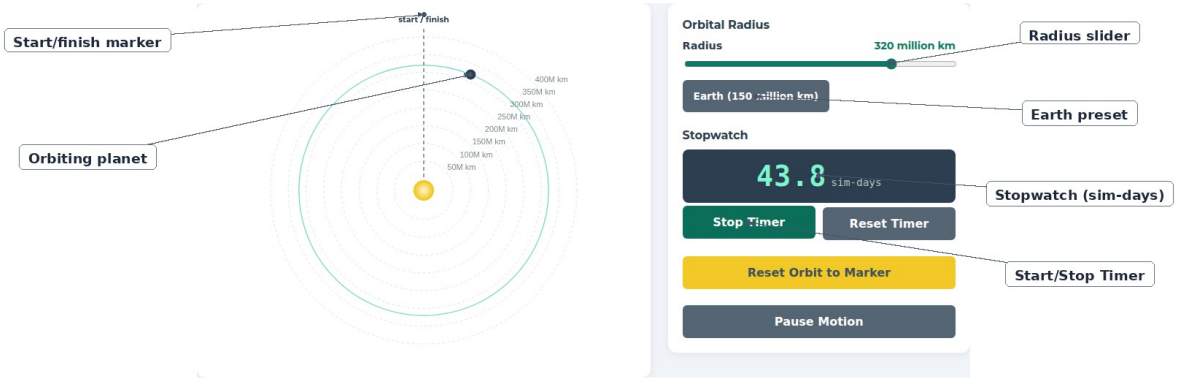
Investigating Orbital Speed

Orbital Radius, Period and Speed

Aim:

You are investigating how the radius of a satellite's orbit affects its orbital speed.



Method:

1. Set the orbital radius using the Radius slider, or click the Earth preset button for 150 million km.
2. Click Start Timer the instant the planet crosses the dashed start/finish marker line at the top of its orbit.
3. Click Stop Timer the next time it crosses that same line, after one complete orbit. This is your period, T.
4. Click Record Reading to log the radius r and period T in the data table.
5. Calculate the orbital speed using **$v = 2\pi r \div T$** (convert million km to km, and sim-days to seconds) and type it into the table to check your answer.
6. Move the slider to a new radius and repeat steps 2–5.
7. Repeat for at least four different radii, chosen across the full range of the slider (50–400 million km).

Prediction:

Compare your first two readings. Do you predict that a satellite in a larger orbit moves faster, slower, or at the same speed as one in a smaller orbit?

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Now complete your table across the full range of radii to test your prediction.

Results:

#	Radius, r (million km)	Period, T (sim-days)	Your speed, v (km/s)	Check

Analysis:

As the orbital radius increases, what happens to the orbital speed?

Plot the radius r (million km) on the horizontal axis and the orbital speed v (km/s) on the vertical axis. Is the relationship a straight line through the origin, or does it curve?

Does doubling the radius double the orbital speed? Use two of your readings to check.

Use your graph to estimate the orbital speed at a radius you did not directly measure. Explain how you read this value from your graph.