Baker Street *Elementary*

PRESENTS

"THE LIFE AND TIMES IN VICTORIAN LONDON"

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THE LIFE AND TIMES IN VICTORIAN LONDON
129 – ADDING IT UP - MATHEMATICS – AUGUST, 2023

WELCOME TO TOPIC NUMBER # 129… TODAY WE WILL BE LOOKING AT MATHEMATICS DURING THE VICTORIAN PERIOD.

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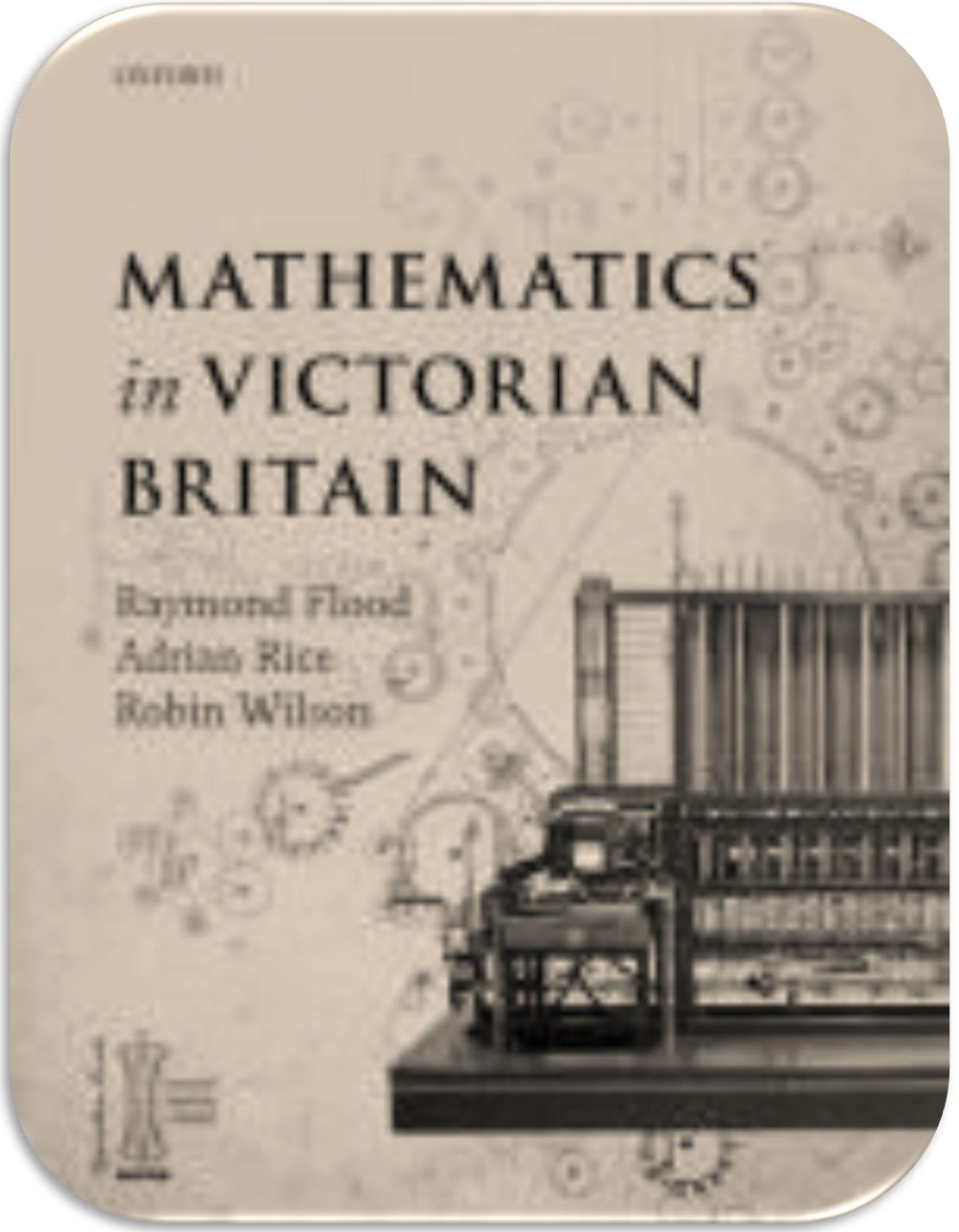
IN 'THE FINAL PROBLEM,' YOU DESCRIBE MORIARTY'S EARLY CAREER AS 'EXTRAORDINARY,' HAVING WRITTEN A TREATISE ON THE BINOMIAL THEOREM AT AGE 21.

THE PIECE WAS CONSIDERED STRONG ENOUGH TO HELP HIM ATTAIN A UNIVERSITY MATHEMATICS CHAIR… YOU WERE NO SLOUCH WHEN IT CAME TO THE SUBJECT EITHER, ALTHOUGH JAMES O'BRIEN CONTENDED HE WAS MORE ADEPT AT CHEMISTRY.

IN A STUDY IN SCARLET AND THE SIGN OF FOUR, FOR EXAMPLE, YOU MENTION EUCLID… SHOWING MORIARTY IS NOT THE ONLY ONE WHO KNEW HIS ANCIENT GREEK THEOREMS… AND YOU DO SOME ACTUAL COMPUTATIONS IN 'THE ADVENTURE OF THE MUSGRAVE RITUAL' AND 'THE ADVENTURE OF SILVER BLAZE.'

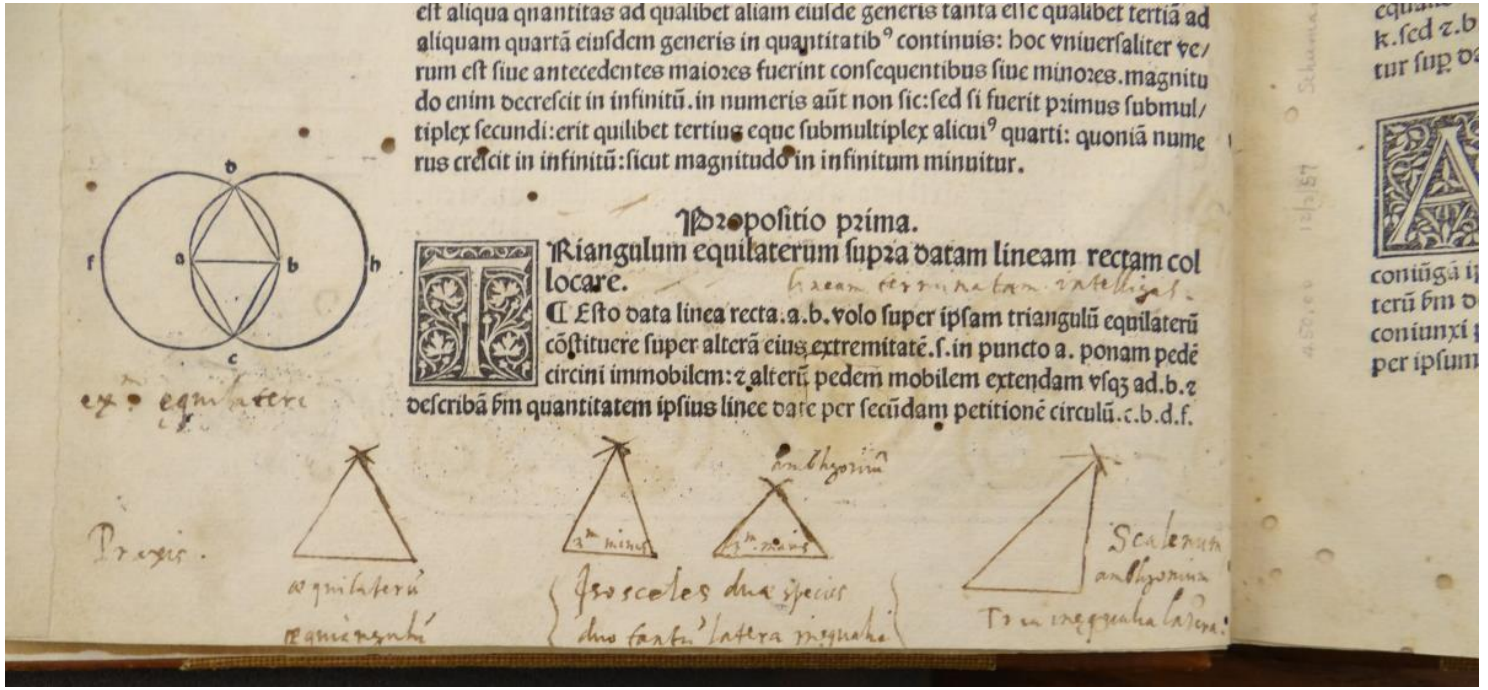
MATHEMATICS MADE SEVERAL SHIFTS DURING THE VICTORIAN PERIOD, FROM AMATEUR ENTHUSIASTS THAT INCLUDED LAWYERS AND THE CLERGY TO TRUE PROFESSIONALS, WITH YOU AND MORIARTY REFLECTING THESE TWO PATHS WITHIN THIS DISCIPLINE.



DESPITE HAVING LIVED MORE THAN TWO THOUSAND YEARS AGO, EUCLID'S TREATISES ON MATHEMATICS, GEOMETRY, AND LOGIC (ELEMENTS) PROVIDED A BASIS FOR ALL WORK THAT FOLLOWED HIM AND ARE STILL USED TODAY.

WHILE USED BY ISLAMIC MATHEMATICIANS AS EARLY AS THE NINTH CENTURY, KNOWLEDGE OF EUCLID'S WORKS IN EUROPE OCCURRED AT LEAST TWO HUNDRED YEARS LATER AND DID NOT BECOME WIDELY KNOWN UNTIL THE LATE 1400s WHEN THE PRINTING PRESS PROVIDED THE FIRST COPIES OF ELEMENTS IN 1482.

TWO OF HIS ELEMENTS ARE SPECIFICALLY MENTIONED IN THE CANON: THE BINOMIAL THEOREM AND 'THE RULE OF THREE.'



est aliqua quantitas ad qualibet aliam eiusde generis tanta erit qualibet tertia ad aliquam quartã eiusdem generis in quantitatib⁹ continuis: hoc vniuersaliter ve/ rum est siue antecedentes maiores fuerint consequentibus siue minores. magnitu do enim decrescit in infinitũ. in numeris aũt non sic: sed si fuerit primus submul/ tiplex secundi: erit quilibet tertius eque submultiplex alicui⁹ quarti: quoniã nume rus crescit in infinitũ: sicut magnitudo in infinitum minuitur.

Propositio prima.

Triangulum equilaterum supra datam lineam rectam col locare.

¶ Esto data linea recta. a. b. volo super ipsam triangulũ equilaterũ cõstituere super alterã eius extremitatẽ. s. in puncto a. ponam pedẽ circini immobilem: z alterũ pedem mobilem extendam vsq; ad. b. z describã tm quantitatem ipsius linee date per secũdam petitionẽ circulũ. c. b. d. f.

Praxis.

MOST WILL RECOGNIZE THE COMMON EXPRESSION OF THE BINOMIAL DEVELOPED BY EUCLID AS

$$(A + B)^2 = A^2 + 2AB + B^2$$

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

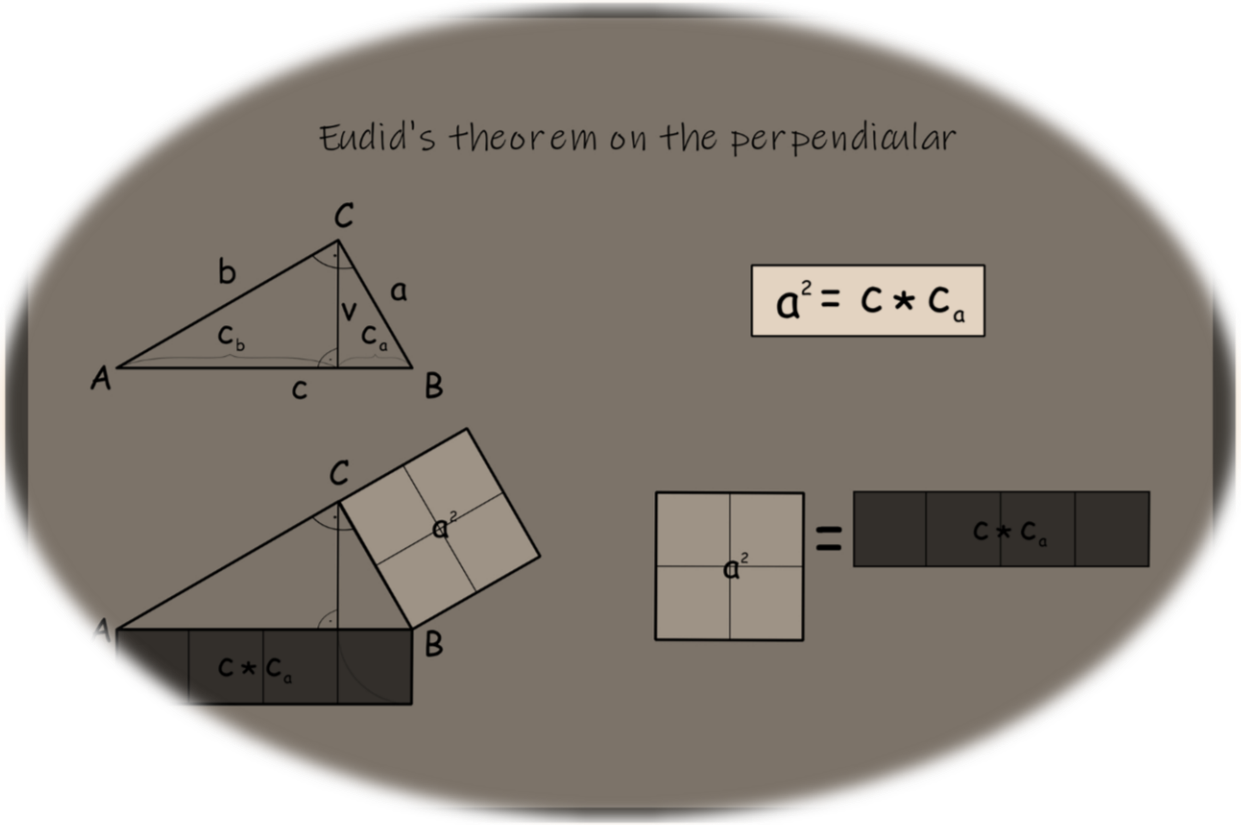
1 5 10 10 5 1

1 6 15 20 15 6 1

1 7 21 35 35 21 7 1

BUT SIR ISAAC NEWTON PROPOSED THE MORE GENERALIZED EXPRESSION FOR ANY POSITIVE INTEGER N AND THE SUM OF ANY TWO NUMBERS TO THE POWER OF N AS

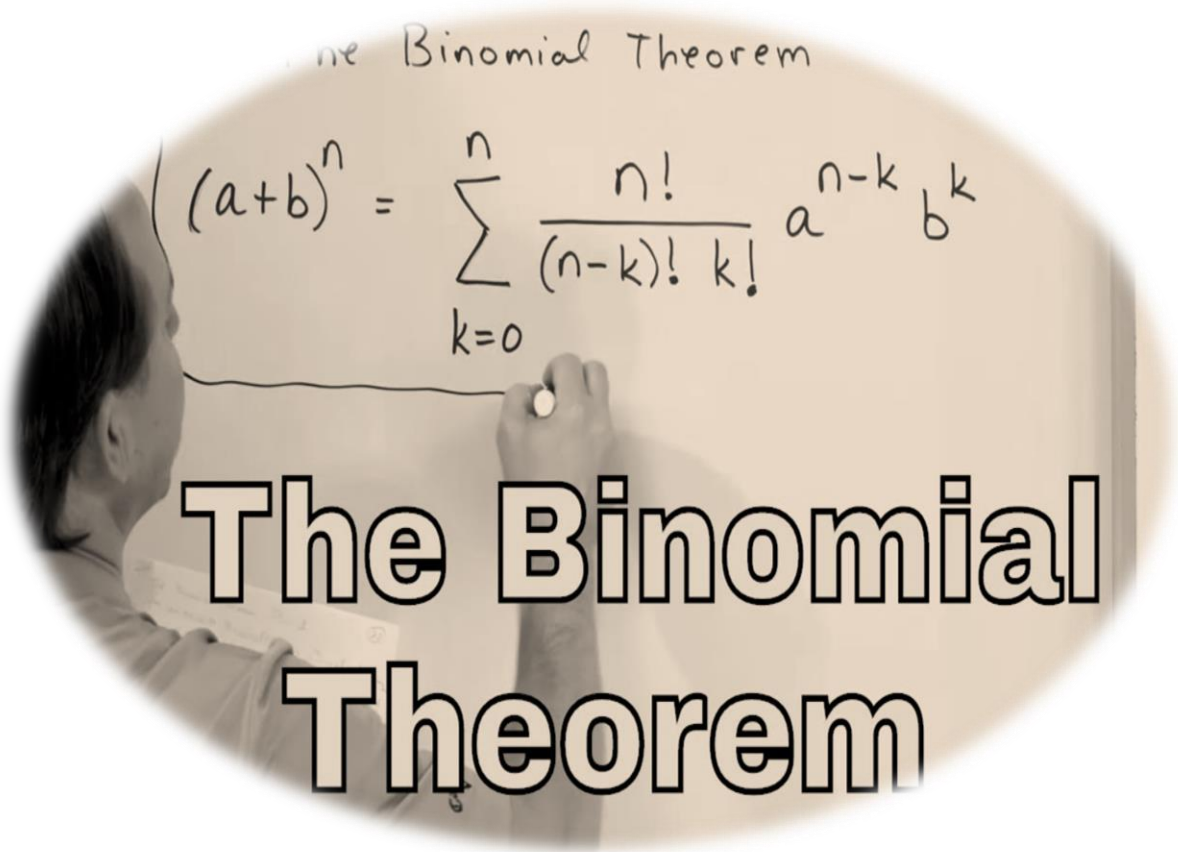
$$\binom{n}{r} a^{n-r} b^{r}$$



MORIARTY'S CONTRIBUTION IN THIS AREA WOULD HAVE FURTHER PROOF OR USE OF THIS EQUATION.

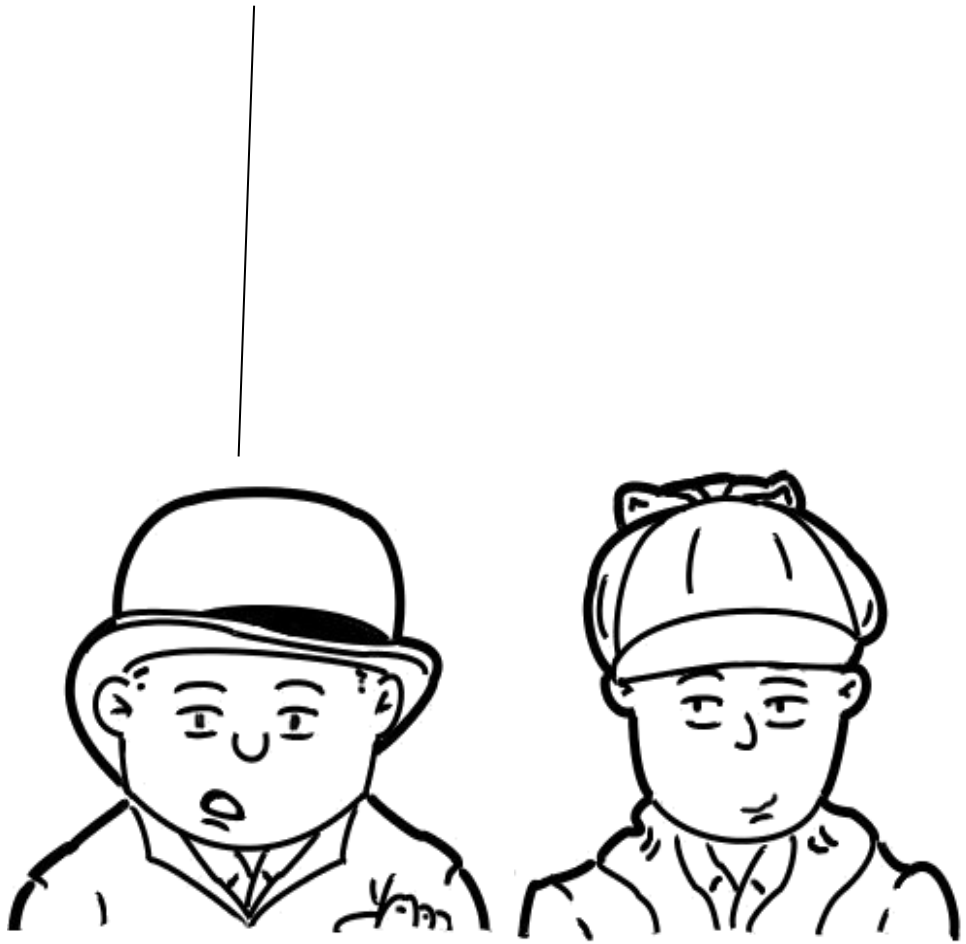
THIS PROPOSITION INVOLVED SOLVING FOR THE FOURTH ELEMENT OF A PROPORTION WHEN THREE ARE KNOWN, OR

IF AB=CD, THEN D=AB/C, IF A, B, AND C ARE KNOWN.



THE PERVASIVENESS OF EUCLID'S WORK CAN ALSO BE SEEN IN CAMBRIDGE'S FAMOUS TRIPOS.

STUDENTS PLANNING TO GRADUATE WITH HONORS HAD TO PASS A FINAL EXAMINATION—CALLED THE TRIPOS—WHICH COVERED EUCLID'S FIRST BOOKS AND NEWTON'S PRINCIPIA MATHEMATICA.



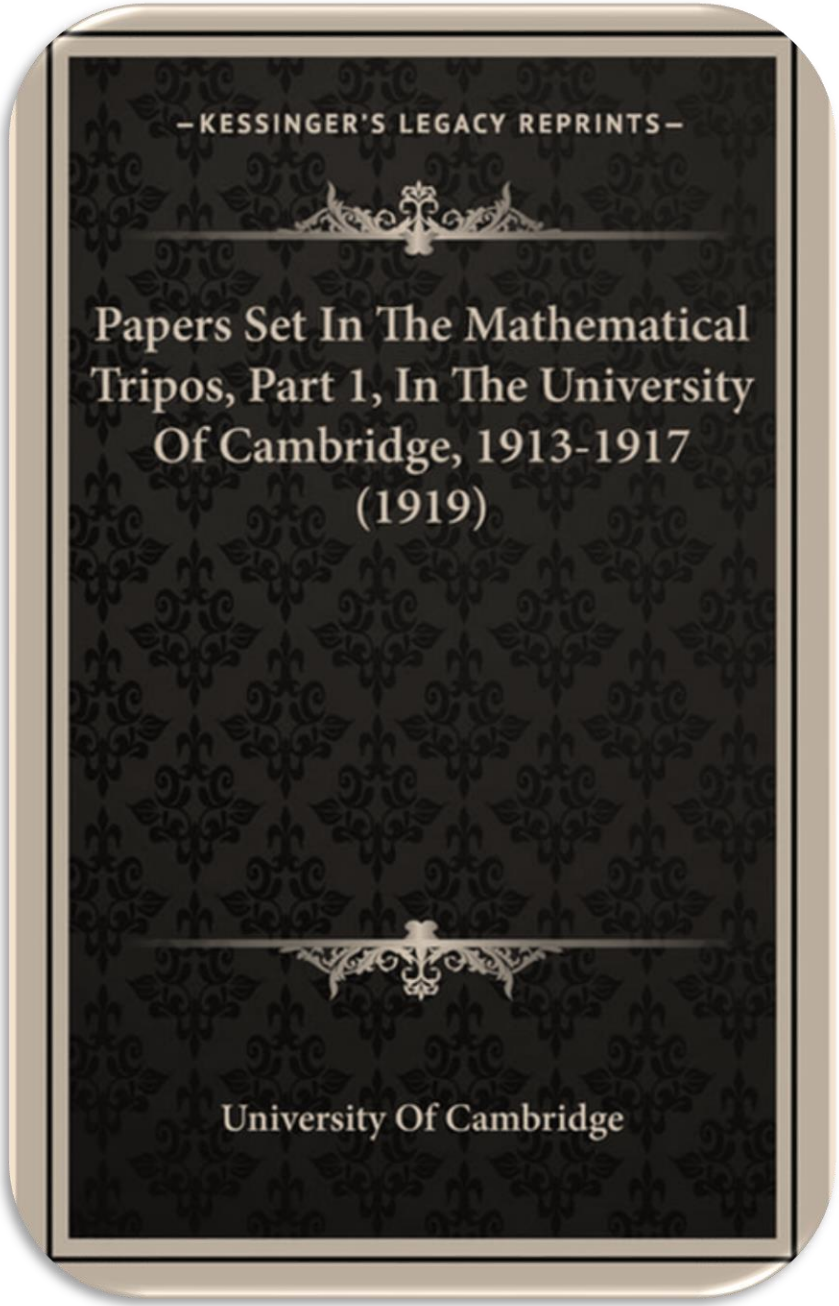
ath Tripos 1884 Exam Questio
University of Cambridge

$$\int_0^\infty \frac{\sin x}{x}\,dx = \int_0^\infty \left(\frac{\sin x}{x}\right)^2 dx = \frac{3}{4}\int_0^\infty \left(\frac{\sin x}{x}\right)^3 dx = \frac{3}{2}\int_0^\infty \left(\frac{\sin x}{x}\right)^4 dx$$

Mathematics

THE TEST WAS SO DIFFICULT AND REQUIRED MEMORIZATION OVER CREATIVITY, STUDENTS HIRED SPECIAL TUTORS TO DRILL THEM THROUGHOUT THEIR TIME AT THE UNIVERSITY.

THE GOAL OF THIS AND OTHER MATHEMATICAL STUDIES AT CAMBRIDGE WAS TO TRAIN STUDENTS (PRIMARILY SEEKING CAREERS IN LAW OR THE CHURCH) TO THINK LOGICALLY.



AS A RESULT, THE CURRICULUM WAS NOT UPDATED AND DID NOT INCLUDE THE ADVANCES THAT WERE APPEARING ON THE CONTINENT WITH RESPECT TO ANALYTICAL APPLICATIONS.

MATHEMATICAL PROBLEMS

ON

THE FIRST AND SECOND DIVISIONS OF THE SCHEDULE OF SUBJECTS

FOR THE

CAMBRIDGE MATHEMATICAL TRIPOS EXAMINATION.

DEVISED AND ARRANGED

BY

JOSEPH WOLSTENHOLME, M.A.

LATE FELLOW AND TUTOR OF CHRIST'S COLLEGE;
SOMETIME FELLOW OF ST JOHN'S COLLEGE;
PROFESSOR OF MATHEMATICS IN THE ROYAL INDIAN ENGINEERING COLLEGE.

"Tricks to shew the stretch of human brain,
More curious pleasure, or ingenious pain."
POPE, *Essay on Man*.

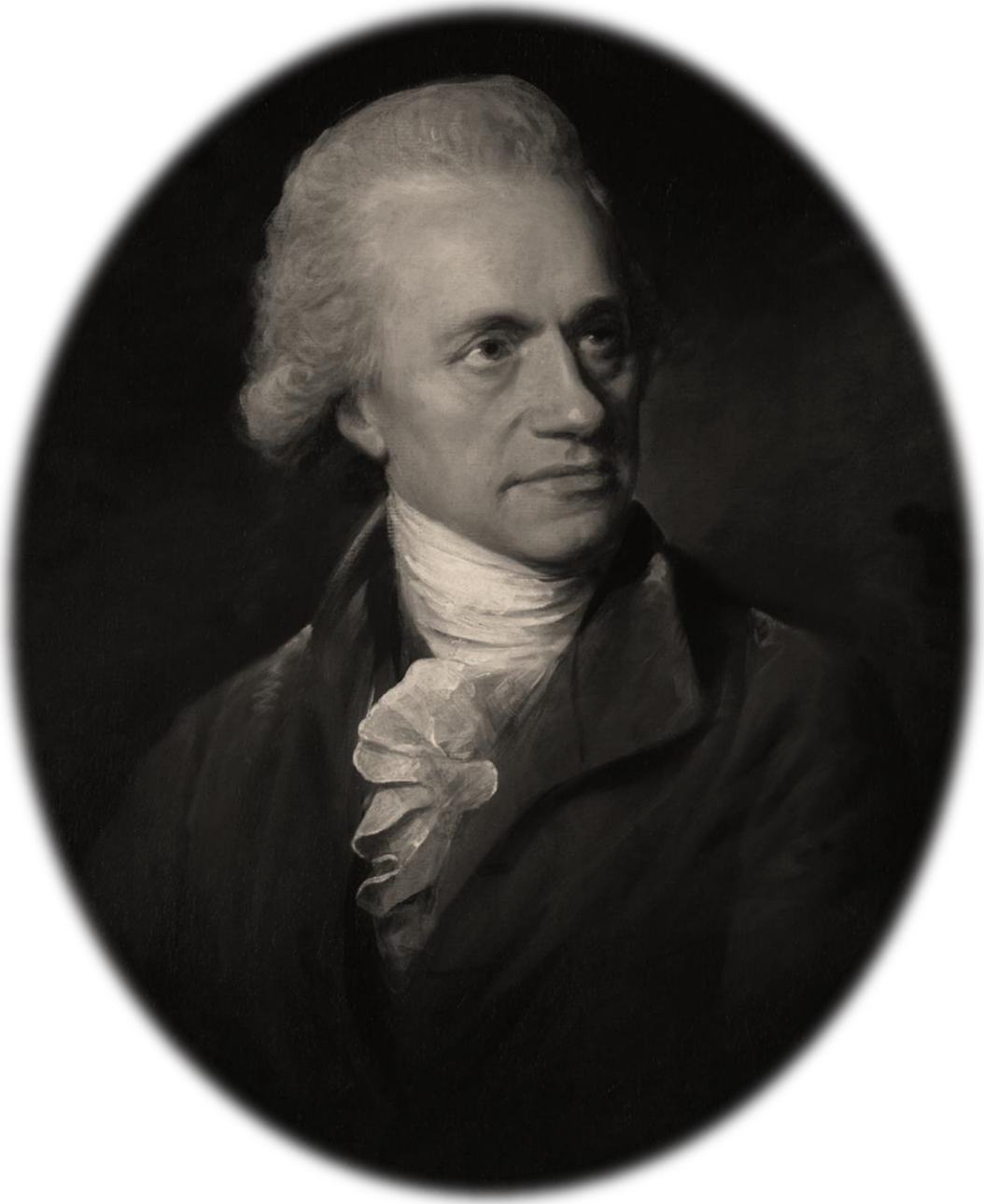
SECOND EDITION, GREATLY ENLARGED.

London:
MACMILLAN AND CO.
1878

[*The Right of Translation is reserved.*]

SEEN BY PRESERVATION SERVICES
DATE.....

DESPITE THIS ANTIQUATED APPROACH, CAMBRIDGE BECAME THE FOREFRONT OF TRUE MATHEMATICAL UNDERSTANDING THANKS TO A GROUP OF UNDERGRADUATES.



THE THREE TOP STUDENTS AT CAMBRIDGE DURING 1809-1810 (FREDERICK WILLIAM HERSCHEL, GEORGE PEACOCK, AND CHARLES BABBAGE) AND OTHERS FORMED THE ANALYTICAL SOCIETY AT CAMBRIDGE TO INTRODUCE THE ANALYTICAL METHODS USED ON THE CONTINENT TO ADVANCE MATHEMATICS.

SOME OF ITS MEMBERS WENT ON TO MODERNIZE THE TRIPOS TO REFLECT THIS MORE INNOVATIVE APPROACH.

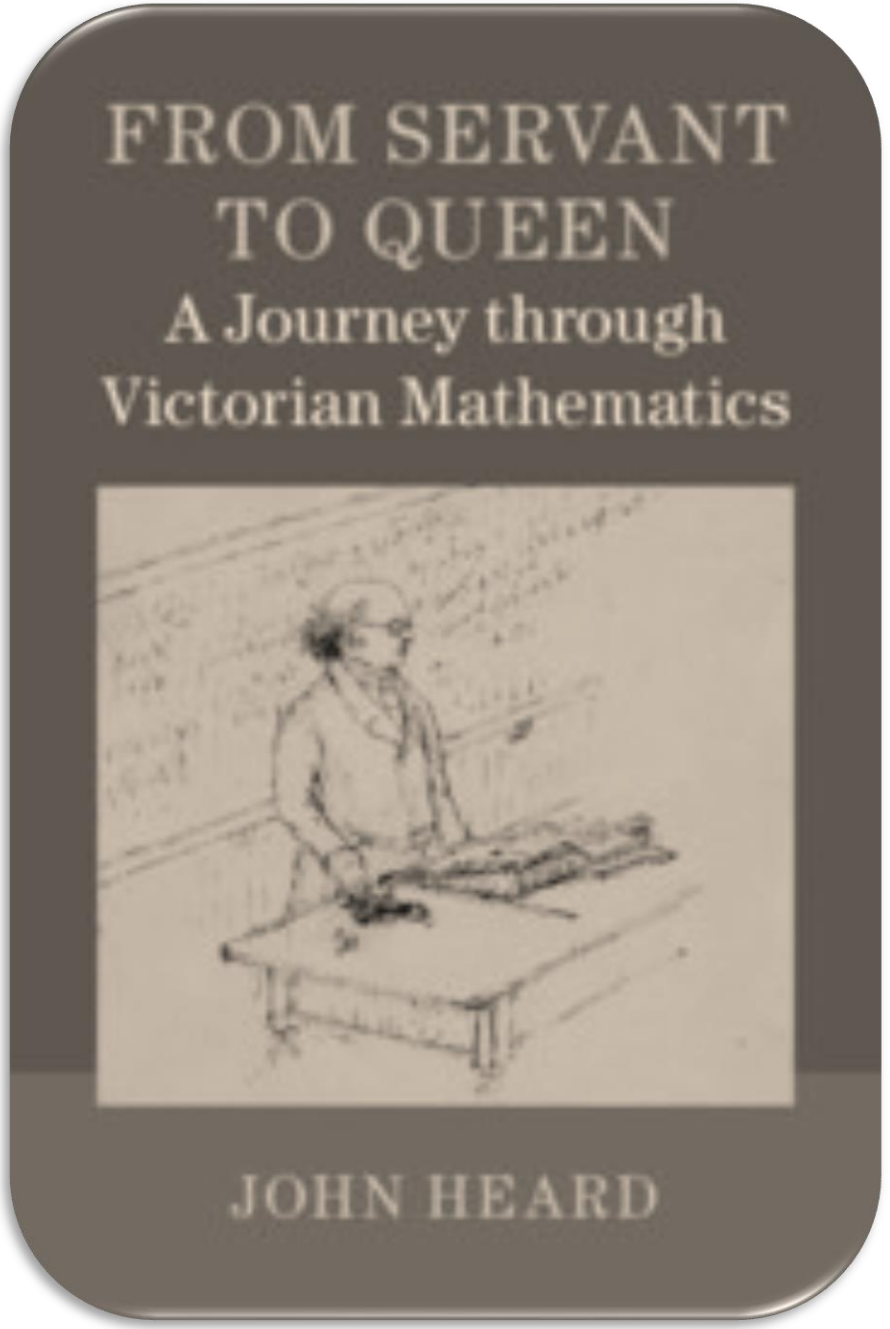
EVEN WITH THE EFFORTS OF THIS SHORT-LIVED SOCIETY AND OTHER PIONEERS IN THE AREA, THE SHIFT TOWARD A MORE PROFESSIONAL APPROACH REGARDING MATHEMATICS WAS A GRADUAL ONE.

W. W. Rouse Ball

Babbage... gave the name to the [Cambridge] Analytical Society, which he stated was formed to advocate 'the principles of pure d-ism as opposed to the dot-age of the university.'

MANY 'RECREATIONAL' MATHEMATICIANS PARTICIPATED IN MATHEMATICAL SOCIETIES AND JOURNALS SUCH AS THE EDUCATIONAL TIMES, WHICH PUBLISHED PROBLEMS FOR READERS TO CONTRIBUTE AND SOLVE, INCLUDING CHARLES DODGSON (LEWIS CARROLL), WHOSE ALICE ADVENTURES INCLUDE NUMEROUS PUZZLES INVOLVING LOGIC.

IT WAS NOT UNTIL THE END OF THE CENTURY THAT TRUE MATHEMATICIANS DOMINATED THE FIELD.



CLEARLY, MY OWN INTEREST IN MATHEMATICS FOCUSED ON ITS PRACTICAL USE (SUCH AS ITS ASSISTANCE IN UNLOCKING THE TRUE MEANING OF THE MUSGRAVE RITUAL) BUT WITH A BACKGROUND IN THE ANALYTICAL SIDE AS WELL…

…AS ONE OF THE MORE ADVANCED RECREATIONAL MATHEMATICIANS… THUS, I COULD APPRECIATE AND UNDERSTAND MORIARTY'S PROFESSIONAL CONTRIBUTION TO THE SPHERE AS WELL.

SO, WE HAVE COMPLETED TOPIC # 129 IN OUR SERIES…

IN TOPIC # 130, WE WILL BE LOOKING AT MATHEMATICS DURING THE VICTORIAN PERIOD.

ORIGINAL SOURCE MATERIAL FOR FOR THIS TOPIC:

- JAMES O'BRIEN, THE SCIENTIFIC SHERLOCK HOLMES, OXFORD: OXFORD UNIVERSITY PRESS, 2013.
- HTTPS://WWW.BRITANNICA.COM/BIOGRAPHY/EUCLID-GREEK-MATHEMATICIAN
- HTTPS://WWW.ENCYCLOPEDIA.COM/SCIENCE/ENCYCLOPEDIAS-ALMANACS-TRANSCRIPTS-AND-MAPS/NINETEENTH-CENTURY-EFFORTS-PROMOTE-MATHEMATICS-EDUCATION-GRADE-SCHOOL-UNIVERSITY-LEVEL
- HTTPS://WWW.BRITANNICA.COM/SCIENCE/BINOMIAL-THEOREM
- HTTPS://LINK.SPRINGER.COM/ARTICLE/10.1007/S00283-022-10170-5
- HTTPS://PILLARS.TAYLOR.EDU/CGI/VIEWCONTENT.CGI?ARTICLE=1008&CONTEXT=ACMS-2013
- HTTPS://WWW.MATHS.CAM.AC.UK/ABOUT/HISTORY
- SALLY MITCHELL (ED.) VICTORIAN BRITAIN: AN ENCYCLOPEDIA, NEW YORK: GARLAND PUBLISHING, INC., 1988

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"THE LIFE AND TIMES IN VICTORIAN LONDON"

IS CREATED THROUGH THE INGENUITY & HARD WORK OF:
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