



Distances in the Solar System

Journey through the Solar System

time

70 minutes

learning outcomes

To:

- know that the distances between the planets are enormous
- have some idea about the distance from the Earth to the Sun
- know that the further a planet is from the Sun, the longer it takes to complete a revolution around the Sun
- know that one year on a planet is the time it takes for that planet to complete one revolution around the Sun
- calculate using proportions

end product

- a living scale model of the Solar System

materials needed

- 24 calculators
- computers with internet
- 5-metre measuring tape

Preparation

For the activities **Nearby or far away?** and **Distances between the planets**, draw two tables with two columns on the board. Over the first column in the first table, write 'Nearby' and over the second column 'Far away'. Over the first column in the second table write 'Planets' and over the second column 'Distance to the Sun'. In the column 'Planets', list the names of all the planets in the following order: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. For the activity **The Solar System is moving!** you need a space with a maximum diameter of 46 metres (2 x 22.49 metres), for example the school playground.



Nearby or far away? 10 min.

Discuss the concept of distance. Ask the children which things they think are nearby and which are far away. Examples to think about are the school, the local supermarket, France, Australia, the Moon, and the Sun. Write the children's answers in the column 'Nearby' or 'Far away'. They may initially think the super-market is far away, but when compared with Australia, it suddenly seems much closer.



The children investigate the distance of the planets from the Sun.



Distances between the planets 15 min.

Organise the children into groups of three. Make each group responsible for one planet. This is the planet they will be investigating today. The children use internet to find out the distance between their planet and the Sun in kilometres. Now they should complete Task 1 on the worksheet.

When they have finished, discuss the answers and write them in the column 'Distance to the Sun' on the board. (The correct answers are shown in column 2 of the table below).

| planet | distance from | | bike days | bike years | by plane hours | by plane days | by plane years |
|---------|-------------------------|---------------|--------------|---------------|----------------------|---------------------|----------------------|
| | the sun 1,000,000 km | bike hours | | | | | |
| Mercury | 58 | 386,6667 | 161,111 | 441 | 64444 | 2685 | 7 |
| Venus | 108 | 720,0000 | 300,000 | 822 | 120,000 | 5000 | 14 |
| Earth | 150 | 10,000,000 | 416,667 | 1142 | 166,667 | 6944 | 19 |
| Mars | 228 | 15,200,000 | 633,333 | 1735 | 253,333 | 10,556 | 29 |
| Jupiter | 778 | 51,866,667 | 2,161,111 | 5921 | 864,444 | 36,019 | 99 |
| Saturn | 1,427 | 95,133,333 | 3,963,889 | 10,860 | 1,585,556 | 66,065 | 181 |
| Uranus | 2,871 | 191,400,000 | 7,975,000 | 21,849 | 3,190,000 | 132,917 | 364 |
| Neptune | 4,498 | 299,866,667 | 12,494,444 | 34,231 | 4,997,778 | 208,241 | 571 |

On holiday to the Sun 10 min.

Explain that the Sun is 150,000,000 kilometres away from the Earth.

The worksheet shows a completed example of a journey to the Sun by bike. Use this example to discuss a similar journey for at least two planets. Then copy column 5 onto the board. Make sure the children realise that in real life it is not possible to cycle or fly in an aeroplane from a planet to the Sun.

The children calculate how long it would take them to fly from their planet to the Sun. An aeroplane flies at an average speed of 900 kilometres an hour. The children complete Task 2 on the worksheet to help them in their calculation. You can find the correct answers in columns 6, 7 and 8 of the above table. Encourage the children to use a calculator for this task.

The Solar System is moving! 35 min.

The class is going to create a scale model of the Solar System. The following figures will be used for the radii.

| planet | workable distance to the Sun in metres |
|---------|--|
| Mercury | 0.29 |
| Venus | 0.54 |
| Earth | 0.75 |
| Mars | 1.14 |
| Jupiter | 3.89 |
| Saturn | 7.14 |
| Uranus | 14.36 |
| Neptune | 22.49 |

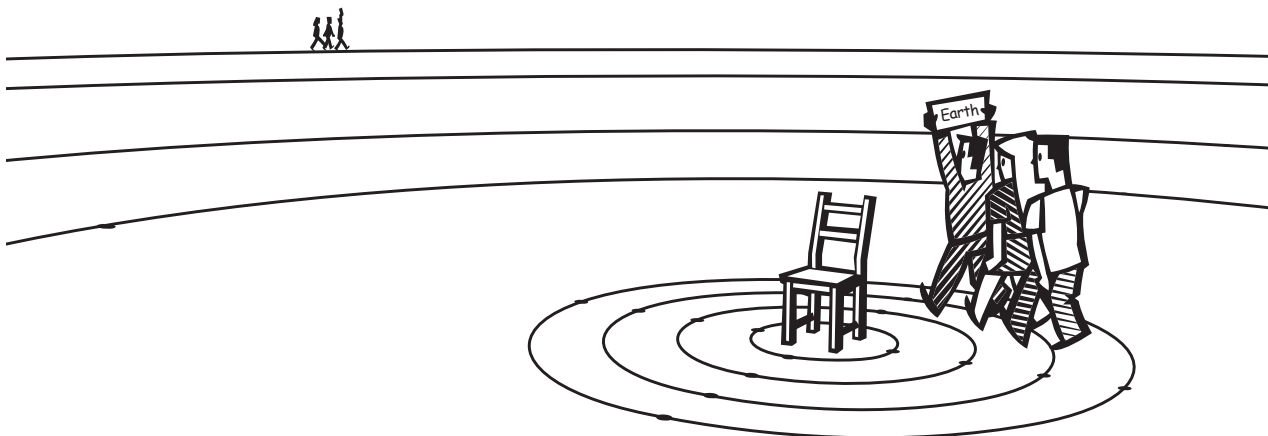
Good to know.

The distances of the planets from the Sun have been scaled down to create workable figures. This has been done by dividing each distance by 200,000,000,000 kilometres. Because all the distances are divided by the same number, the proportion of the distance to the Sun remains the same. If there are any children in the class who are able to calculate at this level, encourage them to calculate this themselves.

Copy the table onto the board and explain that the distances have been scaled down to make them workable. If necessary, explain the concept of workable figures. The children enter the workable figure for their planet in Task 3 of the worksheet.

Take the children outside. Use chalk to mark a spot in the middle of the playground. Explain that the spot represents the Sun. Put a chair on the spot to mark a clear central point around which the planets can revolve.

The children draw the orbit of their planet on the playground, using the results of their calculations from the previous task.



This figure is the radius of their circle. So this is the distance they need to measure from the central spot. Help each group to draw a circle at the correct distance from the Sun using the measuring tape. The children should mark the distance at least at every quarter of the circle. The greater the circle, the more distance marks they will need to draw. When they have drawn enough distance marks, the children can join them up to create a chalk circle. Each group of children lines up on their planet's orbit as shown in the drawing on the previous page. Each group represents a planet. All the groups begin at the same place on their line and walk heel to toe on their circle around the Sun.



Now the children can see clearly that the innermost planets complete a revolution of the Sun much more quickly than the outermost planets. Explain to the children that in reality not all the planets move at the same speed around the Sun. But the time it takes to complete a revolution is longer the further the planet is from the Sun.



Using Tasks 2 and 3 from the worksheet, discuss the research question: How far away are the planets from the Sun?



Distances in the Solar System



In this experiment you will be answering the research question:

How far away are the planets from the Sun?

1 Planet distances



Every planet is a different distance from the Sun. Use the internet to look up the distance of your planet from the Sun. Write the figure in the table below.

Then write the distances that the other groups found out.

| Planet | Distance from Sun (km) |
|---------|------------------------|
| Mercury | _____ |
| Venus | _____ |
| Earth | _____ |
| Mars | _____ |
| Jupiter | _____ |
| Saturn | _____ |
| Uranus | _____ |
| Neptune | _____ |

write your answer
HERE

2 On holiday to the Sun

The distances from the planets to the Sun are enormous. How long would it take

you to get to another planet by plane? Calculate this for

your planet. The next page shows an example of how to calculate this. Here the

distance between the Earth and the Sun has been calculated travelling by bike!

Read through this example carefully before you begin this task.

Example

You get on your bike to cycle to your planet.

Your speed is 15 kilometres an hour. Write this as follows:

Every hour I cycle 15 kilometres

My planet is Earth

The distance of this planet from the Sun is 150,000,000 kilometres

How many hours would it take me to cycle to the Sun?

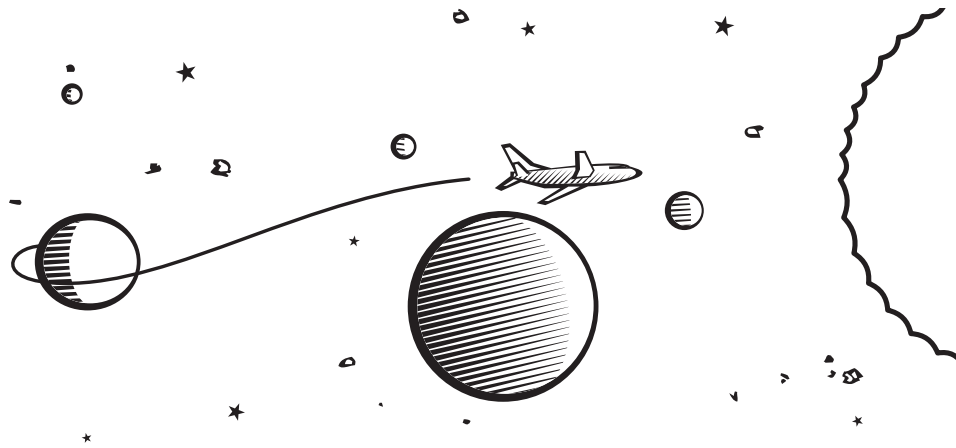
I cycle 150,000,000 kilometres
divided by 15 km/h
= 10,000,000 hours to the Sun

How many days would it take me to cycle to the Sun?

There are 24 hours in a day. It would take me 10,000,000 hours
divided by 24 hours
= 416,667 days to cycle to the Sun

How many years would it take me to cycle to the Sun?

There are 365 days in a year.
So it would take me 416,667 days
divided by 365 days
= 1142 years to cycle to the Sun



Now make your own calculation. Imagine that your group is going to travel from your planet to the Sun by aeroplane. The plane flies at 900 kilometres an hour (km/h) Fill in the information below.

Every hour my plane flies _____ kilometres

My planet is _____

The distance between my planet and the Sun is _____ kilometres

How many hours would it take me to fly to the Sun?

I would fly _____ kilometres

divided by _____ km/h

= _____ hours to the Sun

How many days would it take me to fly to the Sun?

There are 24 hours in a day. I would fly for _____ hours

divided by _____ hours

= _____ days to the Sun

How many years would it take me to fly to the Sun?

There are 365 days in a year. I would fly for _____ days
divided by 365 _____ days
= _____ years to the Sun!

3 *The Solar System is moving!*

In question 1 you could see how enormous the distances really are. If you want to make a model of the Solar System, you need to scale these distances down to create smaller distances. Write your answer here.

The radius of my planet's orbit is _____ metres