Name _____ Date _____

Katherine Johnson & the Human Computers

Unsung Heroes of the Space Race

Learn more about this topic! Each section gives more detail on one of the lyrics from the song. Read each section, and then respond by answering the question or taking notes on key ideas.

1. As a young child, Katherine Johnson was very interested in math. By her own description, she "counted everything." Intelligent and hardworking, she wound up skipping several grades in school. Johnson's father placed a lot of importance on his children's education. In Johnson's hometown of White Sulphur Springs, West Virginia, as in many other places at the time, African Americans like Johnson were not allowed to go to school past eighth grade. Johnson's father moved the family 125 miles away so that she could continue on to attend high school, which she began at age 10.

Notes

2. At 15, Johnson began college at West Virginia State University, where her professors recognized her mathematical abilities. One of these professors, W.W Schiefflin Claytor, was the third African-American man to earn a doctoral degree in mathematics. Claytor told Johnson that she would make a good research mathematician and encouraged her to take many math classes, including a class he created specifically for her about the geometry of space. Johnson graduated college at 18 with degrees in mathematics and French. Despite her dreams of working in the mathematics field, women were limited to careers in teaching and nursing at the time. Johnson became a teacher.

Notes

3. You've likely heard of NASA, the National Aeronautics and Space Administration. NASA is the government agency in charge of science and technology related to air and space. But you may not know that NASA used to be an organization called NACA. NASA originally began as as the National Advisory Committee on Aeronautics (NACA), which was founded 1915. By the start of World War I in 1914, the US was falling behind Europe in airplane technology. In response, NACA was founded to conduct research in aeronautics, the science of flight. Decades later, when space research began, NACA became the organization NASA.

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Human computers at NACA

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In 1935, NACA began hiring white women to measure, calculate and plot the results of flight tests run by the male engineers. These women often had degrees in math or science. Their job title was “computer.” (The modern electronic computers we’re familiar with didn’t yet exist.) An engineer is someone with scientific training who designs and builds complex products, machines, systems or structures.

The human computers’ work was very tedious and precise. It was done mostly by hand, using slide rules, curves, magnifying glasses and basic calculating machines. The computers freed the engineers from having to do this time-consuming work. The engineers used the computers’ completed calculations to design additional tests. A computer job paid more than teaching or nursing. However, men with qualifications similar to the computers were often hired as junior engineers. ″Junior engineer″ was a higher-level job with a higher salary.

Notes

5. In December 1941, the US entered World War II. Millions of men went to serve in the war, creating a big shortage of workers at home. As a result, women had the opportunity to join the workforce in greater numbers. In June 1941, President Franklin Delano Roosevelt had also issued Executive Order 8802. This order banned discrimination based on “race, creed, color or national origin” in the employment of government and defense workers. This meant that someone could not be turned down for this type of job because of the color of their skin, their beliefs or where they came from. NACA began recruiting black women to work as computers, and Johnson joined in 1953.

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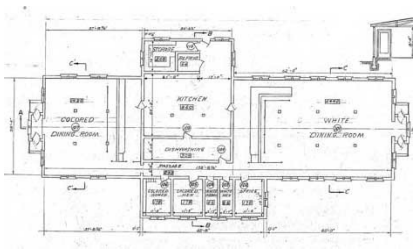
6. 

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Floor plans from NACA show dining areas segregated by race.

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Though NACA opened up jobs to African Americans, the organization imposed the same racial segregation present in much of the US on its employees. In parts of the United States, laws kept black and white people separate and provided black people with inferior resources. Similarly, the black computers at NACA had to work in a separate facility, away from the white computers. They had to use different bathrooms and cafeterias. In 1943, NACA constructed cheap housing for the white computers, but the black computers were forced to find their own housing. Many white computers didn't even know that their African-American counterparts existed.

Notes

7. After a short time working as a computer in a large group of women, Johnson and a colleague were pulled out to work directly with an all-male team of engineers. Johnson's strong geometry skills proved very valuable to the team. The men grew to rely on her and never returned her to the larger group of computers. Johnson defied the expectation that women should simply work quietly. Always inquisitive, she asked questions to learn more about the projects she was working on. And when she noticed that women never went to the engineers' meetings, Johnson asked if there was a law preventing them from attending. When she learned that the answer was no, she attended the meetings.

Notes

8. After World War II, the United States and the Soviet Union were locked in a struggle known as the Cold War. Though they did not directly fight against one another, the US and USSR had a tense, hostile relationship. The Space Race was a competition between these nations to explore space using satellites and spacecrafts. In October 1957, the Soviet Union launched the first artificial satellite, Sputnik. In response to the USSR's achievements, President Dwight D. Eisenhower signed the National Aeronautics and Space Act in 1958. This law created NASA.

Notes

9. In May 1961, astronaut Alan Shepard became the first American in space. Shepard launched from Cape Canaveral, Florida, in the Freedom 7 capsule. He traveled fast enough to reach the edge of outer space but not fast enough to orbit, or travel all the way around, the Earth. After 15 minutes in flight, Shepard successfully splashed down in the Atlantic Ocean, 302 miles away from Cape Canaveral.

Johnson calculated Shepard's trajectory, or the path of his spacecraft. This trajectory took the form of a parabola, a u-shaped curve with special properties. The properties of parabolas allowed Johnson to predict where on the curve Shepard's spacecraft would be at any point in time. She used information about where NASA wanted Shepard's spacecraft to land and worked backwards to figure out other details about its flight.

Notes

10. As space research progressed, American space flights grew more complex. Factors like the location and rotation of the Earth had to be taken into account. In 1962, John Glenn became the first American to orbit the Earth. He completed three revolutions of the planet. Though NASA used an electronic computer to calculate his path, Glenn specifically asked for Johnson to verify the machine's work before he would take off. In 1969, the Apollo 11 mission made history by becoming the first manned mission to land on the moon. Astronaut Neil Armstrong, who took the first steps on another planetary body, called this achievement "one small step for man, one giant leap for mankind." This leap would not have been possible without Johnson, who did the calculations to get the spacecraft safely to and from the moon.

Notes

11. Johnson continued to work for NASA until 1986. Her calculations contributed to every major space program, from Alan Shepard's first flight to the Space Shuttle Program. Johnson has been decorated with awards, including three NASA Special Achievement Awards and the title of 1997 Mathematician of the Year. Multiple universities have given her honorary doctoral degrees, and NASA named a large research facility in her honor. In 2015, Johnson received the Presidential Medal of Freedom, the nation's highest honor given to a civilian.

Johnson often speaks to students, encouraging them to pursue careers in STEM (science, technology, engineering and math). According to Johnson, "We will always have STEM with us. Some things will drop out of the public eye and will go away, but there will always, always be science, engineering and technology. And there will always, always be mathematics."

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