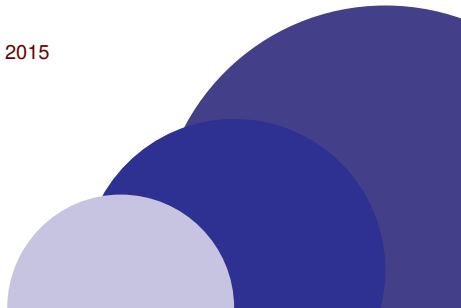


# All

diagrams, examples and exercises

[mismatchtea.co.uk](http://mismatchtea.co.uk)

August 24, 2015



dimensional analysis

introduction

# Dimensional analysis

Sort the following

- all lower case letters represent lengths
- $\pi$  and  $\theta$  are constants

$$\frac{\theta}{360} \times 2\pi r$$

$$\pi r^2$$

$$\frac{a+b}{2} \times h$$

$$x^3$$

$$\frac{1}{3} \pi r^2 h$$

$$2(l+w)$$

$$\frac{abd}{2}$$

$$8p$$

$$\pi d$$

$$\frac{ab}{2}$$

$$\frac{4}{3} \pi r^3$$

$$4\pi r^2$$

# Dimensional analysis

## Solution

length	$\pi d$	$\frac{\theta}{360} \times 2\pi r$	$2(l + w)$	$8p$
area	$\pi r^2$	$\frac{ab}{2}$	$\frac{a + b}{2} \times h$	$4\pi r^2$
volume	$\frac{1}{3}\pi r^2 h$	$\frac{abd}{2}$	$\frac{4}{3}\pi r^3$	$x^3$

# Dimensional analysis

## Extension

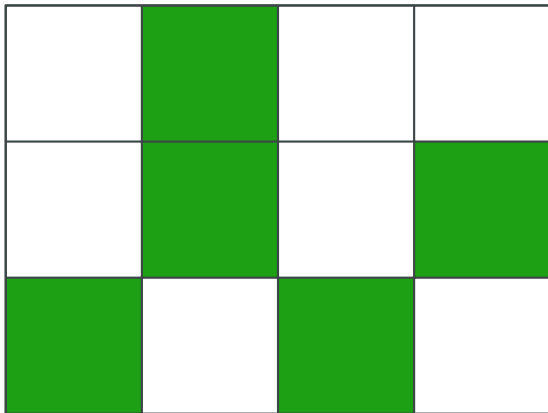
Draw diagrams to represent each of the formulae from the previous activity

fractions

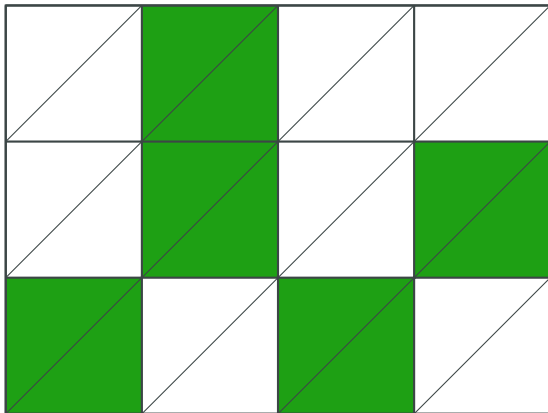
equivalent fractions



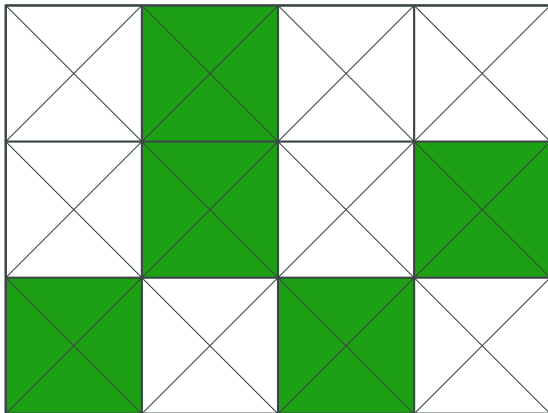
# Equivalent fractions



# Equivalent fractions



# Equivalent fractions



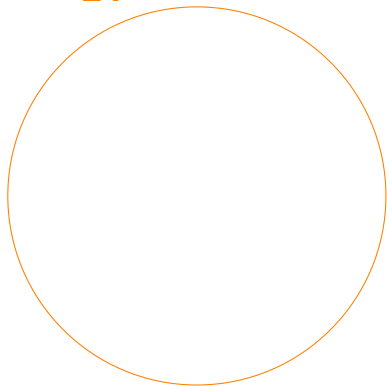
hcf & lcm

venn diagrams

# Venn diagram

Find the HCF and the LCM of 24 and 60.

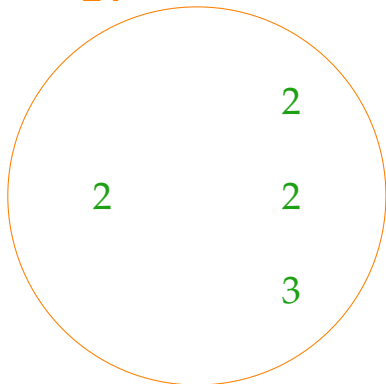
**24**



# Venn diagram

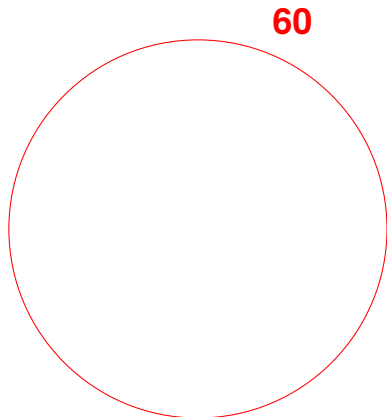
Find the HCF and the LCM of 24 and 60.

**24**



# Venn diagram

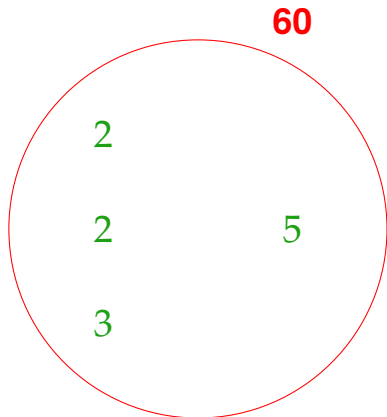
Find the HCF and the LCM of 24 and 60.





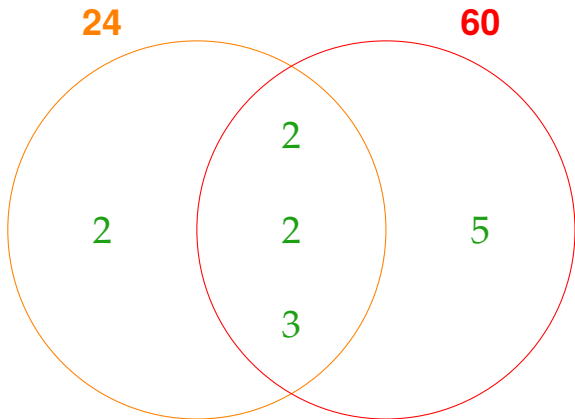
# Venn diagram

Find the HCF and the LCM of 24 and 60.



# Venn diagram

Find the HCF and the LCM of 24 and 60.



exercises

# Exercises 1

Calculate the following

a) LCM (5, 6)

f) HCF (18, 24)

b) LCM (18, 72)

g) HCF (14, 91)

c) LCM (35, 40)

h) HCF (84, 120)

d) LCM (5, 8, 10)

i) HCF (6, 30, 96)

e) LCM (84, 184)

j) HCF (56, 980)

# Exercises 1

Calculate the following

a) LCM (5, 6)

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## Extension

A red light flashes every 5 seconds, a blue light every 8 seconds and a green light every 10 seconds. They have all just flashed at the same time. When will they next flash together again?

# Exercises 1

Calculate the following

a) LCM (5, 6)                      30

f) HCF (18, 24)

b) LCM (18, 72)                    72

g) HCF (14, 91)

c) LCM (35, 40)                    280

h) HCF (84, 120)

d) LCM (5, 8, 10)                  40

i) HCF (6, 30, 96)

e) LCM (84, 184)                  3864

j) HCF (56, 980)

## Extension

A red light flashes every 5 seconds, a blue light every 8 seconds and a green light every 10 seconds. They have all just flashed at the same time. When will they next flash together again?

# Exercises 1

Calculate the following

- |                   |      |                    |    |
|-------------------|------|--------------------|----|
| a) LCM (5, 6)     | 30   | f) HCF (18, 24)    | 6  |
| b) LCM (18, 72)   | 72   | g) HCF (14, 91)    | 7  |
| c) LCM (35, 40)   | 280  | h) HCF (84, 120)   | 12 |
| d) LCM (5, 8, 10) | 40   | i) HCF (6, 30, 96) | 6  |
| e) LCM (84, 184)  | 3864 | j) HCF (56, 980)   | 28 |

## Extension

A red light flashes every 5 seconds, a blue light every 8 seconds and a green light every 10 seconds. They have all just flashed at the same time. When will they next flash together again?

# Exercises 1

Calculate the following

- |                   |      |                    |    |
|-------------------|------|--------------------|----|
| a) LCM (5, 6)     | 30   | f) HCF (18, 24)    | 6  |
| b) LCM (18, 72)   | 72   | g) HCF (14, 91)    | 7  |
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| e) LCM (84, 184)  | 3864 | j) HCF (56, 980)   | 28 |

## Extension

A red light flashes every 5 seconds, a blue light every 8 seconds and a green light every 10 seconds. They have all just flashed at the same time. When will they next flash together again?

40 seconds



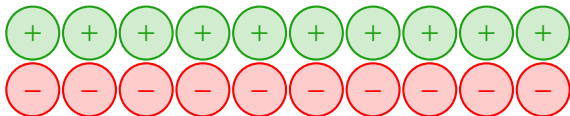
negative numbers

type c (+-)

# Negative numbers

## Addition and subtraction of negative numbers

What is the value of the following diagram?



# Negative numbers

## Touching symbols

When two symbols are touching (e.g.  $7 +^- 6$ )

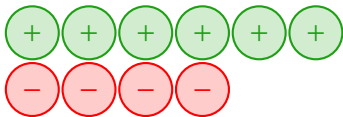
- the first symbol is an instruction to draw (+) or remove (-) discs.
- the second symbol describes the type of disc (+ positive discs or - negative discs).

So  $7 +^- 6$  means 'draw six negative discs'.

# Negative numbers

Adding positive quantities

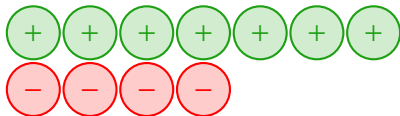
$$2 + + 4$$



# Negative numbers

Adding positive quantities

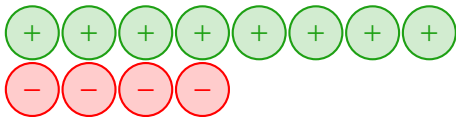
$$2 + + 4$$



# Negative numbers

Adding positive quantities

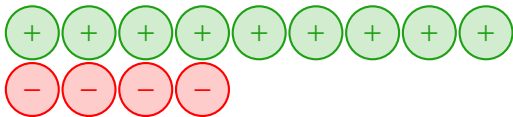
$$2 + + 4$$



# Negative numbers

Adding positive quantities

$$2 + + 4$$





# Negative numbers

Adding positive quantities

$$2 + + 4$$



# Negative numbers

Adding negative quantities

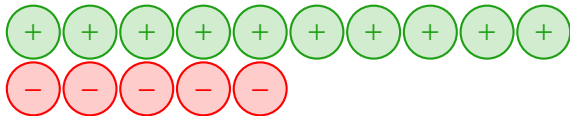
$$6 +^{-} 5$$



# Negative numbers

Adding negative quantities

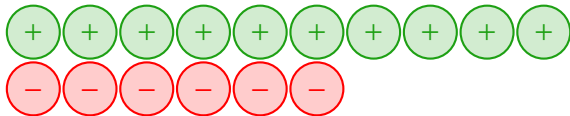
$$6 +^{-} 5$$



# Negative numbers

Adding negative quantities

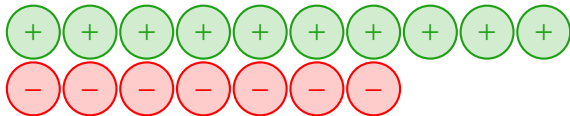
$$6 +^{-} 5$$



# Negative numbers

Adding negative quantities

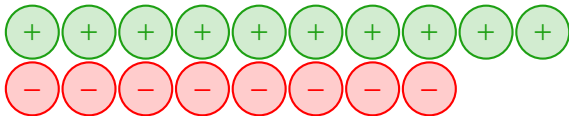
$$6 +^{-} 5$$



# Negative numbers

Adding negative quantities

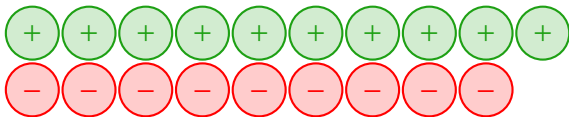
$$6 +^{-} 5$$



# Negative numbers

Adding negative quantities

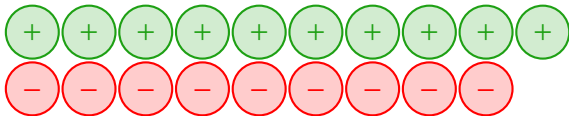
$$6 +^{-} 5$$



# Negative numbers

Subtracting positive quantities

$$1 - ^+ 6$$

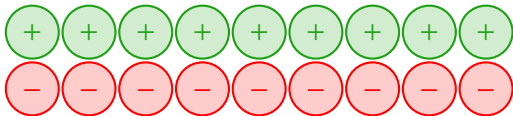




# Negative numbers

Subtracting positive quantities

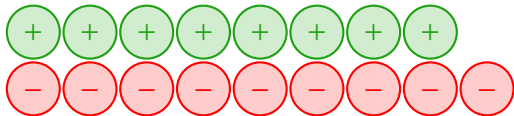
$$1 - ^+ 6$$



# Negative numbers

Subtracting positive quantities

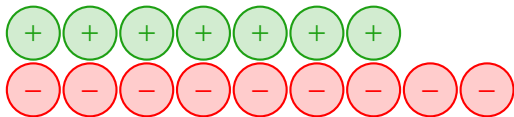
$$1 - ^+ 6$$



# Negative numbers

Subtracting positive quantities

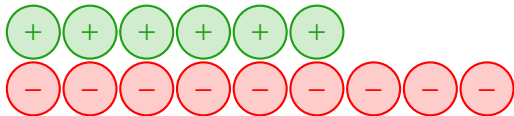
$$1 - ^+ 6$$



# Negative numbers

Subtracting positive quantities

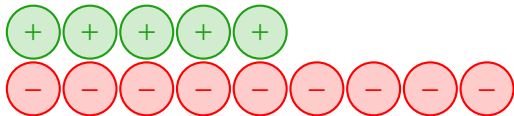
$$1 - ^+ 6$$



# Negative numbers

Subtracting positive quantities

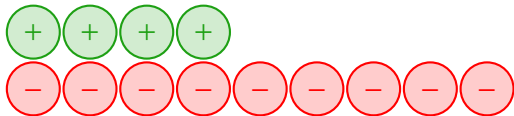
$$1 - ^+ 6$$



# Negative numbers

Subtracting positive quantities

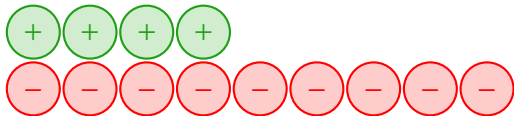
$$1 - ^+ 6$$



# Negative numbers

Subtracting negative quantities

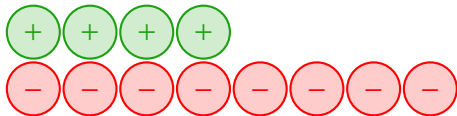
$$-5 - -8$$



# Negative numbers

Subtracting negative quantities

$$-5 - -8$$

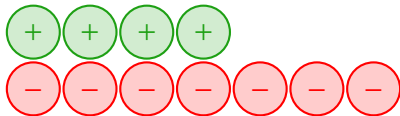




# Negative numbers

Subtracting negative quantities

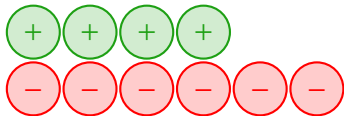
$$-5 - -8$$



# Negative numbers

Subtracting negative quantities

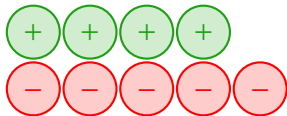
$$-5 - -8$$



# Negative numbers

Subtracting negative quantities

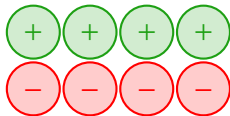
$$-5 - -8$$



# Negative numbers

Subtracting negative quantities

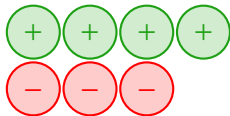
$$-5 - -8$$



# Negative numbers

Subtracting negative quantities

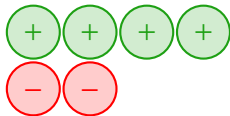
$$-5 - -8$$



# Negative numbers

Subtracting negative quantities

$$-5 - -8$$



# Negative numbers

Subtracting negative quantities

$$-5 - -8$$

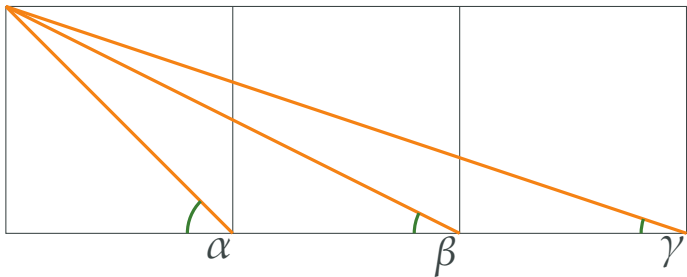


puzzles



geometry

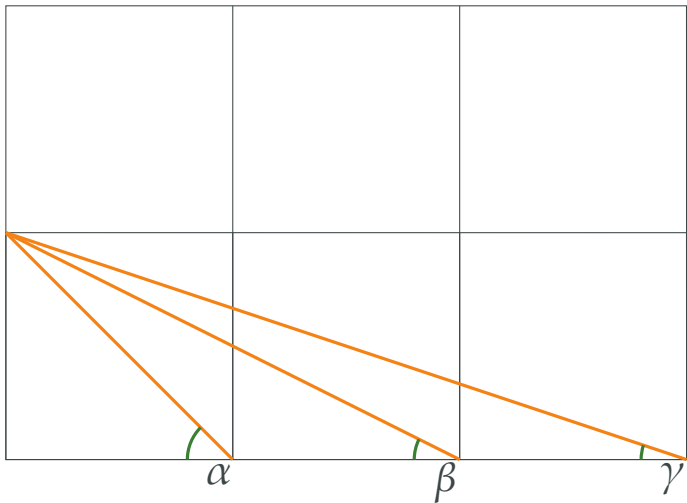
## Three square geometry



$$\alpha + \beta + \gamma = ?$$

# Three square geometry

Hint for finding  $\alpha + \beta + \gamma$

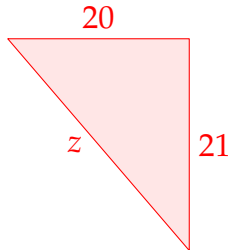
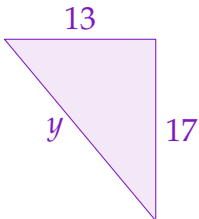
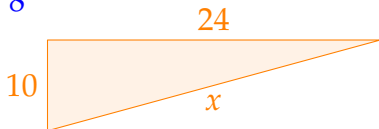
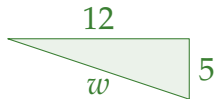
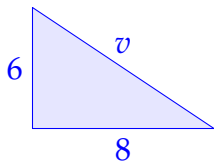


pythagoras

exercises

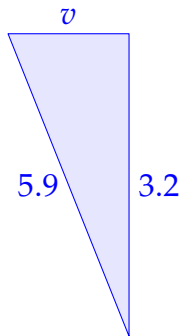
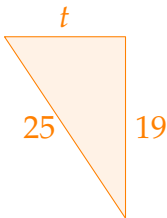
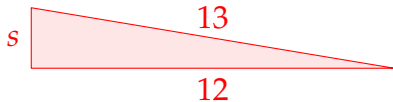
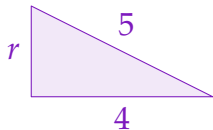
# Pythagoras

Find the missing hypotenuse in these diagrams



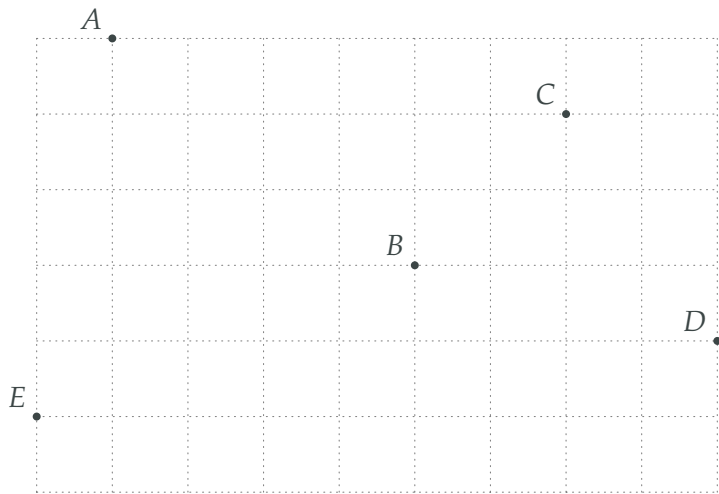
# Pythagoras

Find the missing short side in these diagrams



# Pythagoras

Find the shortest distance between each point

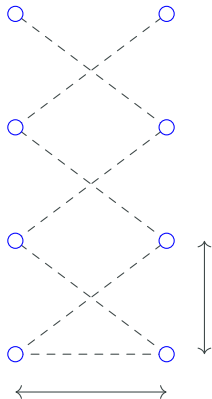




shoe shop investigation

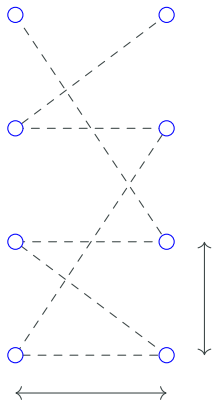
# American laces

Find the length of lace needed to tie an American shoelace



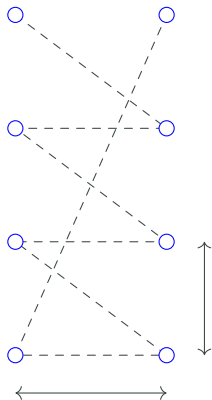
# European laces

Find the length of lace needed to tie a European shoelace



# Shoe shop laces

Find the length of lace needed to tie a shoe shop shoelace



transformations

functions to instructions afl

# Describing transformations

## Instructions

- Describe each transformation in words.
- Draw a sketch to demonstrate the transformation.

### Example

The graph  $f(x)$  is transformed to

$$f(x) + 3$$

# Describing transformations

## Instructions

- Describe each transformation in words.
- Draw a sketch to demonstrate the transformation.

### Example

The graph  $f(x)$  is transformed to

$$f(x) + 3$$

### Solution

A translation by  $\begin{pmatrix} 0 \\ 3 \end{pmatrix}$  (move 3 units up).



## Question 1

The graph of  $f(x)$  is transformed to

$$f(x - 5)$$

## Question 2

The graph of  $f(x)$  is transformed to

$$f(x) + 6$$

## Question 3

The graph of  $f(x)$  is transformed to

$$3f(x)$$

## Question 4

The graph of  $f(x)$  is transformed to

$$f(x - 1) + 3$$

## Question 5

The graph of  $f(x)$  is transformed to

$$\frac{1}{2}f(x) - 7$$

## Question 6

The graph of  $f(x)$  is transformed to

$$f(3x)$$

## Question 7

The graph of  $f(x)$  is transformed to

$$-f(2x)$$

## Question 8

The graph of  $f(x)$  is transformed to

$$-f(x + 2) - 6$$



## Question 9

The graph of  $f(x)$  is transformed to

$$f(9 - x) + 8$$

## Question 10

The graph of  $f(x)$  is transformed to

$$-f(-3x) + 5$$

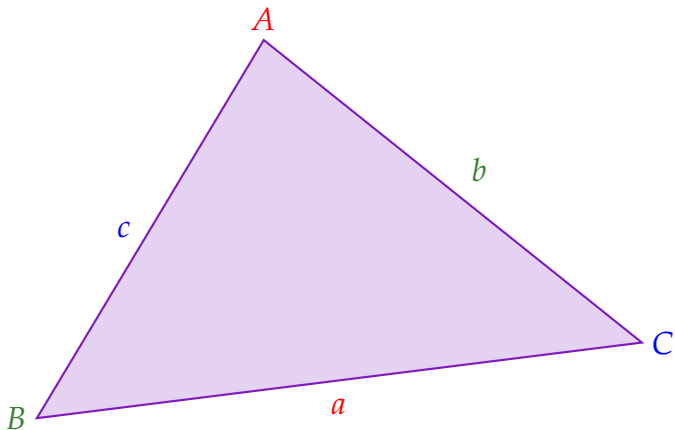
trigonometry

sine rule

# Sine rule

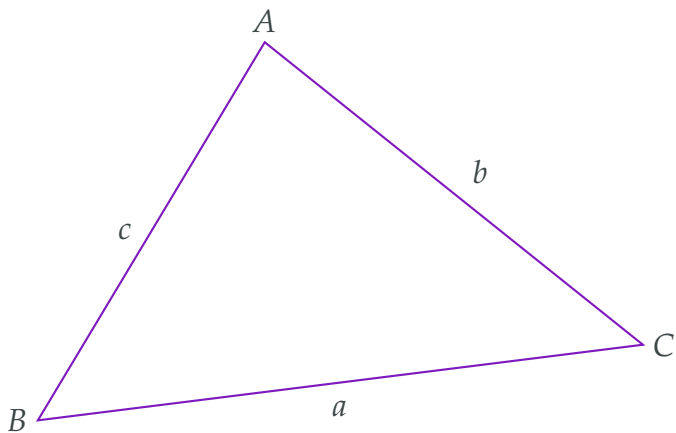
## Labelling triangles

The convention for labelling all triangles is



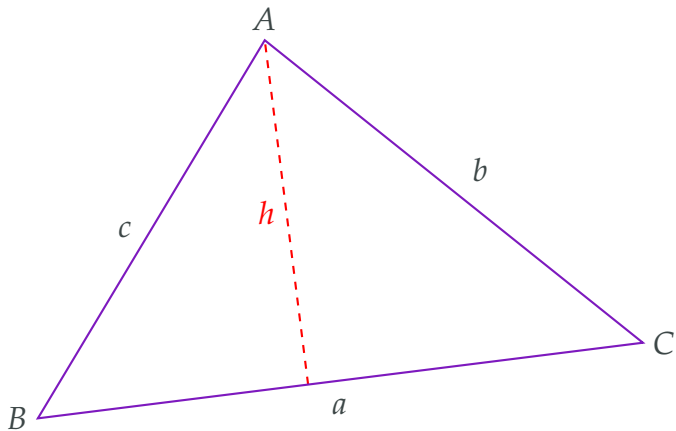
# Sine rule

Derive the rule



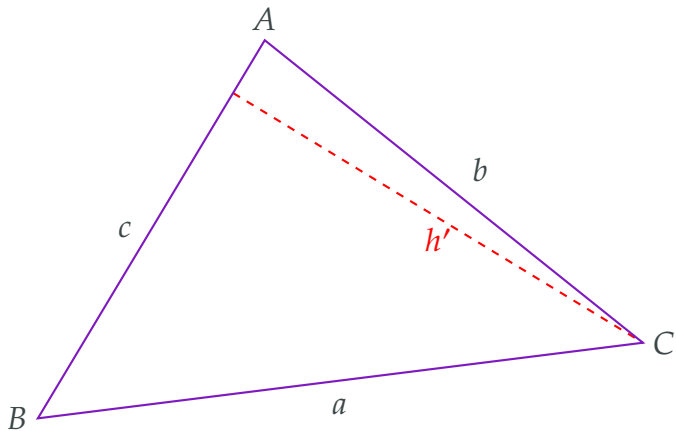
# Sine rule

Derive the rule



# Sine rule

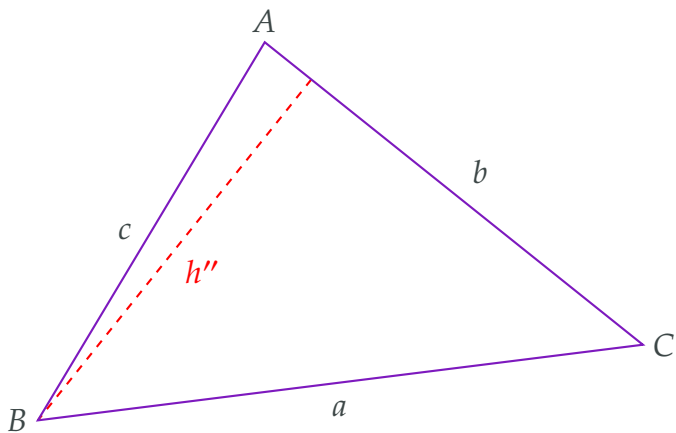
Derive the rule





# Sine rule

Derive the rule

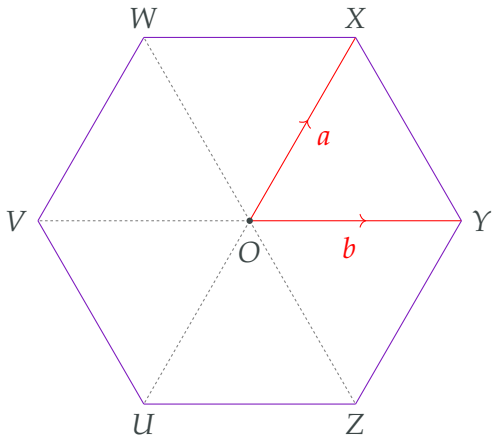


vectors

exercise

# Exercise

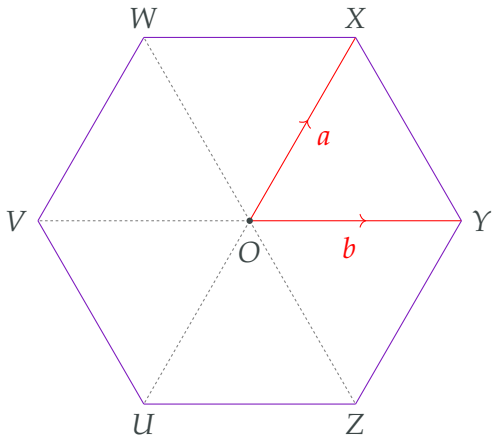
Write down the vectors in terms of  $\mathbf{a}$  and  $\mathbf{b}$



- $\overrightarrow{WX}$
- $\overrightarrow{UX}$
- $\overrightarrow{YV}$
- $\overrightarrow{XY}$
- $\overrightarrow{VU}$
- $\overrightarrow{XZ}$
- $\overrightarrow{WU}$

# Exercise

Write down the vectors in terms of  $\mathbf{a}$  and  $\mathbf{b}$



- $\overrightarrow{WX}$   $b$
- $\overrightarrow{UX}$   $2a$
- $\overrightarrow{YV}$   $-2b$
- $\overrightarrow{XY}$   $b - a$
- $\overrightarrow{VU}$   $b - a$
- $\overrightarrow{XZ}$   $b - 2a$
- $\overrightarrow{WU}$   $b - 2a$