication (change "of" to "x").
- Change the whole number to a fraction over of 1.

Example: $3 = \frac{3}{1}$

- Cross simplify the fractions before multiplying. (see skill 5.2, page 51)

To find $1\% = \frac{1}{100} \Rightarrow$ divide by 100
 $12.5\% = \frac{1}{8} \Rightarrow$ divide by 8
 $33\frac{1}{3}\% = \frac{1}{3} \Rightarrow$ divide by 3
 $66\frac{2}{3}\% = \frac{2}{3} \Rightarrow$ divide by 3
 multiply by 2

OR

- First find 10%.
- Then multiply by the amount needed to make the required percentage, i.e. multiply by 3 to get 30%.

Q. 35% of 60 =

A. $\frac{35}{100} \times \frac{60}{1} =$ *Simplify: $\div 10$* OR A. $60 \div 10 =$ *Find 10%*
 $= 6$
 $6 \times 3 = 18$ *Multiply by 3 to get 30%*
 $\frac{1}{2} \times 6 = 3$ *Half of 10% is 5%*
 $= 18 + 3$ *Add 30% and 5%*
 $= 21$

a) 70% of 10 =

$= \frac{70}{100} \times \frac{10}{1}$

*Simplify:
Divide by 10,
2 times*

$= 7 \times 1$

=

b) 10% of 180 =

=

=

=

c) 15% of 60 =

=

=

=

d) 30% of 400 =

$400 \div 10 = 40$

First find 10%

40×3

=

=

e) 20% of 10 =

=

=

=

=

f) 70% of 20 =

=

=

=

=

g) 5% of 180 =

=

=

=

h) 25% of 20 =

=

=

=

=

i) 75% of 56 =

=

=

=

=

j) 12% of 125 =

=

.....
= =

k) 24% of 50 =

=

.....
= =

l) 80% of 16 =

=

.....
= =

m) 14% of 50 =

=

.....
= =

n) 8% of 600 =

=

.....
= =

o) 13% of 300 =

=

.....
= =

p) 30% of 70 =

=

.....
= =

q) 15% of 50 =

=

.....
= =

r) 20% of 75 =

=

.....
= =

s) 25% of 180 =

=

.....
= =

t) 16% of 50 =

=

.....
= =

u) 2.5% of 800 =

=

.....
= =

v) 1% of 45 =

=

.....
= =

w) 12.5% of 16 =

=

.....
= =

x) $66\frac{2}{3}\%$ of 60 =

=

.....
= =

y) 0.5% of 260 =

=

.....
= =

z) $33\frac{1}{3}\%$ of 72 =

=

.....
= =

A) 0.1% of 300 =

=

.....
= =

Skill 6.5 Calculating percentages from word problems.

MM5.2 1 1 2 3 3 4 4
MM6.1 1 1 2 2 3 3 4 4

- Write a number sentence from the information given.
- Calculate the percentage of the given amount. (see skills 6.3, page 61 and 6.4, page 62)

Q. Finn ate lunch at a restaurant. He left a 5% tip. If the bill was \$52, what was the total cost of his lunch?

$$\begin{aligned} \text{A. } \text{Tip} &= \frac{5}{100} \times \frac{52}{1} = \\ &= 5 \times 0.52 \\ &= \$2.60 \\ \text{Total cost} &= \$52 + \$2.60 \\ &= \mathbf{\$54.60} \end{aligned}$$

a) India won 50 medals at the Commonwealth Games in 2006. Gold medals made up 44% of India's medal tally. How many medals were gold?

.....
..... =

b) Archie leaves an extra 5% of the restaurant bill as a tip. The bill was \$150. How much was the tip?

.....
..... = \$

c) Petrol goes up by 5% tomorrow. If I can pay \$1.40 per litre today, what will I pay tomorrow?

.....
..... = \$

d) The average life expectancy at birth in 1995 was 64 years. In 2025 it will grow by 12.5%. What will the life expectancy be in 2025?

.....
..... =

e) In 2010 we consumed on average 500 g of carbohydrate per day. In 1980 we consumed 80% of this amount. How many grams of carbohydrate did we consume per day in 1980?

.....
..... = g

f) The population of Whyalla in South Australia increased by 20% in the 20 years to 1981. If the population was 13 600 in 1961, what was it in 1981?

.....
..... =

g) The global population reached 6 billion in 1999. What will the global population be in 2025 if it will grow by 30%?

.....
..... = billion

h) You weigh 90 kg. If you lose 5% of your body weight, calculate your weight loss.

.....
..... = kg

i) An island's population of 450 people increased by 2%. How many people live there now?

.....
..... =

j) You weigh 70 kg. If you gain 5% of your body weight, calculate your weight gain.

.....
..... = kg

EITHER

- Change the percentage to a fraction out of 100.

Example: $150\% = \frac{150}{100}$

- Rewrite the question as a multiplication (change "of" to "x").
- Change the whole number to a fraction over 1.

Example: $7 = \frac{7}{1}$

- Cross simplify the fractions before multiplying. (see skill 5.2, page 51)

OR

- First find 100% or other multiples of 100%.
- Then find the remaining percentage.
- Add the results.

To find $200\% = \frac{2}{1} \Rightarrow$ multiply by 2
 $300\% = \frac{3}{1} \Rightarrow$ multiply by 3

Q. 200% of 45 =

A. $\frac{200}{100} \times \frac{45}{1} =$ *Simplify: $\div 100$* OR
 $= 2 \times 45$
 $= 90$

A. 100% is 45.
 So 200% is double that or **90**.

a) 120% of 30 =

$= \frac{120}{100} \times \frac{30}{1}$ *Simplify: $\div 10$, twice*

$= 12 \times 3 = \boxed{36}$

b) 110% of 160 =

Find 10%
 $10\% \text{ of } 160 = 16$

$160 + 16 = \boxed{}$

c) 200% of 70 =

$= \boxed{}$

d) 300% of 28 =

Add the 100% and 10%

$= \boxed{}$

e) 120% of 30 =

$= \boxed{}$

f) How much is 400% of 34?

$= \boxed{}$

g) How much is 150% of 450?

$= \boxed{}$

h) 110% of 230 =

$= \boxed{}$

i) 105% of 32 =

$= \boxed{}$

j) How much is 101% of 400?

$= \boxed{}$

k) 125% of 80 =

$= \boxed{}$

l) 105% of 380 =

$= \boxed{}$

m) How much is 250% of 500?

$= \boxed{}$

n) 120% of 60 =

$= \boxed{}$

o) 110% of 250 =

$= \boxed{}$

Skill 6.7 Increasing an amount by a percentage.

MM5.2 11 22 3 4 4
MM6.1 11 22 3 3 4 4

- Calculate the percentage of the given amount. (see skills 6.3, page 61 and 6.4, page 62)
- Add this result to the given amount.

Hint: If an amount is increased by 20% it will become 120% of its original value.

Q. Increase 30 by 20%.

$$\begin{aligned} \text{A. } \frac{20}{100} \times \frac{30}{1} &= \text{Simplify: } \div 10, \text{ twice} \\ &= 2 \times 3 = 6 \\ 6 + 30 &= \text{Add the 20\% to 30} \\ &= \mathbf{36} \end{aligned}$$

a) Increase 400 by 2%.

1% is 4 so 2% is 8

$$8 + 400 = \boxed{408}$$

b) Increase 70 by 10%.

$$\dots = \boxed{}$$

c) Increase 310 by 50%.

$$\dots = \boxed{}$$

d) Increase 80 by 20%.

$$\dots = \boxed{}$$

e) Increase 600 by 1%.

$$\dots = \boxed{}$$

f) Increase 56 by 25%.

$$\dots = \boxed{}$$

g) Increase 40 by 15%.

$$\dots = \boxed{}$$

h) Increase 300 by 12%.

$$\dots = \boxed{}$$

i) Increase 52 by 50%.

$$\dots = \boxed{}$$

j) Increase 80 by 75%.

$$\dots = \boxed{}$$

k) Increase 64 by 12.5%.

$$\dots = \boxed{}$$

l) Increase 300 by 2%.

$$\dots = \boxed{}$$

m) Increase 15 by 80%.

$$\dots = \boxed{}$$

n) Increase 60 by 45%.

$$\dots = \boxed{}$$

o) Increase 90 by 60%.

$$\dots = \boxed{}$$

p) Increase 500 by 12%.

$$\dots = \boxed{}$$

q) Increase 2500 by 8%.

$$\dots = \boxed{}$$

r) Increase 800 by 5%.

$$\dots = \boxed{}$$

s) Increase 750 by 30%.

$$\dots = \boxed{}$$

t) Increase 90 by 40%.

$$\dots = \boxed{}$$

u) Increase 240 by 12.5%.

$$\dots = \boxed{}$$

Skill 6.8 Decreasing an amount by a percentage.

MM5.2 1 1 2 2 3 3 4 4
MM6.1 1 1 2 2 3 3 4 4

- Calculate the percentage of the given amount. (see skills 6.3, page 61 and 6.4, page 62)
- Subtract this result from the given amount.

Hint: If an amount is decreased by 20% it will become 80% of its original value.

Q. Decrease \$35 by 5%. **A.** $\frac{5}{100} \times \frac{35}{1} =$ *Multiply*
 $= \frac{175}{100} = \$1.75$
 $\$35 - \$1.75 =$ *Subtract the 5% from \$35*
 $= \$33.25$

a) Reduce 700 by 1%.

1% of 700 is 7

$700 - 7 =$

b) Reduce 500 by 10%.

$500 -$

c) Decrease 4000 by 11%.

$4000 -$

d) Decrease 2300 by 4%.

$2300 -$

e) Decrease 500 by 75%.

$500 -$

f) Reduce 20 by 15%.

$20 -$

g) Reduce 75 by 20%.

$75 -$

h) Decrease 120 by 5%.

$120 -$

i) Reduce 120 by 40%.

$120 -$

j) Decrease 350 by 2%.

$350 -$

k) Reduce 600 by 95%.

$600 -$

l) Decrease 25 by 4%.

$25 -$

m) Reduce 55 by 60%.

$55 -$

n) Reduce 800 by 9%.

$800 -$

o) Decrease 220 by 30%.

$220 -$

p) Reduce 150 by 8%.

$150 -$

q) Reduce 200 by 46%.

$200 -$

r) Decrease 500 by 6%.

$500 -$

s) Reduce 330 by 70%.

$330 -$

t) Decrease 800 by 21%.

$800 -$

u) Reduce 520 by 55%.

$520 -$

Skill 6.9 Calculating an amount given a percentage of that amount.

MM5.2 1 1 2 2 3 3 4 4
MM6.1 1 1 2 2 3 3 4 4

- Write the words as an equation.
- EITHER
- Bring the percentage to 100% by methods like doubling or first finding 1%, 5% or 10%.

- OR
- Use algebra.

Q. If 75% or 24 students in the class are boys, how many students are in the class?

A. $\frac{75}{100} \times x = 24$

$$x = \cancel{24}^8 \times \frac{100^4}{\cancel{75}^1}$$

$$x = 8 \times 4$$

$$x = 32$$

Simplify: $\div 25$ then $\div 3$

Write the words as an equation.

Get the unknown amount alone on one side of the equation.

Simplify by dividing both the top and the bottom of the fractions by common factors.

Complete the multiplication.

a) If 20% of the cost is \$13, what is the total cost?

If 20% of x is \$13 then 10% is half or \$6.50

Find 100%

$$100\% = 10\% \times 10 = \$6.50 \times 10$$

\$65

b) The tank is 5% full and has 800 L of water in it. How much water will the tank hold when full?

L

c) Maria's iPod has 400 songs, and only 20% of its memory is full. How many more songs can Maria load on her iPod?

d) In a bag of potatoes, 7 are rotten. If this is 25% of the bag, how many potatoes are in the bag altogether?

e) In a certain college 60% of all students are female. If 90 students are female, how many students are at the college altogether?

f) The pool has 15 000 L of water and it is 30% full. How many litres of water are in the pool when it is 100% full?

L

g) In the railway carriage there are 95 people. This is 25% more than the number of seats. How many seats are in this carriage?

$$x + \frac{25}{100} \times x = 95$$

$$x =$$

$$x =$$

h) Petrol has gone up 75% in the last 3 years to \$1.40 cents per litre. How much per litre was petrol 3 years ago?

$$x =$$

$$x =$$

\$

Skill 6.10 Finding a percentage change.

MM5.2 1 1 2 2 3 3 4 4
MM6.1 1 1 2 2 3 3 4 4

- Find the difference between the amounts (amount of change).
- Divide the amount of change by the original amount.
- Multiply by 100 to find the percentage.

$$\text{percentage change} = \frac{\text{amount of change}}{\text{original amount}} \times \frac{100}{1} \%$$

- Q.** Petrol prices have risen from \$0.75 per litre in 2000 to \$1.11 per litre in 2006. Find the percentage increase.

A. $\$1.11 - \$0.75 = \$0.36$ *Subtract to find the amount of change*

$$\frac{0.36}{0.75} \times \frac{100}{1} \% = \frac{36}{75} \times \frac{100}{1} \%$$

Simplify: $\div 25$

$$= 144 \div 3 = 48\%$$

- a)** Charlie bought a car for \$24 000 and later sold it for \$18 000. Find the percentage loss.

$$24\,000 - 18\,000 = 6\,000$$

$$\frac{6000}{24000} \times \frac{100}{1} \% \quad \text{Simplify: } \div 100 \text{ then } \div 10$$

$$= \frac{600}{24} \% = \frac{50}{12} \% \quad \text{Simplify: } \div 12 \text{ then } \div 2 = 25\%$$

- b)** Lou's wage increased from \$90/week to \$99/week. What is the percentage increase?

$$99 - 90 =$$

$$= \quad = \quad =$$

- c)** Jeans usually sell for \$88 but today they are discounted to \$66. What is the percentage decrease?

$$= \quad = \quad =$$

- d)** Mac bought an old chair for \$80, repaired it and sold it for \$200. What percentage profit did Mac make?

$$= \quad = \quad =$$

- e)** Kate's gas bill decreased from \$300 to \$258. What percentage saving is this?

$$= \quad = \quad =$$

- f)** The year 9 enrolments increased from 120 to 150 students. What is the percentage increase?

$$= \quad = \quad =$$

- g)** Charles sold his \$60 text book at the second hand book shop for \$40. Calculate the loss as a percentage of the cost price.

$$= \quad = \quad =$$

- h)** In Feb 2003 the value of a BHP share was \$9. By Jan 2011 a BHP share was selling for \$45/share. Find the percentage increase.

$$= \quad = \quad =$$

Skill 6.11 Finding a number knowing a percentage of that number.

MM5.2 1 1 2 2 3 3 4 4
MM6.1 1 1 2 2 3 3 4

- Write the words as an equation.

EITHER

- Bring the percent to 100% by methods like doubling or first finding 1%, 5% or 10%.

OR

- Use algebra.

Q. 25% of = 145

A. $\frac{25}{100} \times x = 145$ *Simplify: $\div 25$*
 $x = 145 \times \frac{100}{25}$
 $x = 145 \times 4$
 $x = 580$

Write the % as a fraction.

Get the unknown amount (x) alone on one side of the equation.

Simplify by dividing both the top and the bottom of the fraction by common factors.

Complete the multiplication.

a) 20% of = 90

If 20% of x is 90 then 10% is half, so 45

$100\% = 10\% \times 10 = 45 \times 10 = 450$

b) 5% of = 20

If 5% of x is 20 then 10% is

Find 100%

c) 6% of = 21 *Use algebra*

d) 60% of = 150

e) 11% of = 22

$x = 22 \times \frac{100}{11}$

$x =$

f) 12% of = 54

$x =$

$x =$

g) 80% of = 76

$x =$

$x =$

h) 75% of = 525

$x =$

$x =$

i) 30% of = 54

$x =$

$x =$

j) 15% of = 75

$x =$

$x =$