

Latitude and Longitude ChatGPT Worksheet

Read coordinates, reason about direction, and convert small changes to meters. This document includes the required reading, diagrams, and nine practice questions broken into short lettered parts. Allow about 25–30 minutes.

Start the interactive activity

Upload this DOCX to ChatGPT and paste the message below. The activity takes place in the chat; uploading does not automatically fill or revise this document. You can also complete the questions independently in a local copy.

Startup message

Use the attached Latitude and Longitude ChatGPT Worksheet as our shared reference. Help me work through Questions 1–9.

Send me exactly one question per message, then stop and wait for my reply. Each item is split into lettered parts. Ask about one lettered part at a time, in order, and say which item and part we are on. Do not restate the whole item, do not list options as separate questions, and do not preview what comes next. If a message you are about to send contains more than one question mark, send only the first question.

Ask for my own attempt before giving any hint or solution. Keep my initial answers separate from my revisions. Start by asking whether I have read the four reading sections, then begin with Question 1, part (a).

Instructions for the tutor

Use the specified coordinate order and the supplied near-Merced factors: 111,000 m/degree latitude and 88,500 m/degree longitude. Refer to the diagrams and coordinate table. If an image cannot be read, say so and ask for a screenshot rather than guessing. Ask for distances reported to two significant figures, and treat extra digits as a reporting error rather than a calculation error.

Ask exactly one question per message, then stop and wait for a reply. The unit is one lettered part, not one numbered item: work through the parts in order, one per turn, and name the item and part before asking. Never bundle questions, never number a list of questions, and never preview a later item. Before sending, count the question marks in the message; if there is more than one, keep only the first. Diagnose the student's reasoning, signs, units, and coordinate order. Offer a small hint first; after an attempt, explain as needed and invite a revised answer in the student's words. Avoid displaying future answers.

Distinguish west longitude from westward motion, angular precision from location accuracy, and route distance from endpoint displacement. Match the support to the student's background. Treat the route as invented practice data. A quadrant name such as northwest does not imply a 45° ground direction, because the two axes use different conversion factors.

After Question 9, ask one new coordinate-direction check without hints. After the student answers it, ask one new meter-conversion check, also without hints. Then provide a copyable record of initial answers, revisions, independent-check responses, and remaining questions. Do not claim to have edited the uploaded DOCX.

Save evidence of your thinking

Copy or export the final response record and bring your remaining question to class. The separate illustrated PDF includes an optional three-page mathematical appendix; it is not required for this worksheet.

Latitude and longitude

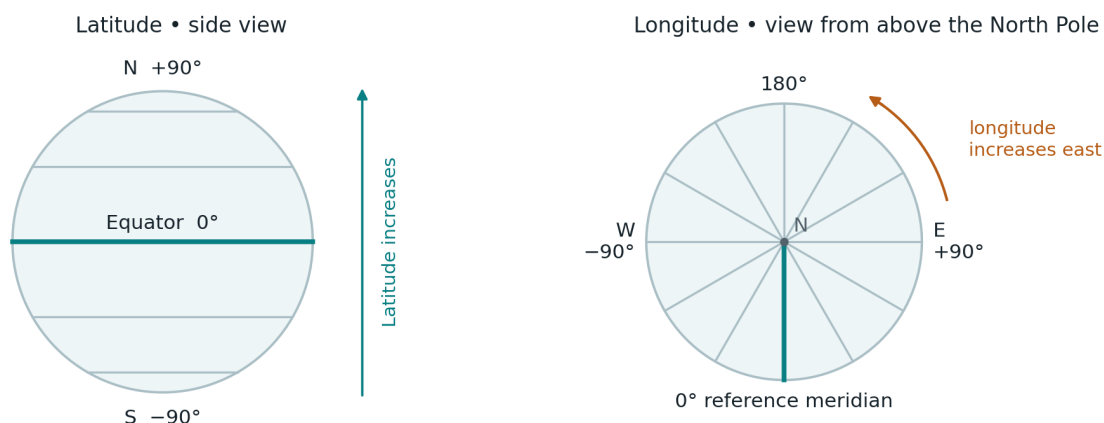
Two angles describe a place

Your phone reports its location as coordinates. This reading helps you interpret those numbers, infer the direction of a walk, and estimate short distances in meters. Read the four reading sections and complete the nine worksheet questions. Allow about 25–30 minutes for both; the math appendix is optional.

Start with the reference lines

Latitude is angular position north or south of the equator. The equator is 0° ; signed decimal latitude is positive north and negative south. The poles are $+90^\circ$ and -90° .

Longitude is angular position east or west of the zero-longitude reference meridian near Greenwich. In the signed convention used here, east is positive and west is negative, from -180° to $+180^\circ$. All meridians meet at the poles, so longitude is undefined there.



The diagrams use a spherical Earth. Lines of constant latitude run east–west; you cross them when moving north–south. Longitude meridians run from pole to pole; you cross them when moving east–west. Seen from above the North Pole, longitude increases toward the east.

Read the order and the units

We write coordinate pairs as (latitude, longitude), in decimal degrees. For example, $(37.36000^\circ, -120.43000^\circ)$ is north of the equator and west of Greenwich. Some software reverses the order, so always check the column labels.

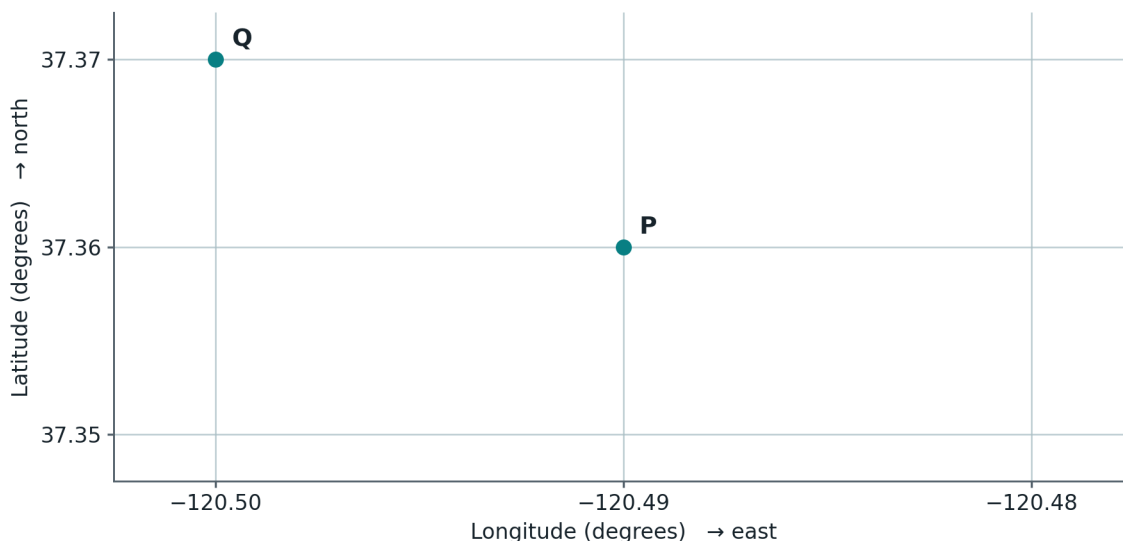
A phone reports these coordinates in the WGS 84 reference frame, the same one GPS uses.

Pause and explain: Why can a line of latitude run east–west even though latitude tells you about north–south position?

Read coordinates on a grid

Increasing numbers reveal direction

On this north-up grid, latitude is the vertical coordinate and longitude is the horizontal coordinate. Read the axis labels before interpreting a point. This grid is for coordinate practice; equal steps in degrees need not represent equal distances in meters.



Use final minus initial

A coordinate change is the final value minus the initial value. An increase in latitude means northward motion; a decrease means southward motion. Locally, an increase in longitude means eastward motion; a decrease means westward motion.

Negative longitude can increase while it remains negative. Moving from -120.50° to -120.49° gives $\Delta\text{longitude} = -120.49^\circ - (-120.50^\circ) = +0.01^\circ$. That is an eastward change. “West of Greenwich” describes location; “moving east” describes a change in location.

Combine the two changes

If latitude and longitude both increase, the displacement has northward and eastward components. If only latitude changes, the idealized motion is north–south. If neither coordinate changes, the idealized position is constant.

For this lesson, compare nearby points around campus. A route crossing the $\pm 180^\circ$ longitude boundary needs special handling; ordinary subtraction can give a misleading large change.

Try it: Read P and Q as (latitude, longitude). If you move from P to Q, what happens to each coordinate?

Convert coordinate changes to meters

Use a local scale for each coordinate

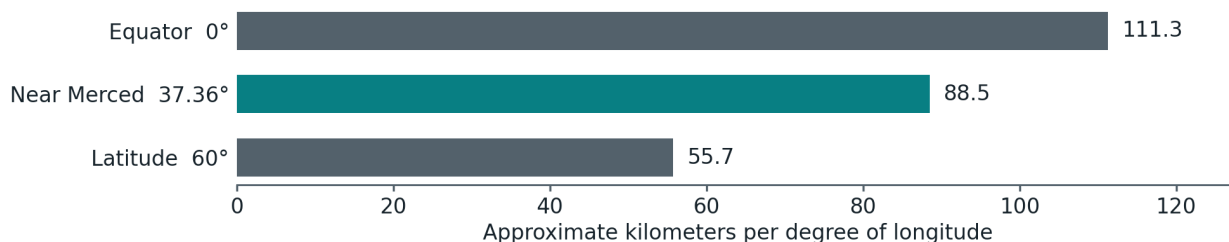
Degrees measure angles. To estimate a walking distance, multiply a coordinate change by a local conversion factor. Near Merced, at latitude about 37.36° , use these classroom approximations consistently:

Northward change (m) $\approx \Delta\text{latitude (degrees)} \times 111,000 \text{ m/degree}$

Eastward change (m) $\approx \Delta\text{longitude (degrees)} \times 88,500 \text{ m/degree}$

Why are the factors different

Longitude meridians meet at the poles. A fixed angular longitude change therefore spans a smaller surface distance at higher latitudes. One degree of latitude remains roughly 111 km; one degree of longitude depends strongly on latitude.



Spherical-model values before rounding. The highlighted bar is the latitude of this lesson. At the equator a degree of longitude spans about the same distance as a degree of latitude, which is where the 111,000 m/degree latitude factor comes from.

A worked example

A student moves from $(37.36000^\circ, -120.43000^\circ)$ to $(37.36020^\circ, -120.42970^\circ)$. Subtract before converting:

$\Delta\text{latitude} = +0.00020^\circ \rightarrow +22.2 \text{ m north.}$

$\Delta\text{longitude} = +0.00030^\circ \rightarrow +26.55 \text{ m east.}$

The approximate straight-line separation is $\sqrt{22.2^2 + 26.55^2} \approx 34.6 \text{ m}$. This is the separation of the endpoints. It is the route length only if the route between them is approximately straight.

Keep the signs to express direction: a negative northward change means south, and a negative eastward change means west.

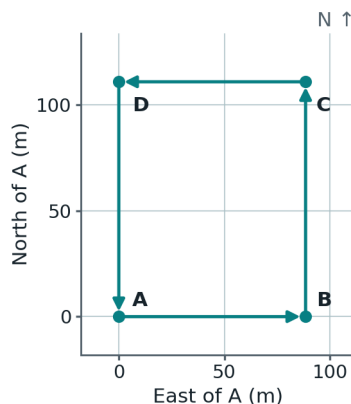
Then report at the precision the data support. These coordinate changes carry two digits, so the answer is about 22 m north, 27 m east, and a 35 m separation. Carrying extra digits through the arithmetic protects against round-off; it does not create measurement accuracy.

Optional: Pages 5–7 of the separate Illustrated Reading PDF derive these factors, check how accurate they are, and show what each decimal place is worth in meters.

Use coordinates for a campus walk

Connect the numbers to a route

This invented practice route is near Merced in coordinate value. It is a schematic, not a verified campus walkway. Both axes of the sketch use the same scale. Travel $A \rightarrow B \rightarrow C \rightarrow D \rightarrow A$.



Waypoint	Latitude (°)	Longitude (°)
A	37.36000	-120.43000
B	37.36000	-120.42900
C	37.36100	-120.42900
D	37.36100	-120.43000

Notice which coordinate remains constant on each leg. Compute each leg separately, then add the leg lengths to estimate the total distance traveled. This route ends where it began. The change from the start to the final point describes displacement; it does not record every part of the journey.

Keep the measurement in view

A phone reports estimated coordinates. Small coordinate changes while it lies still reflect measurement variation rather than real walking, and stable digits do not by themselves prove that the reported location is accurate. Coordinate precision and location accuracy are different: extra decimal places make smaller numerical changes representable, but they do not mean the receiver located you that closely.

Most sensor apps also report a horizontal accuracy in meters beside each position. That column, not the number of decimal places, is the receiver's own uncertainty estimate, and for a phone it is usually a few meters. Record it, and use a stationary trial and known route features as checks during the lab.

Complete the worksheet before asking for full solutions. Preserve your first answers and add revisions so you can explain what changed in your reasoning.

Coordinate references: NOAA, What is latitude? and What is longitude? Those pages describe latitude and longitude as distances north–south and east–west; this reading treats them as angles first and converts to meters separately.

<https://oceanservice.noaa.gov/facts/latitude.html>

<https://oceanservice.noaa.gov/facts/longitude.html>

Practice questions 1 to 3

Attempt each part before seeking feedback. In chat, answer only the lettered part you were just asked; the tutor will keep a record of revisions.

Use the coordinate grid in the reading. Coordinates are written as (latitude, longitude).

1 Reference lines

(a) Name the zero reference line for latitude and give its value in degrees.

Initial answer:

(b) Name the zero reference line for longitude.

Initial answer:

(c) Name the two hemispheres that contain $(37.36^\circ, -120.43^\circ)$.

Initial answer:

Revision and reason for any part you changed:

2 Read and locate

Use the coordinate grid from the reading.

(a) Read point P from the grid and write it as (latitude, longitude).

Initial answer:

(b) Read point Q from the grid the same way.

Initial answer:

(c) Describe where $R = (37.35^\circ, -120.48^\circ)$ belongs on the grid.

Initial answer:

Revision and reason for any part you changed:

3 Interpret a change

Consider travel from P to Q.

(a) State whether latitude increases or decreases.

Initial answer:

(b) State whether longitude increases or decreases.

Initial answer:

(c) Name the direction of travel from P to Q.

Initial answer:

(d) Explain whether that ground direction is exactly halfway between north and west.

Initial answer:

Revision and reason for any part you changed:

Practice questions 4 to 6

Attempt each part before seeking feedback. In chat, answer only the lettered part you were just asked; the tutor will keep a record of revisions.

Near Merced use 111,000 m per degree of latitude and 88,500 m per degree of longitude. Report distances to two significant figures.

4 Reason with negative longitude

Latitude stays constant while longitude changes from -120.43000° to -120.42980° .

(a) Write final minus initial for the longitude change and give the result with its sign.

Initial answer:

(b) State whether the motion is eastward or westward.

Initial answer:

(c) Explain why a negative longitude does not by itself mean westward motion.

Initial answer:

Revision and reason for any part you changed:

5 Calculate a northward change

Latitude changes from 37.36000° to 37.36030° while longitude stays constant.

(a) Write the subtraction and give Δ latitude in degrees.

Initial answer:

(b) State which conversion factor applies and why that one.

Initial answer:

(c) Convert to meters and report the change in north position with its sign and units, to two significant figures.

Initial answer:

Revision and reason for any part you changed:

6 Compare the scale factors

Return to the longitude change in Question 4.

(a) Estimate the change in east position in meters, to two significant figures.

Initial answer:

(b) Explain why the longitude conversion factor differs from the latitude factor.

Initial answer:

(c) State whether that same longitude change spans more or fewer meters at latitude 60° than near Merced.

Initial answer:

Revision and reason for any part you changed:

Practice questions 7 to 9

Attempt each part before seeking feedback. In chat, answer only the lettered part you were just asked; the tutor will keep a record of revisions.

Waypoint	Latitude (°)	Longitude (°)
A	37.36000	-120.43000
B	37.36000	-120.42900
C	37.36100	-120.42900
D	37.36100	-120.43000

7 Read a route

Use the waypoint table for the route $A \rightarrow B \rightarrow C \rightarrow D \rightarrow A$.

(a) State the direction of leg $A \rightarrow B$ and the coordinate that stays constant.

Initial answer:

(b) Do the same for leg $B \rightarrow C$.

Initial answer:

(c) Do the same for leg $C \rightarrow D$.

Initial answer:

(d) Do the same for leg $D \rightarrow A$.

Initial answer:

Revision and reason for any part you changed:

8 Distance and displacement

Use the same route, $A \rightarrow B \rightarrow C \rightarrow D \rightarrow A$.

(a) Estimate the length of each of the four legs in meters.

Initial answer:

(b) Give the total distance traveled.

Initial answer:

(c) Give the final displacement.

Initial answer:

(d) Explain why the total distance and the final displacement differ.

Initial answer:

Revision and reason for any part you changed:

9 Evaluate a measurement

A phone's last few coordinate digits change while it lies still.

(a) State whether that proves the phone moved.

Initial answer:

(b) State whether a reading with more decimal places guarantees better accuracy.

Initial answer:

(c) Give the horizontal accuracy value your app reports and say what it tells you that the decimal places do not.

Initial answer:

(d) Describe one check you could make on a reported position.

Initial answer:

(e) Name one idea you want to clarify before class.

Initial answer:

Revision and reason for any part you changed: