

OUT AND ABOUT

OUTDOOR ACTIVITIES FOR KEY STAGE 2 MATHEMATICS

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SHAPE AND SPACE

Human Sundial

Based on an idea from [Royal Museums Greenwich](https://www.royalmuseums.org.uk/greenwich)

Learning focus

- Use a compass to identify cardinal directions
- Identify local landmarks associated with the cardinal directions
- Measure lengths of shadows and identify directions
- Chart changes in direction and length of shadow throughout the day

Key vocabulary

- Cardinal directions
- Intercardinal directions
- Horizontal
- Vertical
- Perpendicular
- Right angle

Resources

- Chalk
- Metre rulers
- Compasses
- Clock
- Graph paper
- 30 cm rulers
- Lego



Activity

On a sunny day, bring the children to the school grounds. Use questioning to elicit children's ideas about the cardinal directions.

Where did the sun rise this morning? Do you know what direction this is?

What landmarks are north/south/east/west of our school?

How do you know?

If necessary, remind children how to read a compass. In pairs, the children can use compasses to identify the cardinal directions. After their paired work, gather the class together and draw a compass rose on the school grounds using chalk.

Teaching point

The Earth has a magnetic north pole. The needle of a compass always points toward the north.

On a compass rose, the North-South line is perpendicular to the East-West line, with a 90 degree angle between each cardinal direction. The intercardinal directions—northeast, southeast, southwest, and northwest— are located halfway between two cardinal directions.

Ask the children whether they have noticed their shadows and whether they think their shadows are longer/shorter than they are. Ask them to predict how they think the shadows might change over the course of the day.

*Is your shadow longer or shorter than you are?
What direction is your shadow pointing?
Are all shadows going the same way? Why/Why not?
What might happen your shadow as the day goes on?*

Have children work in pairs. Each pair should find any empty part of the school grounds. Using chalk, Partner A marks the point where they are standing with an X. Partner B should trace around the shadow of A and write the time beside this. Together, the partners should decide what direction the shadow is pointing and measure the length of the shadow.

Repeat this process at hourly intervals throughout the school day. Keep a table of results.

Time	Length of Shadow	Direction of Shadow
9:30		
10:30		
11:30		
12:30		
1:30		
2:30		

Ask the children to make a poster to report and explain their findings.

What pattern do you notice from your measurements?

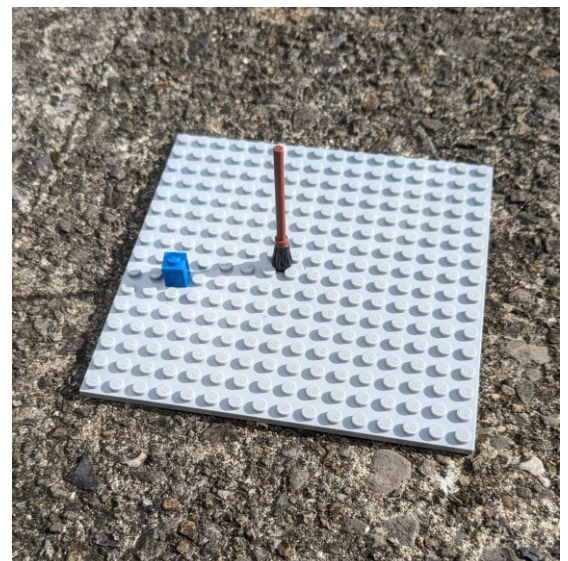
Make a prediction for what direction/length your shadow might be at 5:30. Justify why you think this.

The limited time in the school day will not allow the children to track the full extent of the change in shadows from morning to evening. They can be encouraged to check morning and evening shadows at home.

The children can be encouraged to plot a line graph of length of shadow over time and asked to explain the pattern that they observe.

Taking ideas further

The children can be supported to make their own sundial. A sundial is an instrument which helps you tell the time using shadows from the sun. On a sunny day, children should count the studs on a lego-base plate to find the centre. They can then start building the gnomon, the part at the centre of the sundial which casts a shadow. Find a spot that will stay sunny for most of the day where the sundial can rest undisturbed, e.g., windowsill. Use stones or other materials to weigh this down if necessary. It is important that this does not move throughout the day. On the next hour, mark where the shadow of the gnomon falls, by writing the hour on a lego block and placing it on the appropriate part of the lego-base block. Repeat this at each new hour throughout the day.



Discuss what angle the shadow moves through each hour. Make predictions for where the shadow will be at different times. Protect from the weather if necessary and leave in place and use the sundial to read the time the next day.

Discuss whether this sundial will remain accurate over time. [Note it will not be due to the movements of the planets over time].

Assessment opportunities

Are the children able to:

- Identify cardinal directions reasonably accurately
- Use a compass to identify cardinal directions/bearings
- Measure and record lengths with an appropriate degree of accuracy
- Explain and justify their predictions and their findings