

hidden figures questions and answers for students

Hidden Figures: Questions and Answers for Students Exploring Space and Civil Rights

The movie "Hidden Figures" has captivated audiences worldwide, shedding light on the crucial contributions of African-American women mathematicians at NASA during the Space Race. For students, understanding the historical context, scientific challenges, and personal journeys depicted in this film offers a powerful lesson in perseverance, equality, and the pursuit of knowledge. This comprehensive guide delves into key questions and answers about "Hidden Figures," designed to deepen student comprehension and spark further inquiry. We will explore the roles of Katherine Johnson, Dorothy Vaughan, and Mary Jackson, their individual triumphs, the societal barriers they overcame, and the scientific achievements they facilitated. Whether you're preparing for a classroom discussion, a research project, or simply seeking a more profound understanding of this inspiring true story, these hidden figures questions and answers will equip you with the knowledge to appreciate their legacy.

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Key Figures and Their Roles in NASA's Space Race

The narrative of "Hidden Figures" centers on three extraordinary women whose mathematical prowess was indispensable to NASA's early space missions. These women, often overlooked in historical accounts, played pivotal roles in the monumental achievements of the Space Race. Their story highlights not only their individual brilliance but also the collective strength and resilience they demonstrated in the face of significant societal challenges. Understanding their specific contributions is essential to grasping the film's broader message about equality, perseverance, and the multifaceted nature of scientific advancement.

Katherine Johnson: The Human Computer and Master of Trajectory

Katherine Johnson, often referred to as the "human computer," was a true mathematical prodigy. Her exceptional abilities in calculation and her understanding of complex mathematical concepts were vital for navigating the intricacies of spaceflight. Johnson's meticulous work ensured the accuracy of orbital mechanics, crucial for the success of Project Mercury and subsequent Apollo missions. Her ability to perform complex calculations by hand, even as electronic computers began to emerge, cemented her reputation as a trusted and invaluable asset to NASA. One of her most celebrated contributions was verifying the trajectory calculations for Alan Shepard's first American spaceflight and, most famously, for John Glenn's orbital mission. She was also instrumental in calculating the trajectory for the Apollo 11 lunar mission, ensuring the astronauts could reach the Moon and return safely. Her unwavering dedication to accuracy and her intellectual courage in questioning and re-calculating data made her a linchpin in the race to space.

Dorothy Vaughan: Supervisor, Programmer, and Lifelong Learner

Dorothy Vaughan's journey at NASA was one of leadership, adaptation, and foresight. Beginning as a human computer, she quickly rose through the ranks to become NASA's first African-American supervisor. Her leadership extended beyond managing her team of women mathematicians; she also recognized the impending shift towards electronic computing and took it upon herself to become an expert in the new IBM machines. Vaughan taught herself and her team the FORTRAN programming language, a skill that was crucial for the transition from manual calculations to automated data processing. This proactive approach not only secured her team's relevance in the evolving technological landscape but also demonstrated her commitment to continuous learning and

empowerment. Her ability to anticipate change and equip her colleagues with new skills was instrumental in their continued success and in demonstrating the value of diverse talent within NASA.

Mary Jackson: From Computer to America's First Black Female Engineer

Mary Jackson's story is a powerful testament to the pursuit of aspirations against significant odds. Initially working as a human computer, she was determined to become an aerospace engineer. However, to achieve this goal, she needed to take graduate-level engineering courses offered at a segregated school that did not admit Black women. Undeterred, Jackson petitioned the court and successfully gained permission to attend the classes, proving her commitment and academic capability. Her success in these courses led her to become NASA's first Black female engineer. Jackson's career was marked by her advocacy for equal opportunities and her dedication to inspiring future generations of scientists and engineers. She later moved into roles focused on advocating for women and minority employees within NASA, leveraging her expertise and experience to foster a more inclusive environment.

The Historical Context: The Space Race and Segregation

To fully appreciate the achievements of the women featured in "Hidden Figures," it is crucial to understand the historical backdrop against which they operated. The mid-20th century in the United States was a period defined by immense geopolitical tension, rapid technological advancement, and deeply entrenched racial segregation. The Space Race and the pervasive Jim Crow laws created a unique and challenging environment for these brilliant women.

The Cold War and the Space Race

The Space Race was a direct byproduct of the Cold War, a period of intense rivalry between the United States and the Soviet Union following World War II. This ideological and geopolitical struggle manifested in a competition for global influence, military superiority, and technological dominance. Space exploration became a critical arena for this competition. The Soviet Union's launch of Sputnik in 1957 sent shockwaves through the United States, spurring a national effort to catch up and surpass Soviet achievements in space. This urgency fueled massive investment in science, technology, engineering, and mathematics (STEM) fields, creating new opportunities, but also highlighting existing societal inequalities that would need to be addressed. NASA, established in 1958, was at the forefront of this national

endeavor, tasked with the ambitious goal of landing a man on the Moon.

Jim Crow Laws and Segregation at NASA

Despite the nation's focus on technological advancement and the Cold War competition, racial segregation remained a harsh reality in many parts of the United States, including Virginia, where NASA's Langley Memorial Aeronautical Laboratory was located. The Jim Crow laws enforced racial segregation in all aspects of public life, from education and housing to employment and transportation. At NASA, this manifested in separate bathrooms, dining facilities, and even separate office areas for Black and White employees. The "West Area Computing" unit, where Katherine Johnson, Dorothy Vaughan, and Mary Jackson worked, was essentially a segregated division for Black female mathematicians. These discriminatory practices created significant daily hurdles for the women, demanding immense resilience and a constant battle for basic dignity and equal treatment alongside their demanding professional responsibilities.

Scientific Contributions and Challenges

The work of Katherine Johnson, Dorothy Vaughan, and Mary Jackson was not just about performing calculations; it was about solving complex, real-world problems that had never been tackled before. Their contributions were foundational to the success of America's early space missions, and they faced unique scientific and technical challenges that required exceptional intellect and innovative thinking.

The Importance of Trajectory Calculations

The ability to accurately calculate the trajectory of a spacecraft is paramount to successful spaceflight. This involves understanding the principles of orbital mechanics, gravity, and physics. For the early missions of Project Mercury, every calculation had to be precise to ensure that the astronauts could reach orbit, maintain that orbit, and return safely to Earth. Katherine Johnson's ability to perform these complex calculations, often by hand and with incredible speed and accuracy, was critical. She was trusted to verify the trajectories for Alan Shepard's suborbital flight and John Glenn's orbital mission, ensuring that the complex math used by the burgeoning electronic computers was correct. Her double-checking was a vital safeguard, as a slight miscalculation could have catastrophic consequences.

Early Computing and the Transition to Machines

The era of "Hidden Figures" coincided with a significant technological shift: the introduction of electronic computers. Initially, NASA relied heavily on human computers to perform the vast number of calculations required for aerospace engineering. However, as missions became more complex, the need for faster and more efficient processing became apparent. Dorothy Vaughan recognized the growing importance of these new machines and took the initiative to learn how to program the IBM 700 series computers. She became an expert in FORTRAN, a nascent programming language, and trained her team to operate and program these early computers. This transition was a major challenge, requiring the human computers to adapt their skills and embrace a new technological paradigm. Vaughan's leadership in this area was crucial for the continued productivity and relevance of her division.

The Mercury and Apollo Programs

The work of the human computers was directly applied to NASA's most ambitious projects of the era: Project Mercury and the Apollo program. Project Mercury, launched in the early 1960s, aimed to put the first Americans into space and orbit the Earth. The success of these missions relied heavily on the accurate trajectory calculations performed by women like Katherine Johnson. The Apollo program, a more daring endeavor, set the goal of landing a man on the Moon. The complexities of lunar trajectories and orbital mechanics were even greater than those for Earth orbit. Katherine Johnson's calculations were essential for mission planning, including the precise timing of launch windows and the return path to Earth. The women's meticulous work ensured that these groundbreaking missions, which captured the imagination of the world and marked a significant achievement for the United States, were scientifically sound and operationally feasible.

Overcoming Obstacles and Social Barriers

Beyond the scientific and technical challenges, the women of "Hidden Figures" faced significant social and systemic barriers rooted in racial and gender discrimination. Their ability to excel and achieve their goals in such an environment speaks volumes about their character, determination, and the importance of supportive allies.

Fighting Discrimination in the Workplace

The segregated facilities at NASA, including separate restrooms and dining areas for Black employees, were constant reminders of the discrimination

these women faced. The "Colored Ladies Room" sign was a visible symbol of the indignity they endured daily. Katherine Johnson's experience of being initially denied entry to meetings with engineers due to her race, and her persistence in demanding to be present and to have her calculations heard, highlights the constant need to assert her value and demand equal treatment. These were not minor inconveniences; they were systemic barriers designed to marginalize and exclude. The women had to constantly prove their worth and overcome the prejudice that assumed their inferiority.

Breaking Gender and Racial Barriers

In a society that largely relegated women to domestic roles and denied Black individuals equal opportunities, the professional achievements of Johnson, Vaughan, and Jackson were revolutionary. They defied societal expectations and broke through entrenched glass ceilings in both gender and race. Mary Jackson's pursuit of engineering, a field overwhelmingly dominated by men, and her successful transition into that role, was a monumental achievement. Dorothy Vaughan's leadership position as a supervisor was also groundbreaking for an African-American woman at that time. These women paved the way for future generations, demonstrating that talent and dedication, not race or gender, should be the determinants of opportunity.

The Power of Advocacy and Education

The women of "Hidden Figures" understood the power of advocacy and education in their personal and professional advancement. Mary Jackson's proactive approach to gaining the necessary qualifications for engineering, including the court petition to attend segregated classes, exemplifies this. Dorothy Vaughan's commitment to educating herself and her team about new technologies like FORTRAN was a form of internal advocacy, ensuring their skills remained relevant and their careers progressed. Furthermore, the film subtly portrays the importance of allies, such as their supervisor Al Harrison, who challenged the segregationist policies and recognized their indispensable contributions. Their collective efforts, both overt and subtle, contributed to shifting attitudes and opening doors for others.

Legacy and Impact of Hidden Figures

The story of "Hidden Figures" has had a profound and lasting impact, not only on how we understand the Space Race but also on broader conversations about equality, STEM education, and the recognition of overlooked contributions. The film and the book it's based on have brought these remarkable women's stories into the mainstream, inspiring a new generation.

The legacy of Katherine Johnson, Dorothy Vaughan, and Mary Jackson is multifaceted. They are celebrated for their critical roles in the scientific and technological advancements that defined the Space Race. Their mathematical calculations and problem-solving skills were integral to the success of NASA's most iconic missions, including the Mercury and Apollo programs. Their work directly contributed to putting Americans into space and eventually landing on the Moon, achievements that solidified the United States' position as a leader in technological innovation. Their story serves as a powerful reminder that significant contributions can come from individuals who are often marginalized or hidden from view.

Moreover, their personal journeys are powerful examples of perseverance and the fight for equality. In an era of pervasive segregation and discrimination, they navigated challenging environments, overcame systemic barriers, and achieved professional success through sheer intellect, hard work, and resilience. They shattered racial and gender stereotypes, proving that talent and capability are not limited by these factors. Their achievements opened doors for countless women and minorities in STEM fields, inspiring them to pursue careers in science, technology, engineering, and mathematics. The film has encouraged a re-examination of history, highlighting the importance of inclusive narratives and recognizing the diverse individuals who have shaped our world.

The impact of "Hidden Figures" extends to educational initiatives and public awareness. The story has been widely adopted in classrooms as a tool to teach about the Space Race, civil rights, and the importance of STEM. It encourages students, particularly young girls and minority students, to see themselves in roles in STEM fields. By bringing these "hidden figures" to light, the narrative serves as a catalyst for greater recognition of underrepresented groups in history and science, fostering a more accurate and comprehensive understanding of our past and present.

Frequently Asked Questions about Hidden Figures for Students

Students often have specific questions about the movie and the historical events it depicts. Addressing these queries can enhance comprehension and facilitate deeper learning. Below are some common questions and their answers, designed to clarify key aspects of the "Hidden Figures" narrative and its historical context.

- What were the main jobs of the "human computers"?

The human computers, predominantly women, were tasked with performing complex mathematical calculations essential for aerospace engineering. This included trajectory calculations, analyzing flight data, and

performing engineering computations that were too extensive for early electronic computers to handle efficiently.

- Who was Katherine Johnson and what was her most significant contribution?

Katherine Johnson was a brilliant mathematician whose meticulous calculations were crucial for the success of the U.S. space program. Her most significant contributions include verifying the trajectory for Project Mercury missions, including Alan Shepard's first flight and John Glenn's orbital mission, and calculating the trajectory for the Apollo 11 lunar landing.

- What was Dorothy Vaughan's role and how did she adapt to new technology?

Dorothy Vaughan was a mathematician who became NASA's first African-American supervisor. She foresaw the importance of electronic computers and proactively taught herself and her team the FORTRAN programming language, ensuring their continued relevance and expertise in the evolving technological landscape.

- How did Mary Jackson become an engineer?

Mary Jackson aspired to be an engineer but had to complete graduate-level engineering courses at a segregated school. She successfully petitioned the court to be allowed to attend these classes, and upon completion, she became NASA's first Black female engineer.

- What was the significance of the segregated facilities at NASA?

The segregated facilities, such as separate restrooms and dining areas, were a physical manifestation of the Jim Crow laws and racial discrimination prevalent at the time. They represented the systemic barriers and indignities faced by the Black employees at NASA, highlighting the challenging environment they had to navigate.

- How did the Civil Rights Movement influence the events in Hidden Figures?

The Civil Rights Movement created a broader societal context of demanding equality and challenging segregation. While the film focuses on the women's professional achievements, the underlying fight for civil rights provided the backdrop against which their own struggles for equal treatment and opportunity took place, influencing the broader cultural shift.

- What scientific challenges did the women face?

The women faced immense scientific challenges, including calculating complex orbital mechanics for spaceflights, ensuring the accuracy of trajectory paths, and adapting to the introduction of new computing

technologies like FORTRAN. Their work demanded precision and a deep understanding of physics and mathematics.

- What does the title "Hidden Figures" refer to?

The title "Hidden Figures" refers to both the literal mathematical figures calculated by the women and to the women themselves, whose vital contributions to NASA's early space missions were largely overlooked and unacknowledged by history for decades.

- What lessons can students learn from the story of Hidden Figures?

Students can learn invaluable lessons about perseverance, the importance of education, overcoming adversity, fighting for equality, the power of collaboration, and the significance of recognizing diverse talents in achieving ambitious goals.

- How did the women's education prepare them for their roles?

Their strong educational backgrounds in mathematics and science provided them with the foundational knowledge and critical thinking skills necessary to excel in their roles as human computers and engineers. Their commitment to learning, even beyond formal education, was key to their success.

Conclusion: Remembering the Hidden Figures and Their Enduring Legacy

The story of "Hidden Figures" is more than just a historical account of the Space Race; it is a testament to human ingenuity, resilience, and the relentless pursuit of excellence against formidable odds. Katherine Johnson, Dorothy Vaughan, and Mary Jackson, along with the many other women who formed the backbone of NASA's early computational efforts, played indispensable roles in pushing the boundaries of human exploration. By addressing these key hidden figures questions and answers for students, we aim to foster a deeper appreciation for their contributions, not only to space exploration but also to the broader struggle for civil rights and equality. Their legacy serves as a powerful reminder that talent knows no bounds of race or gender, and that recognizing and valuing diverse perspectives is crucial for scientific advancement and societal progress. The enduring impact of these hidden figures continues to inspire generations to break barriers, pursue their dreams, and ensure that no contribution, however overlooked, remains unseen.

Frequently Asked Questions

Who were the 'hidden figures' in the movie and what were their real-life contributions to NASA's space program?

The 'hidden figures' were brilliant African-American women mathematicians who worked at NASA during the Space Race. Their real-life names were Katherine Johnson, Dorothy Vaughan, and Mary Jackson. Katherine Johnson calculated the trajectories for Project Mercury and Apollo 11, Dorothy Vaughan became NASA's first African-American supervisor and an expert in FORTRAN programming, and Mary Jackson became NASA's first African-American female engineer. Their contributions were crucial to the success of early American space missions, despite facing significant racial and gender discrimination.

What were some of the major challenges these women faced due to segregation and gender bias in the 1960s?

These women faced systemic discrimination. They worked in segregated facilities, used separate bathrooms and lunchrooms, and were often paid less than their white male counterparts. They also had to overcome the prevailing societal belief that women, especially Black women, were not capable of complex scientific and mathematical work. Mary Jackson specifically had to fight to attend segregated engineering classes to qualify for her promotion.

How did the work of Dorothy Vaughan, Mary Jackson, and Katherine Johnson impact the advancement of civil rights and gender equality?

Their success and perseverance in demanding roles within a discriminatory system served as powerful examples. By excelling in their fields and breaking down barriers, they paved the way for future generations of women and minorities in STEM. Their story highlights the injustice of segregation and the importance of equal opportunity, contributing to the broader civil rights movement and the fight for gender equality.

What technologies or concepts did these 'hidden figures' work with, and how were they essential for space exploration?

They worked with complex mathematical calculations, orbital mechanics, and early computer programming. Katherine Johnson's ability to accurately calculate trajectories was vital for ensuring rockets reached their intended destinations and astronauts returned safely. Dorothy Vaughan's expertise in

FORTTRAN was critical as NASA transitioned from human computers to electronic computers, enabling more complex calculations and faster processing of data needed for spaceflight.

Why do you think the story of the 'hidden figures' remained largely unknown for so long, and why is it important to highlight it now?

Their stories were often overlooked due to systemic erasure and the societal norms of the time, which prioritized the achievements of white men in the Space Race. The narrative of the Space Race was heavily focused on the astronauts and engineers in more visible roles. It's important to highlight their story now to provide a more complete and accurate historical account, to recognize the contributions of underrepresented groups in science and history, and to inspire young people, particularly girls and minorities, to pursue careers in STEM.

Additional Resources

Here are 9 book titles related to "Hidden Figures" questions and answers for students, with descriptions:

1_The Souls of Black Folk: Abridged and Annotated for Young Readers
This edition of W.E.B. Du Bois's seminal work offers accessible insights into the Black experience in America. Through carefully selected essays and accompanying explanations, students can grapple with themes of race, identity, and segregation. It provides historical context and thought-provoking questions to encourage critical engagement with the challenges faced by African Americans.

2_We Are the Ship: The Story of Negro League Baseball
This vibrant and engaging book tells the story of the Negro Leagues, a vital part of baseball history that often gets overlooked. It highlights the incredible talent and resilience of Black athletes who were excluded from Major League Baseball due to segregation. Students will learn about the societal context that necessitated the Negro Leagues and the triumphs achieved within them.

3_The Tuskegee Airmen: Black Heroes of World War II
This book delves into the inspiring true story of the Tuskegee Airmen, the first African American pilots in the U.S. military. It details their rigorous training, their courageous combat missions, and the prejudice they overcame to prove their capabilities. Students will gain an understanding of their significant contributions to the war effort and their role in breaking down racial barriers.

4_Brown Girl Dreaming
A powerful and lyrical memoir in verse by Jacqueline Woodson, this book

chronicles her childhood in the 1960s and 1970s during the Civil Rights Movement. It explores themes of family, identity, and the power of words and stories. Students can connect with her personal experiences and learn about the historical backdrop of racial integration.

5_The Immortal Life of Henrietta Lacks: Adapted for Young Adults_

This adaptation makes the compelling story of Henrietta Lacks and her groundbreaking HeLa cells accessible to a younger audience. It examines the scientific and ethical implications of her cells' immortality and the impact they have had on medical research. Students will explore questions of consent, race, and the often-unacknowledged contributions of Black individuals in science.

6_A Black Woman's History of the United States_

This comprehensive yet approachable book offers a vital perspective on American history, focusing on the experiences and contributions of Black women. It covers a wide range of historical periods and movements, highlighting their resilience, activism, and leadership. Students will discover the multifaceted roles Black women have played in shaping the nation.

7_March: Book One_

The first installment in Congressman John Lewis's graphic novel memoir, "March: Book One," vividly recounts his early life and his pivotal role in the Civil Rights Movement. The accessible graphic novel format makes complex historical events relatable for students. It provides a powerful visual and narrative account of the struggles for equality.

8_Claudette Colvin: Twice Toward Justice_

This book tells the courageous story of Claudette Colvin, a teenager who refused to give up her seat on a bus in Montgomery, Alabama, nine months before Rosa Parks. It sheds light on another significant but lesser-known figure in the fight against segregation. Students will learn about the bravery of young people in demanding justice.

9_Who Was Katherine Johnson?_

As part of the popular "Who Was?" biographical series, this book introduces young readers to the brilliant mathematician Katherine Johnson. It details her crucial work as a human computer at NASA, calculating trajectories for early space missions. Students will be inspired by her intelligence and perseverance in a male-dominated field.

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