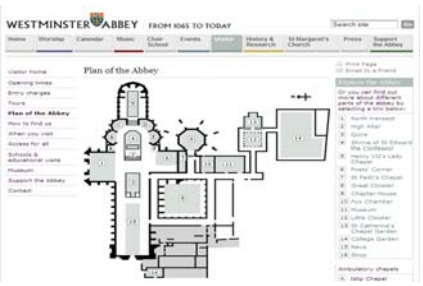

Maths Trails

Purpose

The purpose of a maths trail is to give an example of an experiential learning activity on mathematics in society (which could also be used / adapted for your own classes).

Learning outcomes

At the end of the trail you should have

- experienced a maths trail
- identified some aspects of numeracy in the real world
- written some questions about the landmarks visited to ask another group
- increased knowledge of some aspects of mathematics in history and culture

Tasks

a) Visit the suggested places on one of the identified trails in groups of 2/3. [Spend a maximum of 90 minutes on this activity – you do not have to visit all of them]

b) Find as many places identified in the historical texts as you can.

c) Identify aspects of numeracy from the Adult Numeracy Core Curriculum (use the overview overleaf). Make sure you have at least one example from each of N, MSS and HD.

d) Write 5 numeracy related questions about the landmarks visited for others in the group.
   - four questions should be multiple choice question (each with 4 options)
   - one question should be open ended

e) Be ready to feedback on how you felt about the activity and how useful a similar one might be for your learners.

The Recorde Trail

Places on the way

Site of Kings Bench Prison http://en.wikipedia.org/wiki/King's_Bench_Prison
St George the Martyr Church http://www.stgeorgethemartyr.fsnet.co.uk/history.html
Southwark Bridge http://en.wikipedia.org/wiki/Southwark_Bridge
The Globe http://www.shakespeares-globe.org/
The Tate Modern http://www.tate.org.uk/modern/
The Millennium Bridge http://www.arup.com/MillenniumBridge/
St Pauls Cathedral http://www.stpauls.co.uk/
Bank of England http://www.bankofengland.co.uk/
City of London School http://www.victorianlondon.org/education/cityoflondonschool.htm
Blackfriars Bridge http://en.wikipedia.org/wiki/Blackfriars_Bridge

History

Historical text selections from http://www.dcs.warwick.ac.uk/bshm/zingaz/London.html
British Society for the History of Mathematics, written by David Singmaster

Michael Faraday (1791-1867) was born on 22 Sep 1791 in lodgings somewhere near Elephant and Castle. There is a Southwark plaque on the south side of the ***Elephant and Castle Shopping Centre***, near the Butts pub, but almost concealed by a large billboard just above it [Southwark; DBS]. He was baptised at St. Mary Newington, now vanished, but its churchyard remains as a green space in Newington Butts adjacent to the roundabout. The church was at the northeast of the present green and the walls there may be part of the church??

The birthplace of **Charles Babbage** (1791-1871) has been recently determined - it is about where Larcom St., SE17, enters ***Walworth Road*** in south London [Hyman, pp.5 & 10-11].. Following suggestions of Hyman and myself, a 'Historic Southwark' plaque was erected on the site in 1991. Baptised at St. Mary Newington on 6 Jan 1792. The Babbages move to 10 George Street, Adelphi, later called 10 York Buildings, in late 1799. In 1803, Charles's father and the family retire to Totnes, Devon…

c1820, he begins work on his Difference Engine. In 1822, he has a prototype Difference Engine. In 1823, he is awarded one of the first Gold Medals of the Astronomical Society for the Difference Engine. In 1823, Babbage employs Joseph Clement at 21 Prospect Place, now 63 ***St. George's Road***, near Elephant and Castle, and begins work on the Difference Engine to have 20 figures and constant 6th differences. The first three columns would have 6 extra places. It would have been 9' x 9' x 3'6" deep, have had 25,000 parts and have weighed c4 tons.

Robert Recorde (c1510-1558) was the inventor of the = sign, in his *Grounde of Artes*, 1540, which also introduced the + and - signs to England. He died in the ***Old King's Bench Prison***, to the north of the old graveyard of ***St. George the Martyr*** which is across Tabard Street to the north of the church. (Cf Cocker, above, for the church.) There was a Southwark plaque commemorating the

prison at 203-205 Borough High Street [Southwark]. There are remains of the later Marshalsea Prison on the site (Southwark plaque formerly on 207 Borough High Street [Southwark]), visible if you go down Angel Place, the next entry north of Tabard Place. ***(The King's Bench Prison was later on the west side of Borough High Street at the corner of Borough Road (Southwark plaque formerly on Queen's Buildings, Borough Road)*** [Southwark].)

Edward Cocker (1631-1676), whose *Arithmetick* of 1678 went into over a hundred editions and inspired the catch phrase 'according to Cocker', lived at various places in London, including Gutter Lane, Cheapside, c1664. Shortly before his death, he had to move to be 'within the rules' of the ***King's Bench Prison*** off Borough High Street, which meant he was technically in prison for debt, but had paid for the right to live outside the actual prison. His school was then at the west end of the church. He was buried in ***St. George the Martyr***, Borough High Street, Southwark, better known as 'Little Dorrit's Church'. Plaque in the vestibule of the Church. An exterior Southwark plaque disappeared some years ago [Southwark]. (As with many inner London churches, the actual remains have been removed to cemeteries outside London [Pinder].) The *Arithmetick* asserts it was edited for publication by John Hawkins. But De Morgan asserts "I am perfectly satisfied that Cocker's Arithmetic is a forgery of Hawkins" and then spends several pages detailing this charge and showing that the book is a rather poor compilation from several better books [Augustus De Morgan, *Arithmetical Books from the Invention of Printing to the Present Time*, Taylor and Walton, London, 1847, pp.56-62; reprinted in: D. E. Smith; **Rara Arithmetica**; 4th ed., Chelsea, NY, 1970, pp.635-641]. However, Ruth Wallis [Wallis] has examined the case and finds De Morgan's arguments generally unfounded and sees no reason not to accept Hawkins' assertions at face value.

A number of descendents of **John Napier** were prominent in the 19C. Lady Sarah Napier was married to a descendent and was the mother of General Sir Charles James Napier (1782-1853), the conqueror of Sind who has a statue at SW corner of Trafalgar Square and monument in ***St. Paul's***. Lady Sarah lived at 13 (now 40) Cadogan Place, Chelsea. [Edmonds, below, p.29.] The general's younger brother, General Sir William Francis Napier (1785-1860), the historian of the Peninsular War, lived at Scinde House, now Victoria House, 84 Kings Avenue, Clapham Park, in 1849-1860.

Frederick Temple (1821-1902), Bishop of London in 1885-1896, previously mathematical lecturer at Balliol, later Archbishop of Canterbury, published a 'proof' of the Four Colour Theorem in 1889 [Biggs, Lloyd & Wilson, pp. 105, 108]. In the early 1850s, he was head of a school for training teachers in Kneller Hall, Twickenham. He is commemorated by a relief portrait plaque in ***St. Paul's Cathedral*** in the first alcove in the north aisle. See also under Lambeth Palace.

The monuments of **Christopher Wren** (1632-1723) are all about you in London (and also in Cambridge and Oxford). He attended Westminster School in the 1640s. He came to London as Gresham Professor of Astronomy in 1657 at the age of 25 and lived at Gresham College until 1661. In 1658, he determined the arc length of the cycloid. He was a founder FRS. At one time he devised a recording thermometer, a device for recording the direction of the wind and a recording rain gauge. He also discovered the true motion of the pendulum. In 1662, he devised an apparatus of suspended balls to study impact - Newton's Cradle?? - which Newton explicitly acknowledges as the demonstration of the laws of collision [Summerson, pp. 54-55]. Wren, Wallis and Huygens explicated the laws of collision in three papers to the Royal Society in 1668-1669.

Even before the Great Fire of 1666, he had been consulted about ***St. Paul's***. After the Great Fire, he began architecture in earnest, becoming Surveyor of the King's Works in 1669. Besides St. Paul's, he built 51 (or 52 or 53) other churches in London after the Great Fire of 1666, mostly completed by 1685. The foundation of St. Paul's was laid in 1675 and Wren's son placed the last stone in 1708. He also did the following.

An 18th century house called ***Cardinal's Wharf, 49 Bankside***, across the river from St. Paul's, has a 1951 plaque making the extremely dubious assertion that Wren lived in it while St. Paul's was being built. It is possible that he lived about 100 yards to the west, where a 1907 plaque on the London Hydraulic Power Company says Wren lived in a house on the site during the building of St. Paul's, and there is a 1789 drawing of the house with this information on it. The house was demolished in 1906, and indeed the Hydraulic Power Company closed down in 1977 and the area has been redeveloped so I don't know if this plaque is extant - I couldn't find in 1995. [Kent, pp.202-203.] [Dakers, p.299] describes the plaque at Cardinal's Wharf, but says that Wren's residence here is not proven. [Stephen Humphrey, *Southwark, Bermondsey & Rotherhithe A Second Selection*, Sutton Publishing, Stroud, Glos., 1997, p.9] says the Wren and Catherine stories were started by Malcolm Munthe, who lived in Cardinal's Wharf just after WW2. Humphrey has a photograph of it in c1935 showing no sign of the several coats of arms now over the doorway. Another source notes that the area would have been hardly suitable for a man of Wren's position.

Wren proposed decimal coinage in the late 17C. He is commemorated on the current 50 note.

Edwin Abbott Abbott (1838-1926), author of *Flatland* (1884), was a student at, and then Headmaster (1865-1889) of the ***City of London School***, which recently vacated its 1883 site facing the Thames by ***Blackfriars Bridge*** in 1883. The School has a portrait, a plaque and other mementoes of him, but I don't know if the plaque has been moved to the new site on the other side of the bridge. His house, at Wellside, Well Walk, Hampstead, has a plaque, but it commemorates the site of the Hampstead Wells. He is buried in the West Hampstead Cemetery, Fortune Green, West Hampstead, where his grave has been recently found by Tom Banchoff. [Ian Stewart (author of *The Annotated Flatland*, 2002) gave a talk about Abbott to the BSHM at the University of Greenwich, 4th May 2002 TM]

The Nightingale trail

Places on the way

St George's Circus http://en.wikipedia.org/wiki/St_George%27s_Circus
The Imperial War Museum http://www.iwm.org.uk/
Lambeth Palace http://www.lambethpalacelibrary.org/
St Thomas' Hospital http://www.guysandstthomas.nhs.uk/
Florence Nightingale Museum http://www.florence-nightingale.co.uk/details.htm
London Eye http://www.londoneye.com/
Westmister Bridge http://en.wikipedia.org/wiki/Westminster_Bridge
Houses of Parliament http://www.parliament.uk/
Westminster Abbey http://www.westminster-abbey.org/
Westminster School http://www.westminster.org.uk/index.asp
King's College London http://www.kcl.ac.uk
Victoria Embankment http://en.wikipedia.org/wiki/Victoria_Embankment

History

Historical text selections from http://www.dcs.warwick.ac.uk/bshm/zingaz/London.html
British Society for the History of Mathematics, written by David Singmaster

The birthplace of **Charles Babbage** (1791-1871) has been recently determined - it is about where Larcom St., SE17, enters Walworth Road in south London [Hyman, pp.5 & 10-11].. Following suggestions of Hyman and myself, a 'Historic Southwark' plaque was erected on the site in 1991. Baptised at St. Mary Newington on 6 Jan 1792. The Babbages move to 10 George Street, Adelphi, later called 10 York Buildings, in late 1799. In 1803, Charles's father and the family retire to Totnes, Devon.

FRS, 1816; FRSE, 1820. Helps found RAS, RSS, BAAS.

c1820, he begins work on his Difference Engine. In 1822, he has a prototype Difference Engine. In 1823, he is awarded one of the first Gold Medals of the Astronomical Society for the Difference Engine. In 1823, Babbage employs Joseph Clement at 21 Prospect Place, now 63 *St. George's Road*, near Elephant and Castle, and begins work on the Difference Engine to have 20 figures and constant 6th differences. The first three columns would have 6 extra places. It would have been 9' x 9' x 3'6" deep, have had 25,000 parts and have weighed c4 tons.

William Laud (1573-1645) was a mathematician in his youth. He was Bishop of London from 1630 and Archbishop of Canterbury from 1633. He was imprisoned in the Tower and executed on Tower Hill nearby [Greenwood (2), p.149 with portrait on p.150; Eastman, p.278]. See under ***Lambeth Palace***.

John Pell (1611-1685) was in London, c1638-1643, with Samuel Hartlib's group. He did not want to take holy orders, so he had to go to Amsterdam to find a teaching post in mathematics. He

became Chaplain to the Archbishop of Canterbury in 1661 [Ball (5), p.40] or to Gilbert Sheldon, Bishop of London sometime after the Restoration [DSB]). In the former case, he might have lived in ***Lambeth Palace***. An original FRS in 1663. The DSB says he lived for a time at Brereton Hall, but doesn't indicate where that is. (A Brereton was a founder fellow of the Royal Society.) He died in London. The equation $x^2 - ay^2 = 1$ is known as Pell's equation, though a form of it occurs in Archimedes and the Indian mathematicians of the first millennium had found a general method to find solutions. Even in the modern era, Fermat had anticipated Pell, but Pell did have an early discussion of an example in 1659 and Euler seems to have adopted Pell's name for it. It is a common equation and which occurs in many aspects of mathematics. Cf Brouncker, above.

Frederick Temple (1821-1902), Bishop of London in 1885-1896, previously mathematical lecturer at Balliol, later Archbishop of Canterbury, published a 'proof' of the Four Colour Theorem in 1889 [Biggs, Lloyd & Wilson, pp. 105, 108]. In the early 1850s, he was head of a school for training teachers in Kneller Hall, Twickenham. He is commemorated by a relief portrait plaque in St. Paul's Cathedral in the first alcove in the north aisle. See also under ***Lambeth Palace***.

Cuthbert Tunstall or Tonstall (1474-1559), Bishop of London in 1522, later of Durham in 1529/30, was the author of the first arithmetic book by an Englishman: *De Arte Supputandi*, of 1522. As a bishop during the English Reformation, he had a somewhat more exciting life than the average mathematician. Presumably he lived at Durham House on his London visits, in the Adelphi site, from 1529/30 until the house was exchanged with the Crown in 1535. His London seat was then Cold Harbour, located just east of where Cannon St. Station is now, until 1553, when the house was seized. He had been confined to the house from 20 May to 20 Dec 1551 until he was taken to the Tower and later to the King's Bench prison. He was deprived of his see in 1552/53. After Queen Mary's accession, he was released from prison on 6 Aug 1553 and restored to his position in Apr 1554. On Elizabeth's accession in 1558, he was again in trouble, being summoned to London in 1559 and ordered to consecrate Parker as Archbishop of Canterbury. He refused, and was again deprived of his post and confined to ***Lambeth Palace*** under Parker's custody, where he died on 18 Nov. Buried in St. Mary, Lambeth (plaque in the chancel).

Florence Nightingale (1820-1910) was a private student of Sylvester's. She called herself 'a passionate statistician', much impressed by the work of Quetelet. She was a pioneer in the use of statistics in hospitals. She exerted a great deal of effort in designing standard forms for hospital reports and trying to obtain uniformity in their use. In 1860, she and Dr. Farr (Registrar General) made up the program for the Sanitary Statistics section of the International Statistical Congress in London. She entertained many of the participants and the Congress expressed its approval of her work. In 1861, the Metropolitan Hospitals agreed to adopt a standard registration and record system, but little came of it. She also tried to get more questions onto the census forms. [Richard Francis Mould, *More of Mould's Medical Anecdotes,* Adam Hilger, Bristol, 1989, pp.233-242] She is commemorated by a statue on the Guards' Crimea monument in Waterloo Place at Pall Mall, showing her with a most inappropriate lamp, and panels around the base. The original plaster was at ***St. Thomas's Hospital***, which she helped to design, and was replaced with a bronze version in 1958, but it was stolen in 1970 and has been replaced by a cast in less valuable material. [Blackwood, pp.164-165]. A ***Florence Nightingale Museum*** has recently opened under the Nightingale Nurses' Home in the corner of St. Thomas's Hospital.

Lord Kelvin (William Thomson, 1824-1907) had a house at 15 Eaton Place, Belgravia. He generally lived at Glasgow or Largs (qv), but he had many duties which brought him regularly to London. Knighted in 1866 upon completion of the Atlantic Cable. Made Baron Kelvin in 1892 - the first scientist to be made a peer. PBAAS, 1871. Copley Medal of Royal Society, 1883. PRS, 1890-1895. Privy Councillor, 1902. Founder member Order of Merit, 1902. Buried in ***Westminster Abbey***, near Newton. Commemorated in a stained glass window with Henry V & Dick Whittington. This is confirmed by [Greenwood, p.182], but [Jimmy Black, *The Glasgow Graveyard Guide*, Saint Andrew Press, Edinburgh, 1992, p.48] says he is buried in the Necropolis, east of Glasgow Cathedral.

Isaac Newton (1642-1727) was Warden of the Mint from 1696 to 1699 while he supervised the complete remaking of the silver coinage. From 1699 until his death in 1727, he was Master of the Mint, a less responsible, but better paid, job. He may have lived briefly in the Warden's Residence, which was in the Tower, near the Jewel Tower, or he may have lived in the west side of the Bell Tower, or he may have lived nearby in Haydon Square, in the Minories. [Dyer; Eastman, p.268; Craig, p.13] He moved to 88 Jermyn St., just south of Piccadilly, from 1697 to 1700. He then moved next door to 87 Jermyn St. (Blue Plaque), where he stayed until 1709. He spent a year at Ship House, which was on the site of the present Durham House, Durham Terrace, Chelsea in 1709-1710 [Craig, pp.28 & 76, Richard Edmonds, *Chelsea From the Five Fields to the World's End*, Phene Press, London, 1956, p.66]. He later lived in a house on the site of the Westminster Central Reference Library in St. Martin's St., off Leicester Sq., apparently as a town house. In 1834, there was a proposal to preserve this house in a colossal truncated pyramid with a sphere on top [Lucinda Lambton, *An Album of Curious Houses*, Chatto & Windus, 1988, p.157]. The house was demolished in 1913, but the fore parlour was re-erected at the Babson Institute in the USA [Archibald (2), p.84]. There is a wall inscription on the Library saying Newton lived here from 1710 to 1727 [Eddie Mizzi has provided a photo]. There is a plaque on the adjacent Orange Street Congregational Church stating that Newton's house was built in 1710. ([Eastman, p.268] seems to indicate that the Church building is 35 St. Martin's Street and was Newton's actual house.) In Long's Court, beside the Library, is a doorway labelled 'The Newton Institute', but the Institute is now defunct and is used as a church hall.

Other memorabilia are in the Royal Society, qv, and he is buried in ***Westminster Abbey***, qv.

"Alice" Liddell was born at 19 Dean's Yard in 1852 while her father was headmaster of ***Westminster School***. They moved to Oxford in 1855. She was married to Reginald Hargreaves in Westminster Abbey on 15 Sep 1880. She later lived in Lyndhurst, Hampshire, but was cremated at Golders Green Crematorium in 1934. [Jackman].

Bishop George Berkeley (1685-1753), of *The Analyst*, lies in ***St. Clement Danes, Aldwych***. However, I recently visited the church, which was heavily damaged in the last war. No monuments and no records survived, so the Church has no knowledge of Berkeley. A crypt of coffins was cleared after the war and the churchyard is now under the roadway, so it seems unlikely that he can be found. But Houghton says he was buried in Christchurch Cathedral, Oxford, and [Hammond, p.110] says he was buried at Oxford. Berkeley set out on his trip to the New World from Gravesend in Sep 1728 [Houghton].

Arthur Cayley (1821-1895) was born in Richmond, now part of SW London [Ball (5), p.134]. His father was a Russia merchant and had a business in Great Winchester Street. He was a student at

King's College London, 1834-1838. After Cambridge, he returned to London as a student at Lincoln's Inn in 1846. FRS 1852. He lived in several houses in Blackheath, south of Greenwich. He probably spent his early life at 59 Lee Road (demolished), then lived at Cambridge House, The Grove (now West Grove), from 1847 to 1852 (burnt down later), and later at 5 Montpelier Road (still standing) from 1852 to 1871. He practised at 2 Stone Buildings, Lincoln's Inn (qv under London Inns of Court) in 1849-1863. [Tony Crilly; A Victorian mathematician - Arthur Cayley (1821-1895); *Math. Gaz.* 79 (No. 485) (Jul 1995) 259-262]

There is a Blue Plaque on the house at 42 Rutland Gate where **Sir Francis Galton** (1822-1911), the statistician and eugenicist, lived in 1858-1911. He studied medicine at King's College London. Helped set up Meteorological Office and NPL. His book *Meteorographica* is the first attempt to map the weather on a large scale and is the foundation of meteorology. He originated the ideas of correlation and regression. In 1872, he published "Statistical inquiries into the efficacy of prayer". Despite numerous daily prayers for their health, English sovereigns do not live significantly longer and eminent clergymen have somewhat shorter lives than the average gentry. He also noted that missionaries have shorter lives than average and that churches are as likely as other buildings to be struck by lightning, burned down or destroyed by earthquakes. He created the word 'eugenics', founded the Eugenics Society and set up the Eugenics Laboratory at UCL (presumably that which is now called the Galton Laboratory) in 1904. His will established the Chair of Eugenics at UCL, with Karl Pearson to be the first holder. He also invented the ultrasonic dog whistle and developed fingerprinting into a practical method. He had studied at ***King's College*** Medical School. [Low, pp.115-118]

John Stuart Mill (1806-1873) was born at 12 Rodney Terrace (now Rodney Road), Pentonville, and lived there until 1810. The house is gone. In 1810, they stayed briefly at one of **Bentham**'s houses, where Milton had lived! In 1810-1814, they lived at Newington Green [Eastman, p.401]. In 1814-1831, his parents and he lived at what is now 40 Queen Anne's Gate, part of Jeremy Bentham's property - Bentham was in the adjacent house. He spent 1824-1858 as a civil servant in the East India Company, rising to a high position. In 1831-1836, his parents and he lived in a vanished villa in what is now Vicarage Gate, Kensington Church Street, where James Mill died in 1836. He then lived at 18 Kensington Square (Blue Plaque) in 1837-1851, where he wrote his *System of Logic* (1843) and *Principles of Political Economy* (with Harriet Taylor, 1848). [Dakers, p.182; Blackwood, pp.122-123.] In 1851, after she had been widowed, Mill married his long-time friend and collaborator Harriet Taylor. He then bought a house in Blackheath Park (vanished). After her death in Avignon in 1858, he stayed there most of the rest of his life, but had a home at 10 Albert Mansions, Victoria Street, in 1871-1873 (vanished). [Eastman, p.265.] Statue on ***Victoria Embankment***, east of Temple Station [M. Baker, p.58; Blackwood, pp.122-123].

The Wittgenstein trail

Places on the way

Site of Kings Bench Prison http://en.wikipedia.org/wiki/King's_Bench_Prison
St George the Martyr Church http://www.stgeorgethemartyr.fsnet.co.uk/history.html
St Guy's Hospital http://www.guysandstthomas.nhs.uk/
Southwark Cathedral http://www.southwark.anglican.org/cathedral/
London Bridge http://www.oldlondonbridge.com/index.shtml
Queen's Walk http://en.wikipedia.org/wiki/The_Queen's_Walk
City Hall http://www.london.gov.uk/london-life/city-government/index.jsp
Tower Bridge http://www.towerbridge.org.uk/TowerBridge/English
Tower of London http://www.hrp.org.uk/toweroflondon/
Monument http://en.wikipedia.org/wiki/Monument_to_the_Great_Fire_of_London

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arguments generally unfounded and sees no reason not to accept Hawkins' assertions at face value.

Ludwig Wittgenstein found the war prevented him from thinking and became a porter at ***Guy's Hospital***, near London Bridge, in 1939. He was transferred to a Medical Research Council unit studying shock, as a lab technician. This unit later moved to Newcastle, qv, in Apr 1943. [Lenihan, p. 192]

John Harvard (1607-1638) was born in Southwark and christened at St. Saviour's (***Southwark Cathedral***). Student at Emmanuel College, Cambridge, in 1627-1635. In 1637, he went to Massachusetts and left 800 (= $2000) and his library of 320 books to a new college which was later named for him. His family owned the Queen's Head Inn, formerly at ***103 Borough High Street***, (Southwark plaque) [Southwark; B. Bailey, p.59 has a photo] and I recall that the proceeds of the sale financed Harvard in the New World. [Griffinhoofe, p.77] implies that the inn belonged to his wife's family. Commemorative chapel and window in Southwark Cathedral.

William, 2nd Viscount Brouncker (c1620-1684), corresponded with Fermat and introduced continued fractions to solve the misnamed Pell's equation - cf Pell, below. He also found a (the first?) series for the logarithm and proposed a new musical scale with 17 notes. MP for Westbury in the convention parliament of 1660. A founder FRS and President from the first Charter, 1662-1677. President of Gresham College, 1664-1667. Later a high official in the Admiralty and hence a good friend of Pepys who saw him several times a week. Lived in St. James's Street, Westminster, and died there. Buried in the chapel of St. Catherine's Hospital (Katharine?), near the ***Tower***, of which he had been Master since 1681. Portrait by Lely in the RS. [DNB]

Thomas Harriot (or Harriott) (1560-1621), the early algebraist and astronomer, inventor of the signs < and > (in somewhat different forms), was navigational tutor to Sir Walter Raleigh and his sea captains. In 1585 he went to Virginia and made the first survey of it. While there, he was the first English traveller to record an Indian language, Algonkin, creating a phonetic alphabet and compiling a dictionary. On his return from Virginia in 1585 or 1586, Harriot is said to have been in charge of the consignment of potatoes brought from Peru by Drake and hence was responsible for distributing them in Britain and Ireland. His *A briefe and true report of the new found land of Virginia* of 1588 was one of the earliest descriptions of any part of North America.

He was part of the household of Henry Percy, ninth Earl of Northumberland (1564-1632), from about 1588 (or 1598). The Earl was a notable patron of learning, known as the 'Wizard Earl': Thomas Allen (qv), John Dee, and Nathaniel Torperley were friends and regularly met with him. The Earl was suspected of being part of the Gunpowder Plot in 1605 and spent the next 16 years imprisoned in the ***Tower*** where the group met regularly. They were generally known as 'Henry and his three Magi' - though I'm not sure which the three were - [Muriel Seltman & Eddie Mizzi, 'Thomas Harriot: Father of English algebra?'; *Math. Intell.* 19:1 (1997) 46-49] say they were Harriot, Walter Warner and Thomas Hughes. Raleigh, Harriot, Christopher Marlowe and the Earl were named 'The School of Night' by Shakespeare [Blackwood, p.306]. The earliest known English globe, by Emery Molyneux in 1592 and believed to have been presented by Raleigh to the Earl while they were both in the Tower, is at Petworth House, West Sussex (qv).

He died at the house of Thomas Buckner in Threadneedle St. He was buried in the church of St. Christopher le Stocks in Threadneedle St. His monument was destroyed in the Great Fire. The site was taken over by the ***Bank of England*** in 1781 [Rukeyser, pp.290-299]. Jon Pepper says all the remains in the church were then translated to Nunhead Cemetery in south London, but he hasn't got the vault numbers to hand. In 1971, a commemorative plaque, bearing the original wording of the destroyed monument, was placed inside the Bank of England, to the left of the main door, about where the church was. Unfortunately the public is not admitted at the main door, but if you ask at the Bank of England Museum (entrance in Bartholomew Lane) or telephone the Bank, you may be shown the plaque. Walter Warner edited Harriot's algebraic writings as *Artis Analytic Praxis ...* some years after his death, but much of his work remains in manuscripts in the British Library.

William Laud (1573-1645) was a mathematician in his youth. He was Bishop of London from 1630 and Archbishop of Canterbury from 1633. He was imprisoned in the ***Tower*** and executed on ***Tower Hill*** nearby [Greenwood (2), p.149 with portrait on p.150; Eastman, p.278].

Jonas Moore was made tutor to the Duke of York by Charles I. A friend of Pepys, who records : "Up, and to my chamber, whither Jonas Moore comes, ... and tells me the mighty use of Napier's bones" [Pepys, 26 Sep 1667]. FRS, 1674. Surveyor General of the Ordnance and Governor of the ***Tower of London***, c1675. Instigator of the Royal Observatory, qv, and he even donated the instruments to Flamsteed because there were no funding for them. Flamsteed was his guest at the Tower for the year before he became Astronomer Royal. A founder of Christ's Hospital school - he wrote *New Systeme of the Mathematics*, with contributions from Flamsteed and Halley, for the school.

Cuthbert Tunstall or Tonstall (1474-1559), Bishop of London in 1522, later of Durham in 1529/30, was the author of the first arithmetic book by an Englishman: *De Arte Supputandi*, of 1522. As a bishop during the English Reformation, he had a somewhat more exciting life than the average mathematician. Presumably he lived at Durham House on his London visits, in the Adelphi site, from 1529/30 until the house was exchanged with the Crown in 1535. His London seat was then Cold Harbour, located just east of where Cannon St. Station is now, until 1553, when the house was seized. He had been confined to the house from 20 May to 20 Dec 1551 until he was taken to the ***Tower*** and later to the ***King's Bench prison***. He was deprived of his see in 1552/53. After Queen Mary's accession, he was released from prison on 6 Aug 1553 and restored to his position in Apr 1554. On Elizabeth's accession in 1558, he was again in trouble, being summoned to London in 1559 and ordered to consecrate Parker as Archbishop of Canterbury. He refused, and was again deprived of his post and confined to Lambeth Palace under Parker's custody, where he died on 18 Nov. Buried in St. Mary, Lambeth (plaque in the chancel).

Examples of questions from Neeru Modi, South Thames College

1)

A) A box contains the letters of the Guy's Hospital. One letter is picked out at random. Find the probability that the letter is a consonant:

a) 8/12
b) 4/8
c) 4/12

B) Find the probability that the letter is a vowel:

a) 8/12
b) 4/8
c) 4/12

2) Open Questions

These rubbish bins hold 500kg of rubbish in each

a) Find the population of the Southwark area (find using the internet)
b) How much rubbish is discarded by each person in kg (find using internet)
c) Calculate the amount of rubbish collected per week in this area
d) Calculate the amount of rubbish that can be collected from the whole of England
e) If the volume of one of these containers is 8 square meters, what are the possible length, widths and heights of the container?
f) If the volume of the container is 36 square metres, what are the possible length, widths and heights of the container?

3) The Scoop is an outdoor area to the west of city hall. What is the shape of the scoop?

   a. Oval
   b. Circle
   c. Sphere

Answer the following question and show your working out:

4) City Hall is 45 metre high with 185000 square feet of floor space spread over 10 floors. Approximately calculate the total volume of the building.

5)

A) The length of Tower Bridge is 800 feet. What is the length of the bridge in metres?

   a. 200m
   b. 280m
   c. 244m

B) Tower Bridge cost £1,184,000. Write that amount in words:

   a. One hundred and eighty four thousand pounds
   b. One million one hundred and eighty four thousand pounds
   c. One million and eighty four thousand pounds

Maths Trails

Adult Numeracy Core Curriculum

Number
N

Whole numbers
N1

- Count, read write, order and compare
- Whole numbers
- Add
- Subtract
- Multiply
- Divide
- Round
- Ratio and proportion
- Expressions and formulae
- Use a calculator
- Estimate answers

Fractions/ decimals/ percentages
N2

- Read, write, order and compare fractional numbers
- Add
- Subtract
- Multiply
- Divide
- Fractions
- Decimals
- Percentages
- Equivalent fractions
- Percentage change
- Percentage parts

Measures, shape and space
MSS

Common measures
MSS1

- Money
- Currency conversion
- Time
- Length, weight and Capacity
- Temperature
- Estimate measurements
- Convert units of measure
- Read simple scales
- Scale drawings

Shape and space
MSS2

- 2-D and 3-D shape
- Perimeter
- Area
- Volume
- Positional vocabulary

Handling data
HD

Data and statistical measures
HD1

- Lists, tables and diagrams
- Graphs, charts and pictograms
- Sort and classify objects
- Collect and record numerical information
- Organise and represent data
- Discrete data
- Continuous data
- Averages and spread

Probability
HD2

- Concept of probability
- Express probability
- Combined events
- Independent events
- Record outcomes