NUMERACY
Lesson plans
Weather

Numeracy Lesson 1: Rainy maths games (Key Stage 1)

Aims of the lesson: To make the development of basic numeracy skills motivational by incorporating a theme.

Activity: Begin the session by explaining to the pupils that they are going to create some mathematical problems involving numbers 1- 100 using clouds and raindrops. First ask the class to make some clouds. These can be cut out using plain or coloured card. Then ask the class to place addition, subtraction, multiplication, or division problems on the clouds, such as: 1+1=, 2+1=, 2+2=, 40+20= etc… Then ask the class to make lots of raindrops. Once again these can be made by cutting raindrop shapes from card. Next, ask the class to place the answer to each of their problems on a separate raindrop, making sure that they have included a raindrop answer for all of their questions. The raindrops and clods can then be laminated for durability. Once this is completed, ask the pupils to swap sets of clouds and raindrops between each other and see if they can match the correct cloud (question) with the correct raindrop (answer). To help with this activity, there is a cloud template and a raindrop template in your Numeracy Lesson 1 folder. There is also a ready-made activity sheet with some

Plenary: As an extension activity, you can follow the activity outlined above, except have a cup or an empty margarine container with the question cloud on each one. Have the children place the correct raindrops in the correct cup or container.

Differentiation: As the pupils are setting their own mathematical problems, this activity should be suitable for children of all abilities.

Numeracy Lesson 2: Weather problems (Key Stage 2)

Aims of the lesson: To solve a series of mathematical problems involving technical information about the weather.

Activity: Explain to the class that weather forecasting, predicting and recording is inextricably linked with mathematics. As a topic, any study of the weather involves statistics, graphs, temperature scales, wind speeds and rainfall measurements. All of these items involve an understanding in mathematics. With this in mind, there is a copy of this sheet in Numeracy Lesson 2, offering a selection of mathematical problems that all discuss the weather. This sheet can be printed out for individual or group completion or projected for whole class discussion as a lesson starter. We have also included an answer sheet for ease of marking.

Plenary: A good extension activity is to ask the pupils to write their own mathematical problems involving temperature scales, wind speeds and rainfall measurements. Then in pairs swap before answering the problems.

Differentiation: The problems on the sheet are most suited to Key Stage 2, and some pupils might need some direction into breaking the problems down into stages before working out the answer. However, with this in mind, this activity should be suitable for Key Stage 2 pupils of all abilities. If you have some less able pupils who will struggle with the problems given on the sheet opposite, then ask them to move straight into setting (and answering) problems they devise themselves – working in pairs.

Numeracy Lesson 3: Numbers in words (Key Stage 1)

Aims of the lesson: To write out numbers in full as words.

Activity: Working along the same lines as Numeracy Lesson 1, begin by making a number of raindrops (or you could make suns instead to make this activity even more different! – a template for suns can be found In Numeracy Lesson 3. On one set of raindrops, write various two (or three) digit numbers. On the other set write the numbers out in full as words. This can be done before the lesson, or the pupils can create these sets of raindrops themselves as part of the learning process. Once the two sets are complete, jumble them up and see if the class can match them back together correctly.

Plenary: A good extension activity to consolidate the pupil's ability to write numbers as words is to tell the children a set of numbers (number by number) to write down. These can be written down on cards and then held up or more formally written on paper for marking. For added clarity you could categorise the numbers into numbers 1–10; numbers 11–100; number 101–1,000 and numbers 1,001–10,000.

Differentiation: More able children could be asked to concentrate on larger numbers, even going up to seven digits, and less able pupils can concentrate on smaller numbers.

Numeracy Lesson 4: Tempting temperatures (Key Stage 2)

Aims of the lesson: To interrogate a set of temperature statistics and answer mathematical problems relating to those statistics. To understand and be able to work out mode, median, average and range.

Activity: Begin by telling the class they are going to look at a set of temperature ranges. They will then be given a sheet of problems relating to those temperatures to complete. The sheet of problems is in Numeracy Lesson 4 and we have also included an information sheet. The pupils need an understanding of mode, median, mean and range to complete these problems, so a review of these terms and what they mean is essential. To help with this Numeracy Lesson 4 includes a sheet defining these terms. This sheet could be printed out as A3 or larger and displayed for constant reference.

Plenary: There is a huge array of data available on the Internet, Alternatively, ask the class to record their own daily temperatures, or even rainfall, and then find the mean, mode, median and range of their own data. As an additional activity ask the pupils to plot the data on a graph showing the temperature for each day in a given school week.

Differentiation: This activity is most suitable for Key Stage 2 pupils and, as long as the class understands how to calculate mode, median, mean and range, this activity should be suitable for all pupils.

Numeracy Lesson 5: Probability (Key Stage 2)

Aims of the lesson: To develop an understanding of probability and predict weather using the language of probability.

Activity: In some areas of the world it is critically important for meteorologists to forecast the likelihood of severe weather conditions. Recent events in Asia show only too clearly how important severe weather warnings can be, and weather predictions rely on a mixture of prediction and probability. Experts are constantly developing better and more accurate probability forecasting systems and some are extremely complicated. However, there is much that can be done in the classroom to help pupils develop a better understanding of probability through the concept of weather forecasting. For example, pupils could be asked to decide what the probability is that it will be wet (or sunny, or rainy, or windy) tomorrow? To do this, pupils can record what the weather is like for a week or a month preceding the lesson, and use recorded weather patterns to inform their predictions. It is essential that pupils have studied probability before this activity can be completed, so time spent revisiting some basic principals would be useful. Essentially the pupils must know that:

- The probability of the occurrence of an event can be expressed as a fraction or a decimal from 0-1.
- Events that are unlikely will have a probability near 0.
- Events that are likely to happen have probabilities near 1.

Numeracy Lesson 5 contains two probability weather forecast maps that professional scientists and meteorologists have devised. These can be used to inform the lesson and cover wind and hurricane predictions for Florida. USA.

Plenary: As an extension activity, ask the pupils to think further into the future than just tomorrow or next week. What is the probability that it will be sunny in the middle of August or the middle of December in different countries? What is the probability that there will be a tornado this year in the UK? In America? What sort of geographical information would they need to take into account to make such predictions?

Differentiation: As long as the pupils stick to working out the probability of local weather within a short time frame, this activity should be suitable for pupils of all abilities.

Numeracy Lesson 6: Thermometers (Key Stages 1 and 2)

Aims of the lesson: To develop and/or consolidate the ability to read thermometers.

Activity: This lesson asks the pupils to look at a range of thermometers and record the temperatures being shown. (See the sheet in Numeracy Lesson 6). The pupils should have an understanding of thermometers and a brief discussion as to how thermometers and temperature scales developed would be both useful and interesting. Numeracy Lesson 6 contains an information sheet that details the development of thermometers and temperature scales, covering Galileo all the way through to Lord Kelvin. A discussion of how thermometers work would also be useful. The bulb thermometer is probably one of the most common and it usually contains some type of fluid, generally mercury. Bulb thermometers rely on the simple principle that a liquid changes its volume relative to its temperature. Liquids take up less space when they are cold and more space when they are warm. All bulb thermometers use a fairly large bulb and a narrow tube to accentuate the change in volume. For the pupils to gain a clearer understanding of how bulb thermometers work, they could make one themselves. Numeracy Lesson 6 contains an information sheet explaining how a bulb thermometer can be made.

Plenary: As an additional activity, an array of word problems can be posed to support the development of basic mathematical skills. Alternatively, ask the pupils to convert the temperatures shown on the Activity Sheet below, from degrees Celsius to degrees Fahrenheit.

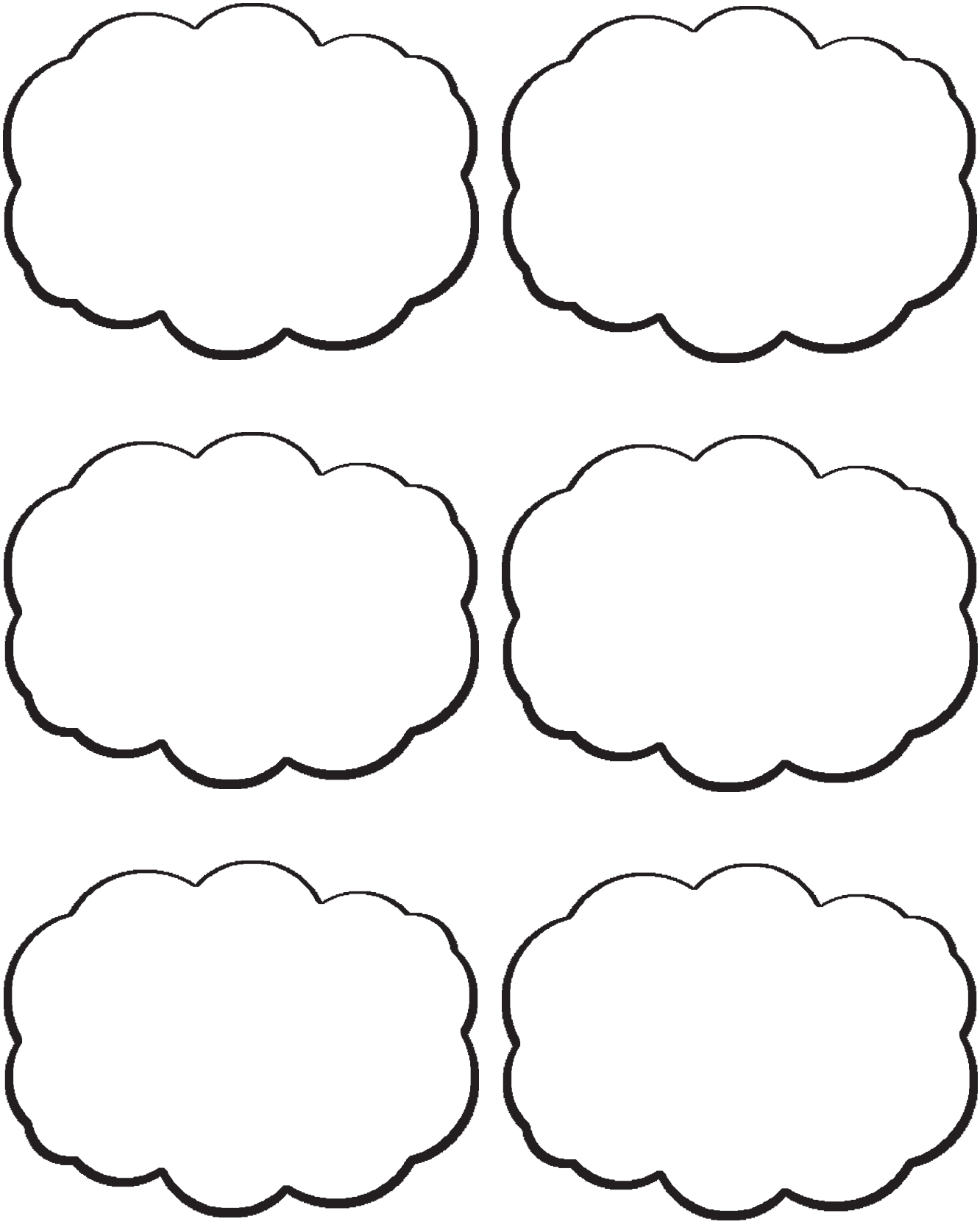
Differentiation: This activity should be suitable for pupils of all abilities. However, if you prefer to select your own temperatures to be recorded (perhaps just restricting the activity to whole numbers) then a blank template of thermometers is included in the Numeracy Lesson resources.

Weather

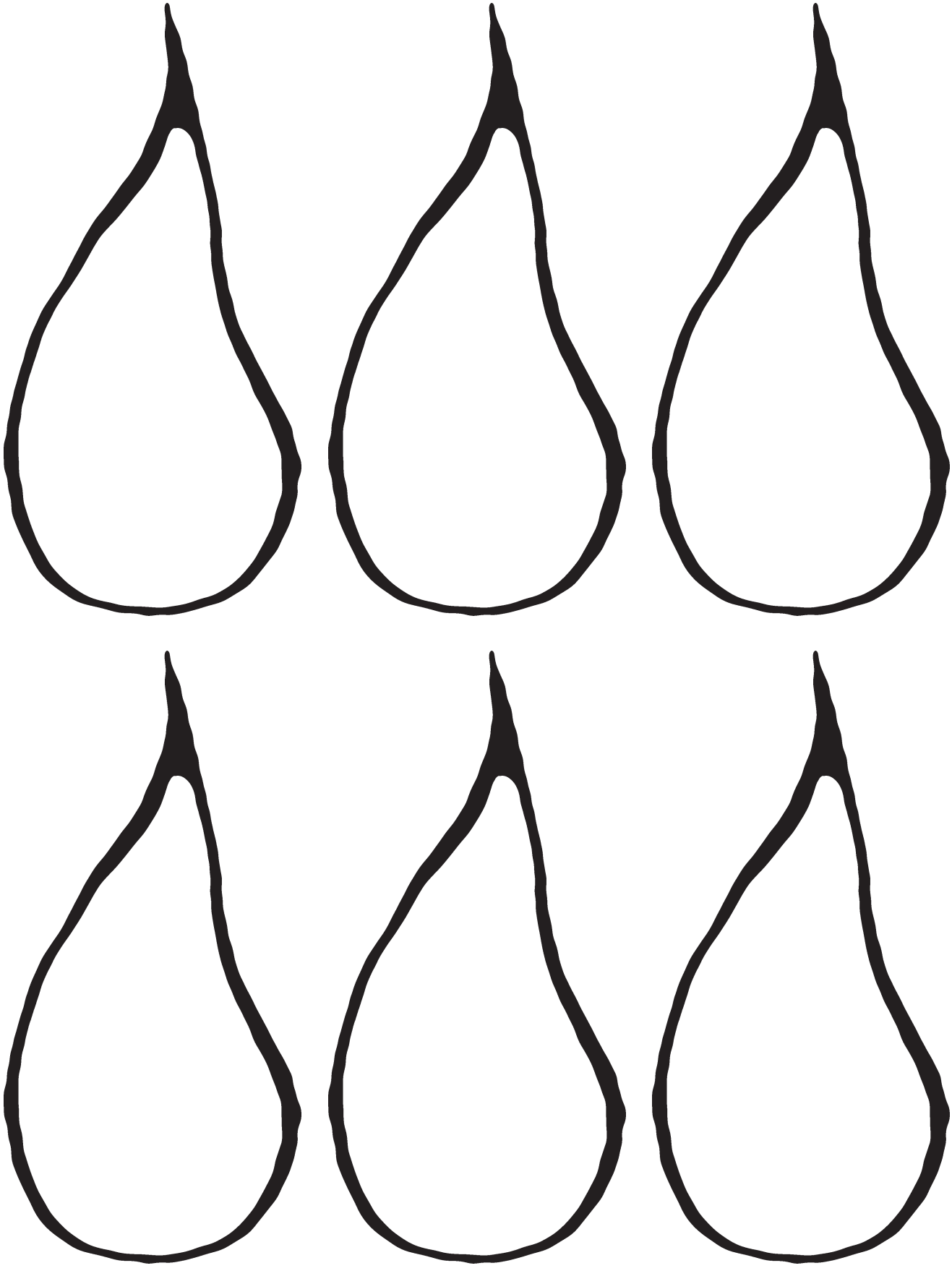
Numeracy Lesson 1: Rainy maths games

Key Stage 1

Clouds template



Raindrops template



Rainy maths

Name: Date:

1.	40	+	60	=	100	
2.	25	+	25	=		
3.	16	+	24	=		
4.	10	+	5	=		
5.	8	+	8	=		
6.	30	+	42	=		
7.	12	+	12	=		
8.	5	+	6	=		
9.	55	+	35	=		
10.	65	+	15	=		
11.	43	+	34	=		
12.	25	+	0	=		

Rainy maths (Answer sheet)

Name: Date:

1.	40	+	60	=	100
2.	25	+	25	=	50
3.	16	+	24	=	40
4.	10	+	5	=	15
5.	8	+	8	=	16
6.	30	+	42	=	72
7.	12	+	12	=	24
8.	5	+	6	=	11
9.	55	+	35	=	90
10.	65	+	15	=	80
11.	43	+	34	=	77
12.	25	+	0	=	25

Weather

Numeracy Lesson 2: Weather problems

Key Stage 2

Weather problems

Name: Date:

1. Jack's weather station recorded a high temperature of twenty degrees Celsius. Malrose's weather station recorded a high temperature that was eight degrees warmer than Jack's. What did Malrose's weather station record as the high temperature? _____

2. Brian's weather station recorded a high temperature of eleven degrees Celsius. Michael's weather station recorded a high temperature that was five degrees colder than Brian's. What did Michael's weather station record as the high temperature? _____

3. In the morning, the wind was blowing fourteen miles per hour southeast. By the afternoon, the wind was blowing eight miles per hour stronger, but in the exact opposite direction. What is the direction and the speed of the wind in the afternoon? _____

4. Last week, there were two cloudy days, three rainy days, and the rest of the week was sunny. How many days last week were sunny? _____

5. The current temperature is twenty-eight degrees Celsius. On the same day in 1966 the record high temperature was set at thirty-six degrees Celsius. How much warmer must it get for the temperature to break the record set in 1966? _____

6. It snowed twelve inches on Sunday, four inches on Monday, and eleven inches on Tuesday. On Wednesday two inches of snow melted. How much snow was left? _____

7. On Friday, sunrise was at 6:58 a.m. Five days earlier on Sunday, sunrise was three minutes earlier. What time was sunrise on that Sunday? _____

8. Yesterday's high temperature was twenty-five degrees Fahrenheit warmer than yesterday's low temperature. If yesterday's high temperature was twenty-seven degrees Celsius, what was yesterday's low temperature? _____

Weather problems (answer sheet)

1. Jack's weather station recorded a high temperature of tewnty degrees Celsius. Malrose's weather station recorded a high temperature that was eight degrees warmer than Jack's. What did Malrose's weather station record as the high temperature?
   Answer: 28 degrees

2. Brian's weather station recorded a high temperature of eleven degrees Celsius. Michael's weather station recorded a high temperature that was five degrees colder than Brian's. What did Michael's weather station record as the high temperature?
   Answer: 6 degrees

3. In the morning, the wind was blowing fourteen miles per hour southeast. By the afternoon, the wind was blowing eight miles per hour stronger, but in the exact opposite direction. What is the direction and the speed of the wind in the afternoon?
   Answer: 22 miles per hour, northwest

4. Last week, there were two cloudy days, three rainy days, and the rest of the week was sunny. How many days last week were sunny?
   Answer: 2 days

5. The current temperature is twenty-eight degrees Celsius. On the same day in 1966 the record high temperature was set at thirty-six degrees Celsius. How much warmer must it get for the temperature to break the record set in 1966?
   Answer: 8 degrees

6. It snowed twelve inches on Sunday, four inches on Monday, and eleven inches on Tuesday. On Wednesday two inches of snow melted. How much snow was left?
   Answer: 25 inches

7. On Friday, sunrise was at 6:58 a.m. Five days earlier on Sunday, sunrise was three minutes earlier. What time was sunrise on that Sunday?
   Answer: 6.55 a.m

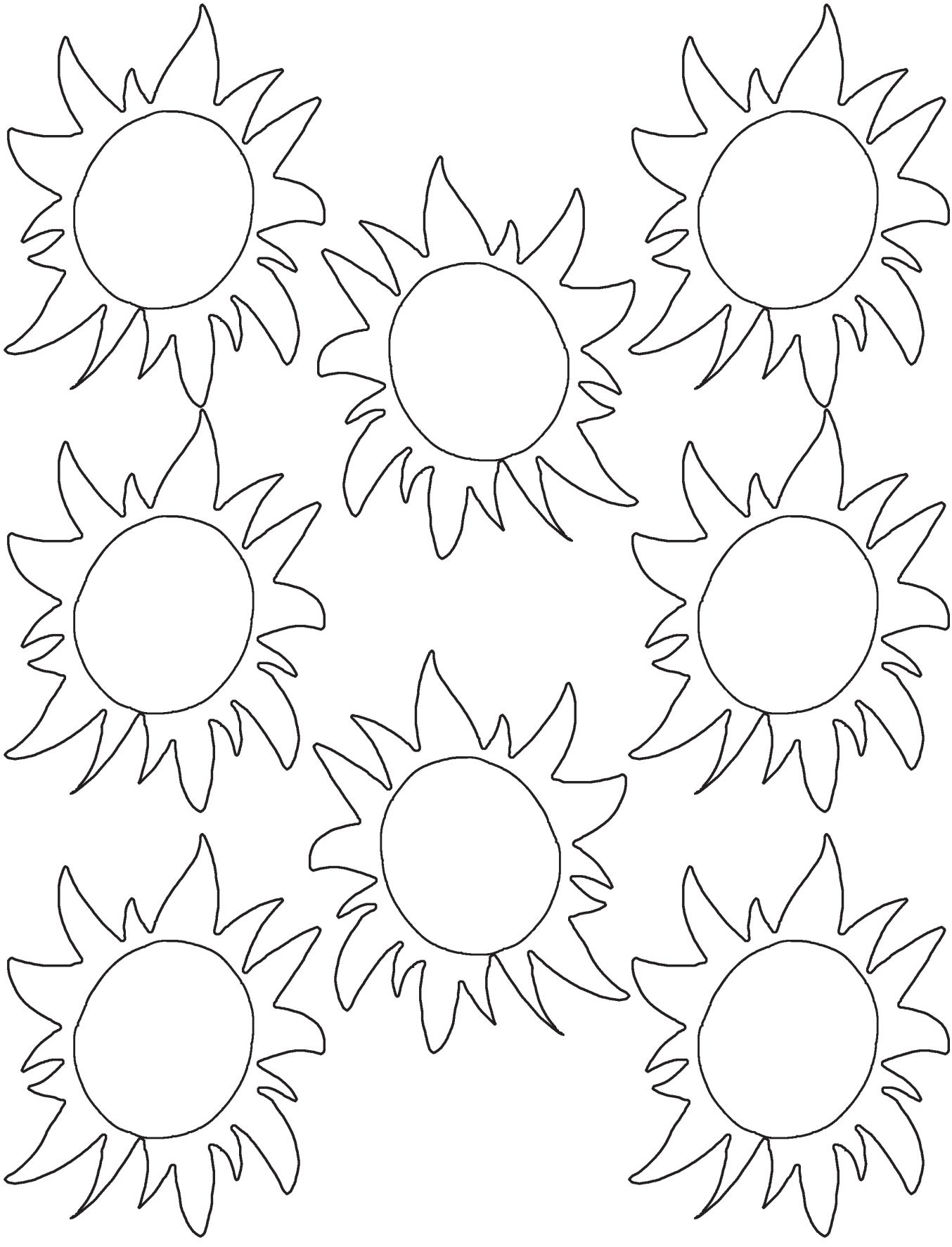
8. Yesterday's high temperature was fifteen degrees Celsius warmer than yesterday's low temperature. If yesterday's high temperature was twenty-seven degrees Celsius, what was yesterday's low temperature?
   Answer: 12 degrees

Weather

Numeracy Lesson 3: Numbers in words

Key Stage 1

Suns template



Weather

Numeracy Lesson 4: Tempting temperatures

Key Stage 2

Definitions for Numeracy Lesson 4

Mean = To calculate the mean, we need to add all the values up and then divide by the total number of values.

$$\textbf{Mean} = \frac{\text{sum of all values}}{\text{total number of values}}$$

Median = To calculate the median, we need to put the numbers in order and find the middle value.

Mode = To calculate the mode, we need to look at which value appears the most often. It can help if the numbers are in order.

Range = To find the range, you first need to find the lowest and highest values in the data. The range is found by subtracting the lowest value from the highest value.

Tempting temperatures

Name: Date:

Lisa and Robert each live in a different city. Each Monday, for eleven weeks, they recorded the highest temperature. The data below is the high temperatures, in Celsius, that they recorded.

Lisa's data:	**52, 52, 46, 49, 50, 45, 49, 49, 55, 52, 55, and 53**
Robert's data:	**69, 69, 71, 69, 77, 74, 74, 71, 70, 63, 60, and 59**

All calculations should be rounded to the nearest whole number.

1. What is the range of temperatures in Lisa's data?

2. What is the mean, median, and mode for Lisa's data? For Robert's data?

3. If you combined the data for both cities, what would be the mean, median, and mode for the combined data?

4. Using Lisa's data, what was the mean temperature in Celsius?

5. Robert calculated the median to be 70. However, he forgot to include one number when calculating the median. Which number did Robert forget?

6. If you could spend the next month in either city, whom would you want to visit? Why?

Tempting temperatures (answer sheet)

Lisa and Robert each live in a different city. Each Monday for eleven weeks, they recorded the highest temperature. The data below is the high temperatures, in Celsius, that they recorded.

Lisa's data:	**52, 52, 46, 48, 50, 45, 49, 49, 55, 52, 55, and 53**
Robert's data:	**69, 69, 71, 69, 77, 74, 74, 73, 70, 63, 60, and 59**

All calculations should be rounded to the nearest tenth.

1. What is the range of temperatures in Lisa's data?
   Answer: The range of Lisa's data is 10.

2. What is the mean, median, and mode for Lisa's data? For Robert's data?
   Answer: Lisa's data: mean = 50.5; median = 50; mode = 52
   Answer: Robert's data: mean = 69; median = 69; mode = 69

3. If you combined the data for both cities, what would be the mean, median, and mode for the combined data?
   Answer: mean = 59.75; median = 55; mode = 52 and 69

4. Using Lisa's data, what was the mean temperature in Celsius?
   Answer: 10.3 (to one decimal place) degrees Celsius

5. Robert calculated the median to be 70. However, he forgot to include one number when calculating the median. Which number did Robert forget?
   Answer: 69

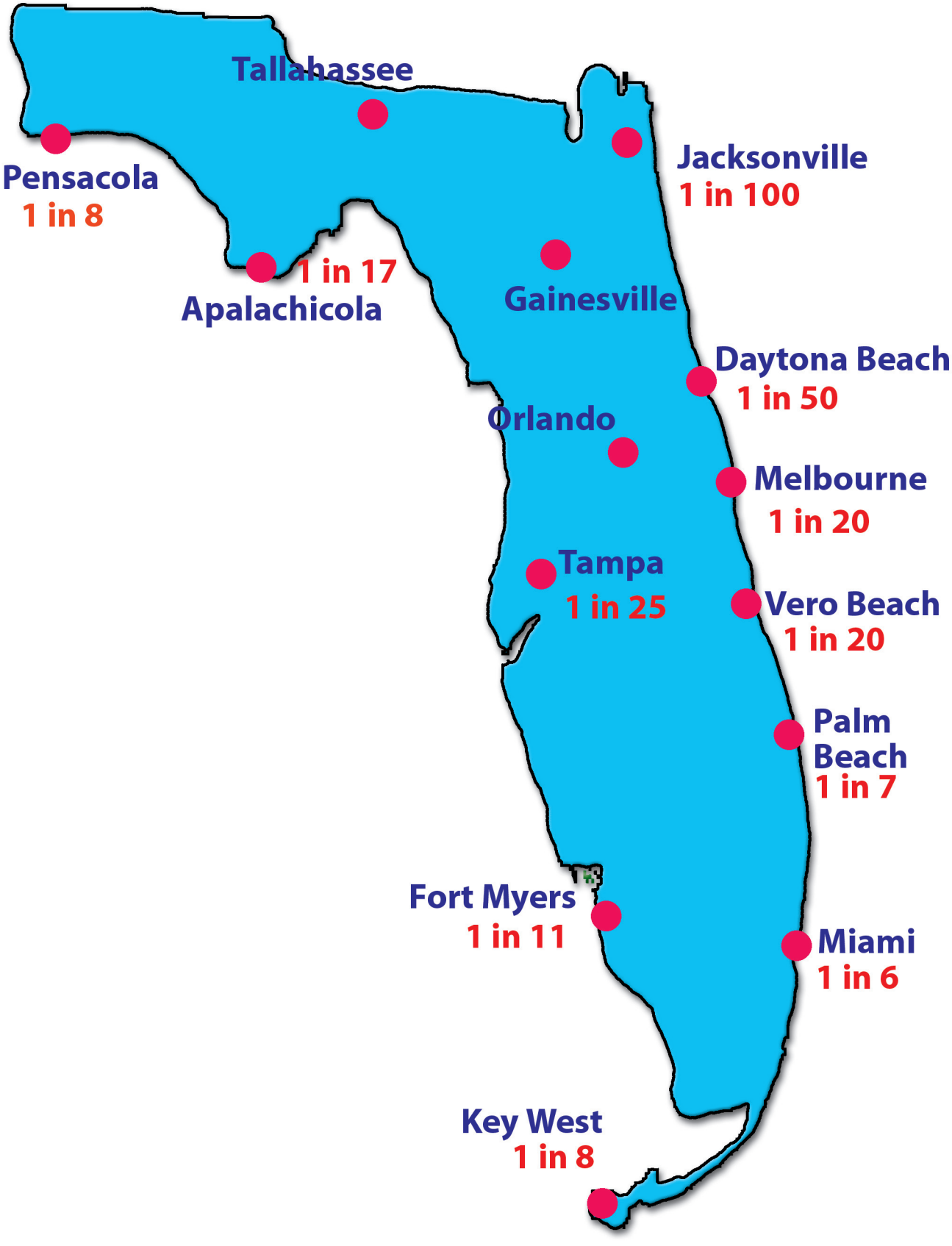
6. If you could spend the next month in either city, whom would you want to visit? Why?
   Answer: Robert

Weather

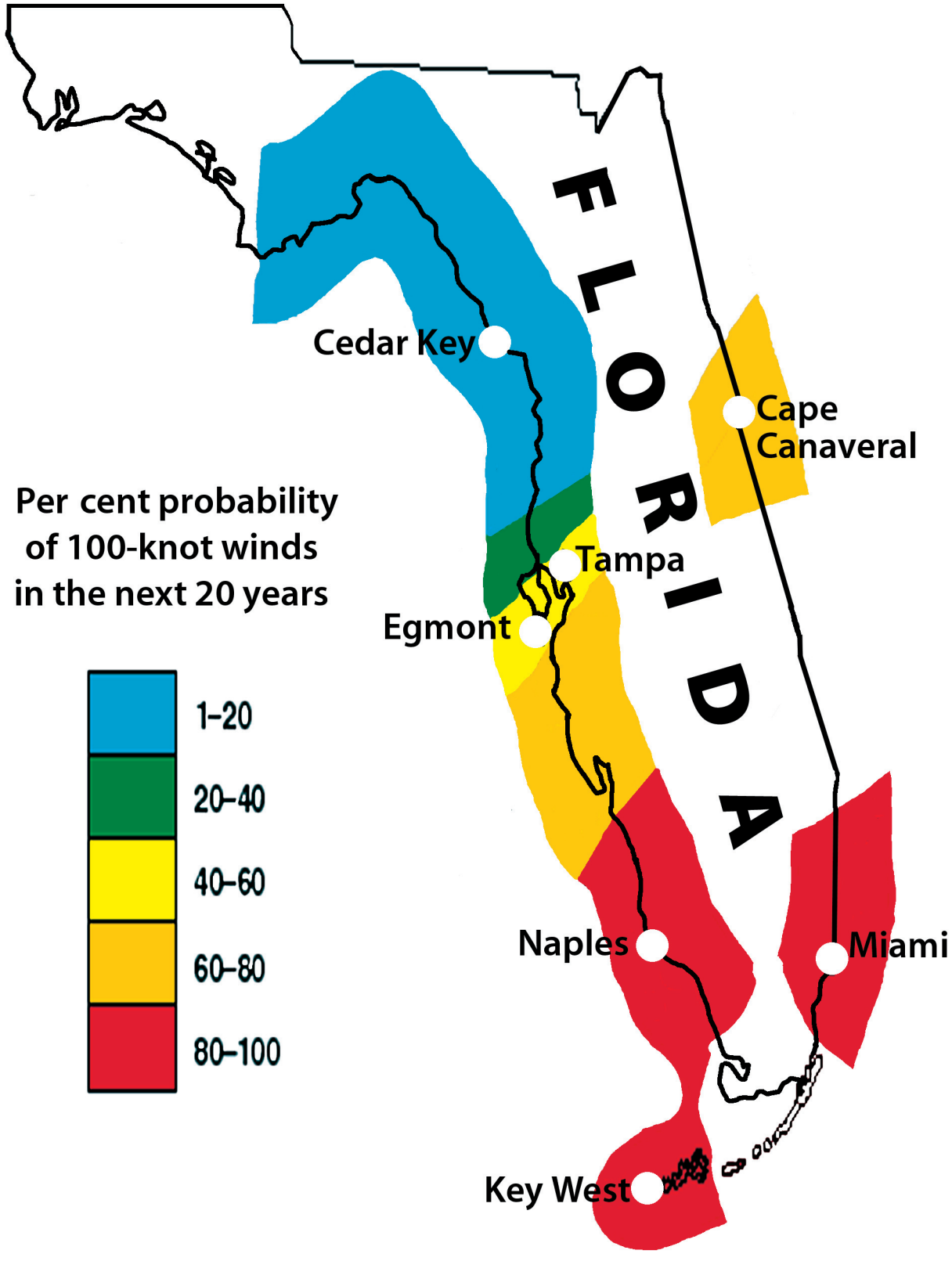
Numeracy Lesson 5: Probability

Key Stage 2

Hurricane probability in Florida, USA



Wind probability in Florida, USA



Weather

Numeracy Lesson 6: Thermometers

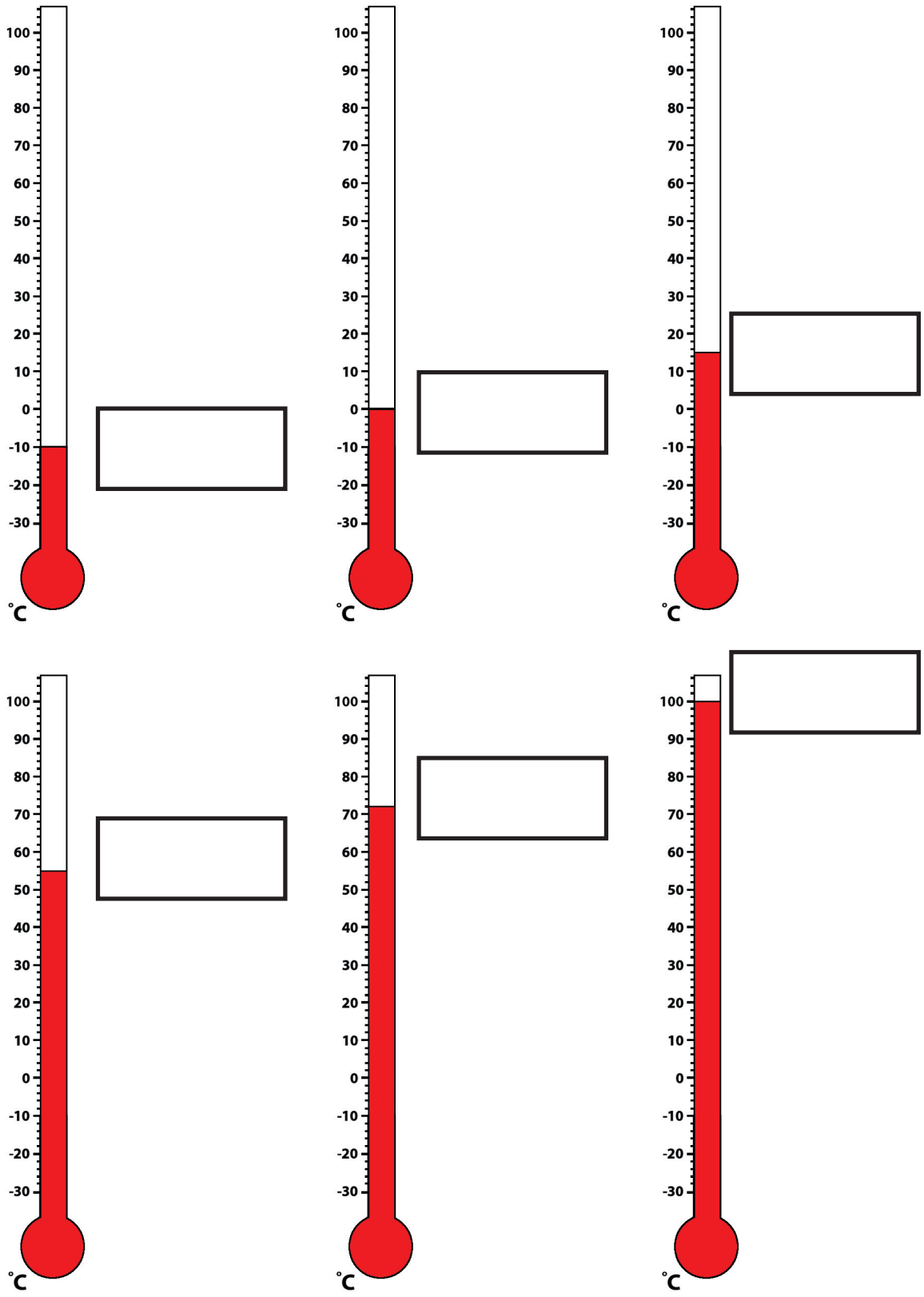
Key Stages 1 & 2

From Galileo to Kelvin – a brief history of thermometers

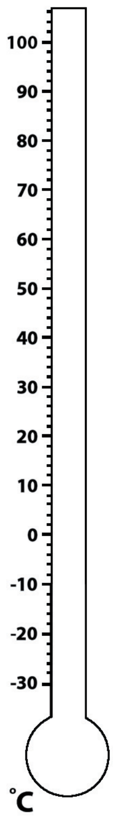
1596	Galileo is often claimed to be the inventor of the thermometer. However, the instrument he invented could not strictly be called a thermometer: to be a *thermometer* an instrument must *measure* temperature differences; Galileo's instrument did not do this, but merely *indicated* temperature differences. His instrument should rightly be called a *thermoscope* .
1612	The Italian Santorio Santorio is generally credited with having applied a scale to an air thermoscope and is thought to be the inventor of the thermometer as a temperature measuring device.
1654	The first sealed liquid-in-glass thermometer was produced in 1654 by the Grand Duke of Tuscany, Ferdinand II. His thermometer had an alcohol filling.
1714	Gabriel Fahrenheit was the first person to make a thermometer using mercury. Fahrenheit used fixed points to devise the first standard temperature scale for his thermometer. He divided the freezing and boiling points of water into 180 degrees. 32 was chosen as the figure for the lower fixed point as this produced a scale that would not fall below zero even when measuring the lowest possible temperatures that he could produce in his laboratory – a mixture of ice, salt and water. The Fahrenheit scale is still in use today.
1742	In 1742 a Swedish scientist named Anders Celsius devised a thermometer scale dividing the freezing and boiling points of water into 100 degrees. Celsius chose 0 degrees for the boiling point of water, and 100 degrees for the freezing point. A year later, the Frenchman Jean Pierre Cristin inverted the Celsius scale to produce the Centigrade scale used today (freezing point 0°, boiling point 100°). By international agreement in 1948, Cristin's adapted scale became known as Celsius and is still in use today.
1848	In 1848 Lord Kelvin of Scotland proposed the Absolute temperature scale, with zero degrees being the theoretical lowest temperature possible where molecular motion ceases. Kelvin defined 1 Kelvin degree as being equal to one Celsius degree. The Degree Kelvin is the current Standard Unit of temperature measurement.

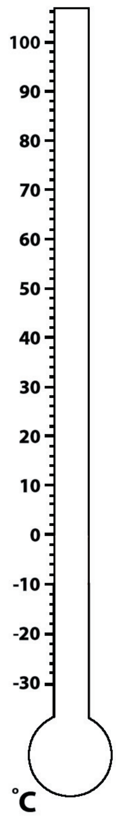
Reading thermometers

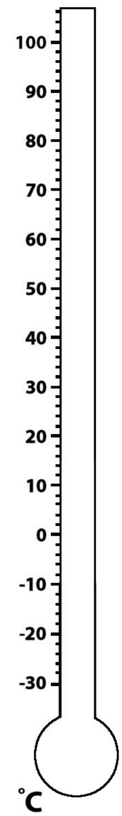
Name: Date:

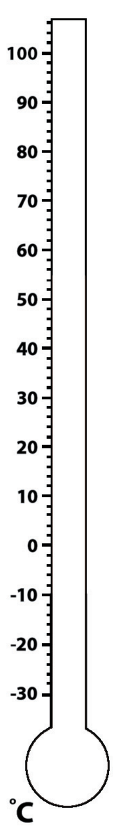


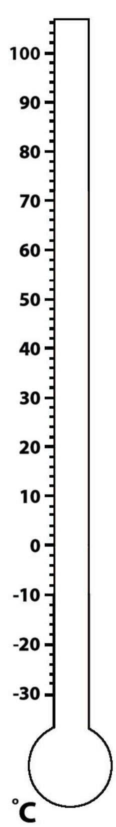
Reading thermometers: Template

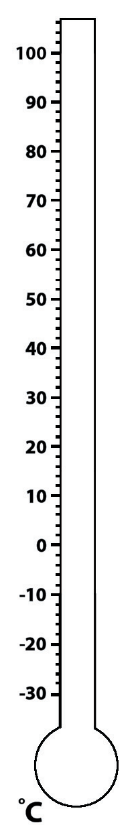












How to make a simple bulb thermometer

You will need:

- A glass jar or bottle with a water-tight lid. The lid should be the screw-on kind and made from metal or plastic. The jar needs to be glass so that its shape does not change when you squeeze it.
- A drill or a hammer and a large nail
- Some putty
- A drinking straw – 8 or 10 inches (about 23 cm) long, the thinner the better, preferably clear

To make your thermometer:

1. Drill or punch a hole in the lid of your jar. The hole should be as close to the diameter of the straw as you can get.
2. Insert the end of the straw into the hole, and then seal around the hole with your putty both on the inside and the outside of the lid.
3. Fill your jar with cold water. You can do this either by filling it with water and leaving it in the fridge overnight, or by making some ice water in a pitcher and then pouring the ice water into your jar (only put the water in the jar and not the ice). Add food colouring if you want to and shake.
4. Put the jar on the table to keep it steady – you want the jar filled to the brim with cold water, as full as you can get it without overflowing.
5. Put the lid on the jar.
6. Place the jar in your kitchen sink, plug the sink and run hot water into the sink until the sink is about half full.
7. Watch the level of the liquid in the straw and a very unusual thing will happen: You will **SEE** the water in the jar expanding. As the water in the jar gets warmer, it will expand and rise up the straw.