# Y9 Lesson 1

Overview:
The aim of this lesson is to describe to students how the mathematics they will learn over the following week will be applied in order to build their knowledge of climate science and weather forecasting. Students will also be informed of how they will collect and interpret weather observations as well as the process of submitting and retrieving their data to the online spreadsheet. The mathematics covered towards the end of this lesson will introduce what a mathematical model is and how we can use a model to investigate the dynamic state of our atmosphere.

Introduction (10 – 15 minutes presentation):
Introduce the project – ask students to describe the role they think mathematics plays in forecasting the weather.

Set a homework task for students to find and print a published five day weather forecast for the school's location for Monday – Friday, to bring in to the Lesson 3:

- This must include the predicted weather conditions, temperature, wind speed and direction at 13:00 on each day.
- Suggested sources are Met Office, BBC Weather, weather.com, newspapers and radio/television forecasts.

Describe how students will collect weather observations using the *Instruction Guide*, distribute copies of this/make copies available for students:

- Organise Year 9 students into 5 groups/Ask for volunteers; each is responsible for the observations on one day of Monday – Friday, to each group if possible allocate one or two year 12 students to act as supervisors.
- On each day observations will be required at approximately midday, however it is recommended that they are taken during the student's lunch break to avoid lesson disruption.
- Observations required will be**: cloud cover, wind direction, wind speed, current weather conditions and air temperature**.

Describe how students will submit the weather observations using the online system available at www.mathmetics.org/bObservations/:

- Homework/Lesson time/Lunchtime activity for students is to input this data into the website, this is required to be accurate and completed each day.
- Explain to students how this data will be used at the end of the week in conjunction with their collected published forecasts for various activities.

Lesson Plan:
* = activity on individual whiteboards/verbal activity

1. Introduce students to the model of a rain-bearing cloud moving in with a constant speed and a constant height above the ground; draw a sketch of this on a whiteboard.
   1.1. *Ask students if they can define speed **v** in terms of distance travelled **x** and time taken **t**. Solution **v=x/t**
   1.2. *Ask students if they can define distance travelled in terms of speed and time taken.
   1.3. Now, first ensure students can convert between km and m, seconds and hours.
      1.3.1. Then work through questions 1, 2 and 3 on the worksheet.

2. Ask students to discuss in pairs for 1 minute what problems there might be with this model for predicting when a cloud might arrive in the real world – pick students to feedback their ideas to the class.

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2.1. Possible hints: Cloud not moving in a straight line, cloud changing speed, cloud changing height, cloud shape changing, etc.

3. Introduce the idea that as speed is the change of distance with respect to time, acceleration is the change of speed with respect to time.
   3.1. *Given an initial speed **u** and final speed **v** and change in time **t**, ask students to write down acceleration **a** in terms of **u, v** and **t**. Solution: **a = (v-u)/t**
   3.2. *Ask students to re-arrange this equation to make the final speed **v** the subject of this equation.

4. Refer to the cloud idea and now suggest that it has started raining, we want to model the speed of the rain drops as they fall from the cloud.
   4.1. Ask students if they can name what force will be causing the rain drops to accelerate.
   4.2. Ask students if they know the acceleration due to this force.*
   4.3. Explain to students that we **assume** this acceleration **a = g = 9.8 m/s$^2$** to be constant everywhere around the world and everywhere in the atmosphere.
   4.4. Ask students to discuss in pairs for 1 minute if they think this is a fair assumption and what would happen to our predictions if the assumption was not fair.
      4.4.1. Hints: no air resistance, changes in the Earth's gravity, force becomes weaker further from the Earth's centre, etc.

5. Now let students individually work through questions 4 and 5 on the worksheet.
   5.1. Question 5 is more challenging, may be best to work through on a whiteboard with the class.

6. End the lesson by informing students that these two examples are mathematical models, which they have used to make predictions and learn more about the processes.
   6.1. Instruct students that these models are essentially equations which represent a process which we want to predict.
   6.2. Identify the importance of making and testing assumptions, as these ensure a model is practical and can be used to easily solve problems!
   6.3. Ask students to suggest other examples of real-life processes we could model
      6.3.1. Hint: Temperature change, economy, medicine effectiveness, etc.

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