GCSE Maths – Statistics

Graphical Representation of Distributions

Worksheet

WORKED SOLUTIONS

This worksheet will show you how to work out different types of questions relating to statistical distributions. Each section contains a worked example, a question with hints and then questions for you to work through on your own.

Section A

Worked Example

Are the following examples of data discrete or continuous?

1. **Shoe size.**

   Shoe size is discrete because shoe size can only take whole or half number values. It cannot take a value such as 5.2 or 4.89.

2. **Time taken to run a race.**

   The time taken to run a race is continuous because the time taken can take any value. For example, someone may take 45.00 seconds but someone else may take 39.891 seconds.

Guided Example

Are the following examples of data discrete or continuous?

1. **Number of oranges sold in a supermarket.**

   Ask yourself whether oranges can take whole number values only? Can a supermarket sell half an orange?

   Discrete

2. **Weight of each puppy in a litter.**

   Can weight only take integer values (whole numbers) or can it be any positive number?

   Continuous

Now it's your turn!
If you get stuck, look back at the worked and guided examples.

1. State whether the following examples of data are discrete or continuous:

a) The height of 6 children

Continuous

b) The eye colour of 15 dogs

Discrete

c) The length of a field of sunflowers

Continuous

d) The number of wins for a team in a sports tournament

Discrete

e) The hair colour of 19 students

Discrete

f) The number of teachers in a school

Discrete

g) How long 7 swimmers take to swim 100m

Continuous

Section B – Higher Only

Worked Example

The following data values are collected:

$$\{2, 2, 3, 4, 8, 8, 9, 11, 12, 12, 13\}$$

Display the data in a box plot.

Step 1: Calculate the median and quartiles.

$$Lower\ quartile = \frac{n+1}{4}\ th\ term$$
$$Upper\ quartile = \frac{3(n+1)}{4}\ th\ term$$

Here, n represents the number of data values so $n = 11$. *So, inputting* $n = 11$ *gives*

$$Lower\ quartile = \frac{11+1}{4}\ th\ term = 3rd\ term = 3$$

$$Upper\ quartile = \frac{3(11+1)}{4}\ th\ term = 9th\ term = 12$$

The median is the middle data value and so can be found by finding the middle value of the data when the set is arranged in ascending order. If there are two middle values, the median should be calculated as the average of these two values.

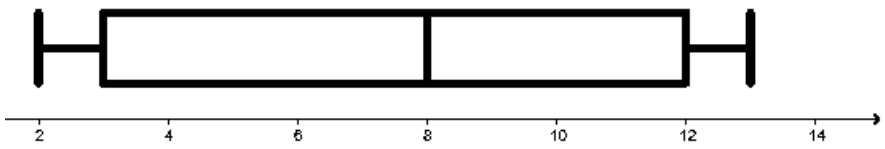
$$Median = Middle\ Value = 8$$

Step 2: Construct the box plot.

Draw the axis and label it appropriately. Mark points along the axis that spread slightly further than the spread of the data point.

Mark the lowest and highest value on the box plot. Mark the median and quartiles.

Connect the median and quartiles with a box. Connect the lowest and highest value with horizontal lines.

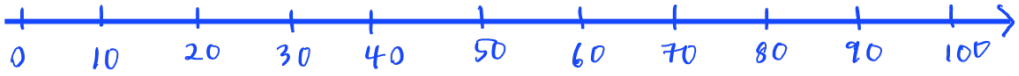


Guided Example

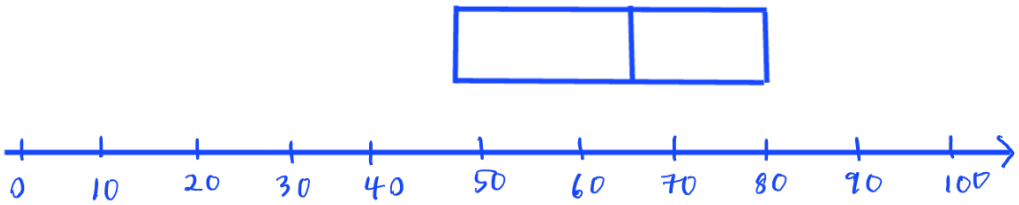
A class of students sat an exam. The total mark out of 100 was recorded for each student. Use the data below to construct a complete box plot to show this data on the students' scores.

Highest score: 98
Lowest score: 35
Lower quartile: 47
Upper quartile: 80
Median: 65

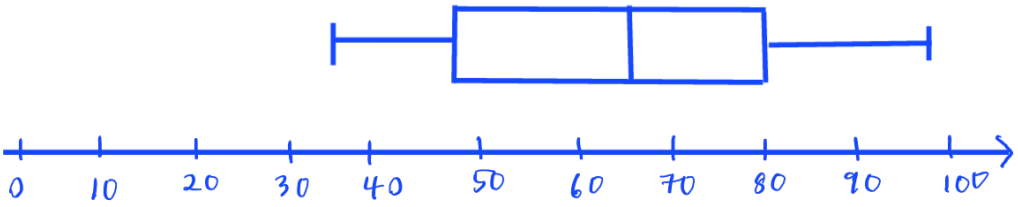
Step 1: Draw a scale which has the values 0 to 100 on it with a suitable interval.



Step 2: Mark the points on the scale where the median, upper and lower quartiles are. Now you can construct the box plot as you have all the information you need given to you in the question.



Step 3: After drawing the box, mark the largest and smallest values on the scale so that you can finish your box plot.



Now it's your turn!
If you get stuck, look back at the worked and guided examples.

2. A class of students took a maths test. The results are summarised below.

- The lowest mark was 10.
- The highest mark was 56.
- The median was 41.
- The upper quartile was 52.
- The interquartile range was 35.

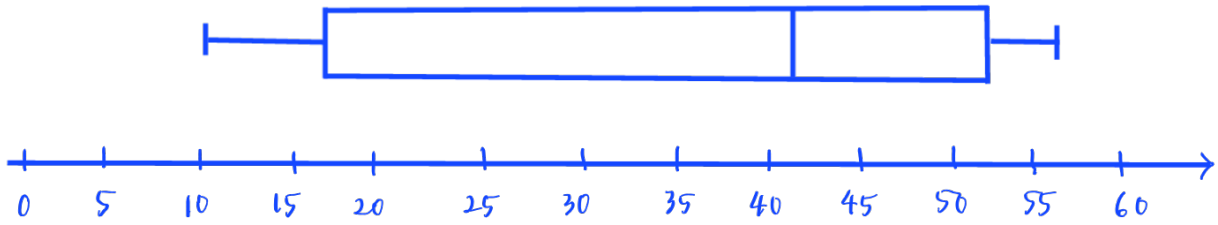
Interquartile = Upper quartile − Lower quartile

$35 = 52 - x$

$x = 17$

Lower quartile = 17

Using the information above, construct a box plot to represent the data.



3. A group of men and a group of women had their heights measured and recorded. The heights were rounded to the nearest cm and are shown in the table below.

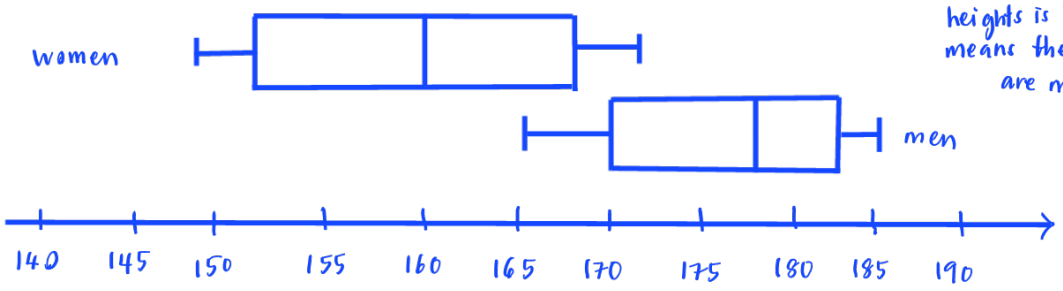
Heights of men (cm)	Heights of women (cm)
165	171
178	155
180	165
175	148
185	160

List the heights according to sequence

Men : 165, 175, 178, 180, 185 Women : 148, 155, 160, 165, 171

a) Draw a box plot for each set of data. Draw both box plots on the same scale.
b) Using the box plots, make two comparisons about the distributions of the men's heights compared with the distribution of the women's heights.

	Median	Lower quartile	Upper quartile
Men	178	(165+175)/2 = 170	(185+180)/2 = 183
Women	160	(148+155)/2 = 152	(165+171)/2 = 168



2 comparisons :

① The median of women's heights is lower compared to the men's heights

② The interquartile range of women's heights is higher than men's which means the heights of women are more spread than men

4. 10 friends measure their heights in cm. The results are shown below:

155 163 150 172 179 174 154 149 160 170

Using a suitable scale, draw a box plot to represent this data.

Arrange the heights according to its sequence :

149, 150, 154, 155, 160, 163, 170, 172, 174, 179

Q_1 median Q_3

$n = 10$

$\text{median} = \frac{(10+1)}{2}$

$= 5.5$

$= 5^{th}$ and 6^{th} term

$= \frac{(160+163)}{2}$

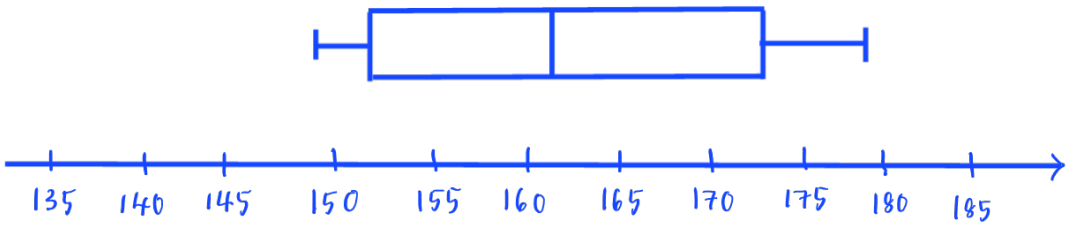
$= 161.5$

lower quartile : $\frac{(10+1)}{4} = \frac{11}{4} = 2.75$ (2nd and 3rd term)

$= \frac{(150+154)}{2} = 152$

upper quartile : $\frac{3(10+1)}{4} = \frac{33}{4} = 8.25$ (8^{th} and 9^{th} term)

$= \frac{(172+174)}{2} = 173$



5. Construct a box plot for the following data set:

2 5 6 6 8 10 12 13 16 17 20 22 24 25 28 30 31 34 38 41

$n = 20$ Q_1 median Q_3

$\text{median} = \frac{(20+1)}{2} = \frac{21}{2} = 10.5 = 10^{th}$ and 11^{th} term $= (17+20)/2 = 18.5$

lower quartile $= \frac{1}{4} \times (20+1) = \frac{21}{4} = 5.25 = 5^{th}$ and 6^{th} term

$= \frac{8+10}{2} = 9$

upper quartile : $\frac{3}{4} \times (20+1) = \frac{63}{4} = 15.75 = 15^{th}$ and 16^{th} term

$= \frac{28+30}{2} = 29$