

# 11. [Percentages]

## Skill 11.1 Writing a number out of 100 as a percentage.

MM7 1 2 2 3 3 4 4  
MM8 1 1 2 2 3 3 4 4

- Write the number followed by the percent symbol “%”  
Hint: “Percentage” means “per hundred” or “of each hundred”.

**Q.** Write as a percentage:  
84 out of 100.

**A.** 84 out of 100 =  
= **84%**

**a)** Write as a percentage:  
60 out of 100.

60%

**b)** Write as a percentage:  
32 out of 100.

**c)** Write as a percentage:  
46 out of 100.

**d)** Write as a percentage:  
12 out of 100.

**e)** Write as a percentage:  
5 out of 100.

**f)** Write as a percentage:  
9 out of 100.

**g)** Write as a percentage:  
61 out of 100.

**h)** Write as a percentage:  
53 out of 100.

**i)** Write as a percentage:  
4 out of 100.

**j)** Write as a percentage:  
7 out of 100.

**k)** Write as a percentage:  
59 out of 100.

**l)** Write as a percentage:  
91 out of 100.

**m)** Write as a percentage:  
28 out of 100.

**n)** Write as a percentage:  
79 out of 100.

- Subtract the given percentages from 100%, to find the remaining percentage.

**Q.** According to a projection for 2020, 39% of the U.S. population will be aged between 0 - 29 and 35% between 30 - 59. What percentage of the population will be aged 60 or more?

$$\begin{aligned} \text{A. } & 100\% - 39\% - 35\% \\ & = 100\% - 74\% \\ & = \mathbf{26\%} \end{aligned}$$

**a)** Approximately 59% of the athletes at the 2000 Sydney Olympics were male. What percentage of the athletes were female?

$$100\% - 59\% = \boxed{41\%}$$

**b)** School is approximately 60% of the calendar year in the Russian Federation. What percentage do holidays account for?

$$100\% - 60\% = \boxed{\phantom{00\%}}$$

**c)** The green-yellow 18-carat gold is 75% gold and the rest is silver. What percentage is silver?

$$\dots\dots\dots = \boxed{\phantom{00\%}}$$

**d)** If 89% of the West Point military academy graduates are male, what percentage are females?

$$\dots\dots\dots = \boxed{\phantom{00\%}}$$

**e)** If 78% of the Supreme Court justices are male, what percentage are females?

$$\dots\dots\dots = \boxed{\phantom{00\%}}$$

**f)** If the cucumber is 96% water, what percentage do the other components equal?

$$\dots\dots\dots = \boxed{\phantom{00\%}}$$

**g)** In Mali 72% of people earn less than \$1 a day. What percentage of people earn more than \$1 a day?

$$\dots\dots\dots = \boxed{\phantom{00\%}}$$

**h)** If 37.5% of the adult teeth are incisors and canines, what percentage is formed by molars and pre-molars?

$$\dots\dots\dots = \boxed{\phantom{00\%}}$$

**i)** Approximately 60.5% of the world population lives in Asia and 13.5% lives in North and South America. What percentage of the population lives in the rest of the world?

$$100\% - 60.5\% - 13.5\% = \boxed{\phantom{00\%}}$$

**j)** Approximately 27.2% of the world population is aged between 0 and 14 years and 65.2% between 15 and 64 years. What percentage of the population is aged 65 years and over?

$$\dots\dots\dots = \boxed{\phantom{00\%}}$$

**k)** If England occupies 57% and Scotland occupies 34% of Great Britain (the main island of the United Kingdom), what percentage is occupied by Wales?

$$\dots\dots\dots = \boxed{\phantom{00\%}}$$

**l)** At the 2008 Beijing Olympics, 39% of the medals won by Germany were gold, and 24% were silver. What percentage of the medals were bronze?

$$\dots\dots\dots = \boxed{\phantom{00\%}}$$

**Skill 11.3** Finding a percentage of multiples of 100 (1).

- Change the percentage to a fraction out of 100.

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

- Rewrite the question as a multiplication (change “of” to “ $\times$ ”).
- Change the whole number to a fraction over 1.

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

- Cross simplify the fractions before multiplying. (see skill 10.4, page 58)

**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

$50\% = \frac{1}{2} \Rightarrow$  divide 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.**  $40\%$  of  $\$6.00 =$

**A.**  $40\%$  of  $\$6.00 =$   
 $= 40\%$  of  $600$  *Convert \$ to cents*  
 $= \frac{40}{100} \times \frac{600}{1}$  *Simplify:  $\div 100$*   
 $= 40 \times 6$   
 $= 240$  cents  
 $= \$2.40$

**OR A.**  $600 \div 10 =$  *Find 10%*  
 $= 60$  cents  
 $60 \times 4$  *Multiply by 4 to get 40%*  
 $= 240$  cents  
 $= \$2.40$

**a)**  $24\%$  of  $100 =$   
 $= \frac{24}{100} \times \frac{100}{1}$  *Divide by 100*  
 $= 24$

**b)**  $85\%$  of  $100 =$   
 $=$

**c)**  $69\%$  of  $100 =$   
 $=$

**d)**  $9\%$  of  $100 =$   
 $=$

**e)**  $7\%$  of  $100 =$   
 $=$

**f)**  $50\%$  of  $100 =$   
 $=$

**g)**  $75\%$  of  $400 =$   
 $= \frac{75}{100} \times \frac{400}{1}$   
 $= 75 \times 4 =$

**h)**  $10\%$  of  $300 =$   
 $=$   *Divide 300 by 10*

**i)**  $30\%$  of  $500 =$   
 $=$   *Find 10% first*

**j)**  $60\%$  of  $200 =$   
 $=$   
 $=$

**k)**  $25\%$  of  $800 =$   
 $=$   
 $=$

**l)**  $70\%$  of  $600 =$   
 $=$   
 $=$

**Skill 11.3** Finding a percentage of multiples of 100 (2).

MM7 1 1 2 2 3 3 4 4  
MM8 1 1 2 2 3 3 4 4

m) 5% of 300 =

$$= \frac{5}{100} \times \frac{300}{1}$$

$$= 5 \times 3$$

=

n) 5% of 500 =

$$500 \div 10 = 50$$

$$50 \div 2$$

Find 10%

5% is half of 10%

=

o) 5% of 700 =

=

=

=

p) 50% of 700 =

=

=

=

q) 20% of 200 =

=

=

=

r) 40% of 500 =

=

=

=

s) 80% of 400 =

=

=

=

t) 90% of 300 =

=

=

=

u) 15% of 400 =

=

=

=

v) 50% of \$5.00 =

=

=

= \$

w) 20% of \$3.00 =

=

=

= \$

x) 75% of \$6.00 =

=

=

= \$

y) 5% of \$4.00 =

.....

=  ¢

z) 40% of \$3.50 =

.....

=  ¢

zz) 30% of \$4.50 =

.....

=  ¢

### Skill 11.4 Finding a percentage of any number (1).

- Change the percentage to a fraction out of 100.

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

- Rewrite the question as a multiplication (change “of” to “ $\times$ ”).
- Change the whole number to a fraction over 1.

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

- Cross simplify the fractions before multiplying. (see skill 10.4, page 58)

Hint:

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.  $66\frac{2}{3}\%$  of 270 =

A.  $66\frac{2}{3}\%$  of 270 =  
 $= \frac{2}{3} \times \frac{270}{1}$  *Simplify:  $\div 3$*   
 $= 2 \times 90$   
 $= 180$

Substitute  $66\frac{2}{3}\%$  with  $\frac{2}{3}$   
 Change “of” to “ $\times$ ”  
 Change 270 to  $\frac{270}{1}$   
 Multiply  $\frac{2}{3}$  by  $\frac{270}{1}$

a)  $20\%$  of 50 =  
 $= \frac{20}{100} \times \frac{50}{1}$  *Simplify:  $\div 10$ , twice*  
 $= 2 \times 5 = \boxed{10}$

b)  $70\%$  of 240 = *Find 10% first*  
 $240 \div 10 = 24$   
 $24 \times 7 = \boxed{\phantom{00}}$  *Multiply by 7 to get 70%*

c)  $80\%$  of 20 =  
 $= \dots = \boxed{\phantom{00}}$

d)  $40\%$  of 80 =  
 $= \dots = \boxed{\phantom{00}}$

e)  $60\%$  of 250 =  
 $= \dots = \boxed{\phantom{00}}$

f)  $30\%$  of 140 =  
 $= \dots = \boxed{\phantom{00}}$

g)  $70\%$  of 120 =  
 $= \dots = \boxed{\phantom{00}}$

h)  $5\%$  of 40 =  
 $= \dots = \boxed{\phantom{00}}$

i)  $5\%$  of 120 =  
 $= \dots = \boxed{\phantom{00}}$

j)  $15\%$  of 60 =  
 $10\% \quad 60 \div 10 = 6$  *Find 10% first*  
 $5\% \quad 6 \div 2 = 3$  *5% is half of 10%*  
 $15\% \quad 6 + 3 = \boxed{\phantom{00}}$

k)  $35\%$  of 80 =  
 $10\% \dots$   
 $5\% \dots$   
 $35\% \dots = \boxed{\phantom{00}}$

l)  $45\%$  of 120 =  
 $10\% \dots$   
 $5\% \dots$   
 $45\% \dots = \boxed{\phantom{00}}$

## Skill 11.4 Finding a percentage of any number (2).

MM7 11 22 3 4  
MM8 11 23 44

m) 25% of 180 =

$$= \frac{25}{100} \times \frac{180}{1}$$

Simplify:  $\div 5$

$$= \frac{90}{2} = \boxed{\phantom{00}}$$

Divide by 10

n) 75% of 40 =

$$= \frac{75}{100} \times \frac{40}{1}$$

$$= \frac{300}{4} = \boxed{\phantom{00}}$$

o) 75% of 120 =

$$= \frac{75}{100} \times \frac{120}{1}$$

$$= \frac{900}{4} = \boxed{\phantom{00}}$$

p) 15% of 40 =

$$= \frac{15}{100} \times \frac{40}{1}$$

Simplify:  $\div 10$

$$= \frac{60}{10} = \boxed{\phantom{00}}$$

q) 6% of 30 =

$$= \frac{6}{100} \times \frac{30}{1}$$

$$= \frac{180}{100} = \boxed{\phantom{00}}$$

r) 8% of 80 =

$$= \frac{8}{100} \times \frac{80}{1}$$

$$= \frac{640}{100} = \boxed{\phantom{00}}$$

s) 1% of 300 =

$$= \frac{1}{100} \times \frac{300}{1}$$

$$= \frac{300}{100} = \boxed{\phantom{00}}$$

t) 1% of 150 =

$$= \frac{1}{100} \times \frac{150}{1}$$

$$= \frac{150}{100} = \boxed{\phantom{00}}$$

u) 2% of 50 =

$$= \frac{2}{100} \times \frac{50}{1}$$

$$= \frac{100}{100} = \boxed{\phantom{00}}$$

v) 12.5% of 560 =

$$= \frac{12.5}{100} \times \frac{560}{1}$$

Simplify:  $\div 8$

$$= \frac{700}{8} = \boxed{\phantom{00}}$$

w) 12.5% of 80 =

$$= \frac{12.5}{100} \times \frac{80}{1}$$

$$= \frac{1000}{100} = \boxed{\phantom{00}}$$

x) 12.5% of 160 =

$$= \frac{12.5}{100} \times \frac{160}{1}$$

$$= \frac{2000}{100} = \boxed{\phantom{00}}$$

y)  $33\frac{1}{3}\%$  of 150 =

$$= \frac{1}{3} \times \frac{150}{1}$$

Simplify:  $\div 3$

$$= \frac{150}{3} = \boxed{\phantom{00}}$$

z)  $33\frac{1}{3}\%$  of 180 =

$$= \frac{1}{3} \times \frac{180}{1}$$

$$= \frac{180}{3} = \boxed{\phantom{00}}$$

A)  $33\frac{1}{3}\%$  of 60 =

$$= \frac{1}{3} \times \frac{60}{1}$$

$$= \frac{60}{3} = \boxed{\phantom{00}}$$

B)  $66\frac{2}{3}\%$  of 90 =

$$= \frac{2}{3} \times \frac{90}{1}$$

$$= \frac{180}{3} = \boxed{\phantom{00}}$$

C)  $66\frac{2}{3}\%$  of 150 =

$$= \frac{2}{3} \times \frac{150}{1}$$

$$= \frac{300}{3} = \boxed{\phantom{00}}$$

D)  $66\frac{2}{3}\%$  of 210 =

$$= \frac{2}{3} \times \frac{210}{1}$$

$$= \frac{420}{3} = \boxed{\phantom{00}}$$

## Skill 11.5 Working with percentages greater than 100%.

MM7 11 22 33 44  
MM8 11 22 33 44

- Change the percentage to a fraction out of 100.

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

- Rewrite the question as a multiplication (change “of” to “ $\times$ ”).
- Change the whole number to a fraction over 1.

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

- Cross simplify the fractions before multiplying. (see skill 10.4, page 58)

Hint:

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

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

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

$300\% = \frac{3}{1} \Rightarrow$  multiply by 3

OR

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

**Q.**  $350\%$  of  $40 =$

**A.**  $350\%$  of  $40 =$  *OR*

$$= \frac{350}{100} \times \frac{40}{1} \quad \text{Simplify: } \div 10, \text{ twice}$$

$$= 35 \times 4$$

$$= \mathbf{140}$$

**A.**  $100\%$  of  $40$  is  $40$   
So  $300\%$  is triple that,  
or  $120$   
 $50\%$  of  $40$  is  $20$   
So  $350\%$  of  $40$  is  
 $120 + 20 = \mathbf{140}$

**a)**  $200\%$  of  $60 =$

$$= \frac{200}{100} \times \frac{60}{1} \quad \text{Simplify: } \div 10, \text{ twice}$$

$$= 20 \times 6 = \mathbf{120}$$

**b)**  $300\%$  of  $50 =$

$$= \frac{300}{100} \times \frac{50}{1}$$

$$= \mathbf{\quad}$$

**c)**  $400\%$  of  $70 =$

$$= \frac{400}{100} \times \frac{70}{1}$$

$$= \mathbf{\quad}$$

**d)**  $120\%$  of  $80 =$  *Find 100%*

$$100\% \text{ of } 80 = 80$$

$$20\% \text{ of } 80 = 16 \quad \text{Find 20\%}$$

*Add the results*

$$80 + 16 = \mathbf{\quad}$$

**e)**  $110\%$  of  $90 =$

$$= \frac{110}{100} \times \frac{90}{1}$$

$$= \mathbf{\quad}$$

**f)**  $250\%$  of  $30 =$

$$= \frac{250}{100} \times \frac{30}{1}$$

$$= \mathbf{\quad}$$

**g)**  $250\%$  of  $40 =$

$$= \frac{250}{100} \times \frac{40}{1}$$

$$= 25 \times 4 = \mathbf{\quad}$$

**h)**  $140\%$  of  $50 =$

$$= \frac{140}{100} \times \frac{50}{1}$$

$$= \mathbf{\quad}$$

**i)**  $220\%$  of  $80 =$

$$= \frac{220}{100} \times \frac{80}{1}$$

$$= \mathbf{\quad}$$

**j)**  $130\%$  of  $60 =$

$$= \frac{130}{100} \times \frac{60}{1}$$

$$= \mathbf{\quad}$$

**k)**  $120\%$  of  $70 =$

$$= \frac{120}{100} \times \frac{70}{1}$$

$$= \mathbf{\quad}$$

**l)**  $350\%$  of  $40 =$

$$= \frac{350}{100} \times \frac{40}{1}$$

$$= \mathbf{\quad}$$

- Calculate the percentage of the given amount. (see skill 11.3, page 67 and skill 11.4, page 69)

To find the **sale price** if a **discount** is applied:

- Subtract this result from the given amount.

To find the **total amount** if a **sales tax** is applied:

- Add this result to the given amount.

**Q.** If a sales tax rate of 6% is applied on a purchase of \$200, what is the total amount that must be paid?

**A.** Sales tax:  $6\%$  of  $200 =$   

$$= \frac{6}{100} \times \frac{200}{1}$$

$$= 6 \times 2 = 12$$

Total:  $200 + 12 =$  **\$212**

**a)** If a \$30 T-shirt is reduced by 15%, what is the discount?

discount:  $15\%$  of  $30 =$

$$= \frac{15}{100} \times \frac{30}{1} = \frac{45}{10} =$$
 **\$ 4.50**

**b)** If a \$120 bike is reduced by 25%, what is the discount?

discount:

$$=$$
 **\$**

**c)** If a \$3000 laptop is reduced by 20%, what is the sale price?

discount:  $20\%$  of  $3000 =$

$$= \frac{20}{100} \times \frac{3000}{1} = 600$$
 Divide by 100

sale price:  $\$3000 - \$600 =$  **\$**

**d)** If a \$500 dress is discounted by 40%, what is the sale price?

discount:

$$=$$
  
 sale price:  $=$  **\$**

**e)** If a sales tax rate of 4% is applied on a purchase of \$500, what is the total amount that must be paid?

sales tax:  $4\%$  of  $500 =$

$$=$$
  
 total:  $\$500 +$   $=$  **\$**

**f)** If a sales tax rate of 5% is applied on a purchase of \$120, what is the total amount that must be paid?

sales tax:

$$=$$
  
 total:  $=$  **\$**

**g)** If a sales tax rate of 6% is applied on a restaurant bill of \$80, what is the total amount that must be paid?

sales tax:

$$=$$
  
 total:  $\$80 +$   $=$  **\$**

**h)** If a sales tax rate of 4% is applied on a purchase of \$60, what is the total amount that must be paid?

sales tax:

$$=$$
  
 total:  $=$  **\$**

- Form a fraction using the two numbers.

EITHER

- Multiply this fraction by 100%:  $\text{fraction} = \text{fraction} \times 100\%$

Hint: 100% equals 1 and does not change the value of the fraction.

- Simplify the resulting fraction and/or change it to a mixed number if necessary. (see skill 9.1, page 39)

OR

- Find an equivalent fraction with the denominator 100, by multiplying or dividing both the numerator and denominator by the same number.
- Write this fraction as a percentage. (see skill 12.9, page 84)

Hint: Both numbers must represent the same unit of measurement.

<p><b>Q.</b> Write as a percentage: 23 out of 50.</p>	<p><b>A.</b> 23 out of 50 =</p> $= \frac{23}{50} \times 100\%$ $= \frac{23}{\cancel{50}^1} \times \frac{100^2}{1} \% \quad \text{Simplify: } \div 50$ $= 23 \times 2$ $= 46\%$	<p>OR</p>	<p><b>A.</b> 23 out of 50 =</p> $= \frac{23 \times 2}{50 \times 2}$ $= \frac{46}{100}$ $= 46\%$
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- a)** Write as a percentage:  
12 out of 60.

$$\frac{12 \div 12}{60 \div 12} = \frac{1}{5} \quad \text{Simplify: } \div 12$$

$$\frac{1 \times 20}{5 \times 20} = \frac{20}{100} \quad \text{Find equivalent fraction}$$

20%

- b)** In Australia 88 out of every 100 people live in an urban area. What percentage is this?

.....

.....

- c)** At the 2010 Delhi Commonwealth Games, 3 out of the 4 medals won by Samoa were gold. What percentage is this?

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=

.....

- d)** For every 20 Skype calls made, 8 calls are video to video. What percentage is this?

.....

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- e)** A male lion weighs 225 kg. It eats 9 kg of food each day. What percentage of its own weight does a lion eat each day?

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.....

- f)** Of the 1 billion cattle in the world, 200 million are in India. What percentage of the world's cattle are in India?

.....

.....

**Skill 11.8** Calculating profit or loss as a percentage of the cost price.

MM7 11 22 33 44  
MM8 11 22 33 44

- Calculate the profit or the loss, as the difference between the selling and the cost price.
- Express the profit or the loss as a percentage of the cost price. (see skill 11.7, page 73)

**Q.** A shop buys jackets in bulk for \$50 each, then sells them for \$95 each. Calculate the profit on each jacket as a percentage of the cost price.

**A.** *profit:*  $\$95 - \$50 = \$45$   
*profit out of cost price:*  $\$45 \text{ out of } \$50 = \frac{45}{50}$   
 $= \frac{45}{50} \times \frac{100}{1} \% = \frac{450}{5} \%$   
 $= \mathbf{90\%}$

**a)** Lorien lost \$40 on a ring costing \$400. What was her loss as a percentage of the cost price?

*loss:* \$40

*loss out of cost:* \$40 out of \$400 =

$= \frac{40}{400} \times \frac{100}{1} \% = \frac{40}{4} \% = \mathbf{10\%}$

**b)** The Cycle Centre made \$30 profit on a bicycle costing \$150. What was the profit as a percentage of the cost price?

*profit:*

*profit out of cost:*

$=$    $=$

**c)** John made \$20 profit on a tool box costing \$100. What was his profit as a percentage of the cost price?

*profit:*

*profit out of cost:*

$=$    $=$

**d)** Jason lost \$15 on a book costing \$30. What was his loss as a percentage of the cost price?

*loss:*

*loss out of cost:*

$=$    $=$

**e)** Serena bought a car for \$5000. If she later sold it for \$3500, find the loss as a percentage of the cost price.

$=$    $=$

**f)** A shop buys school uniforms in bulk for \$75 each, then sells them for \$100 each. Find the profit as a percentage of the cost price.

$=$    $=$

**g)** Amelia bought a table for \$400. If she later sold it for \$350, find the loss as a percentage of the cost price.

$=$    $=$

**h)** A painting was bought for \$6000. If it was later sold for \$7500, find the profit as a percentage of the cost price.

$=$    $=$