



This activity will show you how to use Excel to draw cumulative frequency graphs.

Information sheet

The table gives the results from a survey about hourly earnings in 2010.

Employees earning £30 per hour or more were excluded from the table.

Think about...

Why do you think employees earning £30 per hour or more were excluded?

If you were going to draw a cumulative frequency graph for the men by hand, what would you do first?

| Earnings (£x/hour) | Number of employees | |
|--------------------|---------------------|-------|
| | Men | Women |
| $0 < x \leq 4$ | 46 | 128 |
| $4 < x \leq 6$ | 280 | 382 |
| $6 < x \leq 8$ | 761 | 1174 |
| $8 < x \leq 10$ | 815 | 867 |
| $10 < x \leq 12$ | 652 | 638 |
| $12 < x \leq 14$ | 544 | 433 |
| $14 < x \leq 16$ | 489 | 307 |
| $16 < x \leq 20$ | 652 | 459 |
| $20 < x \leq 25$ | 435 | 408 |
| $25 < x \leq 30$ | 326 | 204 |

Try these

Try the exercises on the next pages.

A To draw a cumulative frequency graph

Complete this cumulative frequency table for the men:

| Earnings (£x /hour) | Cumulative frequency Men |
|---------------------|--------------------------|
| $x \leq 4$ | 46 |
| $x \leq 6$ | 326 (from 46 + 280) |
| $x \leq 8$ | 1087 (from 326 + 761) |
| $x \leq 10$ | |
| $x \leq 12$ | |
| $x \leq 14$ | |
| $x \leq 16$ | |
| $x \leq 20$ | |
| $x \leq 25$ | |
| $x \leq 30$ | |

Now **enter the data** in columns onto an Excel spreadsheet as shown below.

Save your spreadsheet. Choose a name like 'Hourly Earnings' to help you remember what it is. Remember to save your spreadsheet regularly so that you do not lose any work.

Highlight the table.

Then left click **Insert**, the arrow below **Scatter**, then the second option.

Include (0, 0) as well as the values from the cumulative frequency table.

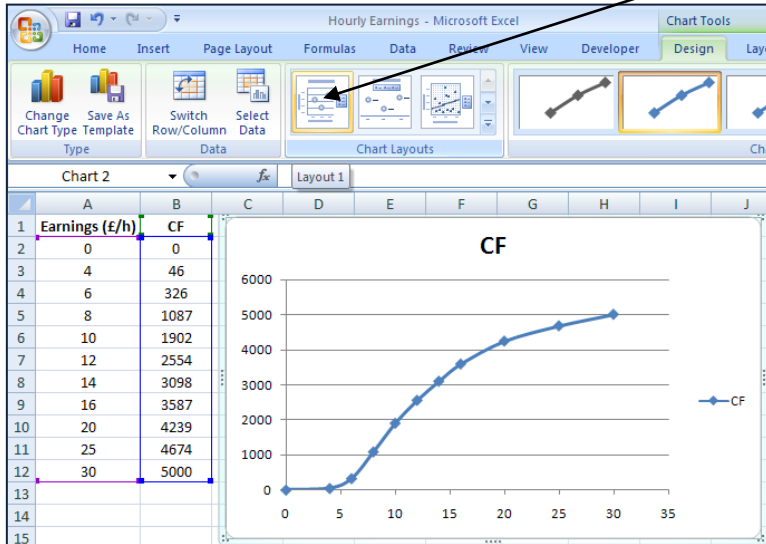
The second option gives data points joined by a smooth curve.

| | A | B |
|----|----------------|------|
| 1 | Earnings (£/h) | CF |
| 2 | 0 | 0 |
| 3 | 4 | 46 |
| 4 | 6 | 326 |
| 5 | 8 | 1087 |
| 6 | 10 | 1902 |
| 7 | 12 | 2554 |
| 8 | 14 | 3098 |
| 9 | 16 | 3587 |
| 10 | 20 | 4239 |
| 11 | 25 | 4674 |
| 12 | 30 | 5000 |

The cumulative frequency graph will appear.

B To label a cumulative frequency graph

To add axis titles to the graph left click on Layout 1 in Chart Tools Design.

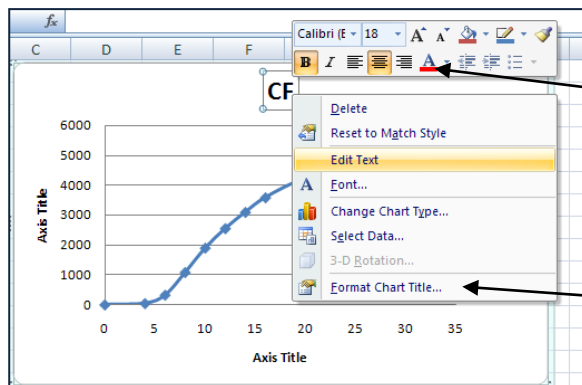


To change the title of the graph, right click on it, then left click **Edit Text**.

Change the title to

'Cumulative frequency graph showing hourly earnings for men'.

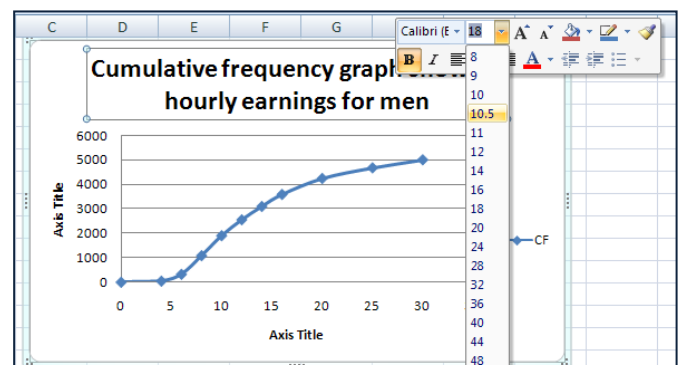
Left click the chart outside the title when you have done this.



These buttons let you change the colour or style of the title. Experiment with these later if you have time.

Format Chart Title gives other ways of changing the title.

To reduce the size of the title, right click on it again, left click on the arrow next to the font size, then left click a smaller value.



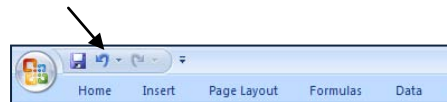
To change the axis titles:

Right click on the **horizontal axis title** and use **Edit Text** to change it to 'Earnings (£/h)'.

Right click on the **vertical axis title** and use **Edit Text** to change it to 'Cumulative Frequency'.

If you have time, **experiment** with other ways of changing the graph and axis titles. (Right click on the item you wish to change and try out the options on the menu.)

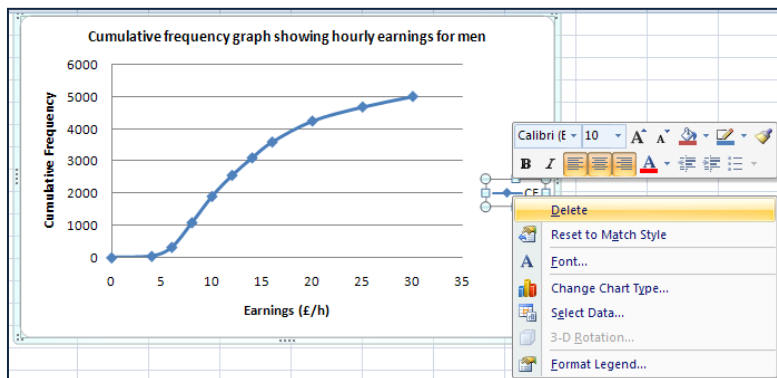
To undo anything you don't like left click on the **Undo** button.



The graph should now have the title and labels shown below.

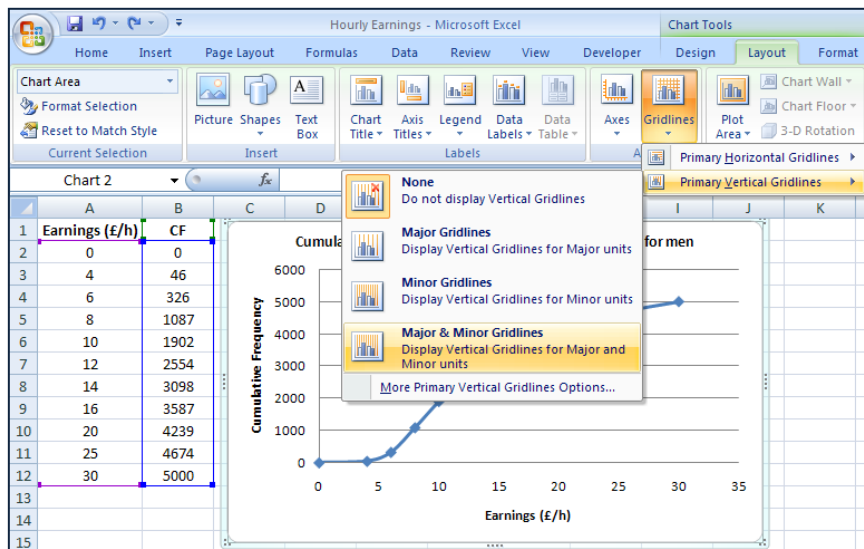
There is no need for the key as there is only one line on the graph.

To remove the key, right click on it, then left click **Delete**.

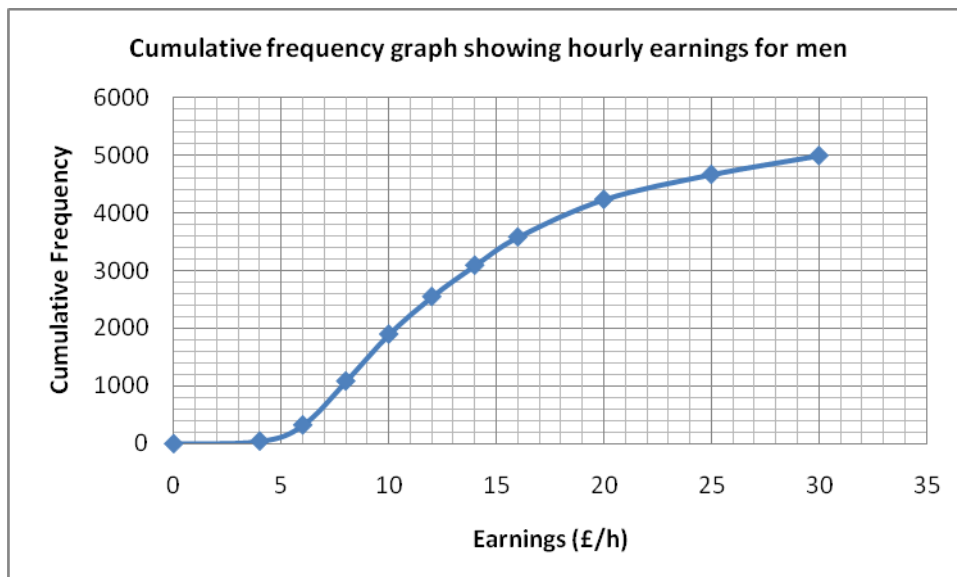


C To alter gridlines and axes on a cumulative frequency graph

To add vertical gridlines to the graph, left click **Chart Tools Layout**, the arrow below **Gridlines**, **Primary Vertical Gridlines**, then **Major and Minor Gridlines**.

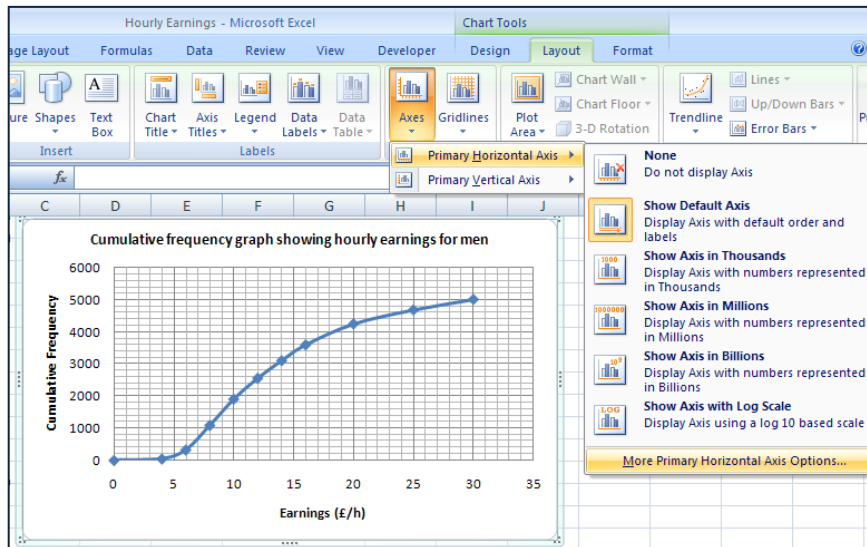


Use the same method to add minor horizontal gridlines (as shown below).



The axes of the graph show values beyond those in the original data.

To change the values on the horizontal axis, left click **Chart Tools Layout**, the arrow below **Axes, Primary Horizontal Axis**, then **More Primary Horizontal Axis Options**.

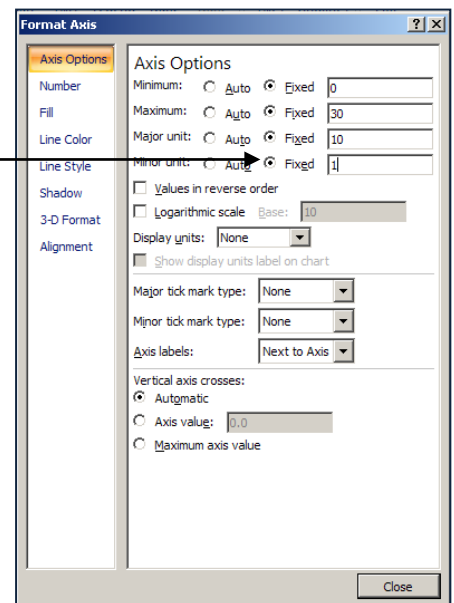


This gives the **Format Axis** menu shown on the right.

When **Auto** is selected, Excel chooses the Minimum and Maximum values on the axis and also the scale.

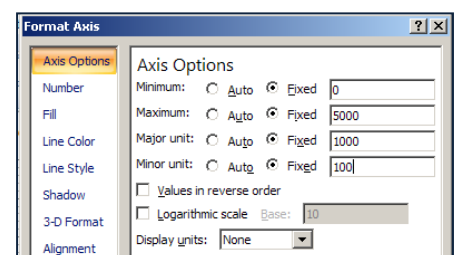
Left click on **Fixed** as shown, then change the values (where necessary) to those given here – this means that the values and scale on the axis will not change later if you change the size of your graph.

Left click **Close** – the horizontal axis should now stop at 30, rather than 35.



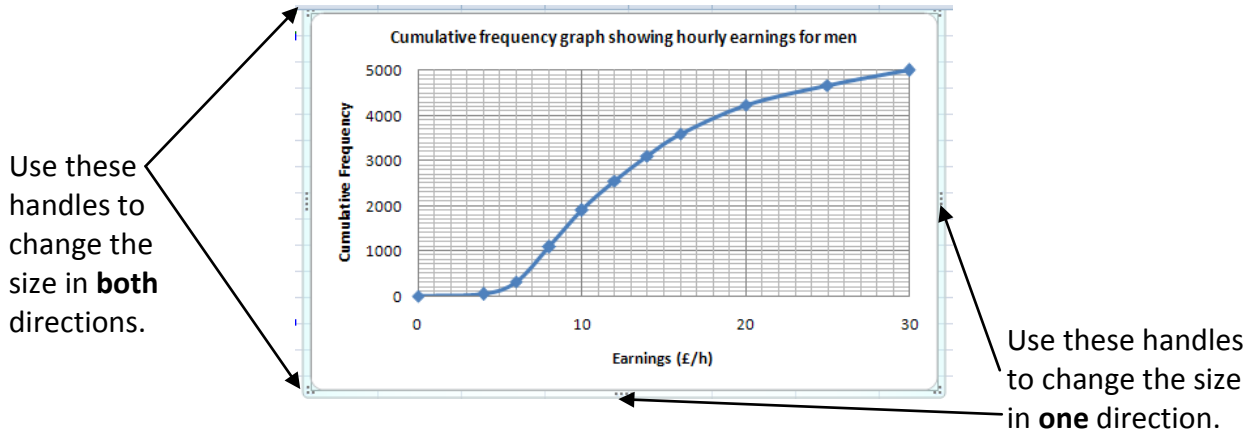
To change the values on the vertical axis, left click **Chart Tools Layout**, the arrow below **Axes, Primary Vertical Axis**, then **More Primary Vertical Axis Options**.

Again select **Fixed** and change the values (where necessary) to those given here.



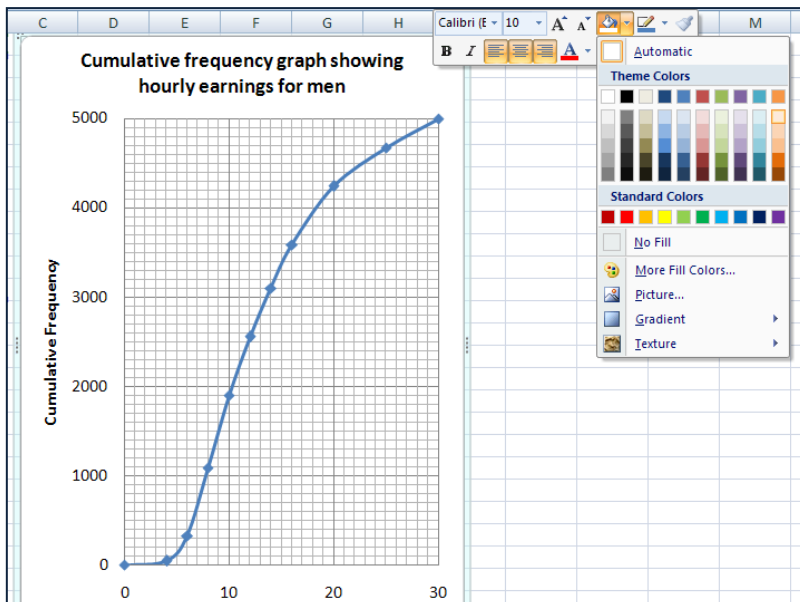
D To alter the appearance of a cumulative frequency graph

Use the handles to re-size your graph.



There are many other ways in which you can change the appearance of your graph. Here is just one more example.

To change the colour of the chart area, right click on an empty part of the graph, then left click on the arrow beside the **Shape Fill** button. This gives a selection of colours to choose from.



If you have time, **experiment** with this and other ways of changing your graph.

To undo anything you don't like, left click on the **Undo** button.

E To find the median and interquartile range

Think about...

How to find the median and interquartile range on a hand-drawn graph.

Print your graph and use it to complete the following for the men:

Median =

Lower quartile =

Upper quartile =

Interquartile range =

F To compare cumulative frequency distributions

You can draw cumulative frequency distributions on the same graph, or draw them separately.

Using separate graphs

A quick way to draw a separate graph for women is to copy the worksheet for men, then change the cumulative frequencies, title and labels.

The separate graphs will then have the same size and scale - this makes comparing them easier.

To copy a worksheet, right click the worksheet tab at the bottom of the screen. This gives the menu shown.

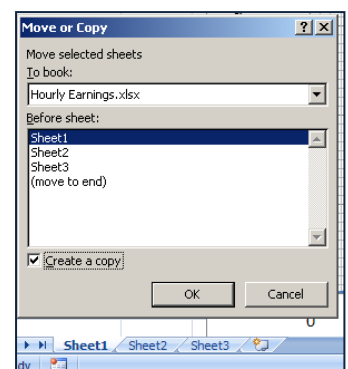
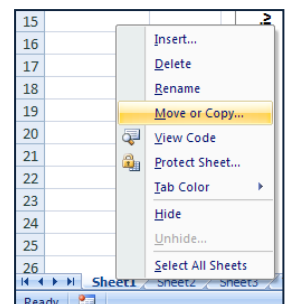
Left click on **Move or Copy**. This gives a second menu.

Left click **Create a copy**. Then **OK**.

This will give another worksheet identical to the first.

Use the data on page 1 to work out the cumulative frequencies for women, then replace the cumulative frequencies for men on the copied worksheet with the cumulative frequencies for women. The graph will be updated, but you will need to change 'men' in the title to 'women'.

Right click the worksheet tab at the bottom of each worksheet and use **Rename** to change the worksheet labels to 'Men' and 'Women'.

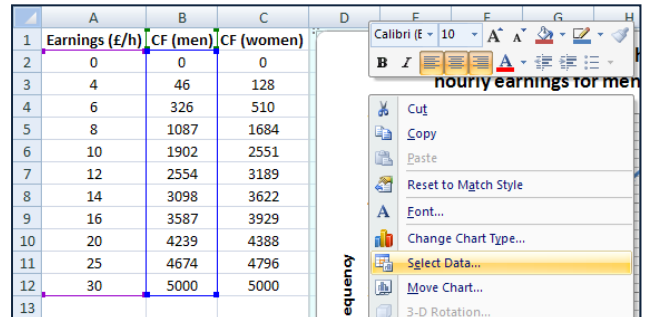


Using the same graph

To add the data for women to the graph you have already drawn for men

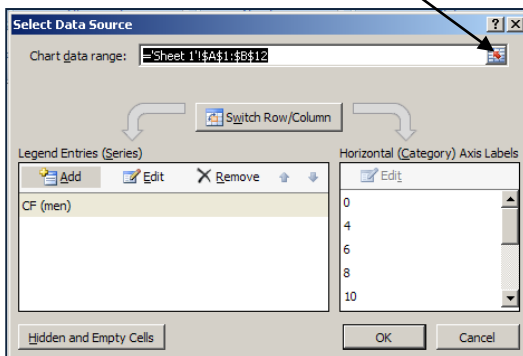
First, enter the cumulative frequencies for women into another column on your worksheet (as shown), then right click on an empty part of the graph – this gives the menu shown.

Left click on **Select Data** - the **Select Data Source** menu should appear (as shown below).



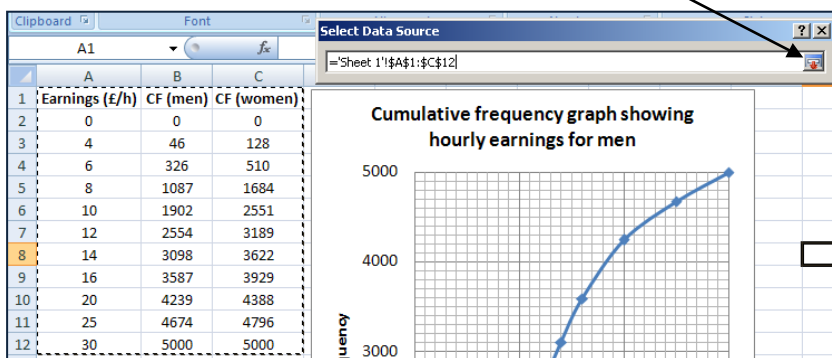
The **Chart data range** shows the data used for the original graph.

To select more data left click here.



It is possible to add data by left clicking **Add**, but this takes longer.

Highlight the whole table then left click this button.

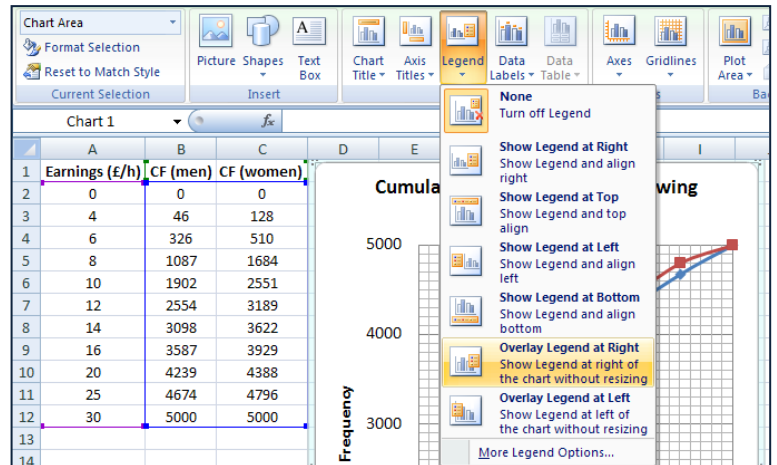


The data for women will be added to the Select Data Source menu and a new line will appear on the graph when you left click OK.

Remove 'For men' from the title of the graph.

To add a key, left click on Chart Tools Layout, the arrow below Legend, then Overlay Legend at Right.

The key will appear on the graph.



Comparing hourly earnings

Using either a separate graph for women or a combined graph:

Print your graph and use it to complete the following for the women:

Median =

Lower quartile =

Upper quartile =

Interquartile range =

Describe what the results and your graph(s) tell you about the hourly earnings of men and women.

At the end of your work

Do you prefer to draw cumulative frequency graphs by hand or using Excel?

What are the advantages and disadvantages of each?

Is it easier to compare two cumulative frequency distributions when they are on separate graphs or when they are on the same graph?

What features of the graphs are useful when making comparisons between two cumulative frequency distributions?