

6. [Percentages]

Skill 6.1 Estimating a percentage.

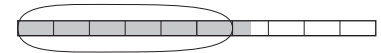
MM9 1 22 33 44
MM10 11 22 33 44

- 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%

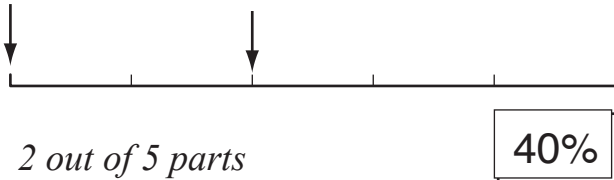


6 out of 10 parts are shaded.
That much is 60%

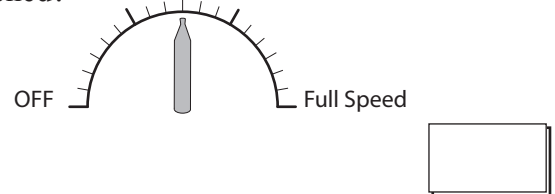


Plus half of another part.
So add another 5%.

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



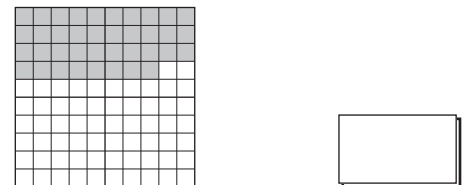
b) What percentage of full speed has been reached?



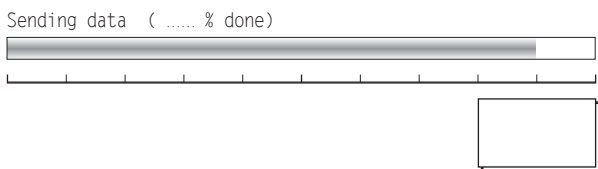
c) What percentage of the file has been transferred?



d) What percentage of the grid is shaded?



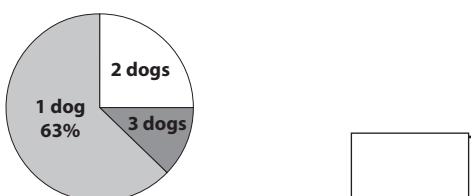
e) What percentage of data has been sent?



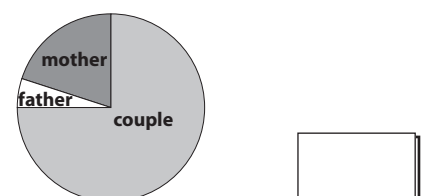
f) Which glass is 75% full?



g) What percentage of dog owners own 3 dogs?



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



- 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?

A. $100\% - 65\% - 20\%$
 $= 15\%$

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) The slopes at Perisher Blue ski resort are classified 22% beginner terrain, 60% intermediate and the remainder advanced. What percentage are advanced slopes?

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

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.

MM9 11 2 3 3 4 4
MM10 1 2 2 3 3 4 4

- Change the % to a fraction out of 100.

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

- Change 'of' to '×'.
- Change the whole number to a fraction over 1, i.e. $3 = \frac{3}{1}$
- Cross simplify the fractions before multiplying.
(see skill 5.2, page 48)

OR

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

Hint:

To find $10\% = \frac{1}{10} \Rightarrow$ divide by 10

$5\% =$ half of 10%

$20\% = \frac{1}{5} \Rightarrow$ divide by 5

$25\% = \frac{1}{4} \Rightarrow$ divide by 4

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%*

$= 60 \times 3$ $= 30$ *Multiply by 6 to get 60%*

$= 180$ 30×6

$= 180$

a) 40% of $200 =$

$= \frac{40}{100} \times \frac{200}{1}$ *Divide by 100*

$=$ 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 $1000 =$

$=$

k) 75% of $2000 =$

$=$

l) 6% of $3000 =$

$=$

Skill 6.4 Finding a percentage of any number.

MM9 1 1 2 3 3 4 4
MM10 1 1 2 2 3 3 4 4

- Change the % to a fraction out of 100.

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

- Change 'of' to '×'.
- Change the whole number to a fraction over of 1, i.e. $3 = \frac{3}{1}$
- Cross simplify the fractions before multiplying.
(see skill 5.2, page 48)

OR

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

Hint:

To find $10\% = \frac{1}{10} \Rightarrow$ divide by 10

$5\% =$ half of 10%

$20\% = \frac{1}{5} \Rightarrow$ divide by 5

$25\% = \frac{1}{4} \Rightarrow$ divide by 4

Q. 35% of $60 =$

A. $\frac{35}{100} \times \frac{60}{1} =$ *Simplify: ÷ 10*
 $= \frac{35}{10} \times \frac{6}{1}$
 $= \frac{210}{10}$ *Simplify: ÷ 10*
 $= 21$

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 $10 =$ *Simplify: Divide by 10. 2 times*
 $= \frac{70}{100} \times \frac{10}{1}$
 $= 7 \times 1 = \boxed{7}$

b) 10% of $180 =$
 $=$
 $= \boxed{}$

c) 15% of $60 =$
 $=$
 $= \boxed{}$

d) 30% of $400 =$ *First find 10%*
 $400 \div 10 = 40$
 $40 \times 3 = \boxed{}$

e) 20% of $10 =$
 $=$
 $= \boxed{}$

f) 70% of $20 =$
 $=$
 $= \boxed{}$

g) 5% of $180 =$
 $= \boxed{}$

h) 25% of $20 =$
 $= \boxed{}$

i) 75% of $56 =$
 $= \boxed{}$

j) 12% of $125 =$
 $= \boxed{}$

k) 24% of $50 =$
 $= \boxed{}$

l) 80% of $16 =$
 $= \boxed{}$

Skill 6.5 Finding a percentage of a quantity.

- Change the % to a fraction out of 100.

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

- Change 'of' to '×'.
- Change the whole number to a fraction over 1, i.e. $3 = \frac{3}{1}$
- Cross simplify the fractions before multiplying.
(see skill 5.2, page 48)

OR

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

Hint:

To find $1\% = \frac{1}{100} \Rightarrow$ divide by 100

$0.5\% =$ half of 1%

$12.5\% = \frac{1}{8} \Rightarrow$ 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

Q. 1% of 79 m =

A. $\frac{1}{100} \times \frac{79}{1} =$ *Multiply*
 $= \frac{79}{100}$ *2 zeros, 2 places left*
 $= 0.79 \text{ m}$ *1 m = 1000 mm*

OR A. $79 \div 100 =$ *÷ by 100 to get 1%*
 $= 0\widehat{79}.0 \div 100$
 $= 0.79 \text{ m}$ *2 zeros, 2 places left*

a) 14% of 50 km =

$= \frac{14}{100} \times \frac{50}{1}$ *Simplify: ÷ 10 then ÷ 5*
 $= 14 \div 2 = 7 \text{ km}$

b) 8% of 600 g =

$=$
 $=$ $=$

c) 13% of 300 L =

$=$
 $=$ $=$

d) 30% of 70 kg =

$=$
 $=$

e) 15% of 50 MB =

$=$
 $=$

f) 20% of 75 m =

$=$
 $=$

g) 1% of 45 kg =

$=$
 $=$

h) 12.5% of \$16 =

$=$
 $=$

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

$=$
 $=$

j) 0.5% of 260 cm =

$=$
 $=$

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

$=$
 $=$

l) 0.1% of 300 km =

$=$
 $=$

Skill 6.6 Finding a percentage of a quantity involving unit conversion.

MM9 11 22 33 44
MM10 11 22 33 44

- Convert the units where necessary. (see Maths Facts, page 427)
- Write the mathematical sentence as a multiplication of fractions.

Q. 1% of 43 m =

A. $1\text{ m} = 100\text{ cm} \Rightarrow 43\text{ m} = 4300\text{ cm}$

$$\frac{1}{100} \times \frac{4300}{1} = \text{Simplify: } \div 100$$

$$= \frac{43}{1}$$

$$= 43\text{ cm}$$

a) 5% of 3 L =

$$1\text{ L} = 1000\text{ mL} \Rightarrow 3\text{ L} = 3000\text{ mL}$$

$$\frac{5}{100} \times \frac{3000}{1} \text{ Simplify: } \div 100$$

$$= 5 \times 30 = \text{input type="text" value="150 mL"}$$

b) 40% of 12 kg =

$$= \text{input type="text" value=""}$$

c) 25% of 45 m =

$$= \text{input type="text" value=""}$$

d) 80% of 10 weeks =

$$= \text{input type="text" value=""}$$

e) 2% of 5 L =

$$= \text{input type="text" value=""}$$

f) 5% of \$24.00 =

$$= \text{input type="text" value=""}$$

g) 75% of 120 cm =

$$= \text{input type="text" value=""}$$

h) 40% of 8 km =

$$= \text{input type="text" value=""}$$

- Change the % to a fraction out of 100.

Example: $120\% = \frac{120}{100}$

- Change 'of' to '×'.
- Change the whole number to a fraction over 1, i.e. $3 = \frac{3}{1}$
- Cross simplify the fractions before multiplying.
(see skill 5.2, page 48)

OR

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

Hint:

To find $10\% = \frac{1}{10} \Rightarrow$ divide by 10

$5\% =$ half of 10%

$20\% = \frac{1}{5} \Rightarrow$ divide by 5

$25\% = \frac{1}{4} \Rightarrow$ divide by 4

$200\% = \frac{2}{1} \Rightarrow$ multiply by 2

Q. 200% of $45 =$

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

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

a) 120% of $30 =$

$= \frac{120}{100} \times \frac{30}{1}$ *Simplify: ÷ 10, twice*
 $= 12 \times 3 = 36$

b) 110% of $160 =$

100% of $160 = 160$ *First find 100%*
 10% of $160 = 16$ *Then find 10%*

Add the results $160 + 16 =$

c) 200% of $70 =$

$=$

d) 300% of $28 =$

$=$

e) 120% of $30 =$

$=$

f) How much is 400% of 34 ?

$=$

g) How much is 150% of 450 ?

$=$

h) 105% of $32 =$

$=$

i) 110% of $230 =$

$=$

j) How much is 101% of 400 ?

$=$

k) 125% of $80 =$

$=$

l) 105% of $380 =$

$=$

Skill 6.8 Finding a number knowing a percentage of that number.

- 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: $\div 25$

$x = 145 \times \frac{100}{25}$

$x = 145 \times 4$

$x = \mathbf{580}$

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 equation 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

$x =$

$x =$

Skill 6.9 Increasing an amount by a percentage.

MM9 11 22 33 44
MM10 11 22 33 44

- Calculate the percentage of the given amount. (see skills 6.4, page 59 and 6.5, page 60)
- 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%.

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

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%.

$$\dots = \boxed{}$$

Skill 6.10 Decreasing an amount by a percentage.

- Calculate the percentage of the given amount. (see skills 6.4, page 59 and 6.5, page 60)
- 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

$700 - 7 =$ 693

b) Decrease 4000 by 11%.

$\dots\dots\dots =$

c) Reduce 500 by 10%.

$\dots\dots\dots =$

d) Decrease 2300 by 4%.

$\dots\dots\dots =$

e) Decrease 500 by 75%.

$\dots\dots\dots =$

f) Reduce 20 by 15%.

$\dots\dots\dots =$

g) Reduce 75 by 20%.

$\dots\dots\dots =$

h) Decrease 120 by 5%.

$\dots\dots\dots =$

i) Reduce 120 by 40%.

$\dots\dots\dots =$

j) Decrease 350 by 2%.

$\dots\dots\dots =$

k) Reduce 600 by 95%.

$\dots\dots\dots =$

l) Decrease 25 by 4%.

$\dots\dots\dots =$

m) Reduce 55 by 60%.

$\dots\dots\dots =$

n) Reduce 800 by 9%.

$\dots\dots\dots =$

o) Decrease 220 by 30%.

$\dots\dots\dots =$

- 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. Find the percentage decrease:
3000 to 1950

A. $3000 - 1950 = 1050$ *Subtract to find the amount of change*

$$\frac{1050}{3000} \times \frac{100}{1} \%$$

Simplify: $\div 100$ then $\div 10$

$$= \frac{105}{300} \%$$

Simplify: $\div 3$

$$= 35\%$$

a) Find the percentage increase:
72 to 126

$$126 - 72 = 54$$

$$\frac{54}{72} \times \frac{100}{1} \%$$

Simplify: $\div 9$ then $\div 2$

$$= \frac{300}{4} \%$$

75%

b) Find the percentage increase:
26 to 39

$$39 - 26 =$$

$$=$$

c) Find the percentage decrease:
160 to 140

$$=$$

d) Find the percentage decrease:
500 to 360

$$=$$

e) Find the percentage increase:
240 to 420

$$=$$

f) Find the percentage increase:
440 to 462

$$=$$

g) Find the percentage increase:
85 to 102

$$=$$

h) Find the percentage decrease:
960 to 816

$$=$$