

CAREERS THROUGH MATHS: ARCHAEOLOGIST



JOB DESCRIPTION

An archaeologist in the UK is a professional who investigates human history and prehistory through the excavation and analysis of material remains. Their work is far from the simple retrieval of artefacts; it is a rigorous scientific process where mathematics is fundamental to every stage. A typical day can vary dramatically, from working on a developer-funded excavation ahead of a new high-speed rail project like HS2, to conducting a geophysical survey in a farmer's field in Yorkshire, or analysing finds in a laboratory. The work environment is split between the outdoors (often in all British weathers), laboratories, and offices, requiring a blend of physical stamina and sharp analytical skills.

Key duties involve designing and executing fieldwork strategies. This begins with desk-based assessments, using historical maps and spatial data to model the likelihood of archaeological deposits. During excavations, archaeologists are not just digging; they are creating a precise, three-dimensional record of the site. Every find, from a tiny piece of flint to a Roman coin hoard, is plotted using a grid system, with its position recorded to the nearest centimetre using an Electronic Distance Measurer (EDM). This spatial data is the foundation for all subsequent interpretation, allowing archaeologists to understand the relationships between different features and reconstruct past human activity.

The role extends beyond the trench. Post-excavation work involves the statistical analysis of finds assemblages—for example, calculating the proportions of different pottery types from a Saxon settlement to understand trade networks. Specialists use

mathematical modelling to date organic materials through radiocarbon dating calibration curves and to extrapolate information about past climates from soil samples. Ultimately, the archaeologist synthesises this quantitative data to write detailed reports for clients, such as local planning authorities or Historic England, ensuring the preservation by record of our national heritage, which is a legal requirement under the National Planning Policy Framework (NPPF).

HOW MATHEMATICS IS USED

- **Spatial Analysis and Geometry:** This is the cornerstone of archaeological fieldwork. The entire excavation process is based on a Cartesian grid system. Archaeologists use trigonometry and coordinate geometry to set out site grids and to plot the exact location of features and finds. For instance, when surveying the layout of a Roman fort near Hadrian's Wall, they use Total Stations to measure angles and distances, creating precise plans and digital elevation models (DEMs) that can reveal subtle earthworks invisible to the naked eye. Geometric principles are also used to calculate the volume of soil removed from a feature, which is crucial for understanding the scale of human activity.
- **Statistics and Data Analysis:** Archaeologists deal with vast, complex datasets that require robust statistical analysis. A common task is quantifying finds. For example, when analysing a midden (a waste deposit) from an Iron Age village, they might perform a statistical frequency analysis of animal bones to determine the proportion of domesticated vs. wild species, informing on past diet and economy. Statistical tests like chi-squared are used to determine if observed patterns in artefact distribution across a site are statistically significant or the result of random chance, moving interpretation beyond mere observation.
- **Proportions, Ratios, and Phasing:** Stratigraphy—the analysis of soil layers (contexts)—is the basis for understanding a site's chronology. Archaeologists use the Harris Matrix, a formal logic system, to represent the spatial and sequential relationships between these contexts mathematically. This involves creating a non-linear sequence of proportional relationships to build a relative chronology. Furthermore, seriation, a statistical technique, is used to place assemblages of artefacts (like pottery) in a relative order by analysing the changing proportions of different styles over time.

- **Dating and Chronological Modelling:** Absolute dating techniques rely heavily on mathematics. Radiocarbon dating produces results with a standard deviation, giving a date range (e.g., 1250 ± 30 BP). Archaeologists use complex calibration curves (like IntCal20) and Bayesian statistical modelling software (such as OxCal) to calibrate these radiocarbon dates into calendar years. This modelling allows them to combine multiple dates from a single site, such as a Neolithic long barrow, to refine its construction and use timeline with a high degree of probability.
- **Geophysical Surveying and Geomatics:** Techniques like magnetometry and resistivity, used to map sub-surface features without digging, produce large datasets of numerical readings. Mathematics is used to process this raw data, applying algorithms to filter out noise and create grayscale or colour-scaled plots. The strength of a magnetic anomaly, measured in nanoteslas, can indicate the presence of a filled-in ditch or a fired clay hearth, allowing for the mathematical interpretation of buried landscapes across entire fields.

KEY SKILLS & TOOLS

Skill/Tool	Application
Geographic Information Systems (GIS)	Used to manage, analyse, and visualise all spatial data. An archaeologist might use GIS (e.g., QGIS or ArcGIS) to perform a viewshed analysis from a hillfort, calculating all areas visible from that point to understand its strategic significance, or to statistically analyse the relationship between settlement sites and proximity to water sources in a region.
Total Station/ Theodolite & GPS	These surveying instruments are used to create highly accurate site plans. They operate on trigonometric principles, measuring horizontal and vertical angles and slope distances to calculate the precise X, Y, and Z coordinates of any point. This data is used to create 3D models of sites and features.
Statistical Software (e.g., R, SPSS)	Employed for advanced quantitative analysis of finds and environmental data. For example, using R to perform a cluster analysis on pottery compositions to identify different production centres, or to run a regression analysis to see if there is a

	correlation between soil phosphate levels and the density of archaeological features.
Database Management (e.g., MS Access)	Essential for managing the vast inventories of finds and records from an excavation. Databases allow for complex querying and relational data management, such as linking a specific context number to all the photographs, plans, and finds associated with it, enabling efficient data retrieval and cross-referencing.
Photogrammetry Software	Used to create 3D models from overlapping photographs. The software uses algorithms based on projective geometry to calculate the 3D structure of an object or feature. This is used for everything from creating a digital record of a fragile artefact to modelling an entire excavation trench for archival and public engagement purposes.
Technical Reporting	The ability to translate complex quantitative data into clear, comprehensible reports for non-specialists, such as planning officers, clients, and the public. This involves explaining statistical certainty, spatial models, and chronological sequences in an accessible manner, often using charts, graphs, and maps.
Quality Assurance (QA)	Following UK standards and guidelines, such as those set by the Chartered Institute for Archaeologists (CIfA) and Historic England. This involves methodological rigour, ensuring mathematical data is collected and processed accurately, and that interpretations are based on sound, verifiable evidence.

Typical Pathway: The most common route begins with a university degree in Archaeology or a related subject, often requiring A-levels; while not always mandatory, A-levels in Mathematics, Sciences, or Geography are highly beneficial. This is followed by a master's degree for specialisation. Entry into the profession is typically as a Trainee Archaeologist or Digger on a commercial excavation, organised through a unit accredited by the Chartered Institute for Archaeologists (CIfA). Career progression leads to roles such as Supervisor, Project Officer, and ultimately Project Manager. Gaining Chartered status (MCIfA) is a key qualification that demonstrates a recognised level of competence and professionalism and is increasingly required for senior roles. Continuous professional development (CPD) is offered by CIfA and other bodies like the Council for British Archaeology (CBA).

Industry Demand: The UK commercial archaeology sector is robust, driven largely by the construction and infrastructure industries, which are legally required to

manage archaeological heritage through the planning process. According to reports from organisations like Landward Archaeology and FAME, the sector has experienced steady growth. Demand for skilled archaeologists with strong technical and analytical capabilities remains high, particularly those proficient in GIS, geomatics, and specialist analysis, as projects become increasingly digital and data-driven.

Real-World Impact: Archaeologists play a vital role in preserving the UK's cultural heritage whilst enabling sustainable development. Their work on major infrastructure projects like HS2 or the Thames Tideway Tunnel ensures that our history is recorded before it is lost. Furthermore, their research, often in partnership with institutions like Historic England, National Trust, and universities, deepens our understanding of the national story, enriches museum collections, and boosts cultural tourism—a significant contributor to the UK economy, particularly in rural areas.