Activity Pack 4: Satellite Navigation

This activity pack goes along with video four and looks at satellite navigation.

Activities include creating art with the power of satellites, trying out triangulation, and a look at how trilateration works.

Topics covered:
Satellites, triangulation, angles, trilateration, speed = distance/time

Satellite Art

In this activity you will be creating a drawing using GPS!

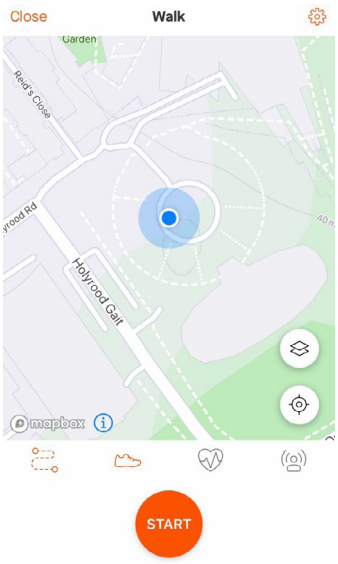
This activity requires downloading an App. Please check your school's guidelines on this as you may need to do this activity at home.

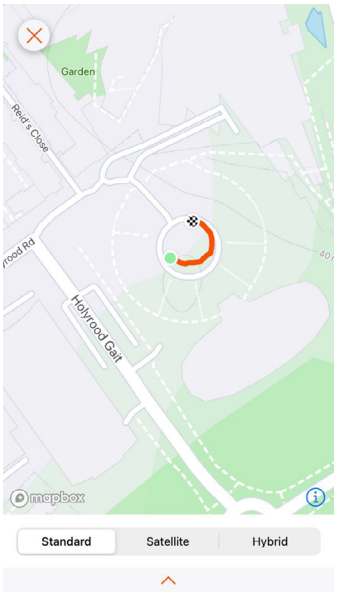
Equipment needed:

- Tablet or smartphone
- Strava or other tracking app
- Paper and pen
- Lots of space (playground or school field are ideal)

Instructions

1. Start by drawing your plan on some paper. Have a think about how far you will have to walk and which directions you need to go.
2. You can't stop and start the Strava tracking software (it will join up to your last location when you restart it) so plan for your drawing to be **one continuous line**.
3. Start up your tracking app and make sure the location is accurate.
4. Press 'start' and get walking to get drawing!





For example: If you start walking in a semi-circle you will have made a C shape!

Triangulation

Equipment needed:

- Compass
- Ruler
- Pencil
- Local area OS map (or you can print out a map from Google Earth Web)

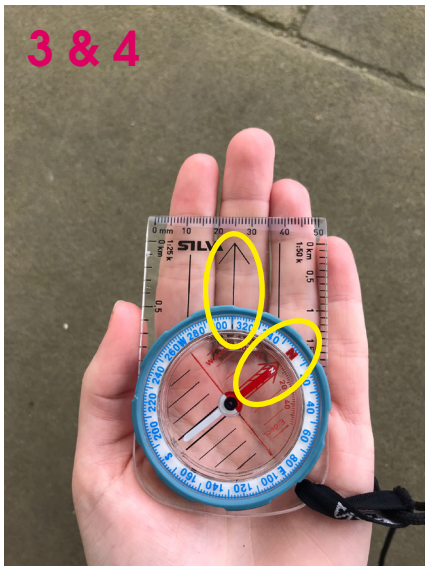
Instructions:

1. Orientate your map correctly by lining up the N arrow on the map with the magnetic needle on the compass.

2. Find a landmark or a geographical feature (e.g. pond or hill) and point your compass towards it.

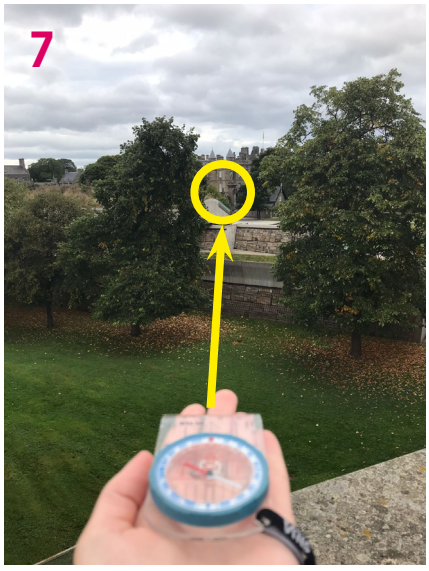
3. Turn the **degree dial** (blue dial in image below) so the magnetic needle lines up with North.

4. Take the bearing of the first landmark (where the degree dial meets the **index line**).



5. Find your landmark on the map.

6. Place the right hand corner of the compass on the landmark, making sure the magnetic needle is still lined up with the orienting arrow. Then draw a line along that side of the compass.



7. Repeat steps 2 – 6 with a different landmark or geographical feature

8. Where the two bearing lines intercept is where you are!

Trilateration

For this activity you will be simulating how satellites use trilateration to pinpoint your location. Using the map and some key maths, you can find out where you are in the world.

Equipment needed:

- Trilateration map (A4)
- String or protractor (to draw an even circle)
- Pencil
- Calculations worksheet

Note: It's important that the trialteration map is printed on A4 for the measurements to work

Instructions:

1. Start by locating a satellite on the map.
2. Using the calculation worksheet, figure out how far away from you the satellite is and convert this into cm using the map scale.
3. Draw a circle around the satellite using the distance in cm as the radius. As the world is round, and our map is flat, the whole circle will not fit on the paper so you will end up with a series of arcs.
4. Repeat Steps 2 & 3 for each satellite
5. Where all three lines intercept each other is where you are!

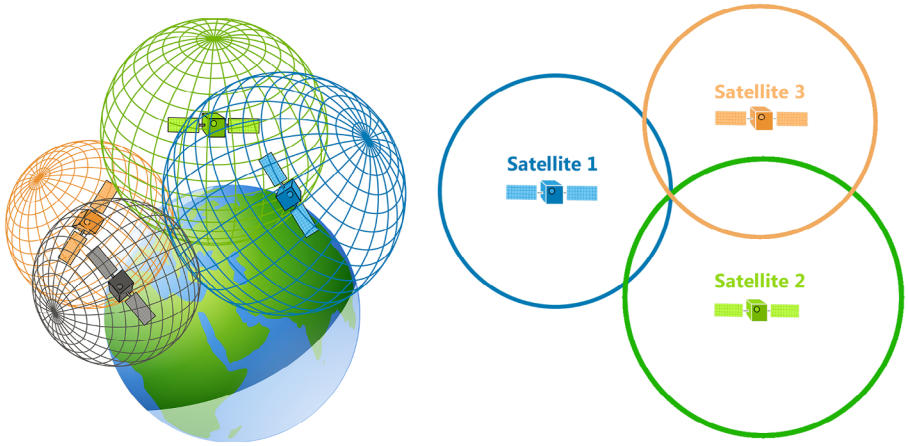


Image credit: GIS Geography

Additional Resources:

Strava Art
How to make Strava Art
GPS Trilateration exercise
GIS Geography - Trilateration
STEM.org.uk - Trilateration
OS maps - what are Trig pillars for?
OS GetOutside - triangulation

Trilateration Calculations

We know the speed of radio waves, around 300,000 km/s and we can measure the time taken for a signal to reach you from a specific satellite.

Therefore using speed = distance/ time we can figure out how far away the satellite is (distance). Do this with three satellites and you can pinpoint where you are in the world.

Don't forget to rearrange speed = distance/time to solve for distance!

Satellite No.	Time (s)	Speed (km/s)	Distance (km)	Distance (cm)
1	0.0705	300,000		
2	0.0635	300,000		
3	0.0672	300,000		

We are using a map in this activity so the distance of the satellite will need to be scaled down. 1cm on the map is equivalent to 1,400km.

Therefore if you divide the distance in km by 1,400 you can work out the distance in cm. Remember to round your answer to 1 decimal place.

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Trilateration Map