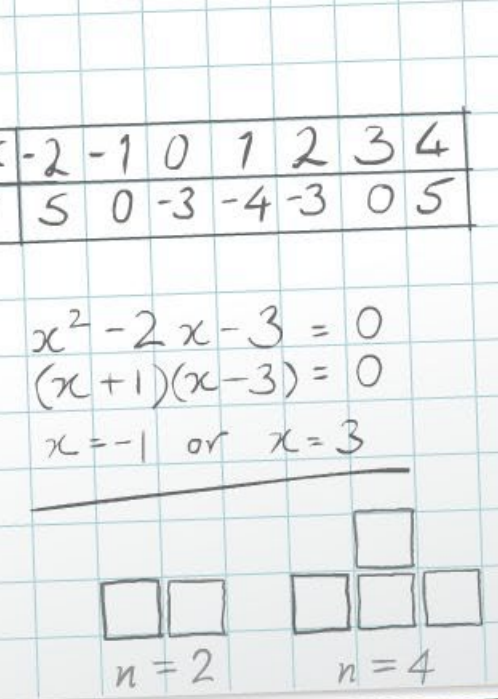
Cumulative frequency

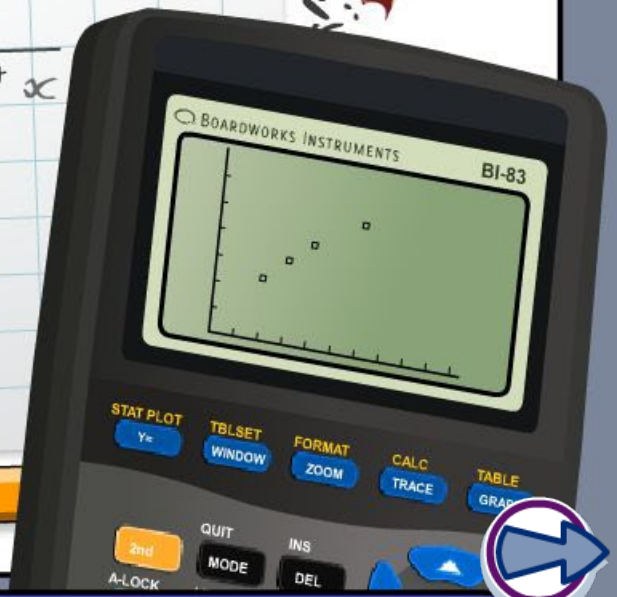
x	-2	-1	0	1	2	3	4
y	5	0	-3	-4	-3	0	5

$x^2 - 2x - 3 = 0$

$(x+1)(x-3) = 0$

$x = -1$ or $x = 3$





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Introduction

Common core icons

This icon indicates a slide where the Standards for Mathematical Practice are being developed. Details of these are given in the Notes field.

Slides containing examples of mathematical modeling are marked with this stamp.

This icon indicates an opportunity for discussion or group work.

The **Standards for Mathematical Practice** outlined in the Common Core State Standards for Mathematics describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

They are:

1) Make sense of problems and persevere in solving them.

2) Reason abstractly and quantitatively.

3) Construct viable arguments and critique the reasoning of others.

4) Model with mathematics.

5) Use appropriate tools strategically.

6) Attend to precision.

7) Look for and make use of structure.

8) Look for and express regularity in repeated reasoning.

This icon indicates that the slide contains activities created in Flash. These activities are not editable.

This icon indicates teacher's notes in the Notes field.

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Cumulative frequency tables

A frequency table records the number of results that lie within a particular interval.

Brett records the distance that his fellow grade 10 students live from school in this table. The data is split into **class intervals**.

distance (km)	frequency
$0 < d \leq 2$	9
$2 < d \leq 4$	6
$4 < d \leq 6$	4
$6 < d \leq 8$	5
$8 < d \leq 10$	1

Brett wants to know how many students live under 2 km away, under 4 km away, under 6 km away, etc. What new columns should he add to his table to show this?

A **cumulative frequency table** is used to record the number of results that occur up to a certain value.

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Cumulative frequency tables

How do you make a **cumulative frequency table** from a frequency table?

Press the **forward** arrow to see the steps involved in making a cumulative frequency table from a frequency table.

The example uses data collected by Brett about the distance (in km) that his fellow grade 10 students live from school.

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Choosing class intervals

How long can everyone in the class keep their eyes open before blinking?

How would you record this information?

- Will you measure the times to the nearest tenth of a second, second or 5 seconds?
- What size of class intervals will you use?

When grouping continuous data like this,

- aim to have between 5 and 10 intervals
- make sure no values are missed out
- make sure there are no overlaps.

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Cumulative frequency graphs

Here are the results of 100 people holding their breath:

time (secs)	frequency	time (secs)	cumulative frequency
$30 < t \leq 35$	9	$0 < t \leq 35$	9
$35 < t \leq 40$	12	$0 < t \leq 40$	9 + 12 = 21
$40 < t \leq 45$	24	$0 < t \leq 45$	9 + 12 + 24 = 45
$45 < t \leq 50$	28	$0 < t \leq 50$	9 + 12 + 24 + 28 = 73
$50 < t \leq 55$	16	$0 < t \leq 55$	9 + 12 + 24 + 28 + 16 = 89
$55 < t \leq 60$	11	$0 < t \leq 60$	9 + 12 + 24 + 28 + 16 + 11 = 100

How could you find exact values or estimates for:

- **the mean?**
- **the mode?**
- **the median?**
- **the range?**

To estimate the median, we can use a **cumulative frequency graph**.

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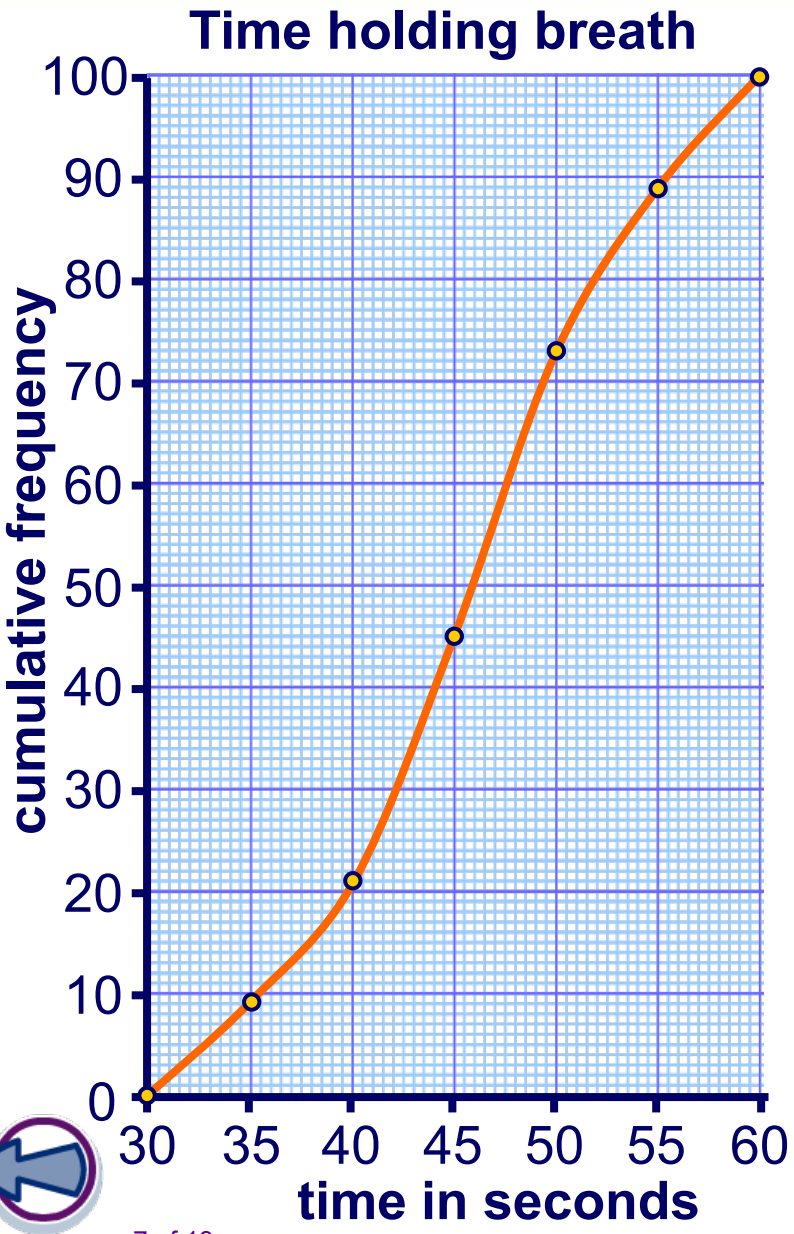
Plotting cumulative frequency graphs



time in seconds	cumulative frequency
$0 < t \leq 35$	9
$0 < t \leq 40$	21
$0 < t \leq 45$	45
$0 < t \leq 50$	73
$0 < t \leq 55$	89
$0 < t \leq 60$	100

The cumulative frequency for each interval is plotted at the **upper** boundary for the interval.

The first point plotted is the lower boundary of the first class interval, which has cumulative frequency 0.

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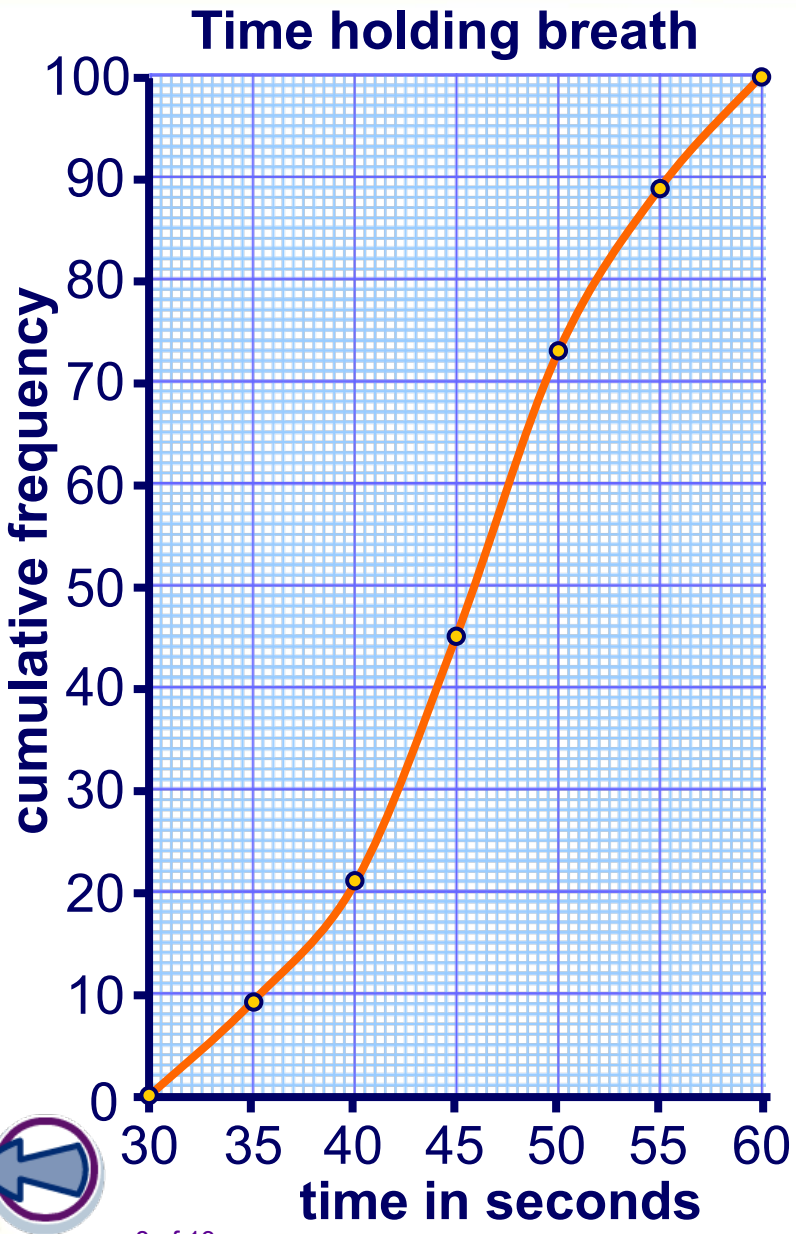
Plotting cumulative frequency graphs



time in seconds	cumulative frequency
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$0 < t \leq 45$	45
$0 < t \leq 50$	73
$0 < t \leq 55$	89
$0 < t \leq 60$	100

The points can be joined by a **smooth curve** or by a series of **straight lines**.

This **S-shape** curve is characteristic of a cumulative frequency graph.

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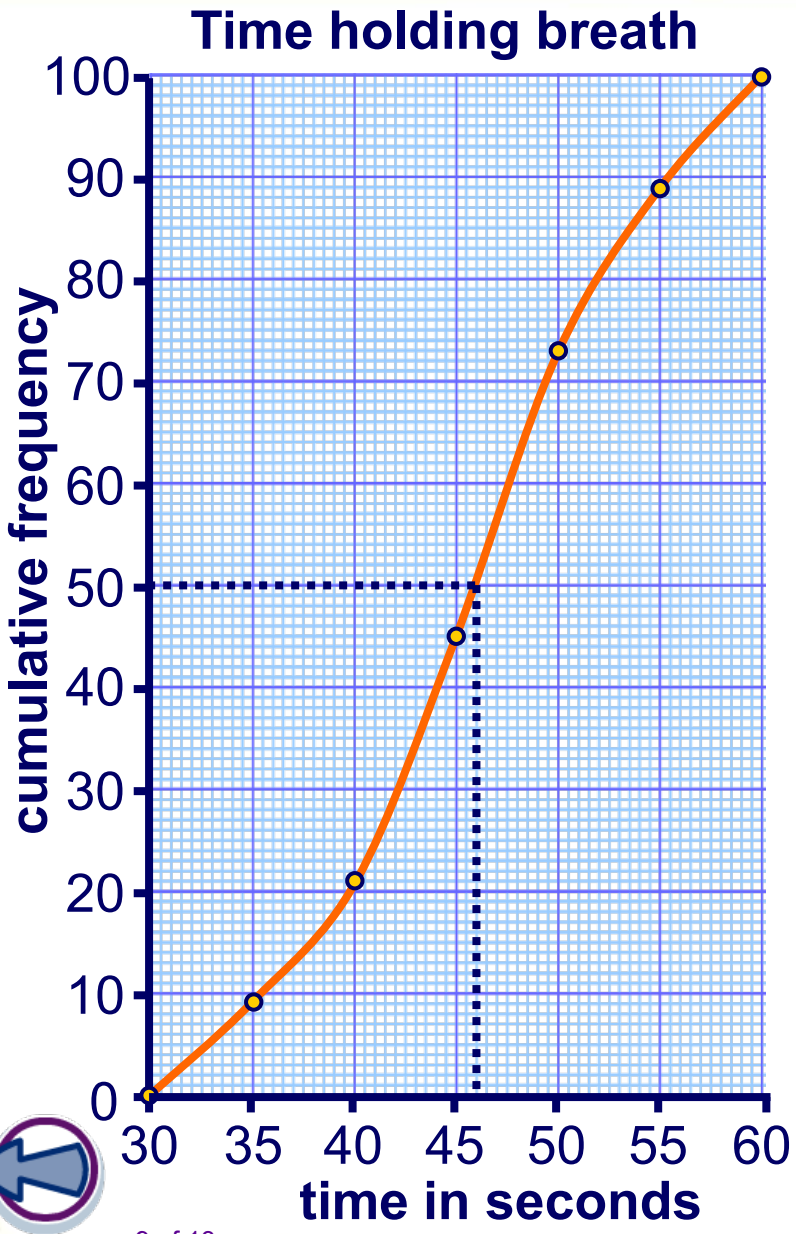
Finding the median



How can we use the graph to estimate the median?

We can estimate the number of seconds the middle person held their breath for by finding the time for the **50th person**.

From 50 on the y-axis, trace a line to the curve and find the corresponding x-value.

This gives us an estimated median time of **46 seconds**.

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Review of interquartile range

Complete the statements by selecting from the drop-down menus.

The range is a measure of [?]. It is the difference between the highest value and the lowest value.

When the range is affected by [?], it is often more appropriate to use the [?] range.

The [?] is the middle [?] of the data.

The lower quartile is found [?] of the way along the list.

The upper quartile is found [?] of the way along the list.

interquartile range = [?] − [?]

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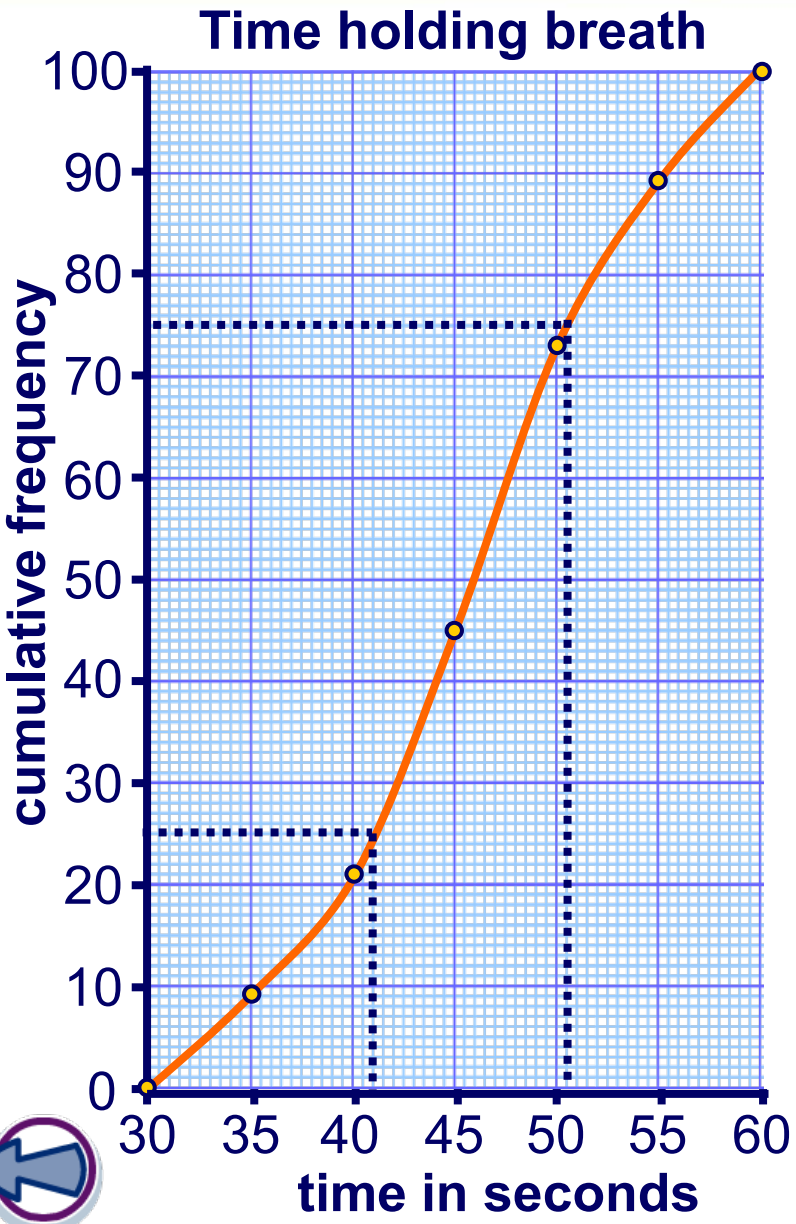
Finding the interquartile range



Use the cumulative frequency graph to locate the upper and lower quartiles, and then find the interquartile range.

The lower quartile is the time of the 25th person: **41 seconds**

The upper quartile is the time of the 75th person: **50.5 seconds**

The interquartile range is the difference between these values.

50.5 – 41 = **9.5 seconds**

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Class experiment

time (seconds)	frequency	cumulative frequency
$0 < t < 20$	0	0
$20 \leq t <$		
$40 \leq t <$		
$50 \leq t <$		
$60 \leq t <$		
$80 \leq t <$		
$100 \leq t$		
$120 \leq t < 130$	0	0

Do a survey of your class to find out how long students can hold their breath. Record the frequencies in the table, then use the graph to estimate the median and the quartiles.

start

Show graph

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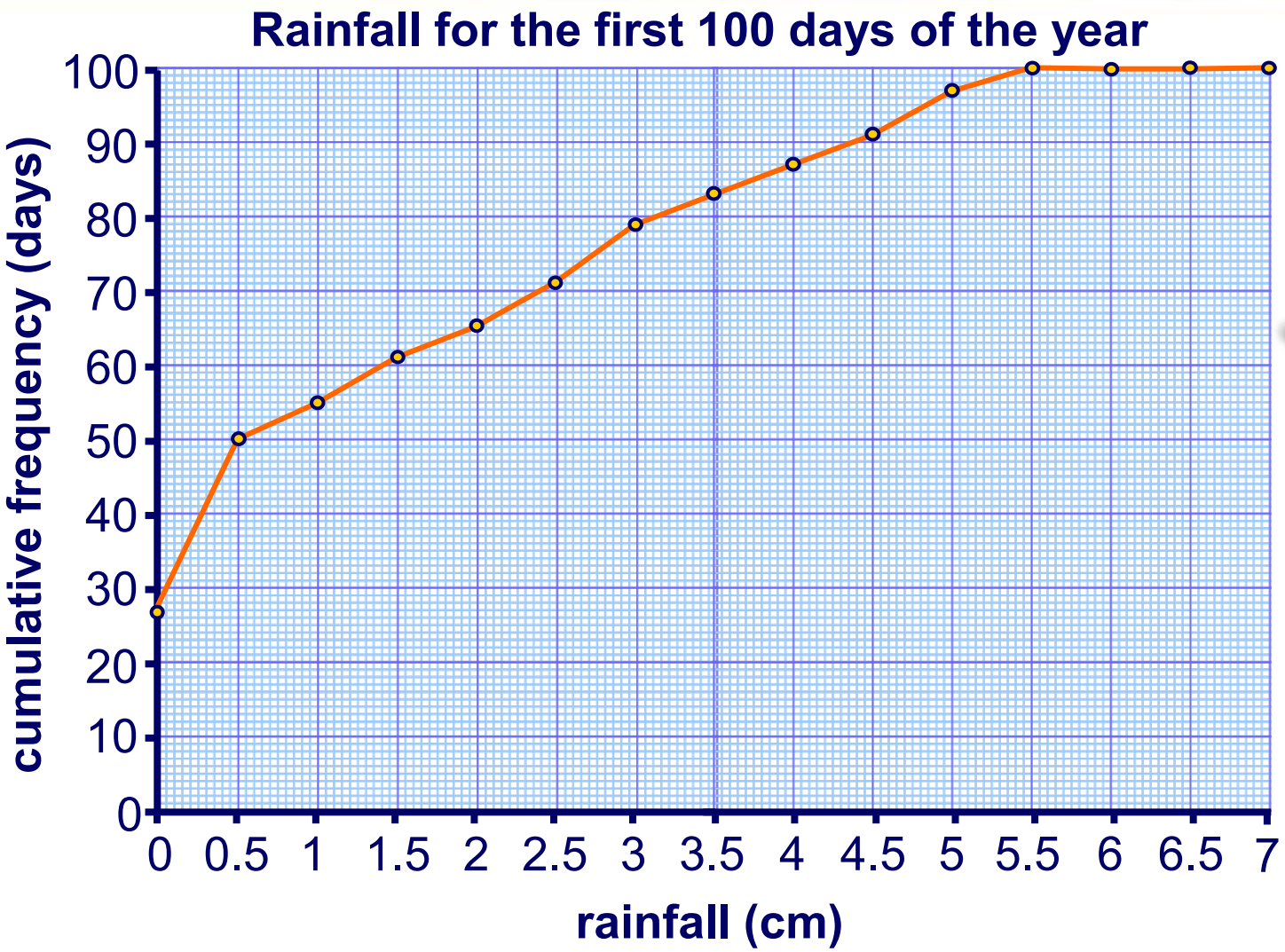
Rainfall



What conclusions can be drawn from this graph?

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