

How Your Phone Actually Knows Where You Are

Bloom's Level: Analyze

Standard:

NGSS MS-PS4-2 — Analyze Waves and Their Applications

ISTE.1.3.b — Use Digital Tools for Learning

TEKS §126.7(c)(2)(B) — Understanding Technology's Impact

STUDENT EDITION

HOW GPS WORKS

1 GPS SATELLITES

A network of at least 24 satellites orbits Earth at about 20,200 km altitude.

2 RADIO SIGNALS

Satellites transmit precise time and position data using radio waves.

3 RECEIVER

The smartphone receives signals from multiple satellites.

4 TRILATERATION

By comparing the arrival time of signals, the phone calculates its exact position (latitude, longitude, and altitude).

ORBITAL DETAILS
Altitude: ~20,200 km
Period: ~119.8 min
Orbits in orbital planes (55° inclination)
Satellites per plane: 4
Total satellites: 24+

GPS SATELLITES

Each satellite continuously broadcasts on L-Band frequencies (1.57542 GHz (L1), 1.22760 GHz (L2), etc.)

ALTITUDE
~20,200 km

3 RECEIVER



4 TRILATERATION



About 31 GPS satellites orbit Earth at roughly 12,000 miles (19,300 km) above the surface, constantly sending radio signals to your phone to calculate your location.

How Your Phone Actually Knows Where You Are

A Tiny Blue Dot With a Big Story

You open a map app, and within seconds, a blue dot appears — right where you're standing. Your phone confidently tells you the nearest burrito place is 0.3 miles (0.5 kilometers) away. But pause for a moment: how does a device in your pocket actually know where it is on a planet with a surface

area of nearly 200 million square miles (510 million square kilometers)? The answer involves satellites, invisible waves, Einstein's theory of relativity, and a surprisingly complex web of hidden infrastructure working together in milliseconds.



About 31 GPS satellites orbit Earth at roughly 12,000 miles (19,300 km) above the surface, constantly sending radio signals to your phone to calculate your location.

Signals From Space: How GPS Works

GPS stands for **Global Positioning System**, and it relies on a constellation of about 31 satellites orbiting Earth at roughly 12,000 miles (19,300 kilometers) above the surface. These satellites are not just floating up there — they are constantly broadcasting radio wave signals that travel at the speed of light toward Earth.

Your phone receives these signals and measures something critical: **how long each signal took to arrive**. Since radio waves travel at a known speed (approximately 186,000 miles per second, or 300,000 kilometers per second), your phone can calculate how far away each satellite is. This is similar to how you can estimate how far away a thunderstorm is by counting the seconds between a lightning flash and the thunder — except GPS does it with invisible waves and extreme precision.

Why Four Satellites?

Here is where analysis becomes essential. One satellite gives you a sphere of possible locations — you could be anywhere on the surface of that sphere. A second satellite narrows it to a circle where two spheres intersect. A third satellite narrows

it to just two points. The fourth satellite eliminates the impossible point (usually one floating in space) and also corrects for tiny errors in your phone's internal clock. Notice the pattern: each additional satellite eliminates a layer of uncertainty. This process is called **trilateration**, and it is the mathematical backbone of every location ping your phone sends.

Einstein Steps In

Here is a detail that surprises most people: GPS would not work without Einstein's theories of relativity. Examine how two opposing forces create this problem. Satellites move fast — about 8,700 miles per hour (14,000 kilometers per hour) — which causes their clocks to tick slightly slower than clocks on Earth (special relativity). But they are also farther from Earth's gravity, which causes their clocks to tick slightly faster (general relativity). These two effects partially cancel each other, but not completely. Engineers must account for a net difference of about **38 microseconds per day**. That sounds tiny, but at the speed of light, 38 microseconds of error would translate to a location error of about **7 miles (11 kilometers)**. Without relativistic corrections, GPS would be useless — a powerful example of how abstract physics directly shapes everyday technology.

When Satellites Aren't Enough: Cell Towers and Wi-Fi

GPS signals struggle indoors, in dense urban areas, or when your view of the sky is blocked. This is where your phone switches strategies. It cross-references signals from nearby **cell towers** and **Wi-Fi networks** to estimate your location — a method called **assisted GPS (A-GPS)**. Cell towers are less precise than satellites, but they respond faster and work in more environments. Wi-Fi networks, especially those with known locations stored in databases, can pinpoint you within a few meters (yards) indoors.

Compare these three methods side by side:

Method	Accuracy	Works Indoors?	Speed
GPS Satellites	~3-5 meters (~10-16 feet)	Rarely	Slower
Cell Towers	~100-300 meters (~330-980 feet)	Yes	Fast
Wi-Fi Networks	~15-40 meters (~50-130 feet)	Yes	Fast

Differentiating among these methods reveals a clear trade-off: greater accuracy generally requires clearer satellite access, while speed and indoor reliability favor tower and Wi-Fi signals. Your phone constantly examines which combination gives the most reliable result, then blends them together intelligently.

The Privacy Question You Should Be Asking

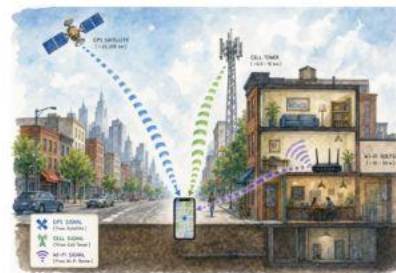
Every time your phone calculates your location, it potentially shares that data — with apps, advertisers, and sometimes governments. Examine this carefully: your phone is, in a very real sense, a tracking device you carry voluntarily. Differentiating between useful location sharing (navigation, emergency services) and invasive location sharing (apps tracking you 24/7 without clear reason) is an important digital literacy skill. Understanding the technology helps you make informed choices about your privacy settings.

Conclusion: Invisible Waves, Visible Dot

That blue dot on your map is the result of radio waves racing from space, mathematical trilateration, relativistic physics, and a network of towers and routers filling in the gaps. Breaking down this system — comparing its parts, examining its trade-offs, and tracing the relationships between physics and everyday experience — reveals how deeply waves, data, and infrastructure are woven into modern life. Understanding the technology in your pocket is the first step to using it wisely.

Lesson Objective

In this lesson, you will investigate how GPS and related technologies use radio wave signals to determine location. You will break down the system into its key parts — satellites, cell towers, and Wi-Fi networks — and examine how wave properties like speed and travel time make trilateration possible. By the end, you will be able to compare the trade-offs between different location methods and explain how physics concepts like wave behavior connect to real-world technology.



Your phone blends signals from satellites, cell towers, and Wi-Fi networks — each with different accuracy ranges — to find the most reliable location estimate.

Standard: NGSS MS-PS4-2 — Analyze Waves and Their Applications; ISTE 1.3.b — Use Digital Tools for Learning; TEKS §126.7(c)(2)(B) — Understanding Technology's Impact

Bloom's Level: Analyze

Bloom's Goal: Students will analyze how wave properties and multiple data sources work together within GPS technology to produce accurate location information.

Explanation: Analyzing requires students to break a system into its components, examine how those parts relate to each other, and identify patterns or trade-offs. In this lesson, students do exactly that by comparing GPS satellites, cell towers, and Wi-Fi signals, and by tracing how wave speed and timing create the mathematical foundation for trilateration.

Application Questions

Read each question carefully, use evidence from the article to support your thinking, and write a complete response.

1. The article explains that GPS requires signals from at least four satellites to determine your location. Analyze why each additional satellite is necessary — what specific problem does each one solve, and what would happen if your phone could only receive signals from two satellites?

Think about: Think about what a single satellite tells you versus what two or three satellites tell you. What kind of uncertainty remains after each step, and how does the fourth satellite play a different role than the first three?

2. Compare the three location methods described in the article — GPS satellites, cell towers, and Wi-Fi networks. Analyze the trade-offs between accuracy and reliability, and explain which combination of methods would be most useful for someone trying to navigate inside a large shopping mall versus someone hiking in an open field.

Think about: Look at the comparison table in the article. What does each method do well, and where does it fall short? How might the environment (indoors vs. outdoors) change which method works best?

3. The article states that without Einstein's theories of relativity, GPS would produce location errors of about 7 miles (11 kilometers). Analyze how this example supports or challenges the idea that abstract scientific theories have real-world importance. What does this tell you about the relationship between physics and the technology you use every day?

Think about: Consider what 'abstract' means — something that seems purely theoretical or disconnected from everyday life. How does the GPS example change or confirm that idea? What might happen to other technologies if scientists had ignored relativity?

PREVIEW
CLASSFABRIC.COM

PREVIEW
CLASSFABRIC.COM

PREVIEW
CLASSFABRIC.COM

PREVIEW
CLASSFABRIC.COM

Data Table & Analysis

Study the data table below, which compares the three location-detection methods used by smartphones. Then answer the three analysis questions using evidence from the table and what you have learned in this lesson.

Experiment: This data set compares three methods smartphones use to determine location: GPS satellites, cell towers, and Wi-Fi networks. The values for accuracy, indoor functionality, and response speed are drawn directly from the lesson article on how phones determine geographic position.

Location Method (N/A)	Accuracy (meters) (meters)	Accuracy (feet) (feet)	Works Indoors? (N/A)	Response Speed (N/A)
GPS Satellites	3-5	10-16	Rarely	Slower
Cell Towers	100-300	330-980	Yes	Fast
Wi-Fi Networks	15-40	50-130	Yes	Fast

- Analyze the trade-off between accuracy and indoor reliability shown in the table. Which method is most accurate outdoors, and why does that same method struggle indoors? Use data from the table to support your answer.

2. Compare cell towers and Wi-Fi networks as location methods. In what situations would Wi-Fi be a better choice than cell towers, and what evidence from the table supports your reasoning?

3. A GPS satellite clock error of 38 microseconds causes a location error of about 7 miles (11 kilometers). Based on the accuracy values in the table, explain why correcting for this relativistic clock error is essential for GPS to be useful, and what would happen to everyday navigation if this correction were not made.

Hypothesis Builder

Read the context below carefully. Then complete each component to build a scientific hypothesis about GPS signal accuracy. Use evidence from what you know about waves, satellites, and location technology to guide your responses.

A student wants to investigate how the number of GPS satellites a phone can detect affects the accuracy of its location reading. She takes her phone to an open field and records the location error (how far off the phone's reported position is from her actual position) while the phone connects to different numbers of satellites. She repeats the test in the same spot multiple times to check her results.

Independent Variable

What is the one factor the student is deliberately changing in this investigation? Identify the variable she is controlling across each trial.

Dependent Variable

What is the student measuring or observing as a result of changing the independent variable? What outcome is she recording in her data?

If

Write the 'If' part of your hypothesis by stating what change is being made to the independent variable. Begin your response with the word 'If...'

Then

Write the 'Then' part of your hypothesis by predicting what will happen to the dependent variable as a result. Begin your response with the word 'Then...'

Because

Write the 'Because' part of your hypothesis by explaining the scientific reasoning behind your prediction. Use what you know about trilateration and how satellites eliminate uncertainty to support your answer. Begin your response with the word 'Because...'

Claim-Evidence-Reasoning (CER)

Read the phenomenon below carefully. Then complete each component of the Claim-Evidence-Reasoning (CER) framework by responding to the guiding prompt. Your responses should demonstrate that you can analyze how wave properties and technology work together in GPS systems.

Phenomenon: A student is hiking in a dense forest and notices that her phone's GPS blue dot is jumping around and showing her location as being 50 meters away from where she is actually standing. When she steps into a clearing with an open view of the sky, the blue dot immediately stabilizes and accurately shows her true position. She wonders why the accuracy changed so dramatically just by moving a short distance.

Claim

Based on the phenomenon, make a claim: Why did the GPS accuracy improve when the student moved from the dense forest into the open clearing? State your claim in one or two complete sentences.

Evidence

Provide at least two specific pieces of evidence from the article that support your claim. Include details about how GPS signals work, how many satellites are needed, and/or how different location methods compare in accuracy.

Reasoning

Explain the scientific reasoning that connects your evidence to your claim. How do the properties of radio waves and the process of trilateration explain why the number of satellites a phone can detect affects location accuracy? Use what you know about waves and GPS technology to justify your answer.

Primary Source Analysis (DBQ)

Read the primary source excerpt below carefully. Then answer the four analysis questions that follow. Use evidence from the source and your knowledge of waves and technology to support your responses.

Memorandum on the Development of a Satellite Navigation System for Civilian Use [Government Memorandum]

The system we propose will rely upon a network of orbiting satellites, each broadcasting precise radio wave signals toward Earth. Receivers on the ground — whether carried by soldiers, pilots, or eventually ordinary citizens — will measure the time elapsed between transmission and reception of these signals. Because radio waves travel at a known and constant speed, this elapsed time can be converted directly into distance. By receiving signals from multiple satellites simultaneously, a receiver can calculate its position on the surface of the Earth with remarkable accuracy. We anticipate that civilian applications will eventually include navigation for automobiles, ships, and personal devices. However, we must caution that the system's clocks will require ongoing correction to account for the effects of both velocity and gravitational variation on timekeeping, as predicted by Einstein's theories. Without such corrections, accumulated timing errors would render the system unreliable within hours of operation.

— Adapted from internal U.S. Department of Defense planning documents regarding the Global Positioning System (GPS), circa 1973

1. Who created this document, and what was their purpose in writing it? How might the author's role in the U.S. Department of Defense influence what information they chose to include or emphasize? [Sourcing]

2. This document was written around 1973, during the early development of GPS. What do you know about the historical and scientific context of this period that helps explain why the government was investing in satellite navigation technology at this time?

[Context]

3. According to the document, why is it necessary to receive signals from multiple satellites rather than just one? What does the author say about the role of radio wave speed in calculating distance, and how does this connect to the concept of trilateration described in the article? [Close Reading]

4. The document warns that Einstein's theories must be applied to correct timing errors in the satellite clocks. How does this claim compare to what the article explains about relativistic corrections in GPS? Do the two sources agree, and what does this tell you about the reliability of each source? [Corroboration]

Case Study

Read the scenario below carefully. Then answer all three questions using what you have learned about GPS, waves, and location technology. Write your answers in complete sentences and use evidence from the scenario and the lesson to support your thinking.

Scenario: Marisol is hiking in a national park with her family. At the trailhead, her map app shows her exact location with a blue dot, accurate to within about 4 meters (13 feet). As the trail winds deeper into a narrow canyon with tall rock walls on both sides, her blue dot starts jumping around erratically, sometimes placing her hundreds of meters from her actual position. Her phone shows only two GPS satellite signals instead of the usual four or more. There are no Wi-Fi networks nearby, and cell tower coverage is extremely weak in the canyon. Marisol remembers from science class that GPS uses radio waves broadcast from satellites orbiting about 12,000 miles above Earth. She also recalls that her phone blends satellite, cell tower, and Wi-Fi signals to determine location. Frustrated, she wonders why her phone was so accurate at the trailhead but is now struggling inside the canyon. Her dad suggests turning on airplane mode to save battery, but Marisol thinks that might make things even worse. She decides to analyze the situation before changing any settings.

1. Analyze why Marisol's GPS accuracy dropped so significantly once she entered the canyon. Use what you know about how satellites, radio waves, and trilateration work together to explain the problem.

2. At the trailhead, Marisol's phone was blending GPS, cell tower, and Wi-Fi signals. Compare these three location methods in terms of accuracy and reliability, and explain which method or methods her phone was most likely relying on at the trailhead versus inside the canyon.

3. Marisol's dad suggests turning on airplane mode. Analyze whether this would help or hurt her location accuracy inside the canyon, and explain your reasoning using evidence from the lesson.

Multiple Choice

Read each question carefully and choose the best answer (A, B, C, or D). Use what you have learned about GPS, waves, and location technology to analyze each situation.

1. A GPS satellite sends a radio wave signal toward Earth. Your phone measures how long the signal takes to arrive. What property of radio waves makes this time measurement useful for calculating distance?
 - A. Radio waves travel at a known, constant speed, so travel time can be converted into distance.
 - B. Radio waves change frequency depending on how far they travel, revealing the distance.
 - C. Radio waves grow weaker over distance, and your phone measures the signal strength to find distance.
 - D. Radio waves bounce off the ground before reaching your phone, creating a measurable echo.
2. With signals from only one GPS satellite, your phone can determine that you are somewhere on the surface of a large sphere. What does receiving a signal from a second satellite allow your phone to do?
 - A. Confirm your exact location with no remaining uncertainty.
 - B. Narrow your possible location to a circle where two spheres intersect.
 - C. Correct errors in your phone's internal clock.
 - D. Determine your altitude above sea level.

3. Why is a fourth GPS satellite necessary when three satellites have already narrowed your location to just two points?

- A. The fourth satellite boosts the signal strength of the other three satellites.
- B. The fourth satellite provides a backup in case one of the other satellites fails.
- C. The fourth satellite eliminates the impossible location point and corrects for clock errors in your phone.
- D. The fourth satellite measures your speed so the map app can give accurate directions.

4. GPS satellites orbit Earth at about 12,000 miles above the surface and travel at roughly 8,700 miles per hour. According to the article, how do these two facts create a problem that engineers must solve?

- A. The satellites move so fast that their signals cannot reach phones on the ground without bouncing off the atmosphere.
- B. The satellites' high speed and distance from Earth's gravity cause their clocks to run at slightly different rates than clocks on Earth, creating location errors if uncorrected.
- C. The satellites travel too fast to stay in a stable orbit, so they must constantly fire engines to stay on course.
- D. The satellites are so far away that their radio wave signals take several minutes to reach Earth, making real-time location impossible.

5. The article states that without relativistic corrections, GPS would produce location errors of about 7 miles per day. What does this example best illustrate about the relationship between physics and technology?

- A. Abstract scientific theories can have direct, practical consequences for everyday technology.
- B. GPS technology was invented specifically to test Einstein's theories of relativity.
- C. Modern smartphones are powerful enough to automatically correct for all physics-based errors.
- D. Satellites must be replaced frequently because relativity causes them to wear out faster.

6. Compare GPS satellites, cell towers, and Wi-Fi networks as location methods. Which conclusion is best supported by the data in the article's comparison table?

- A. Wi-Fi networks are always the best choice for location because they work both indoors and outdoors.
- B. Cell towers are the most accurate method and should be used whenever possible.
- C. Greater location accuracy generally requires clearer satellite access, while indoor reliability favors towers and Wi-Fi.
- D. GPS satellites are the fastest method and should always be used when speed is important.

7. A student is inside a large shopping mall and notices that her map app still shows her location accurately, even though she cannot see the sky. Which combination of technologies is most likely responsible for this?

- A. GPS satellites and relativistic clock corrections working together indoors.
- B. Cell towers and nearby Wi-Fi networks providing location data in place of GPS signals.
- C. The phone's internal compass and accelerometer calculating her position from her last known location.
- D. Bluetooth signals from other shoppers' phones triangulating her position.

8. The article describes trilateration as the "mathematical backbone" of GPS. Based on the article, which statement best explains why trilateration requires signals from multiple satellites rather than just one?

- A. Each additional satellite signal eliminates a layer of location uncertainty, progressively narrowing the possible position.
- B. Multiple satellites are needed because each satellite only covers a small region of Earth's surface.
- C. Each satellite measures a different wave property, and combining them gives a complete picture of your location.
- D. Multiple satellites are required so that at least one signal can always reach your phone without interference.

9. The article raises a concern about location data privacy. Which reasoning best explains why understanding how GPS technology works is important for making privacy decisions?

- A. Knowing how GPS works allows you to disable satellites that are tracking your phone.
- B. Understanding the technology helps you recognize when location sharing is useful versus invasive, enabling informed choices about your privacy settings.
- C. Learning about GPS proves that all location tracking is harmful and should be turned off completely.
- D. Understanding GPS technology allows you to block cell tower signals from reaching your phone.

10. A GPS system that ignores relativistic effects would accumulate about 38 microseconds of clock error per day. Analyze why this small time difference causes such a large location error of approximately 7 miles.

- A.** The error grows because satellites must recalculate their positions thousands of times per day, multiplying the small mistake.
- B.** Because radio waves travel at the speed of light, even a tiny time error translates into a very large distance error.
- C.** The error is large because 38 microseconds is actually a very long time compared to how fast phones process data.
- D.** The location error grows because cell towers amplify the clock error when they assist the GPS signal.

True / False

Read each statement carefully. Decide whether the statement is True (T) or False (F) based on what you have learned about GPS, waves, and location technology. Write T or F for each item.

1. GPS satellites broadcast radio wave signals that travel at the speed of light toward Earth.

True False

2. A phone only needs signals from two satellites to pinpoint an exact location on Earth's surface.

True False

3. The process of using overlapping spheres of distance from multiple satellites to determine location is called trilateration.

True False

4. Because GPS satellites move fast and are far from Earth's gravity, their clocks run at exactly the same rate as clocks on Earth.

True False

5. A 38-microsecond daily clock error in GPS satellites could cause location errors of approximately 7 miles (11 kilometers) if left uncorrected.

True False

6. GPS satellite signals are more reliable indoors and in dense urban areas than cell tower signals.

True False

7. Wi-Fi networks can be used to help estimate a phone's location, sometimes with accuracy within a few meters indoors.

True False

8. Cell towers provide greater location accuracy than GPS satellites but are slower to respond.

True False

9. Einstein's theories of relativity must be applied to GPS systems in order for them to function accurately in everyday use.

True False

10. Understanding how GPS and location technology work can help people make more informed decisions about their digital privacy settings.

True False

Vocabulary

Review each vocabulary term and its definition below. These words are key to understanding how GPS and wave-based technologies work. As you read, look for these terms in the lesson article and think about how each concept connects to the others.

GPS (Global Positioning System)

A navigation system that uses a network of satellites orbiting Earth to determine the precise location of a device on the ground.

Explain in your own words:

Radio waves

A type of electromagnetic wave that travels at the speed of light and is used by GPS satellites to send location signals to devices on Earth.

Explain in your own words:

Trilateration

A mathematical process that uses distance measurements from at least three satellites to calculate an exact location on Earth.

Explain in your own words:

Satellite

An object that orbits Earth and, in the case of GPS, continuously broadcasts radio wave signals used to determine location.

Explain in your own words:

Special relativity

Einstein's theory explaining that objects moving at high speeds experience time slightly more slowly than objects that are stationary.

Explain in your own words:

General relativity

Einstein's theory explaining that gravity affects the passage of time, causing clocks farther from Earth's surface to tick slightly faster.

Explain in your own words:

Assisted GPS (A-GPS)

A method that combines GPS satellite signals with data from cell towers and Wi-Fi networks to improve location accuracy, especially indoors.

Explain in your own words:

Cell towers

Ground-based structures that transmit and receive wireless signals, and can be used to estimate a phone's location when GPS signals are weak.

Explain in your own words:

Frequency

The number of wave cycles that pass a given point per second, which determines properties of the wave such as how far it can travel.

Explain in your own words:

Accuracy

How close a measured or calculated value is to the true value, such as how precisely a GPS system can identify your real location.

Explain in your own words:

Exit Ticket

Answer both questions below in 1-2 sentences each. Use what you learned in today's lesson to support your answers.

1. GPS requires signals from at least four satellites to determine your location. Analyze why each additional satellite is necessary — what does each one eliminate or correct?

2. Your phone uses GPS satellites, cell towers, and Wi-Fi networks to find your location. Analyze the trade-offs between these three methods: which is most accurate, and which works best indoors?

PREVIEW CLASSFABRIC.COM



About 31 GPS satellites orbit Earth at roughly 12,000 miles (19,300 km) above the surface, constantly sending radio signals to your phone to calculate your location.

PREVIEW CLASSFABRIC.COM

PREVIEW CLASSFABRIC.COM

PREVIEW
CLASSFABRIC.COM

PREVIEW
CLASSFABRIC.COM



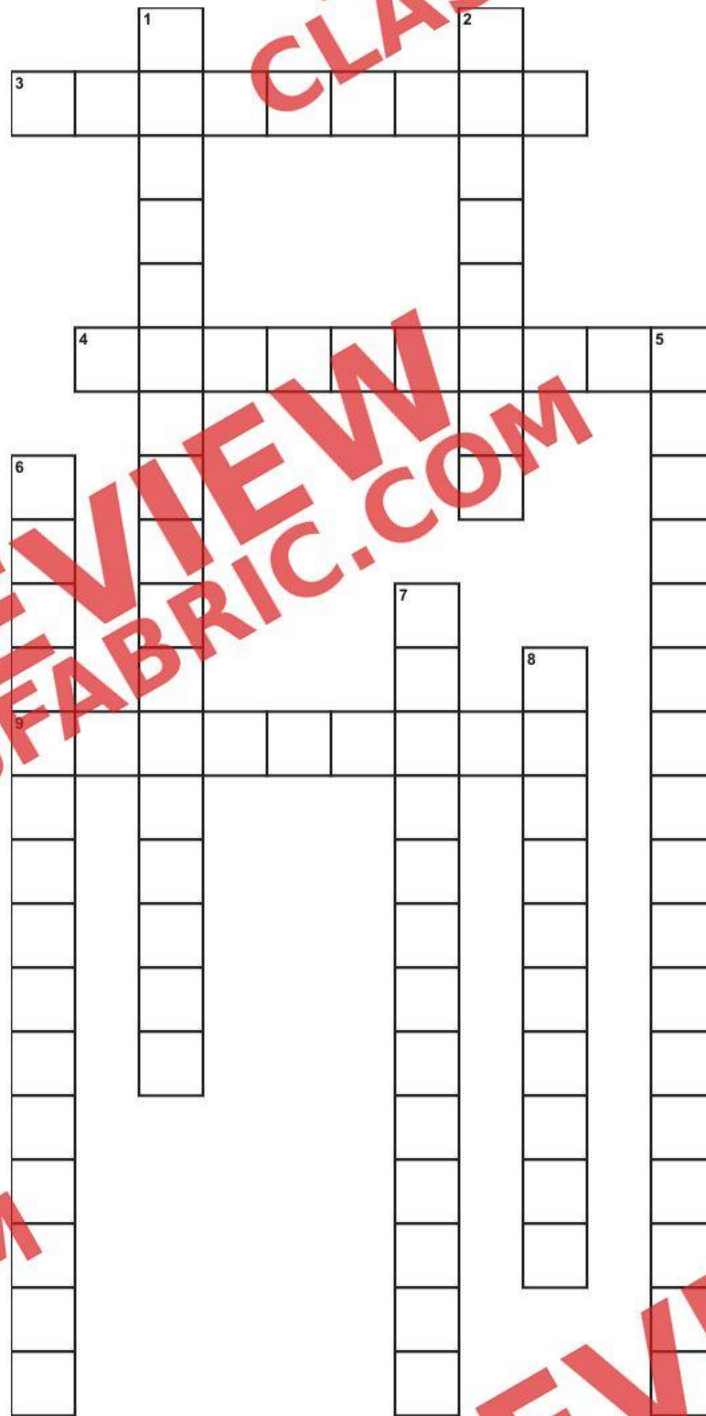
Your phone blends signals from satellites, cell towers, and Wi-Fi networks — each with different accuracy ranges — to find the most reliable location estimate.

PREVIEW
CLASSFABRIC.COM

PREVIEW
CLASSFABRIC.COM

How Your Phone Actually Knows Where You Are

CROSSWORD PUZZLE



How Your Phone Actually Knows Where You Are

CROSSWORD PUZZLE

ACROSS

3. The number of wave cycles that pass a given point per second, which determines properties of the wave such as how far it can travel.
4. A type of electromagnetic wave that travels at the speed of light and is used by GPS satellites to send location signals to devices on Earth.
9. An object that orbits Earth and, in the case of GPS, continuously broadcasts radio wave signals used to determine location.

DOWN

1. Einstein's theory explaining that gravity affects the passage of time, causing clocks farther from Earth's surface to tick slightly faster.
2. How close a measured or calculated value is to the true value, such as how precisely a GPS system can identify your real location.
5. Einstein's theory explaining that objects moving at high speeds experience time slightly more slowly than objects that are stationary.
6. A method that combines GPS satellite signals with data from cell towers and Wi-Fi networks to improve location accuracy, especially indoors.
7. A mathematical process that uses distance measurements from at least three satellites to calculate an exact location on Earth.
8. Ground-based structures that transmit and receive wireless signals, and can be used to estimate a phone's location when GPS signals are weak.

How Your Phone Actually Knows Where You Are

WORD SEARCH

A X U P F Z S B X U B Z D W E A G C C G P W R J R P K W
W A K J R U H V A T J V T R I L A T E R A T I O N V Q H
P T R D A G Y Q D O X Y D F G Z Z E L L M H O K Q O L U
Z Z M S U S B A F B Y J P V H N S J N O U G G M Y A E K
I X N K O C F X L G D N R U G N Z A S S G R I R O V K Z
B Y O W I N Z T C Y E E K H F W A X P K H Y Z A L A C U
F R V S N H L G T E Y N S I J W W U E H V S O G U B E Q
R I X W P X P V U D O P E K Q W N D C K M D O V Q U Z O
E A M A Z D R I V Z F P H R I I A O I S W C I M D L Z W
Q E D S B T C B Y A C C U P A C Y E A E L E M K M Y C X
U O L S H D K E W N Q T A N L L O P L V J S R Z B Q X T
E M Y I J T A G H X S D L L C T R Y R Z S Y K L D O M L
N U O S W E E P A F J Q O W K A G E E N O L S T H Q R L
C T F T M L C E L L T O W E R S E W L P K E L Y O F Z J
Y S B E F D S I U C H N H T T U C E A A J W N I E S Q F
J Z Z D R C A P E O U D M H J W M T T Y T C Q T Q K T Z
K S I G B A L F X H C H D K R J S P I L C I L B Y T V C
Y S Z P G N U O I C Q B Y P O O C G V P T X V K W J W V
T A N S H Z D N A E P F P X Q L B E I J V I J I H K X M
A T V A A R C G F L E F T D C J O K T Y L S N R T B S A
G E B G H P G J P G S Q J T D G B Z Y P E A Q L B Y X K
Q L H P U B K L K Z T O J W P I K N Z H Y W W N W V H L
O L C S A P N M E Q V O S J B A F A T Y T Q E C L A R Z
Q I K R E V V Y S N Z X Q H A I T M V B P R F J W N X F
O T I V T K R D Q Z X T R L X Y Q I R E F L R J G A M H
V E G T H H R A D I O W A V E S P N E A L K D K N S G P
V H A T W K Q E G U G V G T T D V R D Y W P U V M K L G
F W P Z Y W Q U X B E M M U T J V W N F Q R N O M R V U

FIND THESE WORDS

General relativity
Satellite
Trilateration

Special relativity
Accuracy

Frequency
Radio waves

Assisted GPS (A-GPS)
Cell towers