



Activity description

Students use sunshine and rainfall data to carry out significance tests on the difference between sample means. As part of this activity students use either a calculator or a spreadsheet to calculate mean and standard deviation values.

Suitability and Time

Level 3 (Advanced)

1–2 hours (depends on how many significance tests students carry out)

Resources and equipment

Student sheets

Optional: slideshow, spreadsheet

Calculators or computers

Key mathematical language

Mean, standard deviation, estimator, random, Normal distribution, significance test, null hypothesis, alternative hypothesis, critical values

Notes on the activity

There are two versions, a calculator activity and a spreadsheet activity, with different slideshows and student sheets for each. You could use either version or both, with some students working with calculators and some with spreadsheets.

Both slideshows give monthly sunshine data for England and Wales in the years 2001–2010, then ask questions about measures of location and spread. These are for class discussion.

The following slide gives formulae for the best estimators of the population mean and standard deviation, before asking students to find them for July and August.

Students using calculators should use the data for 30 years given on the information sheets, whereas students using a spreadsheet should use the data for 50 years given on the EWSun worksheet.

Answers are given in the slideshow, so that you can check students' work and discuss the results.

Both slideshows then give a summary of the main steps for carrying out a significance test on the difference between sample means, before showing how to use the July and August values to carry out a 5% significance test.

Students are then asked to write down and test other hypotheses involving sunshine and/or rainfall. You will need to provide students who are using calculators with the data you want them to use for this part of the activity.

The accompanying spreadsheets include temperature, sunshine and rainfall data for England and Wales (EW), Scotland (S) and Northern Ireland (NI) for each month in the period 1980–2010 (calculator version) and 1960–2010 (spreadsheet version). You may wish to allocate different datasets to different students.

The 'Rain or shine spreadsheet for teachers' gives the mean and standard deviation values for each month. It is advisable to check that students have the correct values before they use them to carry out a significance test.

During the activity

Individual students or pairs of students could be allocated different hypotheses to test, and the results pooled for final discussion.

Points for discussion

Ensure that students understand how the critical values given in the slideshow are found from Normal tables, and the reasoning behind significance tests.

Emphasise that the use of a significance test does not prove or disprove the hypothesis, but indicates what is likely to be true.

Before students attempt the more open-ended part of the activity, you will need to advise them about how to carry out a significance test when the months concerned have different numbers of days.

Extensions

Students could use hypothesis tests on the difference in proportions, and compare their results with tests on the difference between sample means.

Answers

Monthly hours of sunshine in England & Wales (calculator version)

	July	August
Mean	192.1 hours	180.9 hours
Standard deviation	38.37 hours	31.54 hours

Monthly hours of sunshine in England & Wales (spreadsheet version)

	July	August
Mean	184.4 hours	37.33 hours
Standard deviation	174.8 hours	31.47 hours

Other mean and standard deviation values are given in the 'Rain or shine spreadsheet for teachers'.