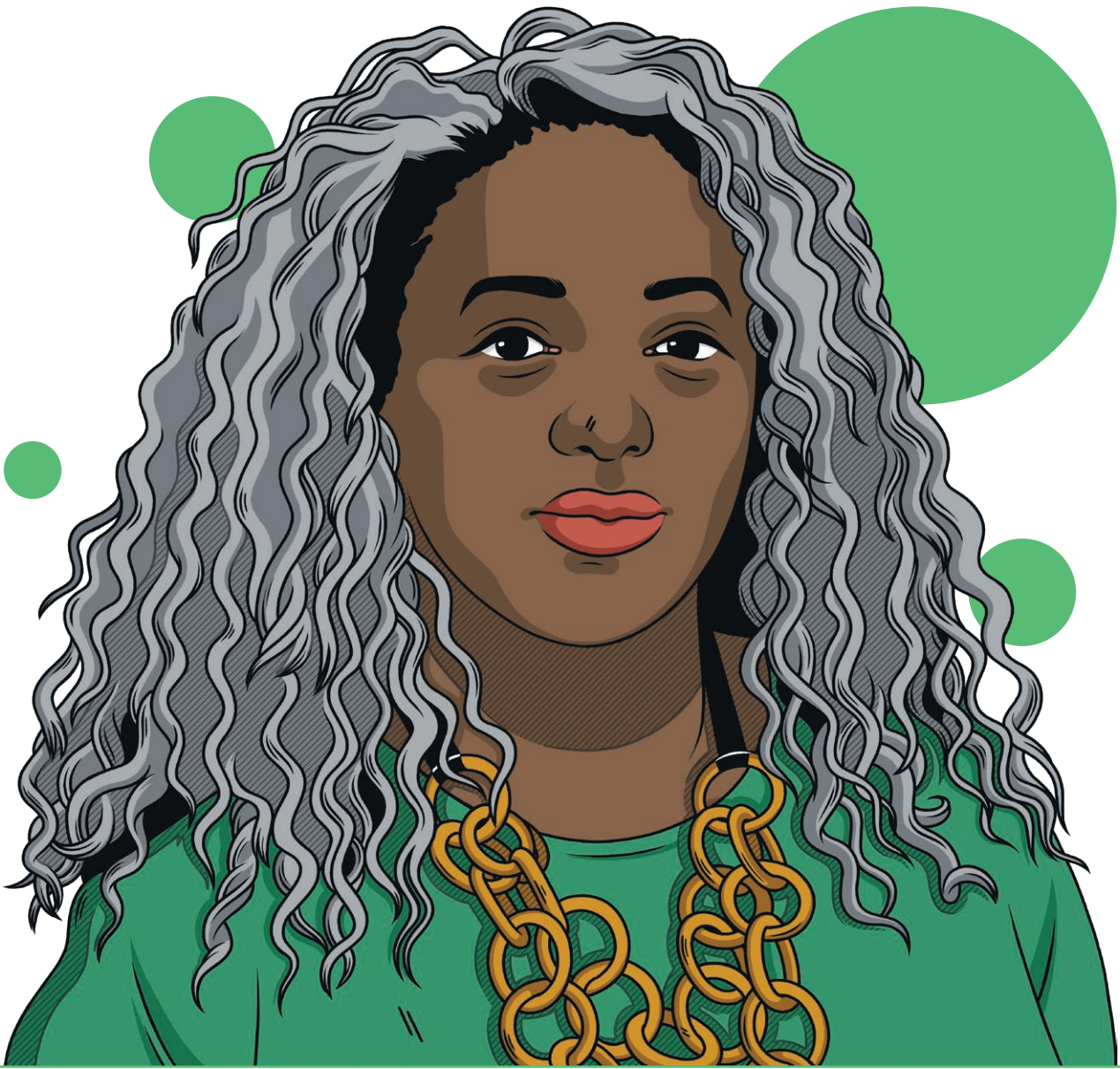# Anne-Marie Imafidon (1990 -)

Anne-Marie Imafidon was born in London in 1990. At the age of 11, she passed her A level in Computer Science – the youngest girl ever to do so. By 20 years old, she received her master's degree in Mathematics and Computer Science from the University of Oxford.

Imafidon then went on to work for high-profile companies including Goldman Sachs and Hewlett-Packard. She received honorary doctorates from the Universities of Kent, Bristol and Coventry, to name but a few!

With her experience and her innovative nature, she cofounded Stemettes, an award-winning social enterprise that supports young women and non-binary people to explore science, technology, engineering and maths (known as STEM). Since it was founded in 2013, over 50 000 people have attended their events.

In 2021, Anne-Marie Imafidon became the co-host of Countdown; the first black co-host of the show.

Benjamin Banneker (1731 - 1806)

Benjamin Banneker was born in 1731 in Maryland, USA. His father, Robert, had been enslaved until given his freedom. His mother, Mary, was the daughter of an English girl who had been accused of stealing milk and then sent to the British Colony in North America. Benjamin was educated at the Quaker School until he was old enough to work on his parents' farm. He was taught to read and write by his English grandmother.

At 22 years old, Benjamin made a clock from wood; using a borrowed pocket watch as a model. The clock, which worked for the rest of his life, seemed to have brought him some fame in the local community. He quickly acquired a reputation for writing and solving mathematical puzzles.

In 1788, Benjamin was lent some astronomy books and instruments by a neighbour. At the age of 57, he taught himself algebra, geometry, trigonometry and astronomy. He learnt how to use the instruments to make astronomical predictions.

In 1791, a survey was carried out for the new capital at Washington DC. Benjamin Banneker was employed as an assistant to one of the surveyors, while also working on an astronomical almanac. Benjamin wrote to Thomas Jefferson, then Secretary of State, sending him a manuscript of his Almanac.

Benjamin published Almanacs until 1797, dedicating them to the cause of equality and peace. The 1793 Almanac contains correspondence between Banneker and Jefferson.

On the day of Benjamin's funeral, the farmhouse was burnt to the ground and his laboratory and the clock he made were all destroyed. Only one of his journals was not in the house and so survived. Every other record of his achievements, except the published Almanacs, were lost in this fire.

David Blackwell (1919 - 2010)
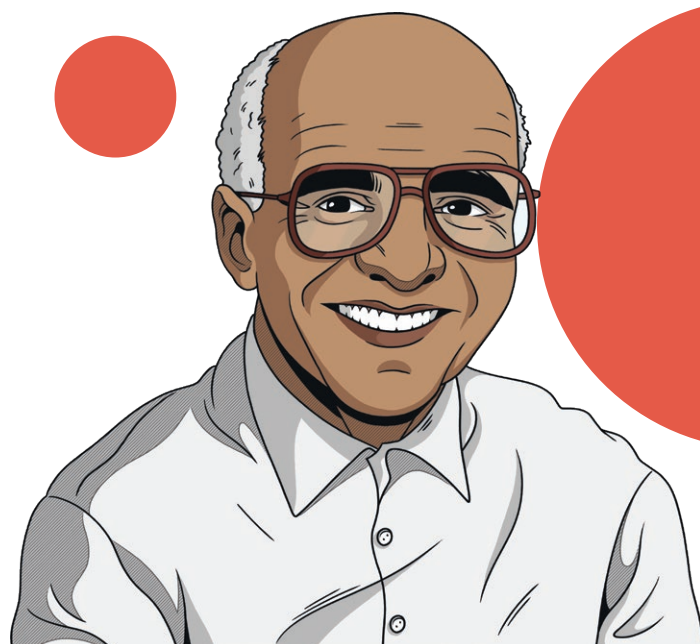
David Blackwell was born in 1919 in Centralia, Illinois, USA. His father, Grover, worked for the Illinois Central Railroad and his job consisted of looking after the locomotives. His mother, Mabel, looked after the family – bringing up David and his three siblings.

David could have attended one of the two racially segregated elementary schools in Centralia but he believed he was fortunate to attend an integrated school. While David excelled in maths at school, algebra and trigonometry were not all that attractive to him. He could do it and could see it was useful, but didn't find it exciting. Instead, he applied his skills to games such as noughts and crosses where he began to analyse whether there was a winning strategy for the first player.

In 1935, at just 16, David Blackwell entered the University of Illinois. To fund his studies, he took jobs to help earn money while also taking courses over the summers. Because of this, he was able to graduate after three years of study. David continued to study at the University of Illinois for his master's degree and then for his doctorate. In 1941, at just 22, David Blackwell earned his PhD.

After a prestigious appointment at Princeton, he was offered a post at the Southern University at Baton Rouge followed by a year as an Instructor at Clark College in Atlanta. In 1944, he moved to Howard University where it took him only three years to be promoted to full professor and Head of the Department of Mathematics.

David Blackwell began to show an interest in statistics. In 1954, along with Abe Girshick, he published a book: 'Theory of Games and Statistical Decisions'. One of the 'games' he studied was that of two duellists: each duellist has a single bullet and, as they approach one another, their chance of successfully hitting the other increases. If one fires and misses, the other can continue to approach them. What is the optimal moment for the duellist to shoot? The Cold War promoted interest in this type of game, and Blackwell soon became a leading expert.

In 1954, Blackwell moved to the University of California, where he stayed until his retirement. He was invited to address the International Congress of Mathematicians. He became the Vice President of the American Statistical Association and the President of the Institute of Mathematical Statistics.

Blackwell said that the work which gave him the most satisfaction was infinite games and analytic sets which he publishedin the Proceedings of the National Academy of Sciences in 1967.

Conduit
Maths

Elbert Cox (1895 - 1969)

Elbert Frank Cox was born in Indiana, USA, in 1895. He grew up in a racially mixed neighbourhood but went to a segregated school which lacked resources. Elbert was offered a scholarship to study violin in Prague but chose to pursue maths instead.

He went on to study for a bachelor's degree at Indiana University, achieving an A in every single maths exam. There were three other black students and all had the word 'colored' printed across all their work.

After he graduated in 1917, he joined the US army to fight in the First World War. After his return to the US, he got a job at Shaw University in North Carolina where he became the chairman of the Department of Natural Sciences.

In September 1922, Elbert received a scholarship at Cornell University and in 1925, he was awarded his doctorate for his thesis, 'Polynomial Solutions of Difference Equations'. Elbert Cox was the first black person in the world to be awarded a doctorate in maths. To truly understand the challenges he faced, and the magnitude of the achievement, note that the USA produced only 28 PhDs in mathematics in 1925, one of whom was Elbert. While in 1926, 31 black people were murdered by lynching in the USA.

On 14 September 1927, Cox married Beulah Kaufman, the daughter of a former enslaved man. In the year after his marriage, Elbert Cox was appointed associate professor of mathematics at Howard University in Washington DC. The University was open to students of any race, colour or creed, but it had been founded in 1867 to provide advanced studies for black students. After his death, Howard University set up the Elbert F Cox Scholarship Fund in 1975 to help black students progress to studying graduate-level mathematics.

Euphemia Lofton Haynes (1890 - 1980)

Euphemia Lofton was born in Washington DC in 1890 and was the eldest child of a dentist and former teacher. Her parents divorced in 1897 and when she was nine years old, she was living with her younger brother and their mother in the home of her aunt and uncle.

Euphemia was highly motivated and ambitious, and excelled in school from a young age. In 1907, she graduated from one of the first high schools for black people in the USA. In 1909, she earned an undergraduate degree in education and 5 years later, a second undergraduate degree in mathematics.

In the 1920 census, Euphemia was living with her husband, Harold Haynes, and was described as the head of the household and owner of the house, giving her occupation as a teacher. Both Euphemia and Harold played a major role in promoting the education of black people. Euphemia taught mathematics at Armstrong High School, served as an English teacher at Miner Normal School and taught mathematics as chair of the department at Dunbar High School.

In 1930, she received a master's degree in education from the University of Chicago. Her husband Harold gained a master's degree in education from the same university in the same year. She was appointed as a professor of mathematics at Miner Teachers College in 1930 and founded the Department of Mathematics at the college – of which she became the head. In the 1930s, the college was still an establishment for black students but it combined with Wilson's Teachers College for white students in 1955. Haynes remained head of the Mathematics Department until she retired in 1959.

Euphemia undertook research for a PhD at the Catholic University of America. Euphemia worked towards a mathematics doctorate with thesis advisor Aubrey Edward Landry. In 1943, she submitted her thesis and was awarded a doctorate. Euphemia Lofton Haynes was the first Black woman to be awarded a PhD in mathematics. Harold retired in 1958 and Euphemia retired in 1959, although she continued to lecture occasionally at Howard University. She was awarded the Papal Medal, the Pro Ecclesia et Pontifice, from the Catholic Church in the year she retired.

Gladys West (1930 -)

Gladys West was born in Sutherland, Virginia in 1930. Her family were sharecroppers, or tenant farmers, so she spent a lot of her childhood working on the family farm.

The biggest obstacle to her education was a financial one; her parents tried their best to save money but sharecroppers were not wealthy. Gladys babysat to raise money to fund her education and worked incredibly hard. At her high school, the top two students of each graduating class received 'full-ride' scholarships to Virginia State College. With much determination and discipline, Gladys graduated valedictorian in 1948 and received the much-needed scholarship.

Gladys chose to study mathematics – a subject mostly studied at her college by men – and became a member of the Alpha Kappa Alpha sorority. She graduated in 1952 with a BSc in Mathematics. She taught maths and science for two years before returning to college to complete her Master of Mathematics degree, graduating in 1955.

In 1956, Gladys West began work at the Naval Proving Ground. She was only the second black women ever hired there and one of only four black employees. She worked as a programmer for large-scale computers and a project manager for systems used in the analysis of satellite data.

In the early 1960s, she participated in an award-winning astronomical study and consequently began to analyse data from satellites to put together models for the Earth's shape. From the mid-1970s, West programmed a computer to deliver increasingly precise calculations to model the shape of the Earth – an ellipsoid with additional undulations, known as the geoid. Her model ultimately became the basis for the Global Positioning System, more commonly known as GPS.

Gladys West's contributions to GPS technology were rediscovered when a member of the Alpha Kappa Alpha sorority read a short biography Gladys had submitted for an alumni function. She was inducted into the United States Air Force Hall of Fame in 2018 – one of the highest honours bestowed by Air Force Space Command.

She once said she had no idea at the time that her work would affect so many: "When you're working every day, you're not thinking, 'What impact is this going to have on the world?' You're thinking, 'I've got to get this right.'"

Conduit
Maths

Grace Alele-Williams (1932 -)

Grace Alele-Williams was born in Warri, Nigeria in 1932. She attended University College of Ibadan and graduated with a degree in mathematics in 1954. For the next three years, she taught mathematics at a school for girls.

Alele-Williams managed to get funding from the Nigerian Head of Service to attend the University of Vermont as a graduate assistant. In 1959, she was awarded a Master's degree in Education. This, along with a financial scholarship, allowed her to go to the University of Chicago to study for a PhD.

Now, this is a relatively normal route to obtaining a PhD. However, it was an amazing achievement for the time. When she received her PhD in 1963, she was the first Nigerian woman ever to be awarded a doctorate. Her thesis was entitled "Dynamics of Education in The Birth of a New Nation: Case Study of Nigeria."

After being awarded her PhD, Alele-Williams returned to Nigeria and began post-doctoral research with the Institute of Education. During this time, she became involved with the African Mathematics Project. This project brought together African, American and British educators in English-speaking African countries to consider changes in mathematical education in Africa.

In 1975, Alele-Williams was appointed as director of the Institute of Education of the University of Lagos. She introduced certificate courses to allow more women to become primary school teachers, particularly older women who may have missed out on opportunities earlier in life. She pushed for more "modern mathematics" to be taught in schools, to bring Nigeria in line with Europe and America.

Alele-Williams was appointed Vice-Chancellor of the University of Benin in 1985 – the first woman to hold this position at an African university. In 2004, at a talk on Gender Dignity, Grace Alele-Williams said "As long as we are celebrating a woman vice-chancellor because she is the first or a woman chief judge because she is the first, then we have not arrived. We look forward to the time when we will have many women in such positions and we will be celebrating so many of them."

Conduit
Maths

Kate Adebola Okikiolu (1965 -)

George Olatokunbo Okikiolu is a renowned Nigerian mathematician and the most published mathematician on record. In 1962, he married a maths teacher, Patricia Edwards, and had two daughters. Their first daughter, Jeannie Adetokunbo Okikiolu, went on to study mathematics at the University of Cambridge. Their second daughter was Katherine Adebola Okikiolu.

At high school, Kate Okikiolu developed an interest in art and maths. She was also an outstanding athlete. Despite being part of a family of mathematicians, she learnt maths on her own from textbooks. She also spent a lot of time studying art and wanted to pursue a career as an artist. However, she was convinced by her family to work for a maths degree first, to ensure she could always earn a living.

In 1985, Kate attended Newnham College, University of Cambridge. By the time she had finished at Cambridge, she was dedicated to maths and didn't consider other careers. After she graduated in 1987, she went to the USA to undertake research for a doctorate. In 1991, she earned a PhD from the University of California in Los Angeles.

Between 1993 and 1995, Kate Okikiolu was an assistant professor at Princeton University before becoming a visiting assistant professor at the Massachusetts Institute of Technology between 1995 and 1997. In 1997, she won a Sloan Research Fellowship – becoming the first black recipient of this fellowship. In the same year, she was awarded a Presidential Early Career Award for Scientists and Engineers for both her mathematical research and her development of mathematics curricula for inner-city school children. This award is given to only 60 scientists and engineers each year and has a prize of $500 000.

Her field of study is called spectral geometry. It studies how the shape of an object affects the modes in which it can resonate. It is all about the question, "Can one hear the shape of a drum?".

Katherine Johnson (1918 - 2020)

Katherine Johnson was born on 26th August 1918 in White Sulphur Springs, West Virginia. From a young age, Katherine loved maths. She even started high school early, when she was just 10 years old, and started taking college classes to become a mathematician at 15.

Katherine first worked as a teacher but, when she was 34, she heard that NACA (later called NASA) was hiring African American women to solve maths problems, as 'computers'. At this time, the word 'computer' didn't yet refer to electronic machines, but people who carried out calculations. Katherine applied for one of the jobs, but the jobs were already taken. She applied again the next year and, this time, she was hired, working with other female African American mathematicians on topics such as aerodynamics.

America had yet to put a human into space, and NACA was still trying to work out the maths behind working out a safe trajectory – all the factors that affected a flight so that the astronaut could land safely. Katherine's skill with mathematics, particularly geometry, made her ideal for this work, however, racial segregation between white and African Americans was still legally enforced at this time – African Americans attended different schools, ate in different cafeterias and used different bathrooms. Katherine's assertiveness and mathematical abilities helped her overcome some of these barriers, and she was reassigned to work on guidance and flight control in a group staffed by white male engineers. There, she made major contributions to human spaceflight in the United States.

Katherine continued working for NASA (after it was formed from NACA). She calculated the trajectory for the first American in space, and when electronic computers were first introduced, she checked their calculations (in fact, the astronaut, John Glenn, refused to fly unless Katherine had checked the results). She helped calculate the trajectory of flights to the moon, including Apollo 13. She continued working for NASA until 1988.

Mamokgethi Phakeng (1966 -)

Mamokgethi Phakeng was born in 1966 in Pretoria, South Africa. Her mother returned to school to qualify as a teacher and her father was one of the first black radio announcers for the South African Broadcasting Company.

Mamokgethi achieved a BSc in Pure Mathematics from the University of North-West and an MSc in mathematics education at the University of the Witwatersrand. In 2002, she became the first black South African woman to be awarded a PhD in Mathematics Education.

Her research focuses on mathematics in multilingual contexts. In 1998, she was concerned about the low maths performance of South African students who learn in a language that is not their home language.

Since 2006, she has been focusing on developing methods and guidance for multilingual mathematics classrooms. So far, she has developed a proactive and strategic use of a learners' home language in the teaching of mathematics, specifically focusing on algebra.

Mamokgethi Phakeng has been awarded many honours including the Order of the Baobab (Silver) for her excellent contribution in the field of science in 2016, the CEO Magazine award for being the most influential woman in education and training in South Africa, and the NSTF award for being the most outstanding Senior Black Female Researcher over the last 5 to 10 years.

In 2004, she founded the Adopt-a-learner Foundation. This non-profit organisation provides financial and education support to students from rural areas. In 2018, Mamokgethi Phakeng became Vice Chancellor at the University of Cape Town. As of September 2021, she still holds this role.

Nira Chamberlain (1969 -)

Nira Chamberlain was born in Birmingham, England and is of Jamaican parentage. Although mathematics was his strongest subject at school, a career teacher discouraged him from pursuing maths and told him to become a boxer instead. Despite this, he went on to graduate with a BSc in Mathematics in 1991 and an MSc in Industrial Mathematical Modelling in 1993.

When he first applied to do a PhD in maths, inspired by a conference for black mathematicians, he was rejected. His parents gave him the advice "You don't need anybody's permission to be a great mathematician". In 2014, he completed his PhD at Portsmouth University.

Nira uses maths to model industrial problems, helping industries like defence, aerospace and energy. He created a model showing the lifetime running costs of aircraft carriers versus the operating costs, specifically for HMS Queen Elizabeth.

He has many achievements in the field of maths. In 2012, he was involved in the UK STEM project 'Being a Professional Mathematician'. In 2014, he was named one of the UK's top scientists by the science council. He was one of only five mathematicians selected. In 2018, he was awarded the title of 'World's Most Interesting Mathematician'.

His notable talks include 'The Mathematics That Can Stop an AI Apocalypse' and 'The Black Heroes of Mathematics'. The latter has proved to be influential and popular throughout the UK and is regularly repeated during Black History Month.

Conduit
Maths