Word

integer

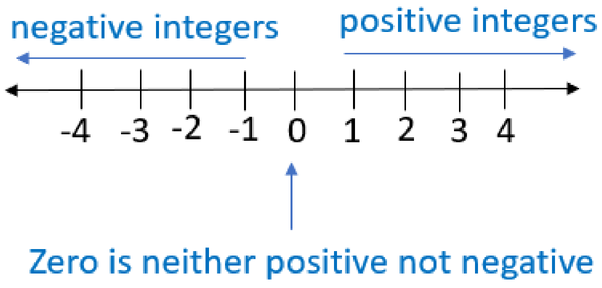
Example

-15 , 7 , 43

are all integers

Picture, model, or diagram

Integer Number Line



Non-Example

0.5 , -6.2 , 81.9

are not integers

Word

divisor

$18 \div 3 = 6$

3 is the divisor.

Picture, model, or diagram

18		
6	6	6

18 divided between three

The number of groups is the divisor

$18 \div 3 = 6$

18 is the dividend

Word

dividend

$18 \div 3 = 6$

18 is the dividend

Picture, model, or diagram

18		
6	6	6

18 divided between three

The original amount to be divided is the dividend

$18 \div 3 = 6$

3 is the divisor.

Word

quotient

Example

18 ÷ 3 = 6
6 is the quotient

Picture, model, or diagram

18		
6	6	6

18 divided between three gives six in each group
The size of the group is the quotient
(The ‘answer’ to a division calculation)

Non-Example

18 ÷ 3 = 6
18 is the dividend

Hampshire Services
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Word

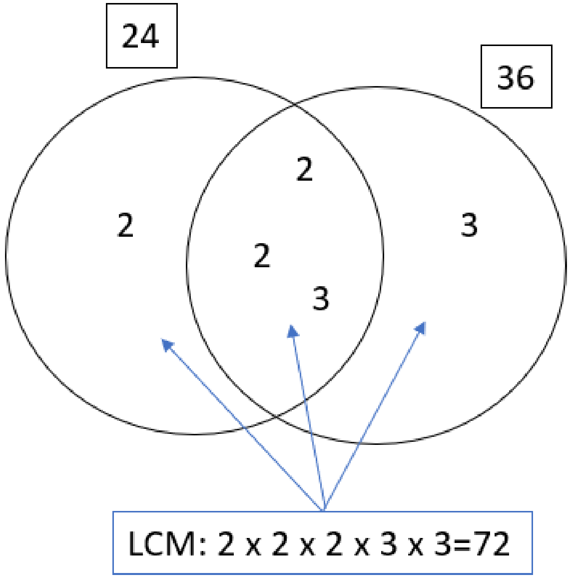
lowest common multiple (LCM)

Example

The LCM of 24 and 36 is 72

Picture, model, or diagram

Prime Factor Form
24 = 2 x 2 x 2 x 3
36 = 2 x 2 x 3 x 3



Non-Example

The HCF of 24 and 36 is 12 (highest common factor)

Word

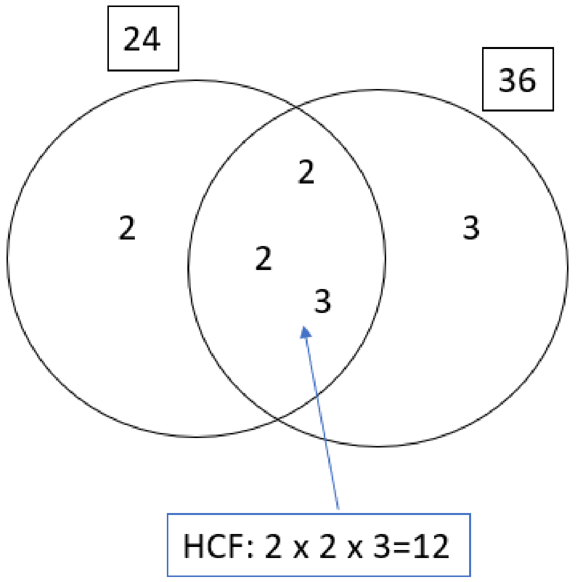
highest common factor (HCF)

Example

The HCF of 24 and 36 is 12

Picture, model, or diagram

Prime Factor Form
24 = 2 x 2 x 2 x 3
36 = 2 x 2 x 3 x 3



Non-Example

The LCM of 24 and 36 is 72 (lowest common multiple)

Word

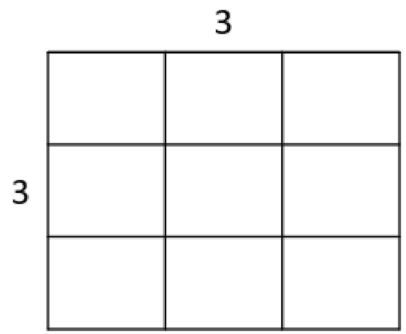
square root

Example

$$\sqrt{9} = + / - 3$$

$$\left\{ \begin{array}{l} 3 \times 3 = 9 \\ -3 \times -3 = 9 \end{array} \right\}$$

Picture, model, or diagram



$3 \times 3 = 3^2$

$3 \times 3 = 9$

$\sqrt{3^2} = 3$

Non-Example

$$\sqrt[3]{8} = 2$$

$$\{ 2 \times 2 \times 2 = 8 \}$$

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Word

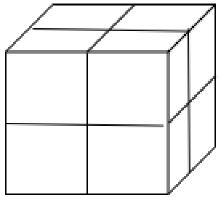
cube root

Example

$$\sqrt[3]{8} = 2$$

$$\{2 \times 2 \times 2 = 8\}$$

Picture, model, or diagram



$2 \times 2 \times 2 = 2^3$

$2 \times 2 \times 2 = 8$

$\sqrt[3]{8} = 2$

Non-Example

$$\sqrt{9} = + / - 3$$

$$\left\{\begin{array}{l} 3 \times 3 = 9 \\ -3 \times -3 = 9 \end{array}\right\}$$

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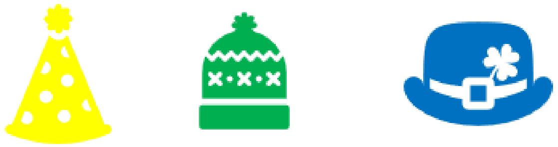
Word

product rule

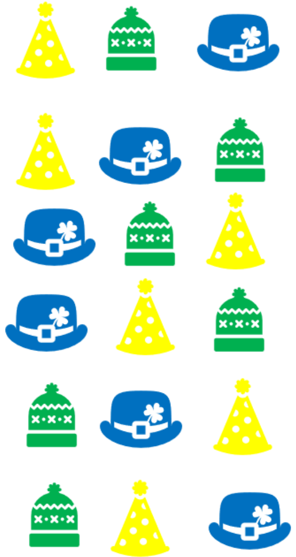
(for counting)

Example

The number of different ways 3 hats can be distributed amongst 3 people is 3 x 2 x 1 = 6



Picture, model, or diagram



Person 1 has three choices (YGB)
Person 2 then has two choices (GB)
Person 2 than has one choice (B)

Non-Example

The probability of selecting yellow, then green, then blue is $\frac{1}{6}$

Word

index (indices)

Example

$14^3 = 14 \times 14 \times 14 = 2744$

14 is the base

3 is the index (or power)

Picture, model, or diagram

$x^1=14$

x^4	x^3	x^2	x^1	x^0
38416	2744	196	14	1

Non-Example

$14 \times 3 = 42$

Word

surd

Example

$$\sqrt{3}$$

{3 is an 'imperfect square'}

A surd is not a whole number . It's decimal equivalent is a non-repeating, non-terminating decimal.
You cannot place it accurately on a number-line.

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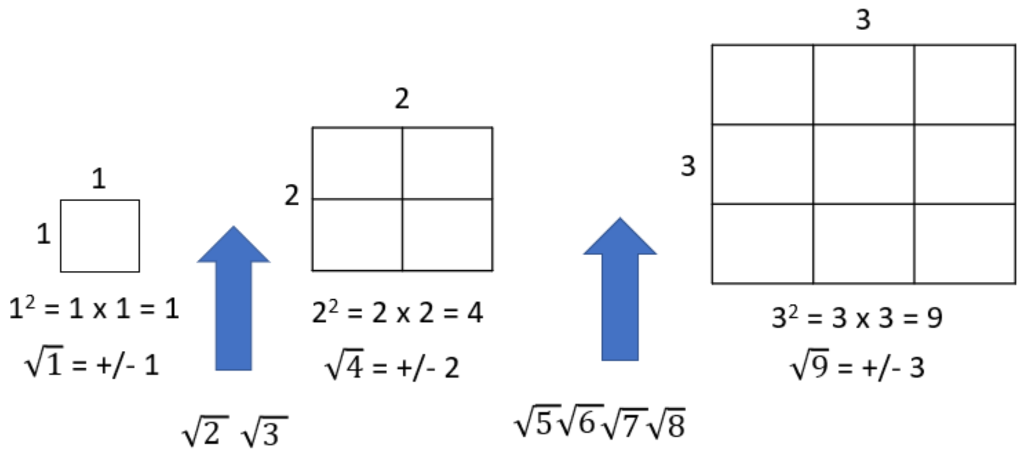
Picture, model, or diagram



Non-Example

$$\sqrt{4}$$

{4 is an 'perfect square' and can be evaluated as +/- 2 }

Word

rationalise (denominator)

Example

$$\frac{2}{\sqrt{3}} = \frac{2}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$$

3 is a rational number ~ you can place it on a number-line

Picture, model, or diagram

$$\frac{a}{\sqrt{b}} = \frac{a}{\sqrt{b}} \times \frac{\sqrt{b}}{\sqrt{b}} = \frac{a\sqrt{b}}{b}$$

$$\frac{\sqrt{b}}{\sqrt{b}} = 1$$

Non-Example

$$\frac{2}{\sqrt{3}}$$

This fraction has an irrational (surd) denominator
A surd is not a whole number . It's decimal equivalent is a non-repeating, non-terminating decimal. You cannot place it accurately on a number-line

Word

standard (index) form

Example

3.754×10^5

Picture, model, or diagram

Numbers in standard form have two parts

A number from 1 to 10, not including 10 x A power of 10

Standard index form	Ordinary form
1×10^3	1000
1×10^2	100
1×10^1	10
1×10^0	1
1×10^{-1}	0.1
1×10^{-2}	0.01
1×10^{-3}	0.001

Non-Example

375 400

Word

upper bound

Example

The length of a book is 27.3 cm to one decimal place
What is the upper bound of the book length?

The upper bound is +0.05cm

27.25 ≤ book length < 27.35

The upper bound is 27.35cm

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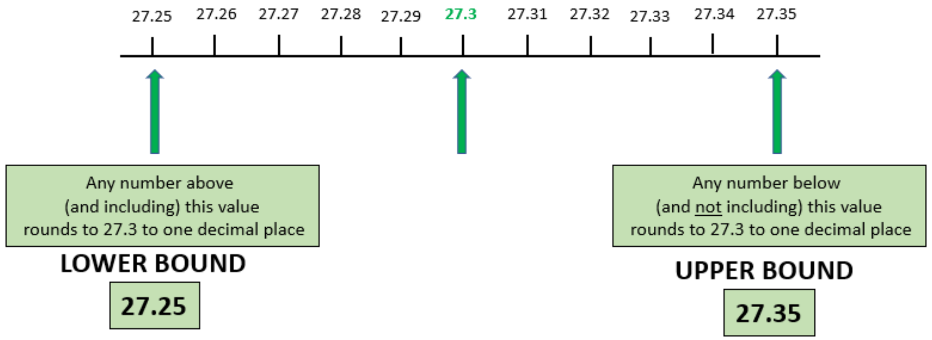
Picture, model, or diagram

The length of a book is 27.3 cm to one decimal place
What is the longest length the book could be ?



Non-Example

The lower bound is - 0.05cm

27.25 ≤ book length < 27.35

The lower bound is 27.25cm

Word

lower bound

Example

The length of a book is 27.3 cm to one decimal place
What is the lower bound of the book length?

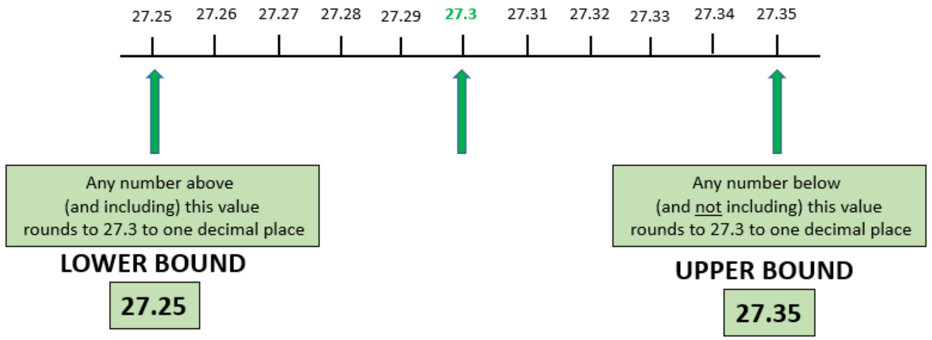
The lower bound is - 0.05cm

27.25 ≤ book length < 27.35

The lower bound is 27.25cm

Picture, model, or diagram

The length of a book is 27.3 cm to one decimal place
What is the longest length the book could be ?



Non-Example

The upper bound is +0.05cm

27.25 ≤ book length < 27.35

The upper bound is 27.35cm

Word

substitute

Example

Evaluate $7x - 10$ when $x = 12$

substitute $x = 12$ into the expression

$7\,(12) - 10 = 74$

Picture, model, or diagram

x	x	x	x	x	x	x	-10
12	12	12	12	12	12	12	-10

74

Non-Example

Find x when $7x - 10 = 74$
Solve for x

$7x = 84 \quad (\div 7)$

$x = 12$

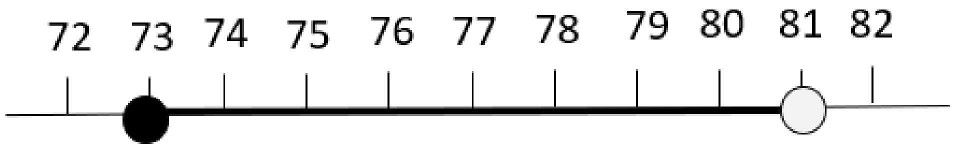
Word

inequality

Example

$73 \le t < 81$

Picture, model, or diagram



Non-Example

$t = 80$

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Word

expand (brackets)

Example

$$(x + 3)(x - 5) = x^2 - 2x - 15$$

Picture, model, or diagram

F = first pair
O = outer pair
I = inner pair
L = last pair

F $(x + 3)(x - 5) = x^2$

O $(x + 3)(x - 5) = x^2 - 5x$

I $(x + 3)(x - 5) = x^2 - 5x + 3x$

L $(x + 3)(x - 5) = x^2 - 5x + 3x - 15$

	x	+3
x	**x^2**	**+3x**
-5	**-5x**	**-15**

Non-Example

$$3 \times 4 + 7 \times 4 = 10 \times 4$$

Word

factorise

Example

$$x^2 - 2x - 15 = (x + 3)(x - 5)$$

Picture, model, or diagram

Factor pairs to -15
-15 = +3 x -5
-15 = -3 x +5
-15 = -1 x +15
-15 = +1 x -15

	x	+3
x	**x^2**	**+3x**
-5	**-5x**	**-15**

Which pair also sum to -2
For the x-term?
-2 = +3 – 5

Non-Example

$$10 \times 4 = 3 \times 4 + 7 \times 4$$

Word

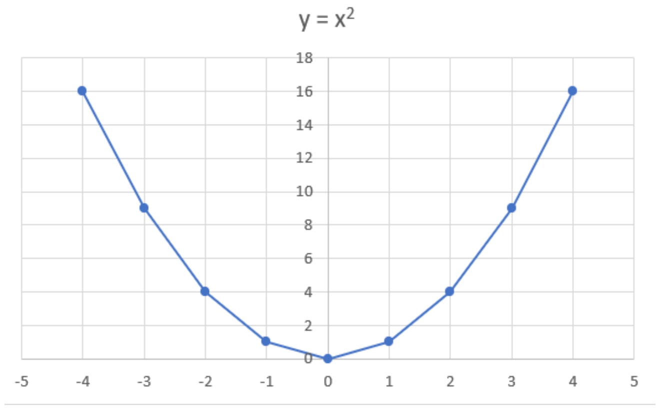
quadratic (function)

Example

$$y= 3x^2 + 5x - 6$$

In general , quadratic functions are of the form $y= ax^2 + bx - c$

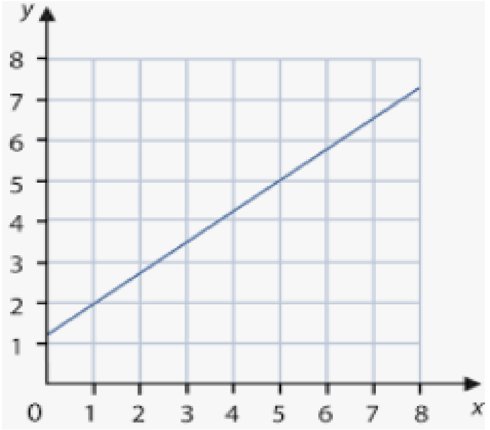
Picture, model, or diagram



$y = x^2$

$y = ax^2 + bx - c$
$(a = 1; b = 0; c = 0)$

Non-Example



$y = x + 1$

Word

n^{th} term

Example

15, 18, 21, 24, 27 …

The nth term of this sequence is
3n+12
$U_n = 3n+12$
$n=1$, $U_1 = 3(1) + 12 = 15$
$n=2$, $U_2 = 3(2) + 12 = 18$
$n=3$, $U_3 = 3(3) + 12 = 21$

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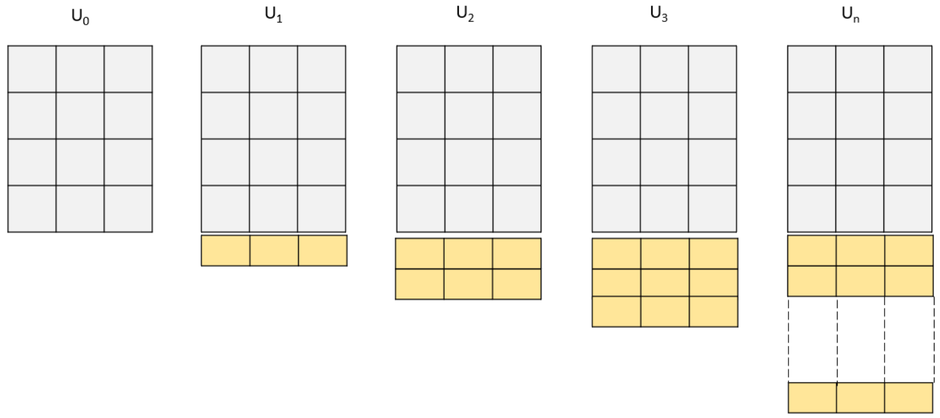
Picture, model, or diagram



$U_n = 3n+12$

Non-Example

15, 18, 21, 24, 27 …

The term-to-term rule for this sequence is ‘add 3’

Word

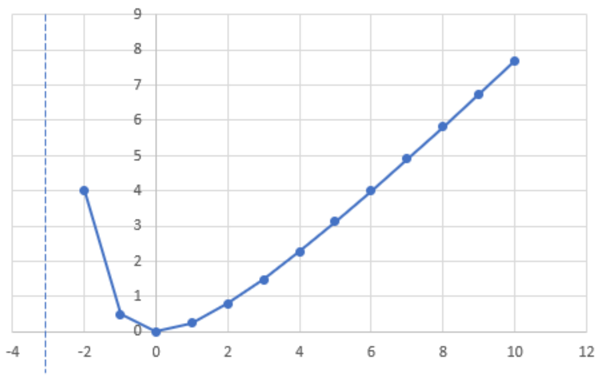
algebraic fraction

Example

$$\frac{x^2}{x+3}$$

Picture, model, or diagram

$y = \frac{x^2}{x+3}$ for x > -3



This graph has an asymptote at x=-3

Non-Example

$$2x\,(x+4)$$

Word

identity (≡)

Example

$$a^2 - b^2 \equiv (a + b)(a - b)$$

$$(a - b)(a + b) = a^2 + ab - ab - b^2$$

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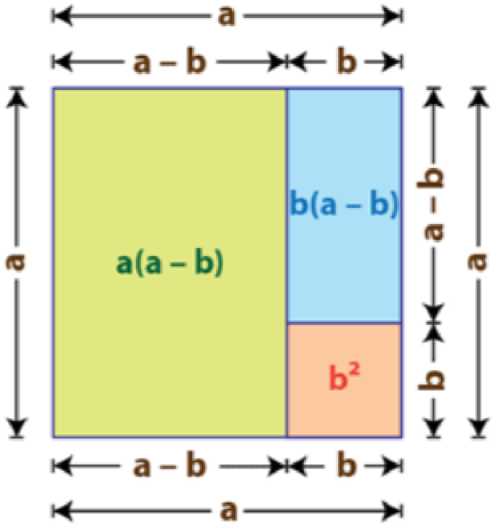
Picture, model, or diagram



Non-Example

$ab \approx 17$

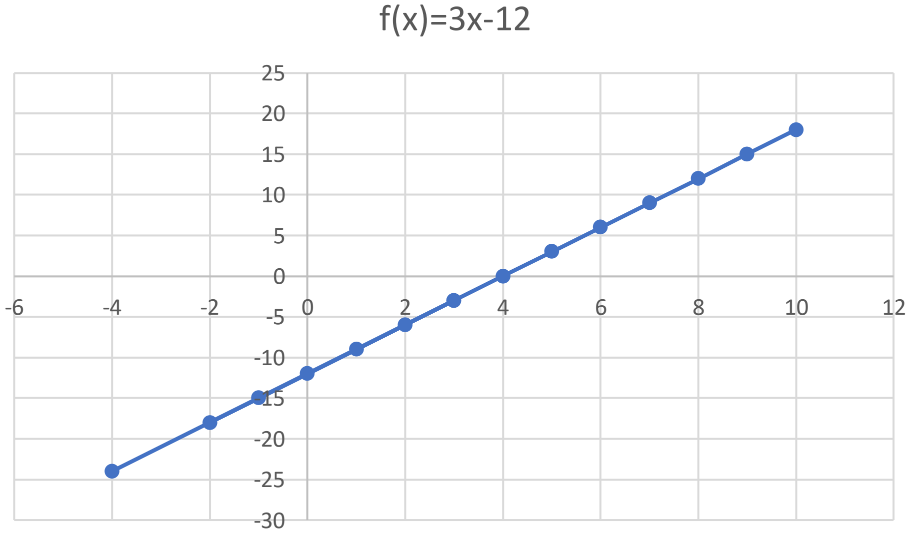
Word

function

Example

$$f(x) = 3x - 12$$

Picture, model, or diagram



Non-Example

$$3x - 12$$

Word

inverse function

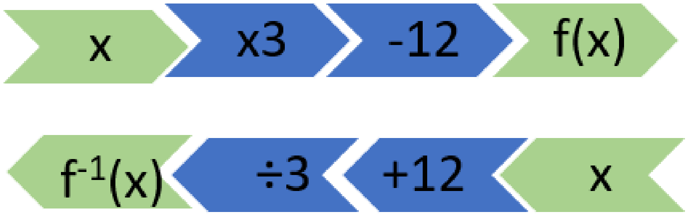
$$f^{-1}(x)$$

Example

$$f(x) = 3x - 12$$

$$f^{-1}(x) = \frac{x + 12}{3}$$

Picture, model, or diagram



Non-Example

$$3x - 12$$

Word

composite function

gf (x)

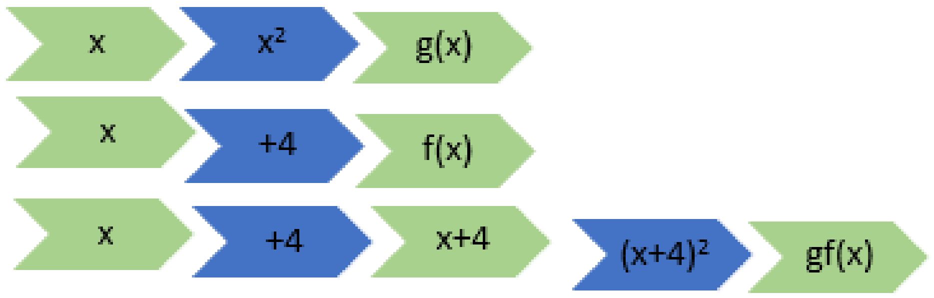
Example

$f(x) = x + 4$

$g(x) = x^2$

$gf(x) = (x + 4)^2$

Picture, model, or diagram



Non-Example

$g(x) = x^2$

Word

turning point

Example

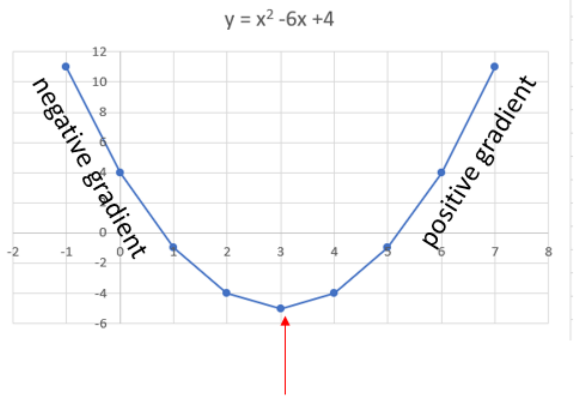
$y = x^2 - 6x + 4$

Complete the square

$y = (x-3)^2 - 5$

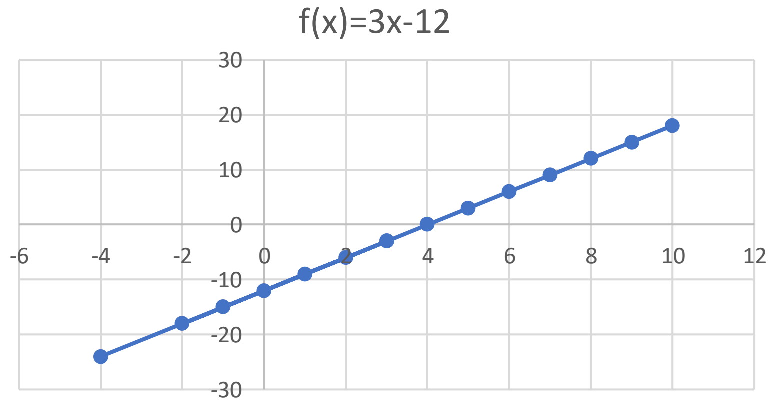
turning point is at (3,-5)

Picture, model, or diagr



Turning point at (3 , -5)

Non-Example



This linear graph has no turning point

Word

iteration

Example

Use the iterative formula $x_{n+1} = 1 + \frac{11}{x_n - 3}$

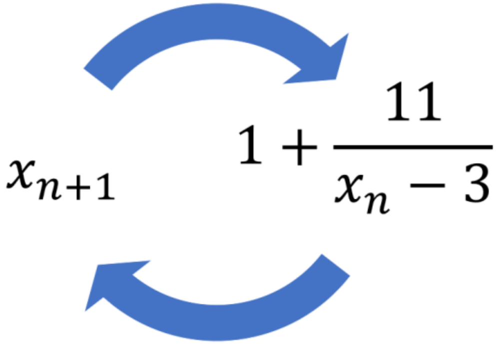
and the starting value x_1 = -2 to find a value for x_4

$x_2 = 1 + \frac{11}{-2-3}$ $\quad x_2$ = -1.2

$x_3 = 1 + \frac{11}{-1.2-3}$ $\quad x_3$ = -1.619

$x_4 = 1 + \frac{11}{-1.619-3}$ $\quad x_4$ = -1.381

Picture, model, or diagram



Non-Example

Substitute x = -2 into the equation

y = $1 + \frac{11}{x-3}$ to find the value of y

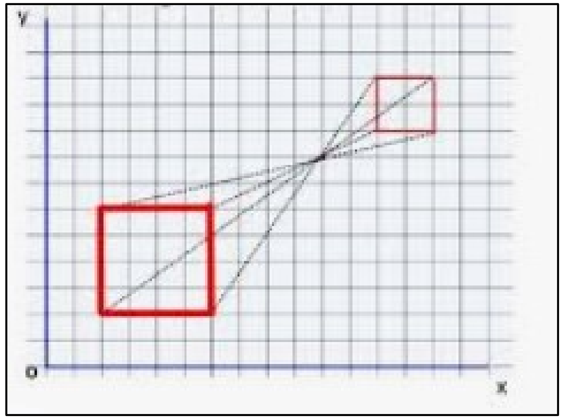
y = $1 + \frac{11}{-2-3}$

y = -1.2

Word

scale factor

Example



This is an enlargement with a scale factor of -2

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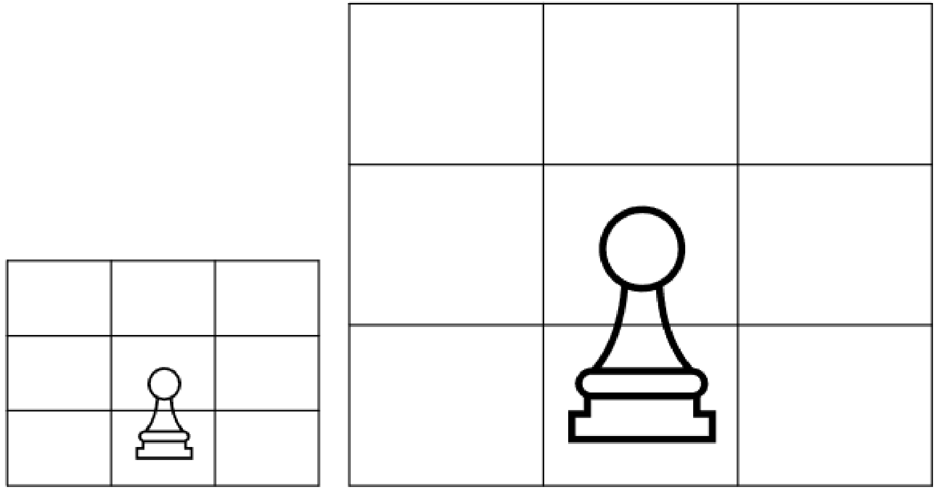
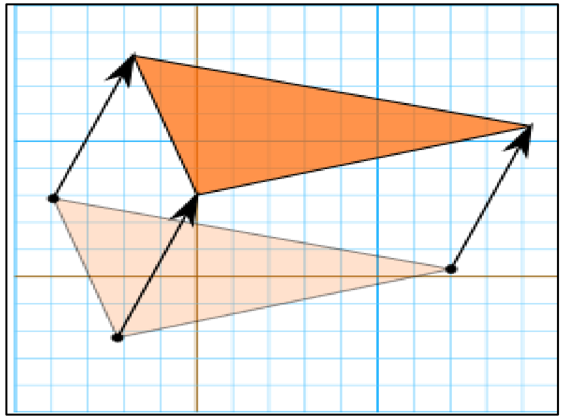
Picture, model, or diagram



Scale factor 2 → corresponding edges are twice as long

Non-Example



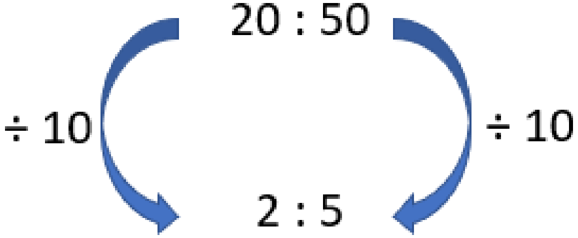
This is a translation.

Word

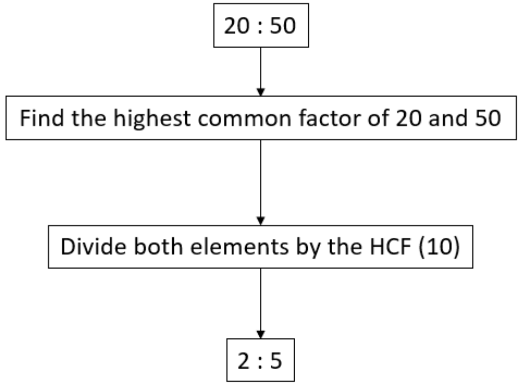
reduce

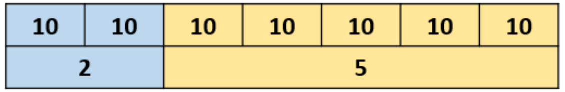
(to simplest form)

Example

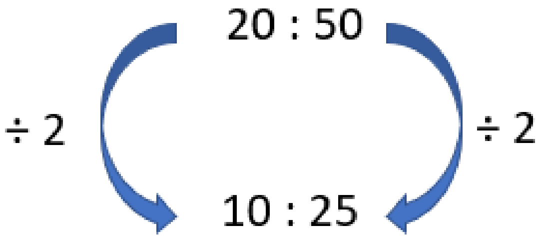


Picture, model, or diagram





Non-Example



Word

percentage (decrease)

Example

A watch is bought at a car boot sale for £50. It is later sold in a shop for £25. What is the percentage loss?

The watch has decreased by £25
The percentage decrease is
(difference / original) x 100 = 25/50 x 100 = 50%
A 50% loss has been made.

Picture, model, or diagram

original cost	
sold price	loss (difference)

The **percentage decrease** is (difference ÷original) x 100

Non-Example

A watch is bought at a car boot sale for £40. It is later sold in a shop for £50. What is the percentage profit?

The watch has increased by £10
The **percentage increase** is
(difference / original) x 100 = 10/40 x 100 = 25%
25% profit has been made.

Word

percentage (increase)

Example

A watch is bought at a car boot sale for £40. It is later sold in a shop for £50. What is the percentage profit?

The watch has increased by £10
The percentage increase is
(difference / original) x 100 = 10/40 x 100 = 25%
25% profit has been made.

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Picture, model, or diagram

sold price	
original cost	difference

The **percentage increase** is (difference ÷ original) x 100

Non-Example

A watch is bought at a car boot sale for £50. It is later sold in a shop for £25. What is the percentage loss?

The watch has decreased by £25
The **percentage decrease** is
(difference / original) x 100 = 25/50 x 100 = 50%
A 50% loss has been made.

Word

compound

(units)

Example

Calculate the density of aluminium if 20 cm^3 has a mass of 54 g.

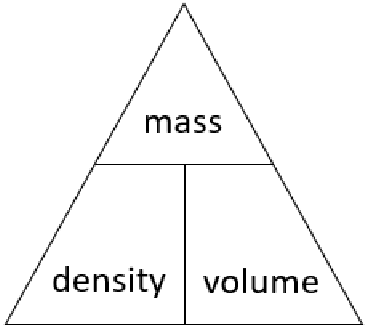
Density = mass ÷ volume

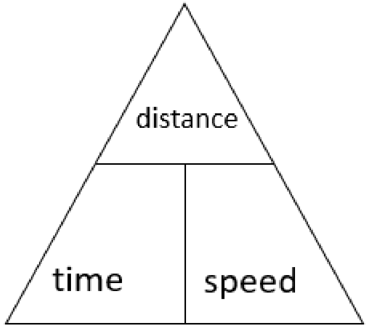
= 54 ÷ 20

= 2.7 g / cm^3 (grams per cubic centimetre)

Density is measured using compound units

Picture, model, or diagram





Non-Example

The mass of one apple is 10 grams

Calculate the mass of 5 apples

10g x 5 = 50g

Word

directly proportional

Example

y is directly proportional to x

when x = 3 , y = 15

write an equation for y in terms of x

y ∞ x

y = kx

→

15 = 3k

k= 5

y = 5x

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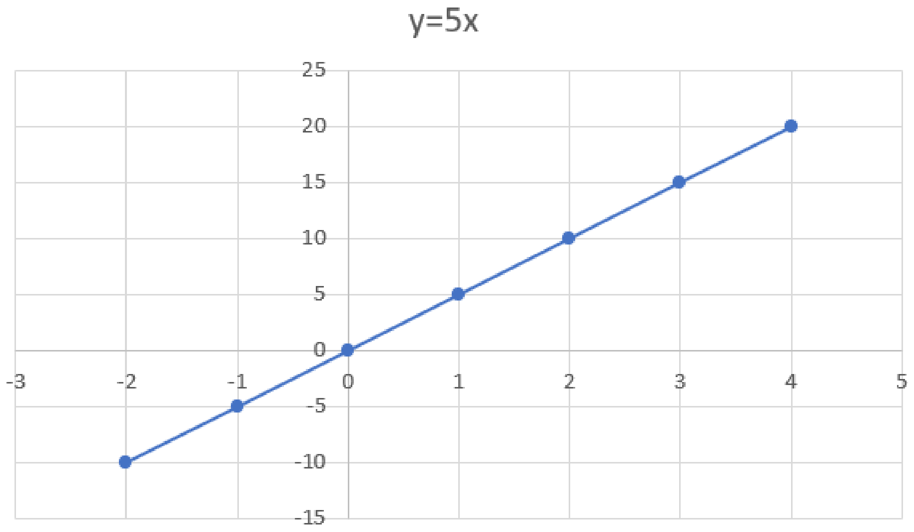
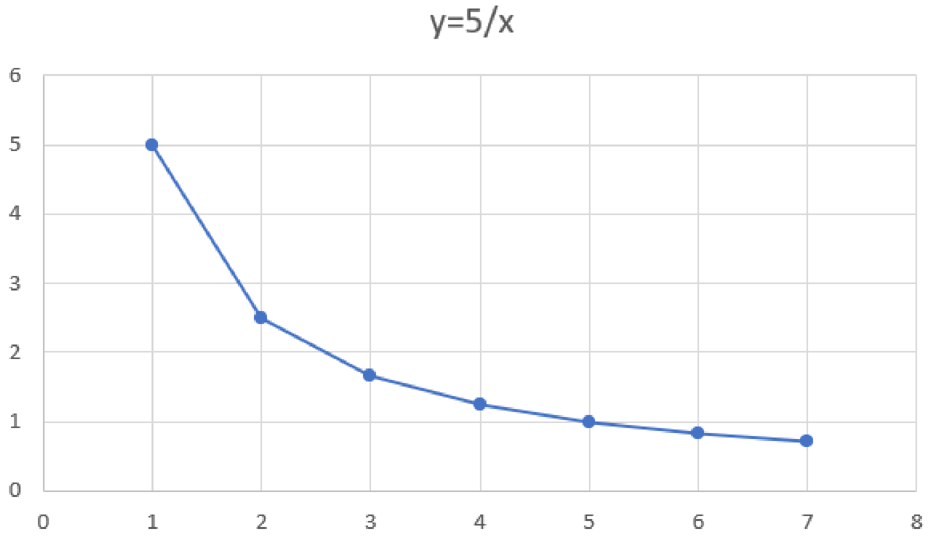
Picture, model, or diagram



This graph shows direct proportion

Non-Example



This graph shows inverse proportion

Word

inversely proportional

Example

y is inversely proportional to x

when x = 5 , y = 1

write an equation for y in terms of x

$y \propto \frac{1}{x}$

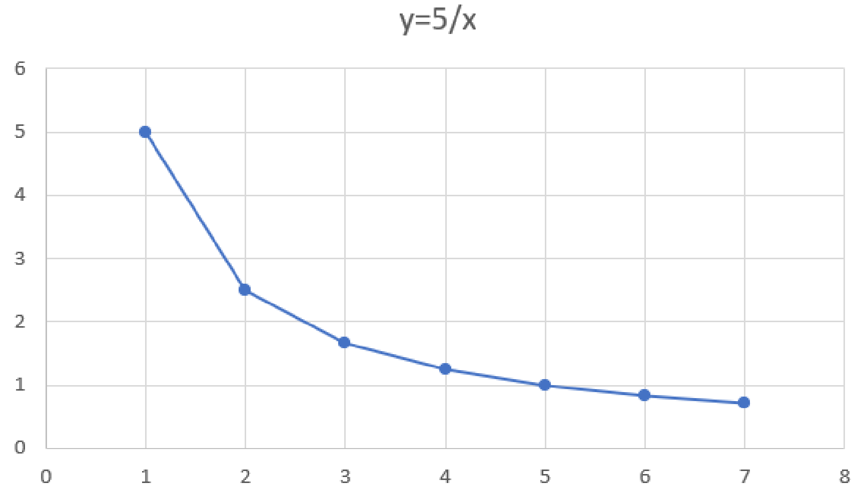
$y = \frac{k}{x}$

$1 = \frac{k}{5}$

k= 5

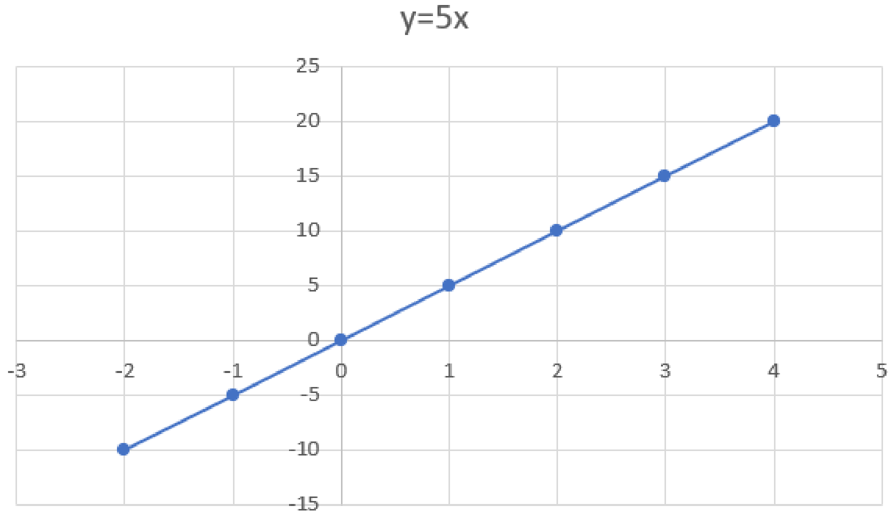
$y = \frac{5}{x}$

Picture, model, or diagram



This graph shows inverse proportion

Non-Example



This graph shows direct proportion

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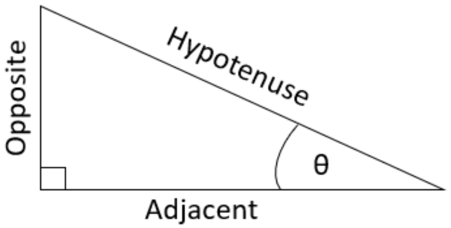
Word

trigonometric ratio (trigonometry)

Example

$$\cos\theta = \frac{adjacent}{hypotenuse}$$

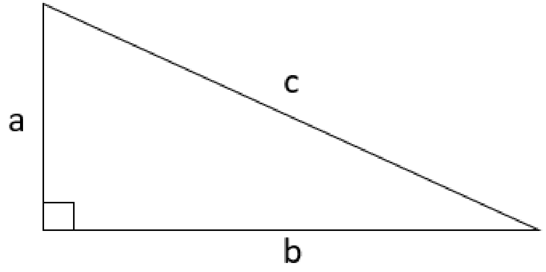
Picture, model, or diagram



SoH CaH ToA

$\sin\theta = \frac{opposite}{hypotenuse}$ $\cos\theta = \frac{adjacent}{hypotenuse}$ $\tan\theta = \frac{opposite}{adjacent}$

Non-Example



$a^2 + b^2 = c^2$

Word

exponential growth

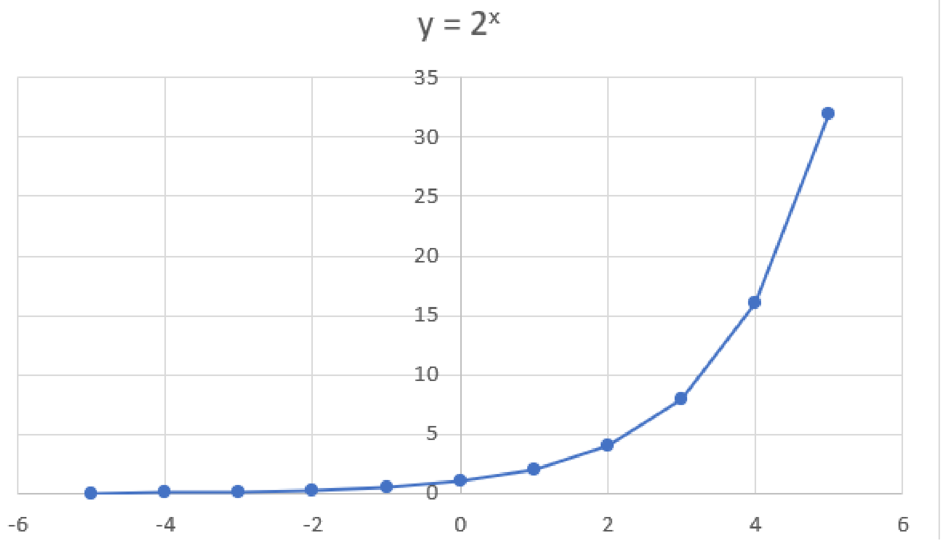
Example

A population of rabbits doubles every month.

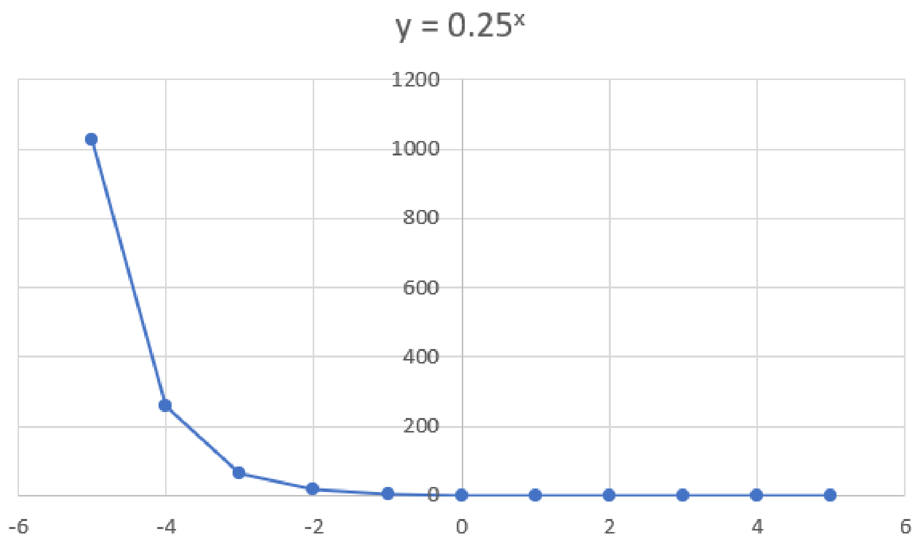
The population is growing exponentially.

Month	Number of rabbits
1	$2 = 2^1$
2	$4 = 2^2$
3	$8 = 2^3$
4	$16 = 2^4$
5	$32 = 2^5$
6	$64 = 2^6$
n	2^n

Picture, model, or diagram



Non-Example



Word

exponential decay

Example

Year	Grams of salt
1	2500000
2	1250000
3	625000
4	312500
5	156250
6	78125
7	39063
8	19531
9	9766
10	4883
11	2441
12	1221
13	610
14	305
15	153

A restaurant decreases its salt use by 50% per year. In year 0, the restaurant uses 5,000,000 grams of salt. Salt usage is decaying exponentially.

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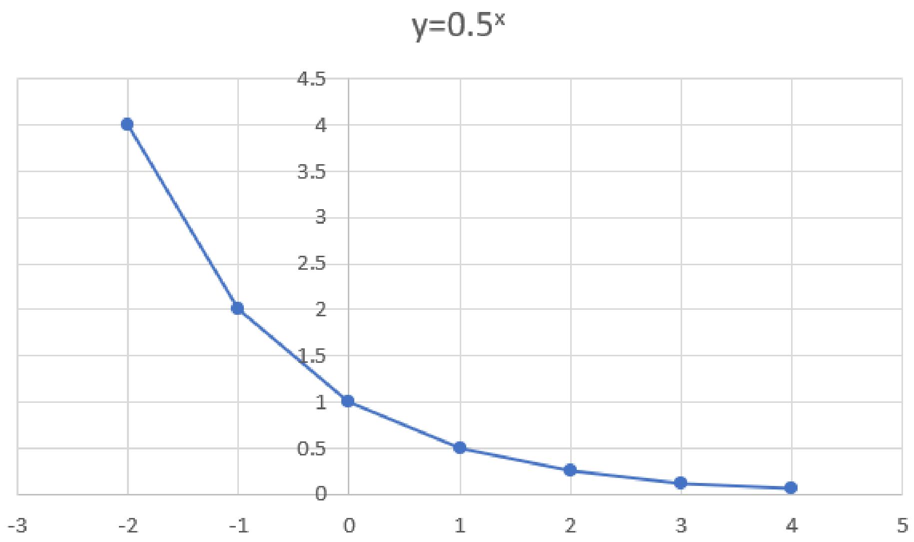
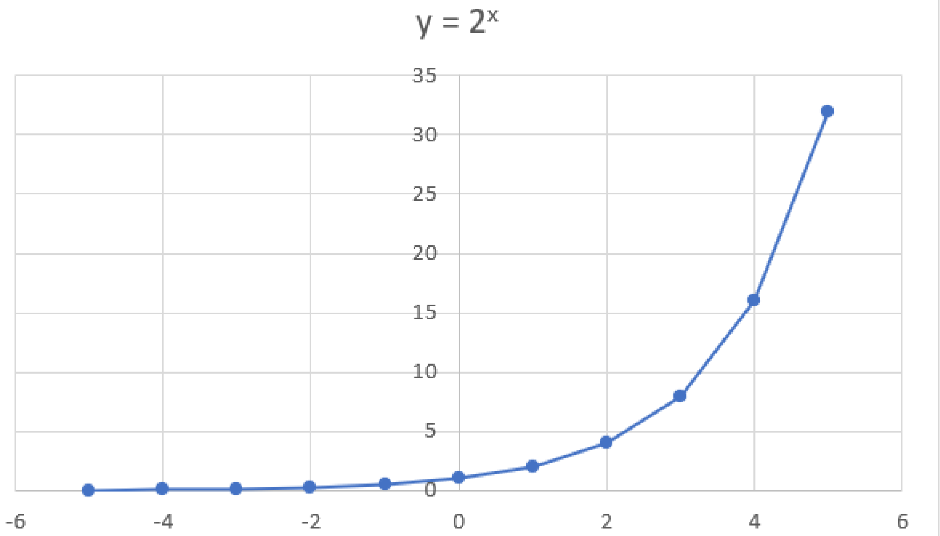
Picture, model, or diagram



Non-Example

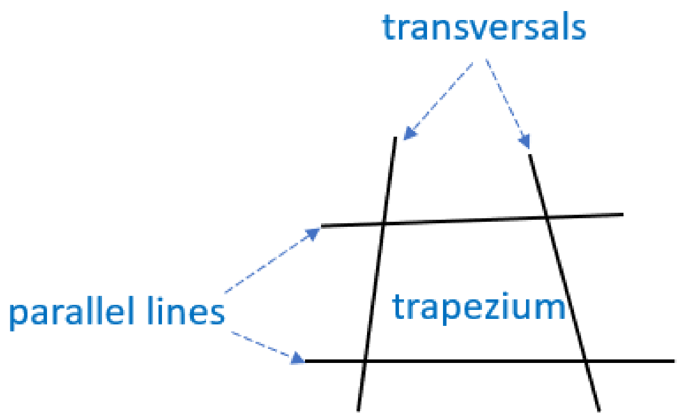


Word

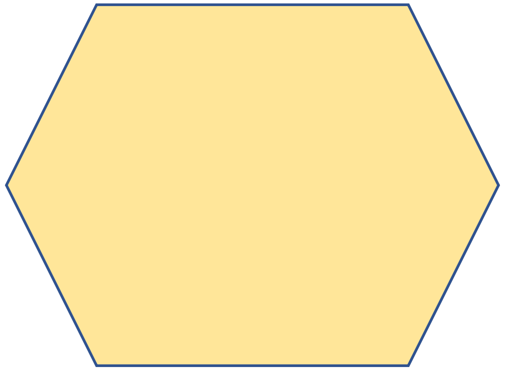
trapezium (-a)

Example

Picture, model, or diagram



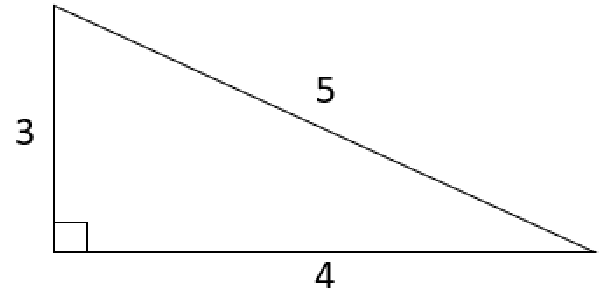
Non-Example



Word

Pythagoras' Theorem

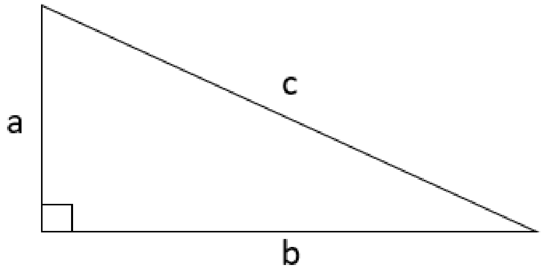
Example



$3^2 + 4^2 = 5^2$

$9 + 16 = 25$

Picture, model, or diagram



$a^2 + b^2 = c^2$

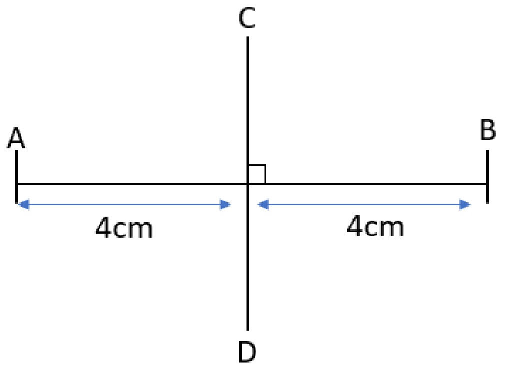
Non-Example

$$\cos\theta = \frac{adjacent}{hypotenuse}$$

Word

perpendicular bisector

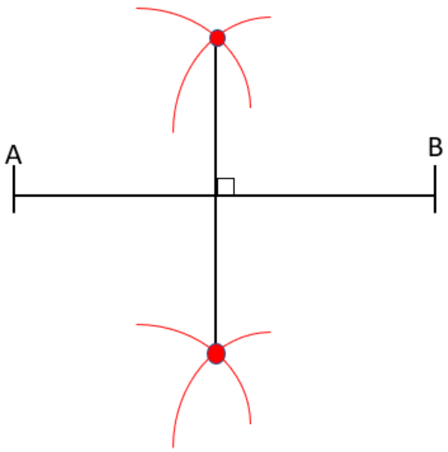
Example



AB = 8cm

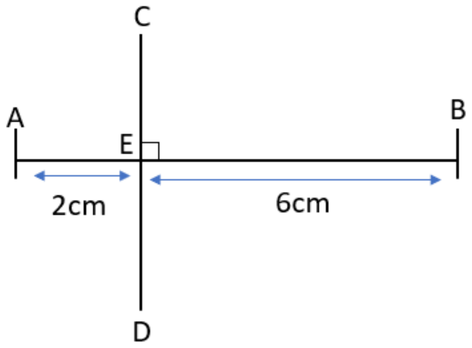
CD bisects AB at 90^o

Picture, model, or diagram



Use a pair of compasses.
Place the point on A and open the compasses to over half way
Make an arc above and below the line.
Repeat from B
Join the arcs

Non-Example



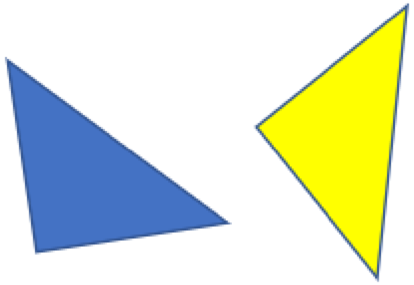
AB = 8cm

CD intersects AB at 90^o at E

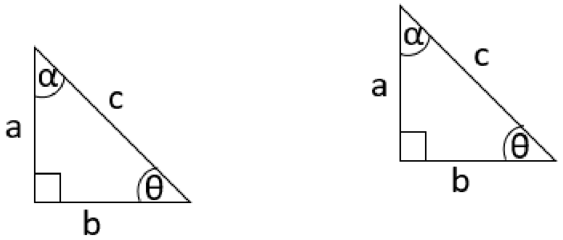
Word

congruent

Example

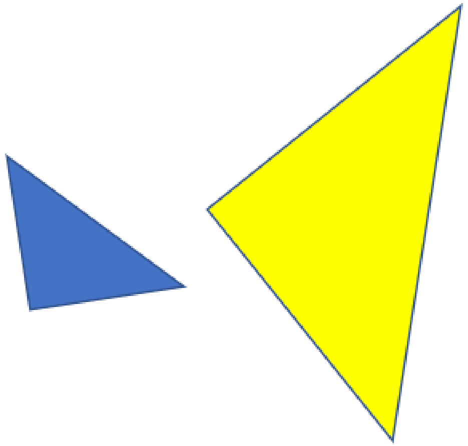


Picture, model, or diagram



These triangles are congruent
All corresponding angles are the same size
All corresponding sides are the same length

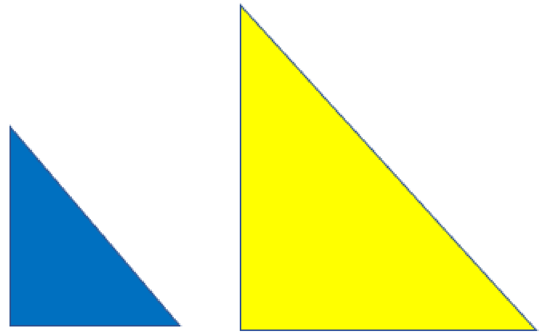
Non-Example



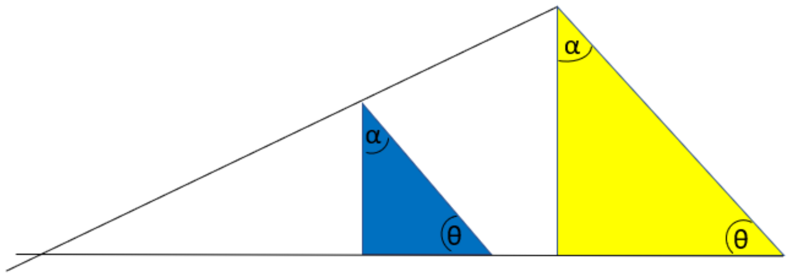
Word

similar

Example

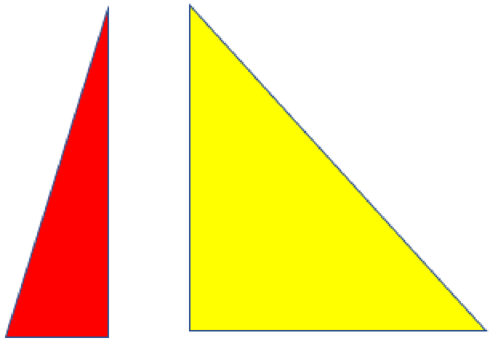


Picture, model, or diagram



These triangles are similar
All corresponding angles are the same
All corresponding sides are proportional

Non-Example

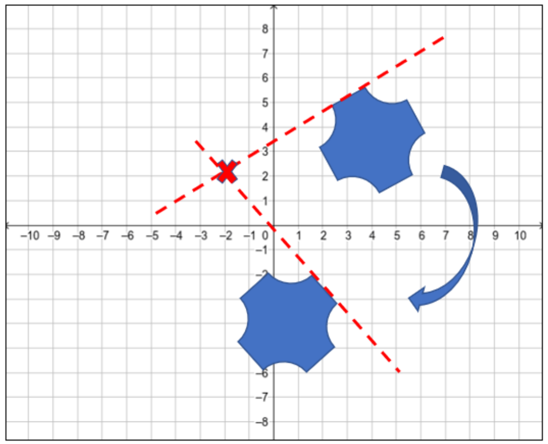


Word

rotation

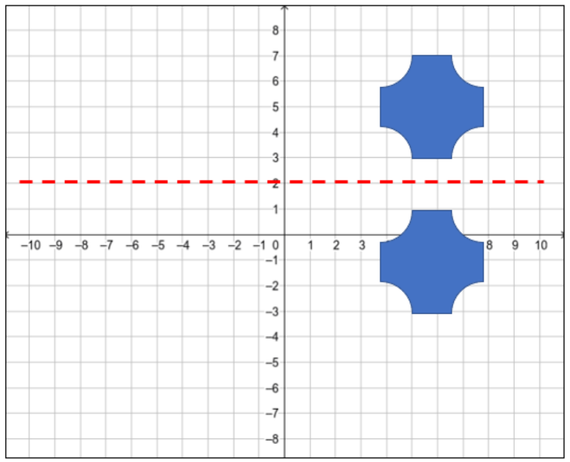
Example

Picture, model, or diagram



This is a rotation of 90^{o} clockwise about the point (-2 , 2)

Non-Example



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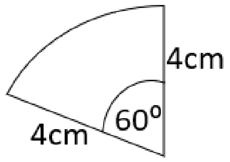
Word

sector

Example

Calculate the area of this sector to 1 decimal place

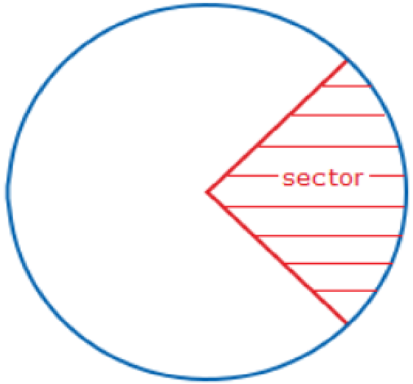


Sector area is $\frac{60}{360}$ of the circle area

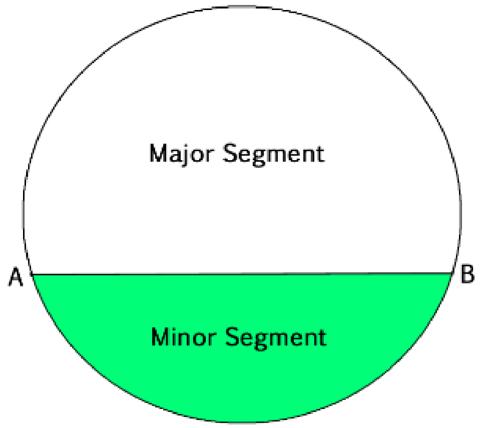
Sector area = $\frac{1}{6} \times \pi \times 4 \times 4$

Sector area ≈ 8.4 cm^2

Picture, model, or diagram



Non-Example



Word

segment

Example

A circle has a radius of length 3cm
The area of a major segment is twice the area of the minor segment.
What is the area of the minor segment?

Area of circle = πr^2

Area = 9π cm^2

$Area_{minor} : Area_{major}$

1 : 2

3 : 6

Area of minor segment = 3π cm^2

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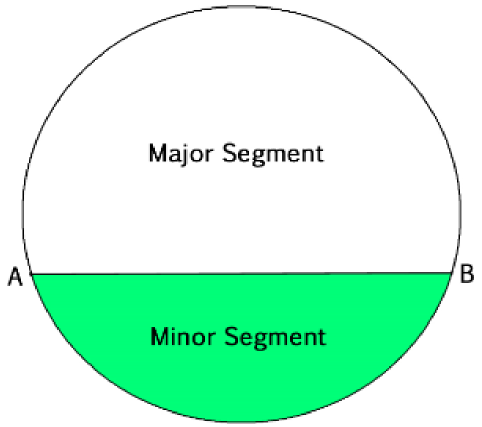
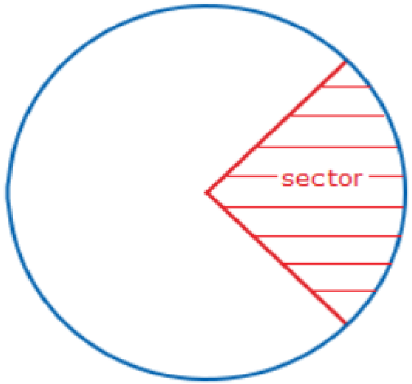
Picture, model, or diagram



Non-Example

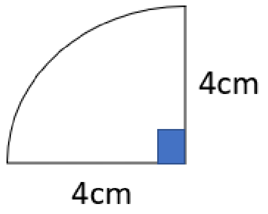


Word

arc

Example

Calculate the arc length to 2 decimal places



Arc length is 0.25 of the circumference

Arc length = 0.25 x π x 8

Arc length ≈ 6.28cm

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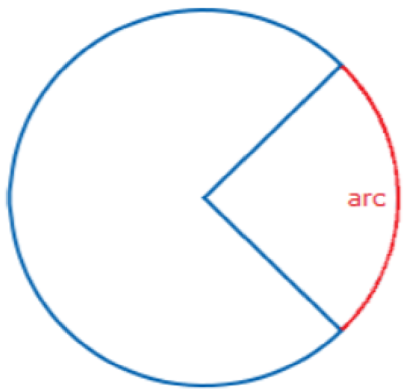
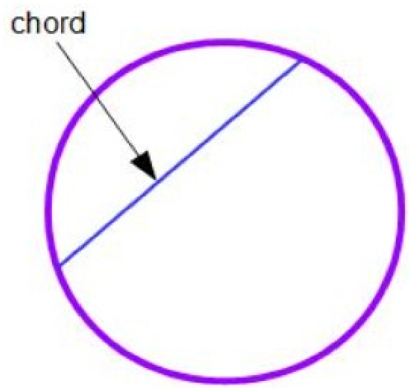
Picture, model, or diagram



Non-Example

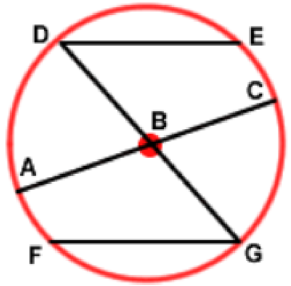


Word

chord

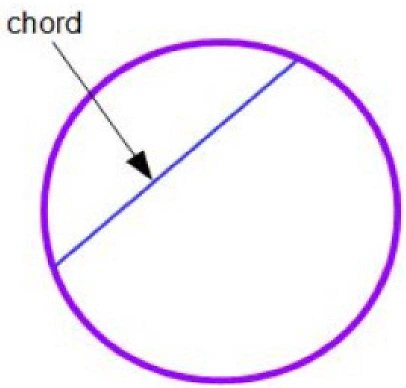
Example

All these lines are chords
DG and AC are also diameters

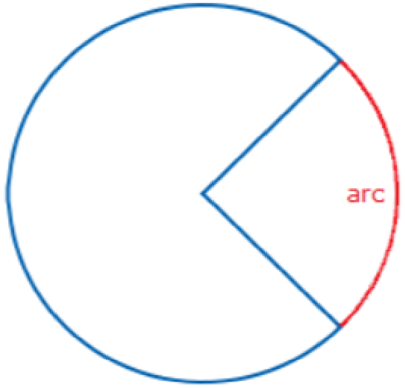


The diameter is the longest possible chord in a circle

Picture, model, or diagram



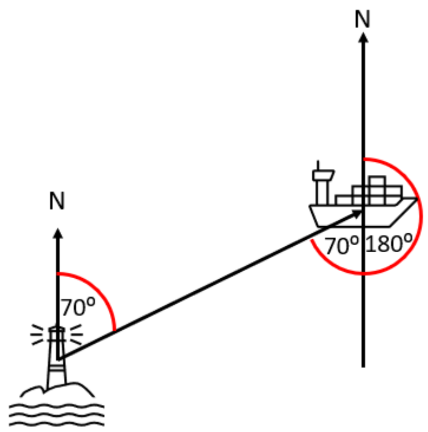
Non-Example



Word

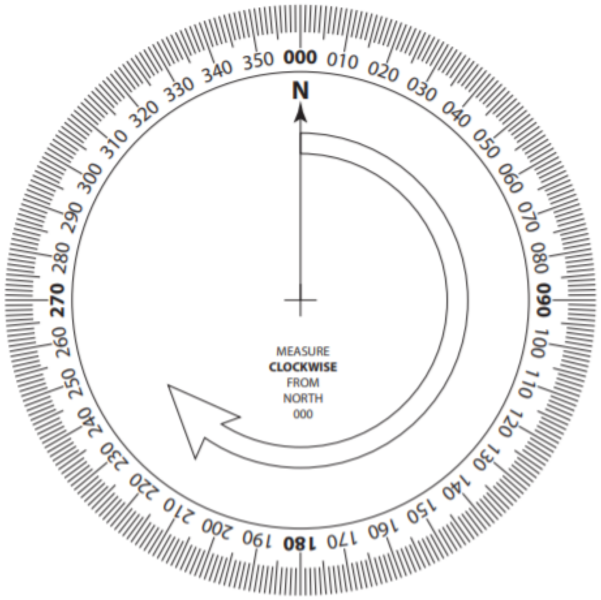
bearing

Example

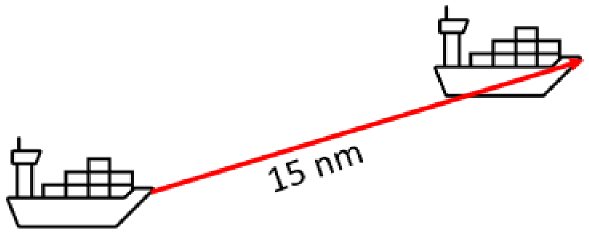


The bearing of the lighthouse from the ship is 250°

Picture, model, or diagram



Non-Example

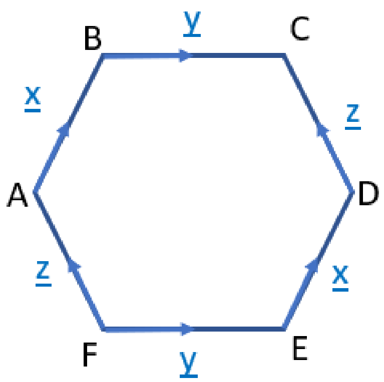


These ships are 15 nautical miles apart

Word

vector

Example



ABCDEF is a regular hexagon

$\overrightarrow{AB} = \overrightarrow{ED} = \underline{x}$

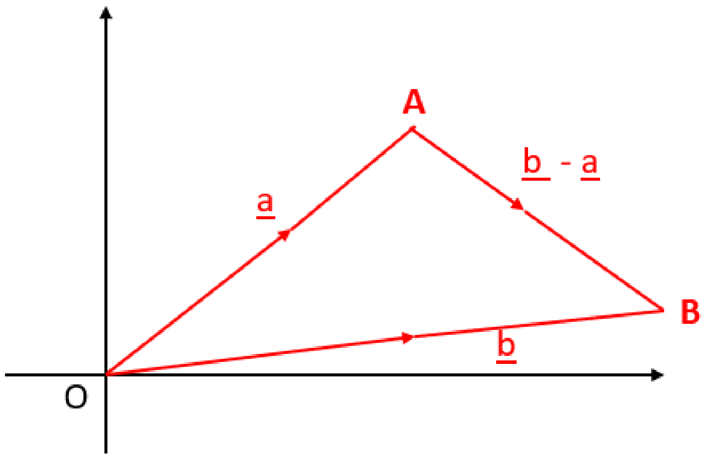
$\overrightarrow{BC} = \overrightarrow{FE} = \underline{y}$

$\overrightarrow{DC} = \overrightarrow{FA} = \underline{z}$

Find $\overrightarrow{BE}$

$\overrightarrow{BE} = \overrightarrow{BC} - \overrightarrow{DC} - \overrightarrow{ED} = \underline{y} - \underline{z} - \underline{x}$

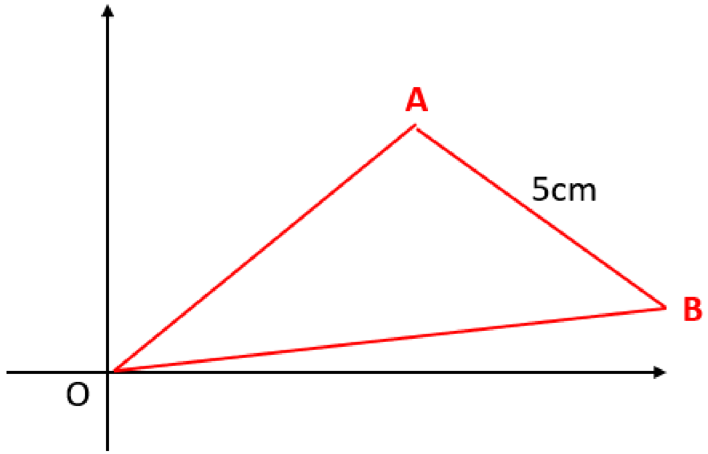
Picture, model, or diagram



$\overrightarrow{AB} = \underline{b} - \underline{a}$

A vector has magnitude and direction

Non-Example



AB = 5cm

A length has magnitude but no direction

Word

relative frequency

Example

In a probability experiment, coloured counters were taken from a bag without looking and then replaced

Colour	Frequency	Relative Frequency
Purple	**7**	**0.35**
Blue	**3**	**0.15**
Pink	**5**	**0.25**
Orange	**5**	**0.25**
Total	***20***	**1.00**

The relative frequency of the event ‘select blue’ is 0.15

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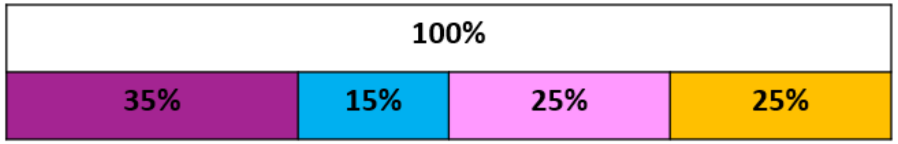
Picture, model, or diagram



The relative frequency shows the proportion of the total for each event occurring.
It can represented as a fraction , a decimal or a percentage.

Non-Example

In a probability experiment, coloured counters were taken from a bag without looking and then replaced. This was repeated twenty times.

Colour	Frequency
Purple	**7**
Blue	**3**
Pink	**5**
Orange	**5**
Total	***20***

‘Blue’ was selected three times

Word

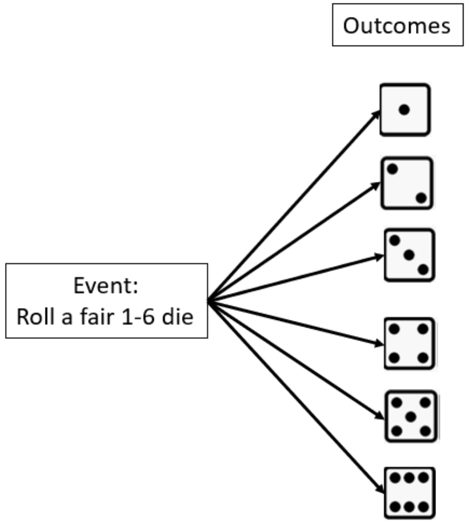
outcome

Example

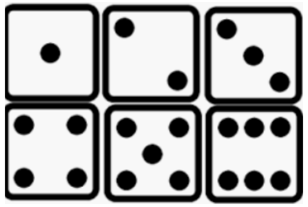
Roll a fair 1-6 die

‘6’ is one possible outcome

Picture, model, or diagrar



Non-Example



Roll a fair 1-6 die

‘7’ is impossible and so is **not** an outcome

Word

random

(variable)

Example

A discrete random variable:

The number of marbles in a jar

A continuous random variable:

The number of seconds taken to complete a race

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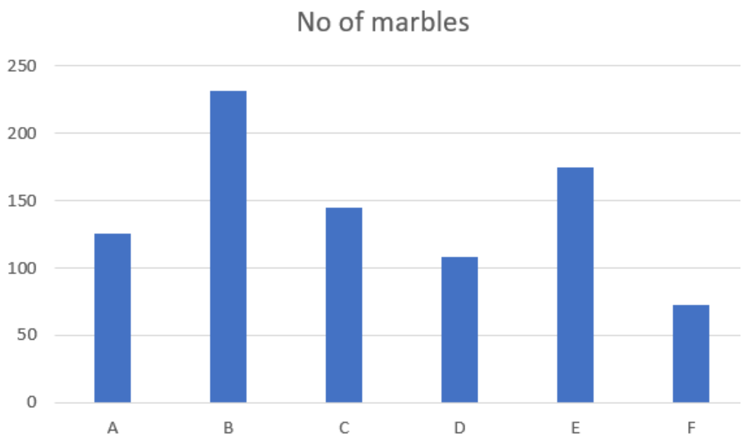
Picture, model, or diagram

A variable that can take on different values

Marble Jar	Number of marbles
A	126
B	232
C	145
D	108
E	175
F	73



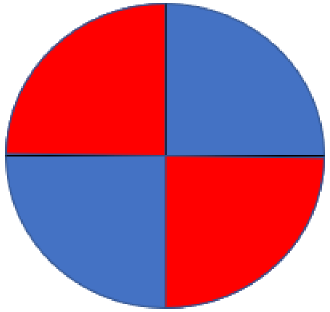
Non-Example

A sample of exactly 10 marbles from each jar

Word

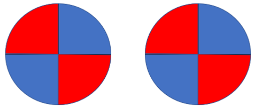
fair

Example



This spinner is fair.
There is a equal chance of ‘blue’ and ‘red’.

Picture, model, or diagram



Outcomes (First spin × Second spin)

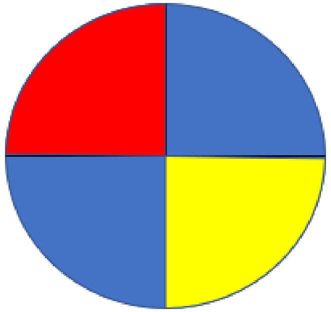
First spin \ Second spin	Red	Blue
Red	RR	RB
Blue	BR	BB

Probability (First spin × Second spin)

First spin \ Second spin	Red	Blue
Red	0.25	0.25
Blue	0.25	0.25

When using two fair spinners,
the probability of each outcome is the same (0.25)

Non-Example



This spinner is unfair.
There is a greater chance of ‘blue’ than ‘red’ or ‘yellow’

Word

probability scale (0-1)

Example

Event: Toss a coin
The probability of getting a 'head' is 0.5
The probability of getting a 'tail' is 0.5

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Picture, model, or diagram

impossible	unlikely	even chance	likely	certain

0 —— 0.5 —— 1

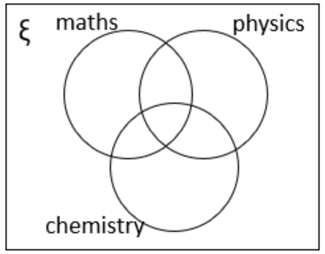
Non-Example

Event: Toss a coin
A 'head' was the result 53 times

Word

Venn diagram

Example



In a year group of 142 students:
23 study only maths
18 study only physics
60 study physics
45 study only chemistry
32 study physics and chemistry only
8 study none of these subjects
7 study all three subjects

How many study mathematics and chemistry only?

Step one: Fill all the information into the diagram
Step two: Subtract the number of students accounted for from 142
Solution: 6 students studied maths and chemistry only

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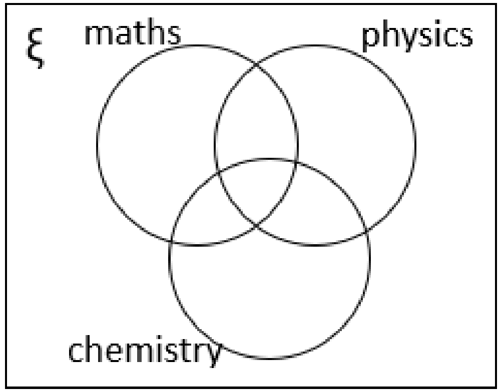
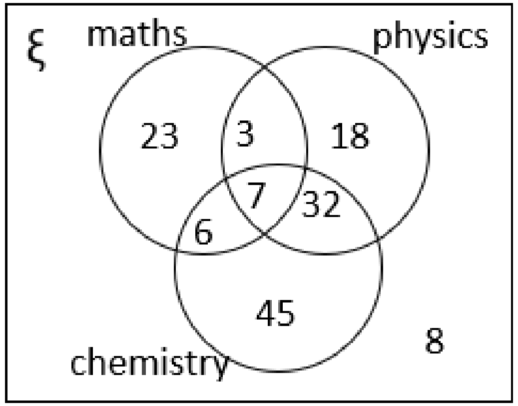
Picture, model, or diagram





Non-Example

Subject	No of students
Maths	39
Physics	60
Chemistry	90

This table shows the number of students studying each subject

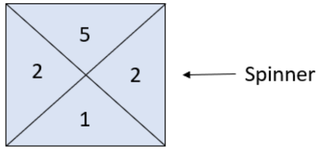
Word

sample space

Example

The spinner is spun **twice** and the score is **added** and recorded in the sample space table below

+	1	2	2	5
1				
2				
2				
5				



Use the sample space to record all possible outcomes and hence work out the probability of scoring **more than 4**

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Picture, model, or diagram

+	1	2	2	5
1	2	3	3	6
2	3	4	4	7
2	3	4	4	7
5	6	8	7	10

P(more than 4) = $\frac{7}{16}$

Non-Example

Colour	Frequency
Purple	7
Blue	3
Pink	5
Orange	5
Total	*20*

Word

exhaustive set

Example

If a coin in tossed, there are two possible outcomes **Heads** or **Tails**

The probability of getting a head or a tail is 100%

'Heads and Tails' are an exhaustive set

An exhaustive set contains **all** possible outcomes

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Picture, model, or diagram

Event: Roll a fair 1-6 die

100%					
1	**2**	**3**	**4**	**5**	**6**

Event: Toss a coin

100%	
H	**T**

Non-Example

If a fair six-sided (1-6) die is rolled ten times and the outcomes are:
6,6,4,4,3,4,3,5,6,2

The set of actual outcomes is not exhaustive, since 1 has not appeared

Word

empirical

Example

The theoretical probability of rolling a 6 on a fair 1-6-sided die is $\frac{1}{6}$

We can carry out a number of trials to gather **empirical** data to test this.

Picture, model, or diagram

Event: Roll a fair 1-6 die

Result	Frequency
1	45
2	42
3	39
4	47
5	38
6	44

A probability experiment collects empirical data

Non-Example

The theoretical probability of rolling a 6 on a fair 1-6-sided die is $\frac{1}{6}$

We can use this **theoretical** probability to work out the probability of rolling a 4

Word

theoretical (probability)

Example

Event: Roll a fair 1-6 die

What is the theoretical probability of rolling a 4?

Result	$\frac{\text{number of each outcome}}{\text{number of possible outcomes}}$
1	$\frac{1}{6}$
2	$\frac{1}{6}$
3	$\frac{1}{6}$
4	$\frac{1}{6}$
5	$\frac{1}{6}$
6	$\frac{1}{6}$

$P(4) = \frac{1}{6}$

For a fair die, each number has an equal chance in theory

Picture, model, or diagram

Event: Roll a fair 1-6 die

1	2	3	4	5	6
$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$

Non-Example

Event: Roll a fair 1-6 die

Result	Frequency
1	45
2	42
3	39
4	47
5	38
6	44

A probability experiment collects empirical data

Word

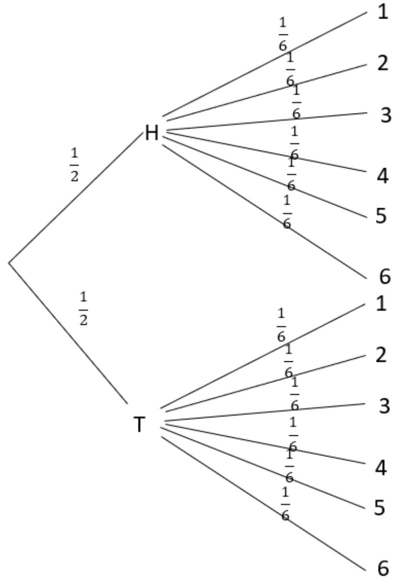
independent

Example

Landing on heads after tossing a coin
AND
rolling a 5 on a single 6-sided die
are examples of independent events.

Picture, model, or diagram

Event 1: Toss a coin
Event 2: Roll a fair 1-6 die



The probability of Event 2 is independent of Event 1

Non-Example

A card is chosen at random from a standard deck of 52 playing cards.
Without replacing it, a second card is chosen.

What is the probability that the first card chosen is a queen and the second card chosen is a jack?

P(Queen) = 4 / 52 ; P(Jack) = 4 / 51
P(Queen and a Jack) = 4 / 52 x 4 / 51 = 16 / 2652
P(Queen and a Jack) = 4 / 663
The probability of the Jack is dependent on the probability of the Queen.

Word

dependent

Example

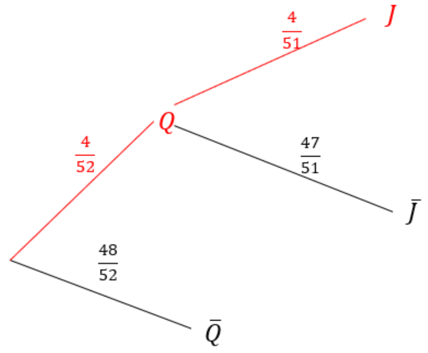
A card is chosen at random from a standard deck of 52 playing cards.
<u>**Without replacing it**</u>, a second card is chosen.

What is the probability that the first card chosen is a queen and the second card chosen is a jack?

P(Queen) = 4 / 52 ; P(Jack) = 4 / 51
P(Queen and a Jack) = 4 / 52 x 4 / 51 = 16 / 2652
P(Queen and a Jack) = 4 / 663
The probability of the Jack is **dependent** on the probability of the Queen.

Picture, model, or diagram

Event 1: Draw a card, do **not** replace
Event 2: Draw a card



The probability of drawing a Jack second is dependent on whether or not a Queen was drawn first

Non-Example

Landing on heads after tossing a coin
AND
rolling a 5 on a single 6-sided die
are examples of **independent** events.

Word

conditional

Example

	Have pets	Do not have pets	Total
Male	0.41	0.08	0.49
Female	0.45	0.06	0.51
Total	0.86	0.14	1

What is the (conditional) probability that a randomly selected person is male, given that they have a pet?

P(male and have a pet) = 0.41
P(have a pet) = 0.86
P(male | have a pet) = 0.41 / 0.86 = 0.477

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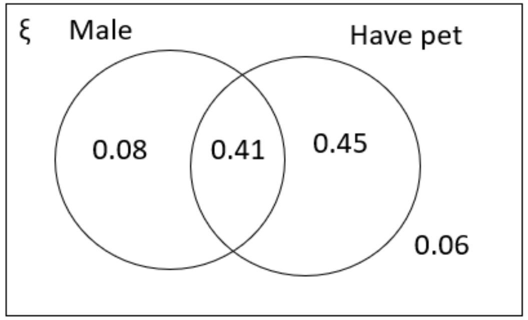
Picture, model, or diagram

$$P(\text{ male}|\text{ have a pet}) = \frac{P(\text{ male U have a pet})}{P(\text{have a pet})}$$



Non-Example

Event	H	T
H	HH	HT
T	TH	TT

There are four possible outcomes when a fair coin is tossed twice

Word

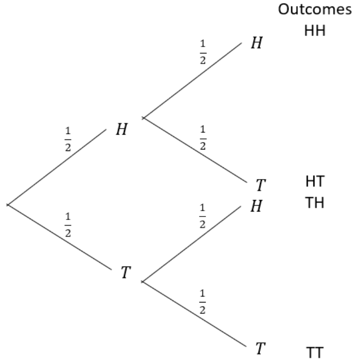
tree diagram

Example

Event 1: Toss a coin

Event 2: Toss a coin

Use a tree diagram to work out the probability of HH

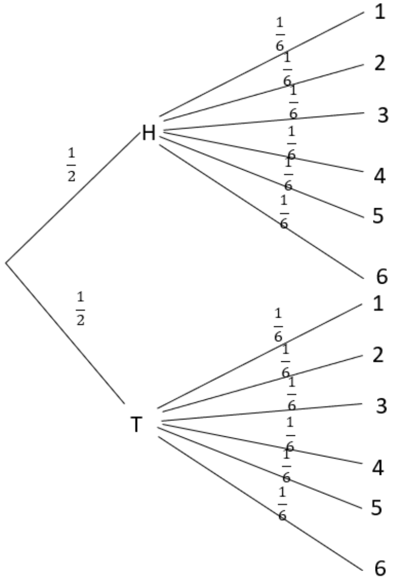


$$P(HH) = \frac{1}{4}$$

Picture, model, or diagram

Event 1: Toss a coin

Event 2: Roll a fair 1-6 die



Non-Example

Event	H	T
H	HH	HT
T	TH	TT

Word

grouped (data)

Example

Observed data arising from counts and grouped into non-overlapping intervals is called grouped data.

The length of feet of 25 planks of wood were measured.

The lengths were grouped into classes of width 10 feet

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Picture, model, or diagram

Length (feet)	Frequency (f)
0≤ ft<10	2
10≤ ft<20	6
20≤ ft<30	9
30≤ ft<40	5
40≤ ft<50	3

Non-Example

The number of different colour smarties in a pack of 25

It is not possible to group the data as each colour is separate

colour	Frequency (f)
Green	2
Orange	6
Blue	9
Yellow	5
Purple	3

Word

mean ($\bar{x}$)

Example

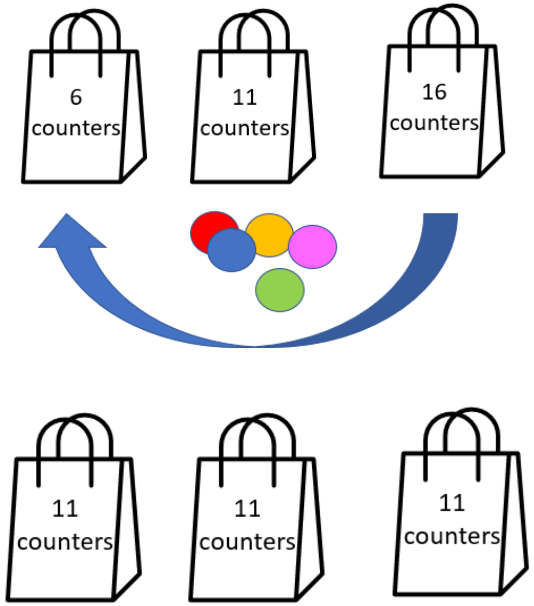
The **mean** average of 6, 11 ,16 is 11

(6 + 11 + 16) ÷ 3 = 11

$\bar{x}$ = 11

Picture, model, or diagram

The mean ($\bar{x}$) can be thought of as ‘equal’ shares



Non-Example

The **median** of 12, 6, 3, 5, 8 is 6

3, 5, **6**, 8, 12

Word

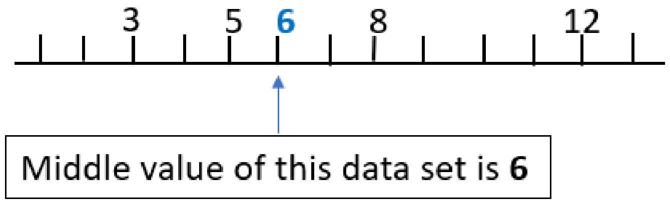
median

Example

The **median** of 12, 6, 3, 5, 8 is 6

3, 5, **6**, 8, 12

Picture, model, or diagram



Non-Example

The mode of 8, 5, 6, 8, 9, 8 is 8

5, 6**, 8, 8, 8**, 9

Word

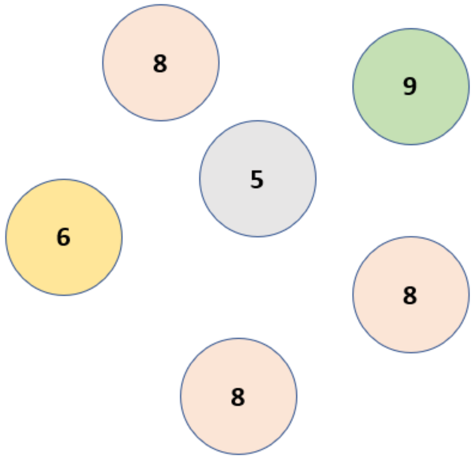
mode

Example

The mode of 8, 5, 6, 8, 9, 8 is 8

5, 6, **8, 8, 8**, 9

Picture, model, or diagram



'8' occurs most frequently

Non-Example

The **median** of 12, 6, 3, 5, 8 is 6

3, 5, **6**, 8, 12

Word

range

Example

The **range** of 12, 6, 3, 5, 8 is 9

It is the difference between the maximum (12) and the minimum (3) value in the set.

3, 5, 6, 8, 12

12 – 3 = **9**

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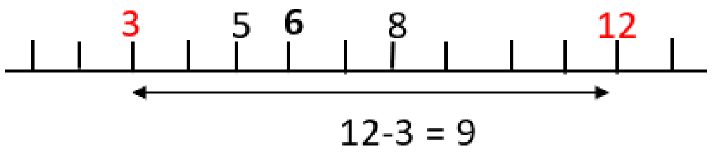
Picture, model, or diagram



The range of this data set is 9

Non-Example

The **median** of 12, 6, 3, 5, 8 is 6

3, 5, **6**, 8, 12

Word

outlier

Example

In a maths test, the following marks were scored:
25, 29, **3**, 32, **85**, 33, 27, 28
Both 3 and 85 are outliers.
They lie outside the main cluster of scores.

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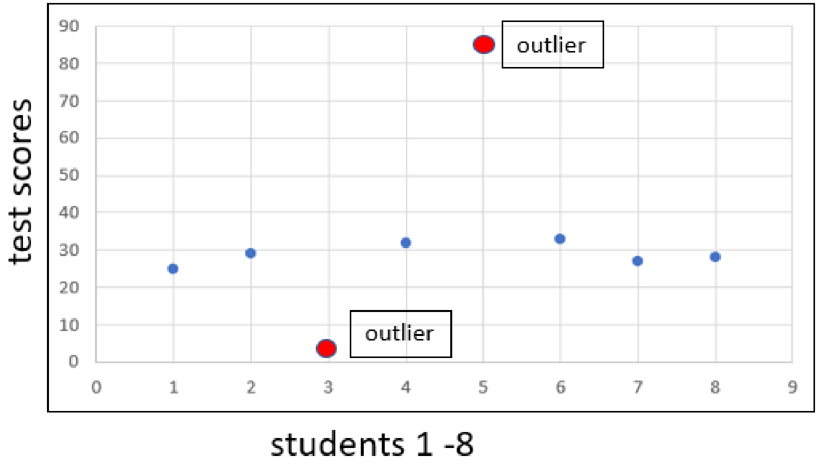
Picture, model, or diagram



Non-Example

In a maths test, the following marks were scored:
25, 29, 3, 32, 85, 33, 27, 28
The range of scores is 82

85 – 3 = 82

Word

bivariate (data)

Example

Ice cream sales versus the temperature on that day. The two variables are 'Ice cream sales' and 'Temperature'.

The warmer the temperature, the more ice creams are sold. 'Temperature' and 'Ice cream sales' are bivariate

Temperature (^{0}C)	Ice Cream Sales (£)
14.2	215
16.4	325
11.9	185
15.2	332
18.5	406
22.1	522
19.4	412
25.1	614
23.4	544
18.1	421
22.6	445
17.2	408
13.9	207
25.8	620

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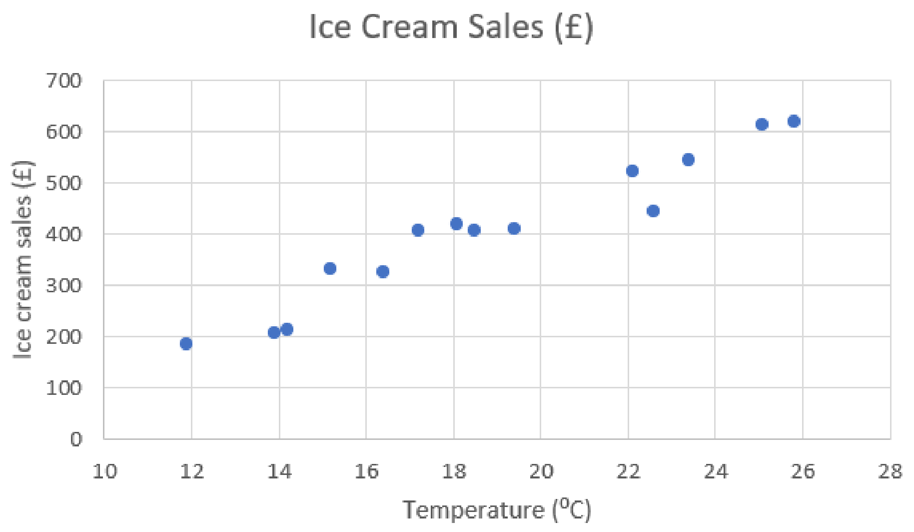
Picture, model, or diagram



With bivariate data we have **two** sets of related data we want to **compare.**

Non-Example

Univariate means one variable (one type of data)

Example: Travel Time (minutes): **15, 29, 8, 42, 35, 21, 18, 42, 26**

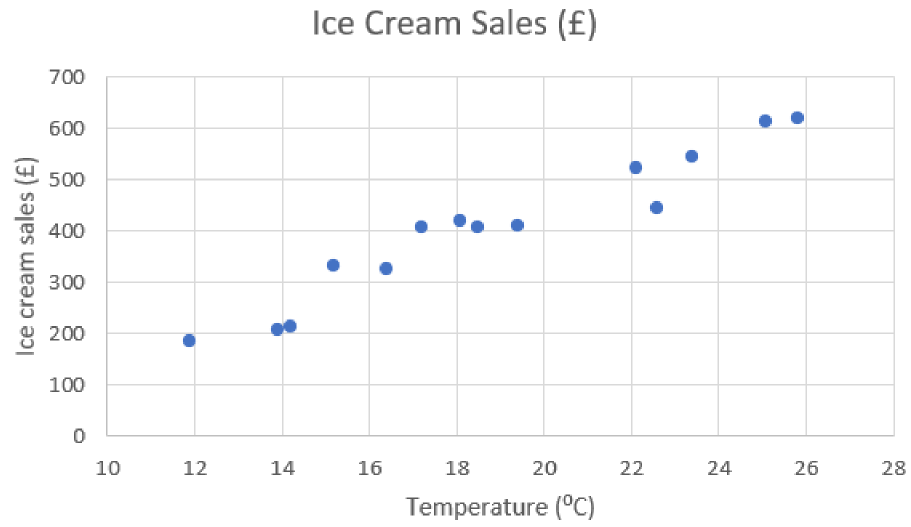
The variable is **Travel Time**

Word

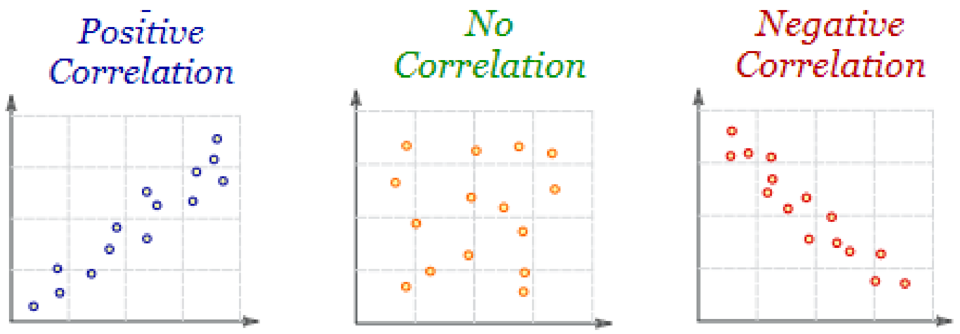
scatter graphs

Example

Bivariate data

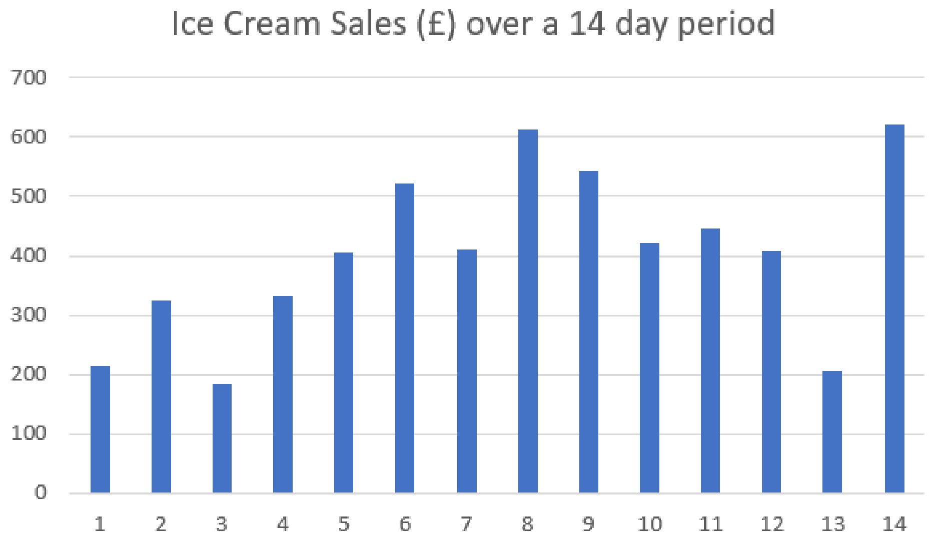


Picture, model, or diagram



Scatter graphs are used to compare two sets of data.
Positive correlation means that as one variable increases, so does the other.
No correlation means that one variable does not have an effect on the other.
Negative correlations means that as one variable increase, the other decreases.

Non-Example



Univariate data

Word

histogram

Example

Histograms look like bar charts but the area of the bar represents the frequency, not the height.
The class widths can be unequal in a histogram

The ages of 28 children on a school trip

Age	Frequency	Class width	Frequency density
4-9	6	6	6÷6=1
10-15	18	6	18÷6=3
16-17	4	2	4÷2=2

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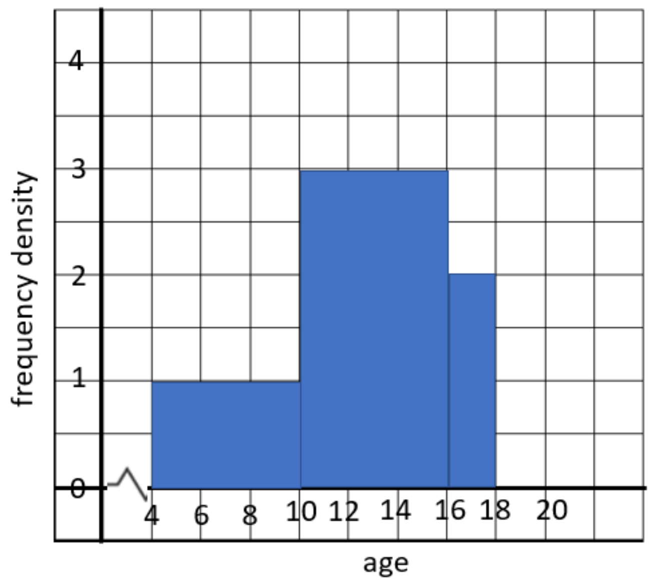
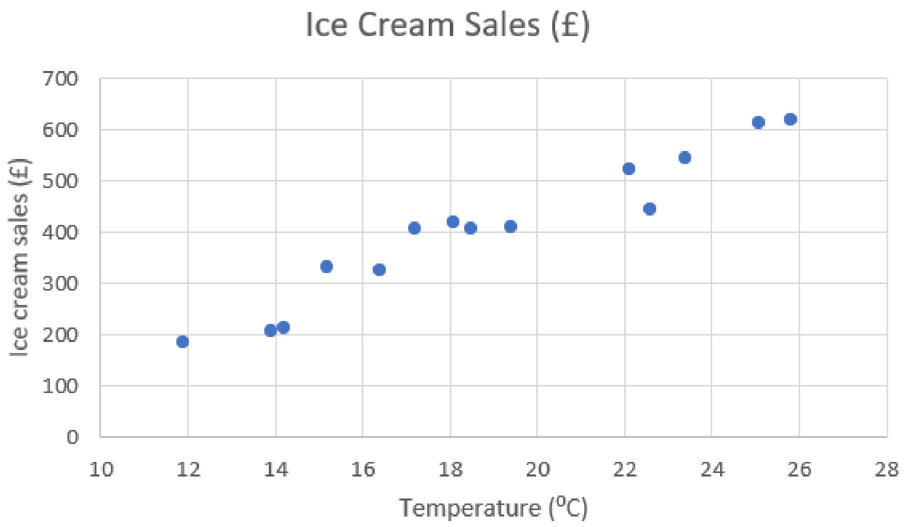
Picture, model, or diagram



Non-Example



Word

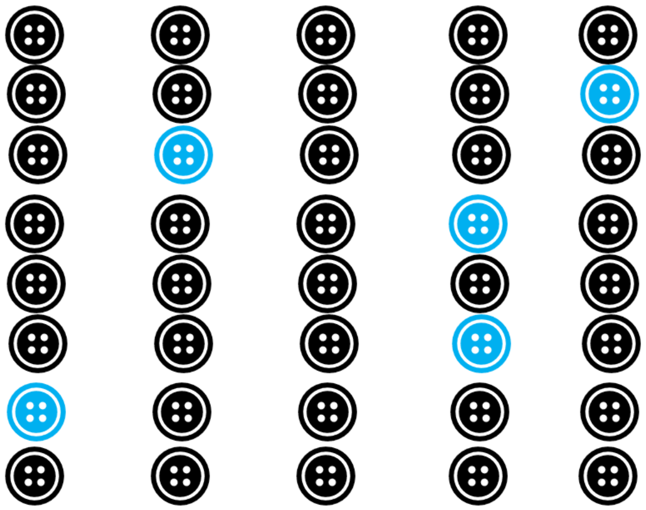
sample

Example

Sample: A collection of data from **part** of the population

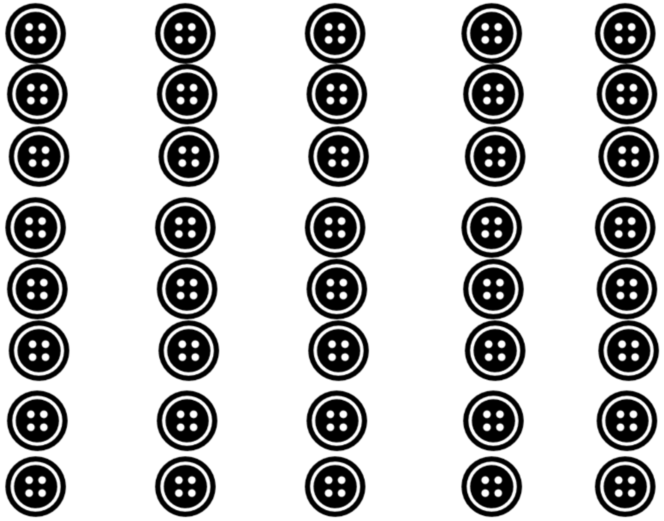
Example: A random selection of five buttons from a box of forty buttons

Picture, model, or diagram



The blue buttons are a random sample from the population

Non-Example



This is the population ~ all the 40 buttons in the box

Word

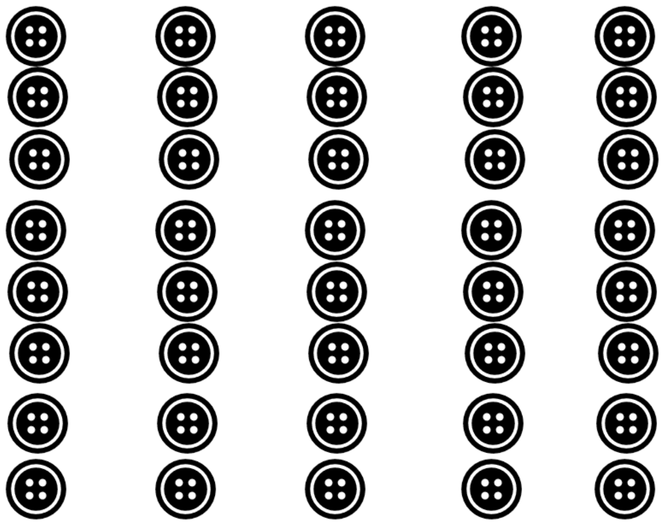
population

Example

Population: The whole group we are interested in

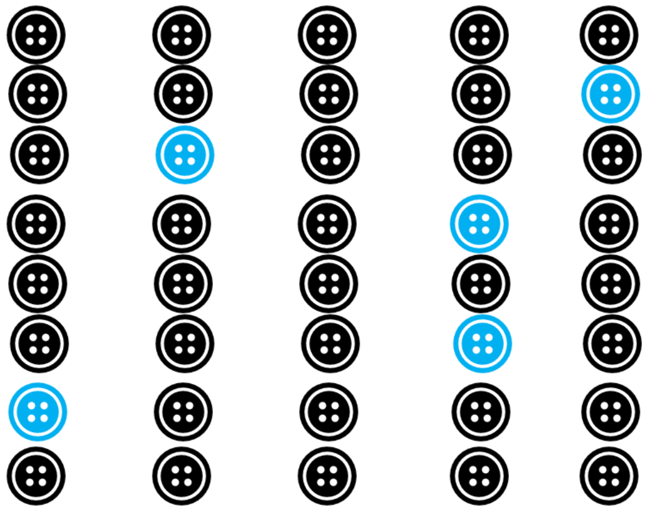
Example: all the buttons in a box of 40 buttons

Picture, model, or diagram



This is the population ~ all the 40 buttons in the box

Non-Example



The blue buttons are a random sample from the population

Word

cumulative frequency

Example

Heights, h (cm)	Frequency	Cumulative frequency
150 < h ≤ 160	13	13
150 < h ≤ 160	33	46
150 < h ≤ 160	35	81
150 < h ≤ 160	11	92

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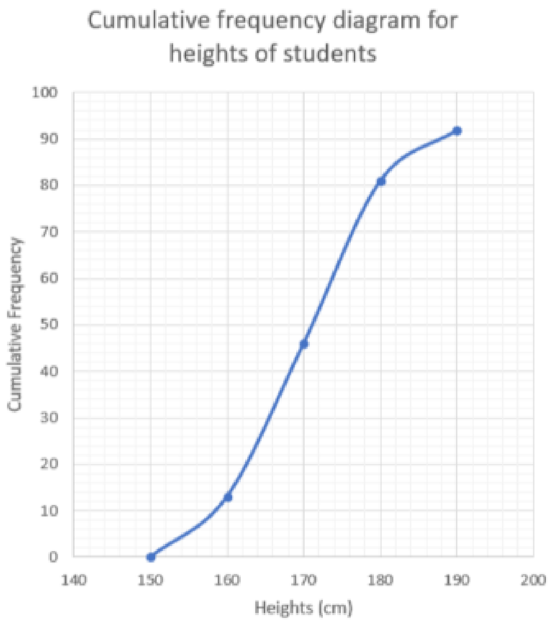
Picture, model, or diagram



Non-Example

Heights, h (cm)	Frequency
150 < h ≤ 160	13
150 < h ≤ 160	33
150 < h ≤ 160	35
150 < h ≤ 160	11

Word

box plot
(box and whisker diagram)

Example

This data shows the ages of 11 people on a boat trip

9, 10, *10*, 12, 13, **14**, 17, 18, *19*, 21, **21**

The data is ordered and the median, quartiles, maximum and minimum values identified.

This is then plotted on a horizontal axis as a box for the middle 50% of the data, with 'whiskers' to show the first and last 25%

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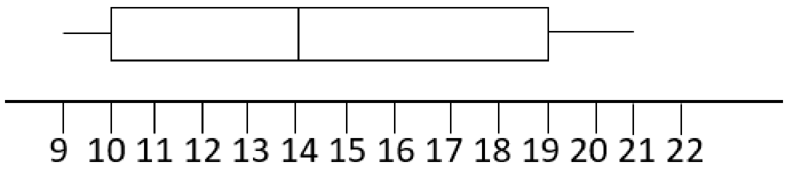
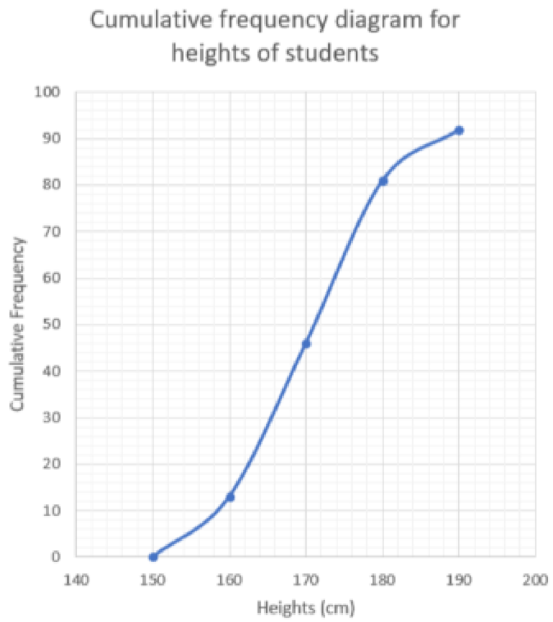
Picture, model, or diagram

9, 10, *10*, 12, 13, **14**, 17, 18, *19*, 21, **21**



Non-Example



Word

lower quartile

Example

Quartiles are the values that divide a list of numbers into quarters

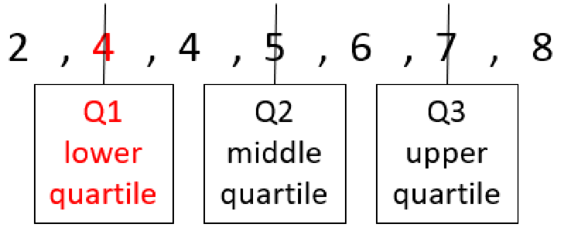
Example: 5,7,4,4,6,2,8

Order: 2,4,4,5,6,7,8

Quarter the list:

Lower quartile (Q1) = 4
Median (Q2) = 5
Upper quartile (Q3) = 7

Picture, model, or diagram



Lower quartile (Q1) = 4
Median (Q2) = 5
Upper quartile (Q3) = 7

Non-Example

The mode of 8, 5, 6, 8, 9, 8 is 8

5, 6**, 8, 8, 8**, 9

Word

upper quartile

Example

Quartiles are the values that divide a list of numbers into quarters

Example: 5,7,4,4,6,2,8

Order: 2,4,4,5,6,7,8

Quarter the list:

Lower quartile (Q1) = 4
Median (Q2) = 5
Upper quartile (Q3) = 7

Picture, model, or diagram

2 , 4 , 4 , 5 , 6 , 7 , 8

Q1 lower quartile	Q2 middle quartile	Q3 upper quartile

Lower quartile (Q1) = 4
Median (Q2) = 5
Upper quartile (Q3) = 7

Non-Example

The mode of 8, 5, 6, 8, 9, 8 is 8

5, 6**, 8, 8, 8**, 9

Word

inter quartile range

Example

Quartiles are the values that divide a list of numbers into quarters

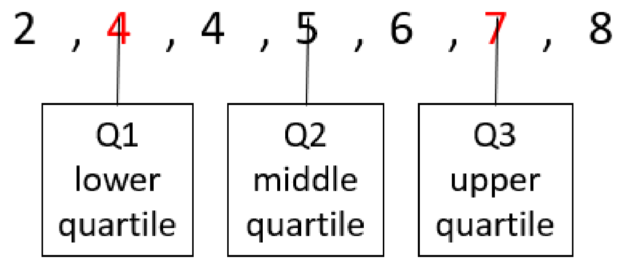
Example: 5,7,4,4,6,2,8

Order: 2,4,4,5,6,7,8

Quarter the list and find the difference between the upper and lower quartiles

Lower quartile (Q1) = 4
Median (Q2) = 5
Upper quartile (Q3) = 7
Inter quartile range (IQR) = 3

Picture, model, or diagram



Lower quartile (Q1) = 4
Median (Q2) = 5
Upper quartile (Q3) = 7
Inter quartile range (IQR) = 7 – 4 = 3

Non-Example

2 , 4 , 4 , 5 , 6 , 7 , 8

The range for this data set is 8 – 2 = 6

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Word

Example

Picture, model, or diagram

Non-Example

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Word

Example

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Picture, model, or diagram

Non-Example