Points on a Grid

Rocket Woman

Meet the secret space hero who helped get astronauts to the moon and back

▲ Katherine Johnson

◀ This rocket launched astronaut John Glenn into space in 1962.

When thinking of space pioneers, a few great astronauts probably come to mind. Alan Shepard was the first American in space in 1961. John Glenn orbited Earth in 1962. Neil Armstrong and Buzz Aldrin walked on the moon in 1969.

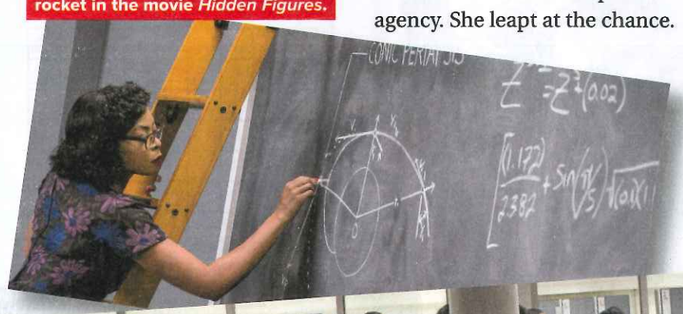
Americans still celebrate these heroes and read about them in history books. But there are women whose work was critical to the success of all three of these missions. You probably haven't heard of them. One is named Katherine Johnson.

To appreciate Johnson's extraordinary achievements, we must understand the world she lived in. Johnson is black. She grew up during a time when segregation, or separating people by skin color, was legal in much of the American South. African-Americans had to use separate bathrooms and attend separate schools.

In the 1940s and 1950s, the U.S. government hired Johnson and dozens of other black women to work as "human computers." Computers as we now know them didn't exist back then. As human computers, the women did the math that made scientific breakthroughs possible.

Now Johnson and her colleagues are getting the recognition they deserve. A movie about Johnson and other black female mathematicians at NASA, the nation's space agency, debuted in December. Called *Hidden Figures*, it's based on a new book of the same name.

▼ Katherine Johnson, played by actress Taraji P. Henson, calculates the curved path of a rocket in the movie *Hidden Figures*.



People as Computers

Before modern computers and calculators were invented, people did math with paper and pencil. Advanced mathematics was critical for many fields of science.

Yet for much of the 1900s, male scientists viewed computing as "women's work." They hired black and white women to do these tasks at labs around the country.

Katherine Johnson was one of those women. The West Virginia native finished high school at age 14. In college, Johnson took every math class her school offered. A professor even created a special math class just for her.

After college, Johnson heard about computing jobs for black women at the nation's space agency. She leapt at the chance.

Space Race Math

When Johnson began at the space agency in June 1953, she and her black co-workers had to sit apart from the white women who did the same tasks. Their lunch table was marked with a sign: "Colored Computers."

Johnson didn't let this hold her back. She asked thoughtful questions about the work she was doing. Her team noticed her curiosity and mathematical ability. Less than two weeks after she started, Johnson joined a group of engineers exploring the possibility of space flight.

By 1958, the space agency was developing spacecraft that could launch humans into space. Each launch required precise geometric coordinates for where the spacecraft should take off, where it should fly, and where it should land. Johnson worked on the calculations for these missions.

In 1962, John Glenn was preparing to launch into space

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▲ Close to 50 black women worked as human computers at the national space agency in Virginia between 1943 and 1980. They made important contributions to early space exploration.

and orbit Earth. An early electronic computer made the mission calculations. But Glenn didn't trust it. He wanted Johnson to do the math herself.

Johnson calculated every minute of the flight path that would circle Earth three times. Her numbers were correct, and Glenn became the first American to orbit the planet.

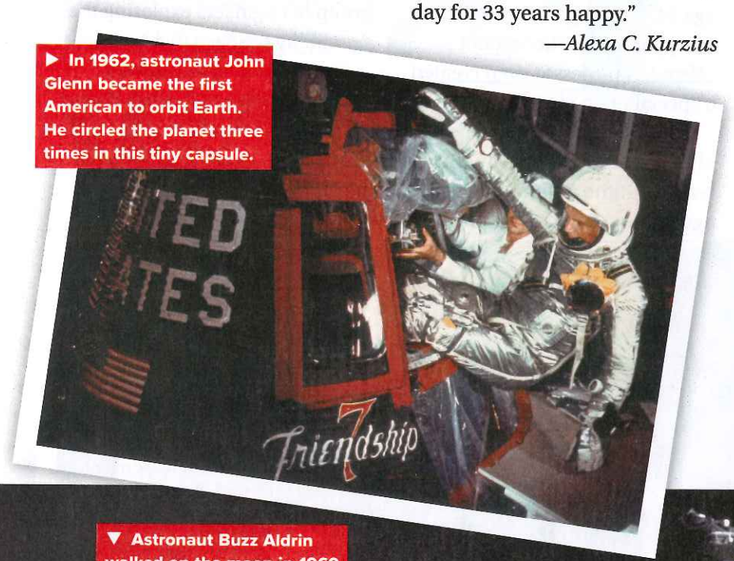
To the Moon and Back

Johnson's work wasn't done. NASA planned a mission to land astronauts Neil Armstrong and Buzz Aldrin on the moon. But getting them home would be another hurdle.

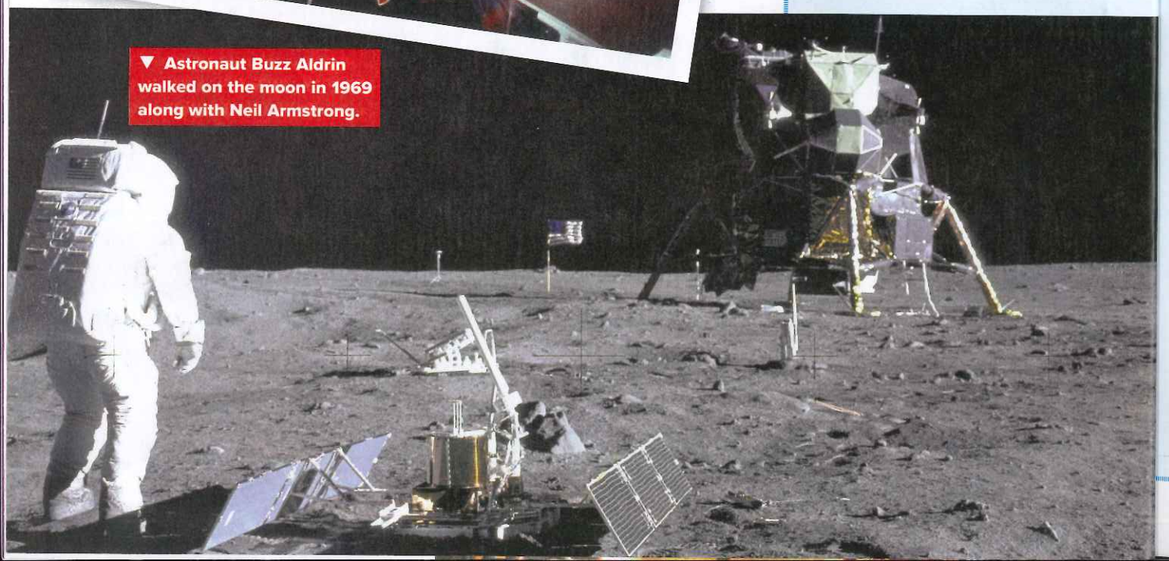
It was Johnson's job to figure out the exact time that the moon lander and the command unit should reconnect following the moon landing. She considered this complicated task her greatest contribution to the space program.

"I found what I was looking for" at NASA, says Johnson, who is now 98. "I went to work every day for 33 years happy."

—Alexa C. Kurzius



▶ In 1962, astronaut John Glenn became the first American to orbit Earth. He circled the planet three times in this tiny capsule.



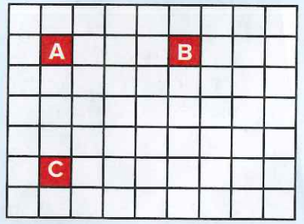
▼ Astronaut Buzz Aldrin walked on the moon in 1969 along with Neil Armstrong.

NASA (ALL IMAGES)

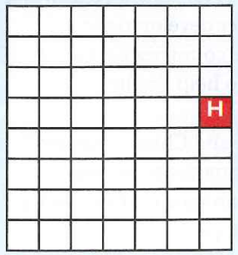
Points on a Grid

Use your knowledge of geometry to answer the following questions. *(See the "Homework Helper" buttons on this page of the digital issue for grade-specific explanations.)*

1 For her calculations, Johnson had to know where Earth and the moon would be at different points in time. The moon constantly orbits, or moves around, Earth. Let's say the grid shows the positions of Earth (square A) and the moon. Square B represents the moon at one point of the mission. Square C represents the moon's position 10 hours later.



2A. While they were on the moon, astronauts Neil Armstrong and Buzz Aldrin traveled away from the lander. In the grid below, the lander is labeled H. Let's say that Armstrong moves 6 unit squares to the left. Label this square G.



B. Let's say that Aldrin moves 3 unit squares below H. Label this square J.

C. Which astronaut moved farther from the lander?

A. How many unit squares are between points A and B?

B. How many unit squares are between A and C?

C. Are your answers from parts A and B the same or different? What might this tell you about the distance between Earth and the moon?

3A. Using your grid from question 2, draw a straight line connecting points H and G. Draw another straight line connecting points H and J.

B. Fill in the blanks: Line segment HG and line segment HJ connect to form ___ lines.

Use the coordinate grid below to answer questions 4 through 6.

4A. Let's say the grid above shows the distance between Earth and the moon on a different scale. Point E represents Earth and point M represents the moon. Draw a point 2 unit squares to the right of point E. This represents the location of the spacecraft one day after leaving Earth. Label it S.

B. Three days into the journey, the moon is 5 unit squares right of point E. Plot the moon's new location and label it N.

C. During that time, the spacecraft, point S, has moved 3 unit squares to the right. Did the spacecraft (S) meet up with the moon (N)? How do you know?

5A. What are the *x*- and *y*- coordinates for point E?

B. What are the coordinates of point M?

6A. The moon continues on its orbit. Let's say that at another point during the mission, the moon appears at (1, 6). Plot this point on the grid and label it O.

B. Draw a curved line that connects points M, N, and O. If this curved line represents the path of the moon, what shape do you think the entire path forms?

C. What information would you need to predict where the moon would be at any given time?

SCHOLASTIC.COM/DYNAMATH
- **Skills Sheet:** Apply It: Points on a Grid
- **Video:** Breaking Barriers: NASA's Science Superstar