Émilie du Châtelet

http://projectvox.library.duke.edu/du-chatelet-1706-1749/

Required Reading

The required reading is a biography of Émilie du Châtelet which begins below the list of sources and optional readings.

Sources and Optional Reading

- **Math Equals: Biographies of Women Mathematicians+Related Activities**, by Teri Perl, Addison Wesley, ISBN 0-201-05709-3, p. 29-37
- **Women in Mathematics**, by Lynn M. Osen, MIT Press, ISBN 0-262-65009-6, p. 49-69

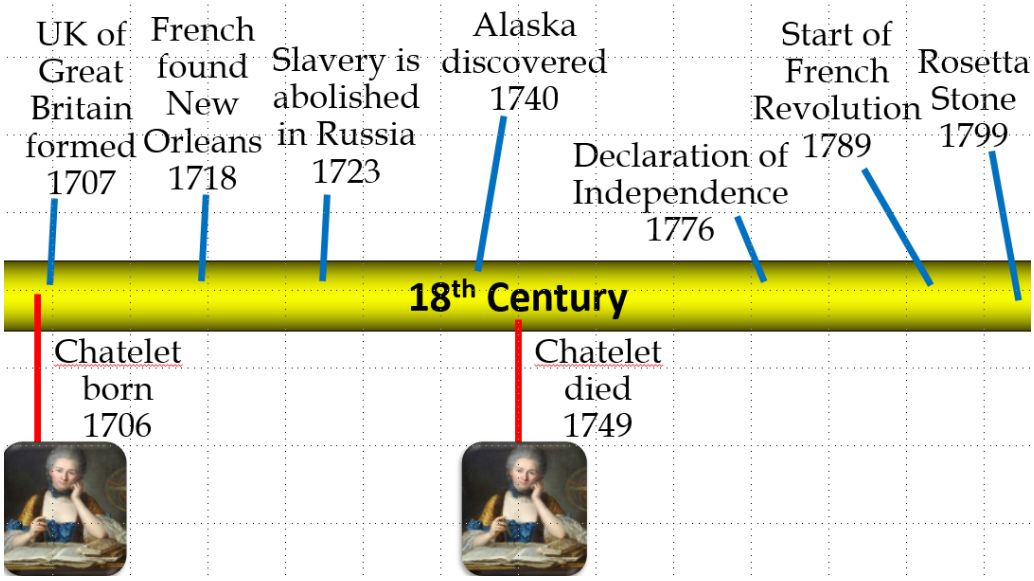
- **Gabrielle Émilie Le Tonnelier de Breteuil Marquise du Châtelet**, https://mathshistory.st-andrews.ac.uk/Biographies/Chatelet/
- **Émilie du Châtelet,** https://en.wikipedia.org/wiki/%C3%89milie_du_Ch%C3%A2telet
- **Du Châtelet (1706-1749)** http://projectvox.library.duke.edu/du-chatelet-1706-1749/
- **Passionate Minds: Émilie du Châtelet, Voltaire, and the Great Love Affair of the Enlightenment,** by David Bodanis, 2006, ISBN 9780307237217
- **Emilie Du Chatelet: Daring Genius of the Enlightenment**, by Judith Zinsser, 2007, ISBN 9780143112686

Mathematical Passion –

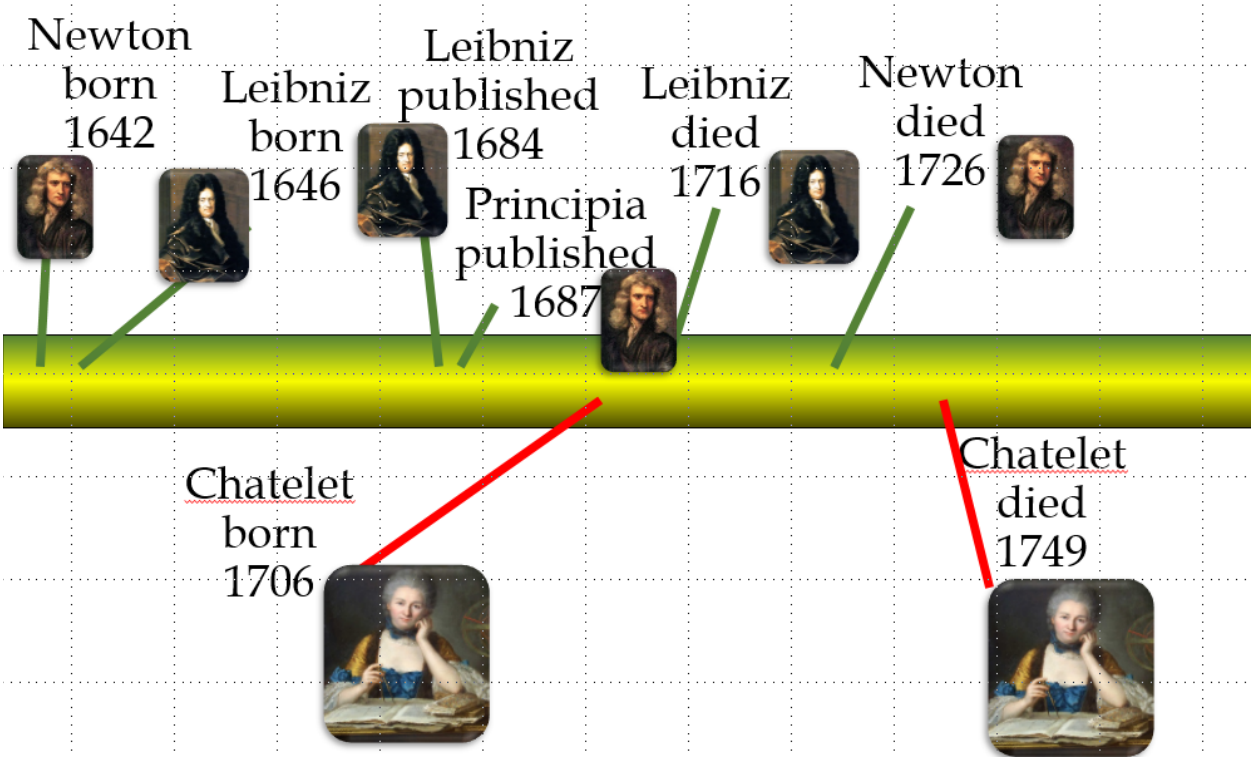
A look at Émilie du Châtelet

http://projectvox.library.duke.edu/du-chatelet-1706-1749/

Émilie du Châtelet was born in 1706 and died in 1749 in France. The timeline below shows some of the things that were going on in the world about this time. As an interesting side note, Italy didn't become a country until March 17, 1861.



This next timeline shows some important dates dealing with the invention/discovery of Calculus by Newton and Leibniz. It is included because the Calculus Controversy (an intense fight over who was first, which pitted mathematicians in the UK against those on the Continent, resulting in many people ignoring the work of those on the other side) ends up playing a major role in Émilie's mathematical contributions.



[Picture of Newton is a copy of a painting by Sir Godfrey Kneller(1689). This copy was painted by Barrington Bramley. - http://www.newton.cam.ac.uk/art/portrait.html, Public Domain, https://commons.wikimedia.org/w/index.php?curid=37337, Picture of Leibniz is by Christoph Bernhard Francke - /gbrown/philosophers/leibniz/BritannicaPages/Leibniz/LeibnizGif.html, Public Domain, https://commons.wikimedia.org/w/index.php?curid=146619]

[https://en.parisinfo.com/paris-museum-monument/71304/Jardin-des-Tuileries]

Letters and documents survive that provide information about the life of Émilie. Émilie was from a wealthy family with court connections. She was named Gabrielle-Émilie Le Tonnelier de Breteuil and her family called her Gabrielle-Émilie. Later in life, people called her Émilie. Her family home overlooked the Tuileries in Paris, near the Louvre. At the time, the Louvre was still a palace and not yet the museum that it is today. Evidently, she was not considered very pretty as a young girl and her parents were concerned she would not grow up to be able to make a good match for an arranged marriage. Her father also did not have a very high opinion of certain churchmen and didn't want to send her to a convent. As a result, he saw that she was well-educated by himself and then tutors, so that if she was going to be a spinster, at least she would be a well-educated one. Here is a quote from Émilie's father talking about her:

> "My youngest is an odd creature destined to become the homeliest of women. Were it not for the low opinion I hold of several bishops, I would prepare her for a

religious life and let her hide in a convent. She stands as tall as a girl twice her years, she has prodigious strength, like that of a wood-cutter, and is clumsy beyond belief. Her feet are huge, but one forgets them the moment one notices her enormous hands. Her skin, alas, is as rough as a nutmeg grater, and altogether she is as ugly as a Gascon peasant recruit in the royal footguards." [Math Equals]

Émilie was bright and loved learning. She taught herself analytic geometry. She also figured out she could get some money of her own by counting cards quickly to give her a chance to win at gambling, which was popular at the time. Her father wrote, "My daughter is mad. Last week she won more than two thousand gold louis at the card tables, and…spent…half on new books. I argued with her in vain, yet she would not understand that no great lord will marry a woman who is seen reading every day." [Bodanis, Passionate Minds] (Picture from http://en.tourisme-semur.fr/spip.php?article96#)

As she matured into a young woman, Émilie blossomed. She wanted to continue her studies and was not interested in attention from many of the young men at court whom she considered shallow. She even challenged one to a sword fight (she had had lessons). Although she didn't win, she did well enough to scare the unwanted suitors off. She did find a man who met her needs, a heavyset, polite man in his thirties, who was a musketeer. They were married in June 1725. She was 18.

[http://uraniatheplay.com/casting-notes/]

He moved her to his home in Burgundy. They quickly had two children, and he went off on military duties. He did realize Émilie was unhappy, bored, and missing her science studies. So he set her up in a grand apartment in Paris.

[Google maps]

While in Paris, Émilie met the duc de Richelieu, who seemed to have a way with women. According to David Bodanis in *Passionate Minds* (p. 47), "He was woman's idolized lord. The coquette and the prude, the duchess and the princess – all alike yielded to him… never a passion, but much debauchery. He even has mistresses who aid him in his acts of infidelity, their jealousy stifled by their desire to please."

By Jean-Marc Nattier - Own work, (photo by Paul Hermans), 2010-10-21, Public Domain, https://commons.wikimedia.org/w/index.php?curid=11941826

The duc de Richelieu was also a powerful man. Émilie was so different from other women that he fell in love with her and her intelligence. After a while though, Émilie realized he wasn't the man that she was looking for to aid her in her quest for learning, "but she was so graceful during the breakup that the two became lifelong correspondents and friends." [Bodanis, p. 47] From the experience, she gained "confidence crucial for the next stage in her life." [Bodanis, p. 47]

Then along came Voltaire, who was an accomplished poet and philosopher. After having spent time hiding out in England to avoid arrest, he was back in Paris, and mutual friends thought the two would enjoy each other's company. He was 38 and she was 26. They immediately hit it off and Voltaire soon wrote the following poem about Émilie - "Why did you only reach me so late? What happened to my life before? I hunted for love, but found only mirages. I found only shadow of our pleasure. You are a delight, you are end, What pleasure I find in your arms." [Bodanis, p. 66]

https://media1.britannica.com/eb-media/51/82551-004-47847D29.jpg

The painting below is of card playing at Versailles in late February 1745. It is very likely that Émilie was actually there that evening.

[http://www.pilloledistoria.it/4833/storia-moderna/versailles-sali-odorosi-per-profumare-stanze-sporche?lang=en]

Card playing got Émilie into trouble in 1748, when she played with a group at court that was cheating and lost on credit the fortune of 84,000 francs (equivalent to about a million dollars today). She and Voltaire had to flee, but she devised a scheme like derivatives of today to earn the money to pay off the debt. Earlier in his life, Voltaire had acquired a fortune by buying up all of the lottery tickets in a lottery held by the crown, thus ended up winning the lottery which was worth more than what he spent on the tickets.

www.bbc.co.uk

Émilie had been attracted to the ideas of Newton, as had Voltaire. Voltaire had never had an intellectual partner like Émilie. He wrote to a friend, I swear to you, she's a tyrant. To be with

her I have to speak of metaphysics (I'd rather speak of sex) [Bodanis, p. 68] "Voltaire was so delighted at finding someone who adored him – and whose intellect he admired so much – that his creativity rose to a higher level. She also encouraged him to "do more thoughtful work and spend less time on mere rhymes." [Bodanis]

[Public domain, https://commons.wikimedia.org/wiki/File:Marquise_du_Ch%C3%A2telet_par_Largilli%C3%A8re.JPG]

Voltaire was the first to admit that Émilie was brighter than he was, and when she wanted to investigate things like force lines and tangents from Newton's work, he would rather tell anecdotes like the story of the apple falling from the tree giving him the idea for his theory of gravity. So later that first year when he got sick, troubles arose. He was also a hypochondriac and when he actually was sick, he was not a pleasant patient, demanding lots of attention and being cranky. She thought "he was no longer the confident, powerful man who would give her the support she needed to organize her tentative thoughts, [and] perhaps even to help her to become one of the great writers and thinkers she admired so much." Yet, he thought she was failing him by not showing him love when he was sick. He did brag to Émilie that he knew an eminent young mathematician who was an expert on Newton. This young man was Pierre Louis Maupertuis, and it

[https://upload.wikimedia.org/wikipedia/commons/1/11/Pierre-Louis_Moreau_de_Maupertuis_(Levrac-Tourni%C3%A8res).jpg]

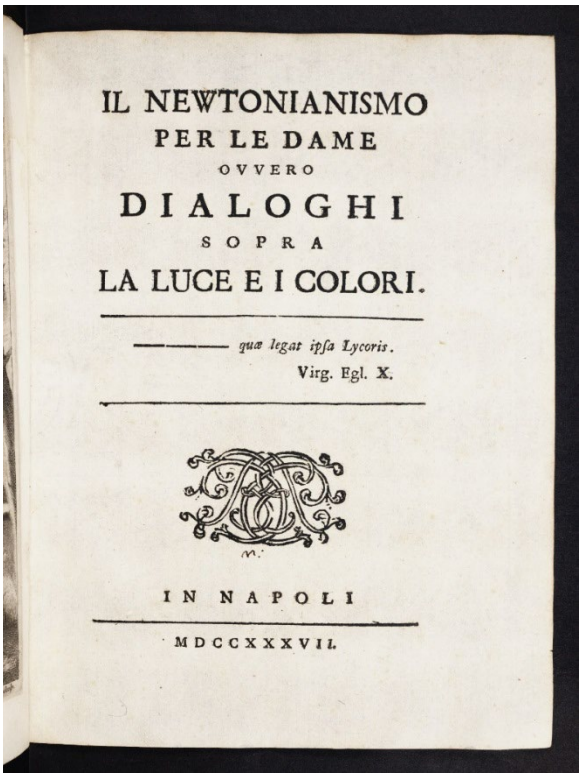
led to another affair, along with lessons in advanced calculus. But Maupertuis already had established the habits of a confirmed bachelor, so when Voltaire recovered from his illness, Voltaire and Émilie ended up back together. This on again/off-again pattern continued throughout their lives.

[Public domain images, https://en.wikipedia.org/wiki/%C3%89milie_du_Ch%C3%A2telet#/media/File:Cirey-1.jpg, https://commons.wikimedia.org/wiki/File:D%27apr%C3%A8s_Maurice_Quentin_de_La_Tour,_Portrait_de_Voltaire,_d%C3%A9tail_du_visage_(ch%C3%A2teau_de_Ferney).jpg]

Voltaire ended up getting in trouble with the French government yet again and needed a place to hide out. He asked Émilie about the Chatelet estate of Cirey which was at the time in disrepair. Knowing that Émilie was upset with him, he used some insider knowledge of troop movements, and bought supplies the army would need at cheap prices and sold them to the army at high prices. He then used the money to fix up the estate hoping to appease Émilie's anger with him for being careless and getting in trouble again.

[By LaurPhil (château de Cirey sur Blaise) [CC BY 2.0 (https://creativecommons.org/licenses/by/2.0)], via Wikimedia Commons]

Voltaire was able to eventually convince Émilie to join him. Together at Cirey, they studied Newton's work and carried out experiments with magnifying lenses, a telescope, prisms, a pendulum, and other devices. They often had visitors as well, one of whom was Francesco Algarotti.



IL NEWTONIANISMO
PER LE DAME
OVVERO
DIALOGHI
SOPRA
LA LUCE E I COLORI.

——— quæ legat ipſa Lycoris.
Virg. Egl. X.

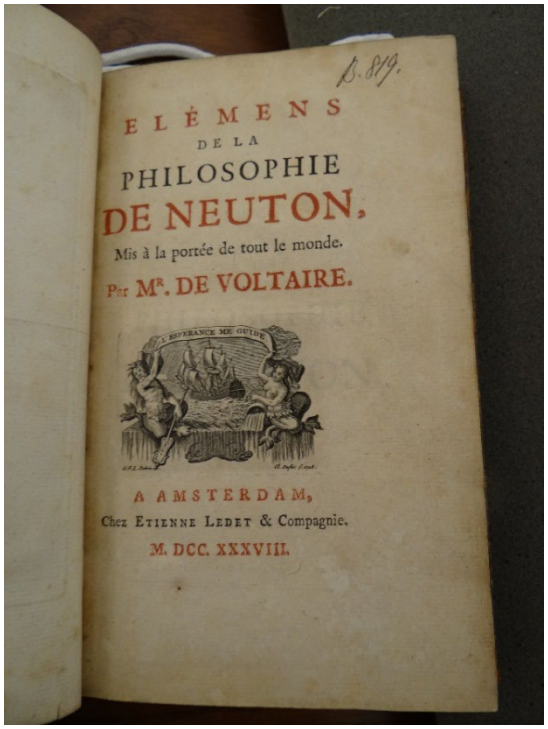
IN NAPOLI

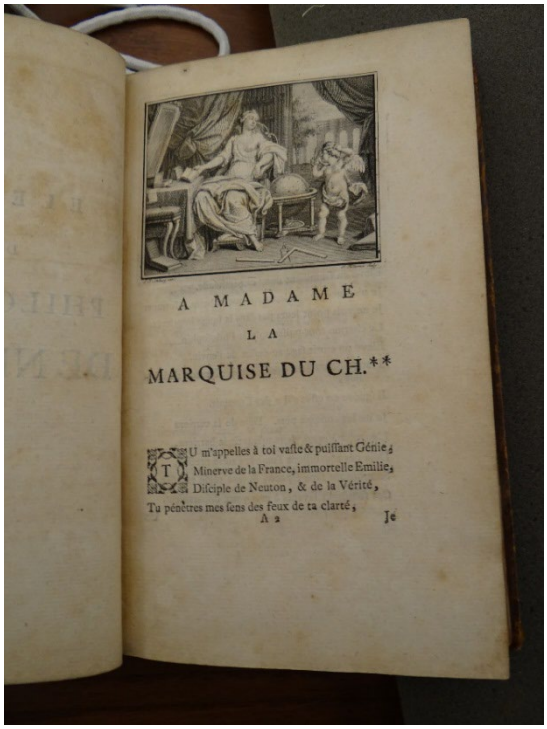
MDCCXXXVII.

Francesco Algarotti [link https://en.wikipedia.org/wiki/Francesco_Algarotti] was an Italian polymath, philosopher, and author during the Age of the Enlightenment. One of his books, Il newtonianismo per le dame ovvero dialoghi sopra la luce e i colori (Newtonianism for the ladies, or dialogues on light and colours), was instrumental in popularizing Newtonianism [link https://en.wikipedia.org/wiki/Newtonianism] in continental Europe. The book consists of a series of six conversations in which Newton's ideas and experiments on light and colors are explained to a fictional marchioness. The first edition was published in 1737, missing the usual permissions, and with a forged imprint of Naples on the title page. According to Massimo Mazzotti, in his article Newton for ladies: gentility, gender, and radical culture, "due to the intervention of religious authorities Algarotti's radical Newtonianism became gradually less visible in subsequent editions and translations." The Linda Hall Library has three editions: the first 1737 Italian edition (which was on the Roman Catholic church's 1739 list of prohibited books), a 1738 French edition (available online at http://lhldigital.lindahall.org/cdm/ref/collection/color/id/33627 , and a 1739 Italian edition. Another interesting thing about the first edition is the frontispiece, which is a portrait of Algarotti and Émilie du Châtelet portraying the characters in the book. (Algarotti spent some time with Émilie du Châtelet and Voltaire at her estate of Cirey while he was finishing the book.)

Occasionally Emilie and Voltaire spent time in Paris, possibly at this now hotel, which Emilie's husband purchased in 1739.

[Public domain, https://commons.wikimedia.org/wiki/File:H%C3%B4tel_Lambert.jpg]

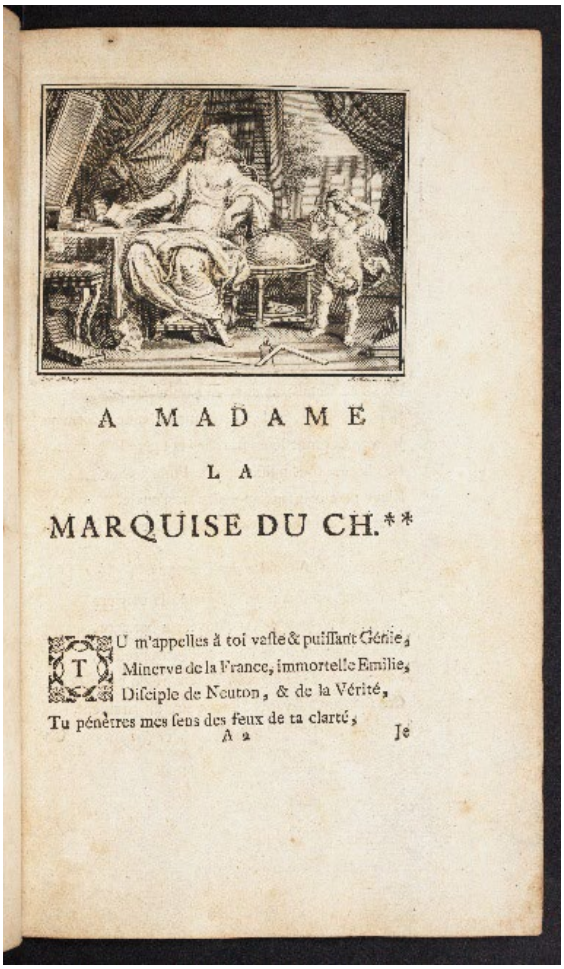




Voltaire published a book on the Philosophy of Newton, greatly influenced by Emilie. In fact, all of the calculations would have been carried out by her. Notice that the title page lists

Voltaire's name as the sole author. There is speculation that if the book had been written in a different culture and age that Émilie du Châtelet would have been listed as a co-author. He did dedicate the book to her - "the fruit of your worthy aid is what I now offer to the public." There are two frontispieces. One is a portrait of Voltaire. The other was designed by Voltaire and features Émilie as a goddess directing light from Newton down onto Voltaire working at a writing desk.

Voltaire explicitly gives credit to Émilie du Châtelet in an acknowledgment and foreword. Images of the first page of each of these are below.



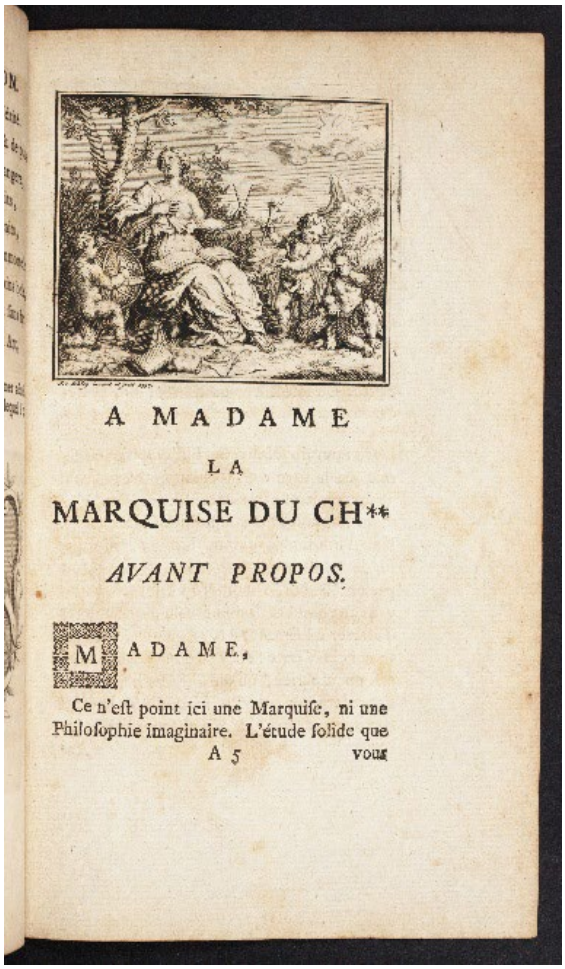
A MADAME

LA

MARQUISE DU CH.**

TU m'appelles à toi vaſte & puiſſant Génie,
Minerve de la France, immortelle Emilie,
Diſciple de Neuton, & de la Vérité,
Tu pénètres mes ſens des feux de ta clarté,

 Je



A MADAME

LA

MARQUISE DU CH**

AVANT PROPOS.

MADAME,

Ce n'eſt point ici une Marquiſe, ni une Philoſophie imaginaire. L'étude ſolide que

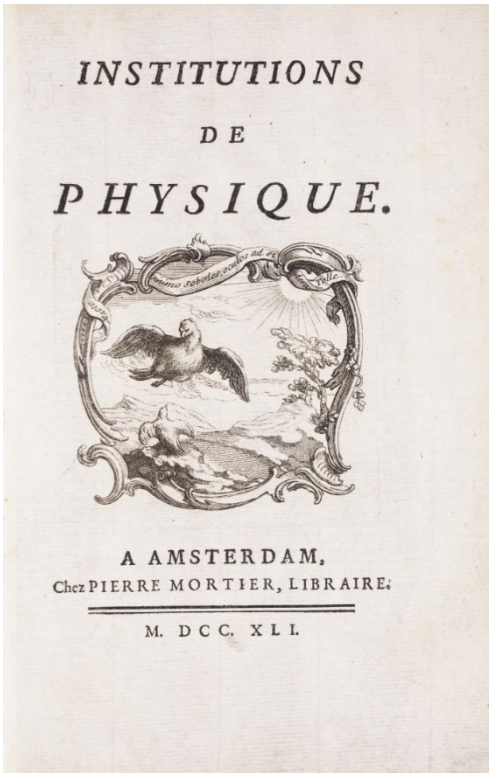
 vous

The Academy of Sciences in Paris had a prize competition to determine the nature of heat, light, and fire. Voltaire decided to enter. Émilie helped him, but realized he was going off in the wrong direction. She didn't feel bold enough to tell him, so she secretly did her own work at night not with experiments but with calculations and thought. Both entered and both ended up getting honorable mention. For political reasons related to the Calculus Controversy, no paper mentioning Newton got the top prize. People were impressed with Émilie's submission and her reputation and fame spread first with researchers, then the top salons, and beyond.

[Public domain, https://commons.wikimedia.org/wiki/File:Emilie_Chatelet_portrait_by_Latour.jpg]

“Now almost everyone who counted had heard rumors that she was a woman who’d learned Latin, English, Italian, and a good bit of Dutch and Greek; translated Virgil, as well as English social critics; written commentaries on the Bible; done all the technical work for a shared exposition of Newton; performed original research on fire and light; accumulated one of Europe’s leading research libraries; and made Cirey a research center for important thinkers. Most of all, she’d created a unique way of living, and become – despite having been excluded from all the official, males-only institutions – a respected correspondent with top researchers” around the world including the Bernoullis. [Bodanis, p. 183] Émilie even became interested in the ideas of Leibniz, which caused problems with Voltaire. No one had synthesized the thinking of Leibniz and Newton before. She wanted to show how the best ideas of each could be combined. Everyone else was solidly in one camp or the other, but as a female, she was excluded from the main science academies and was far enough on the outside that she could view them both objectively.

The following image is the title page of a revised French edition of Émilie du Châtelet’s Institutions de Physique, published in 1741 in Holland. The first edition was published the previous year, and several other editions followed. Émilie wrote this book, in which she assimilated points of view of Descartes, Newton, and Leibniz, to teach new ideas in physics to her thirteen year old son. Notice that her name is not mentioned on the title page of this edition. There was a 1742 edition also published in Amsterdam which was not anonymous.



INSTITUTIONS

DE

PHYSIQUE.

A AMSTERDAM,

Chez PIERRE MORTIER, LIBRAIRE.

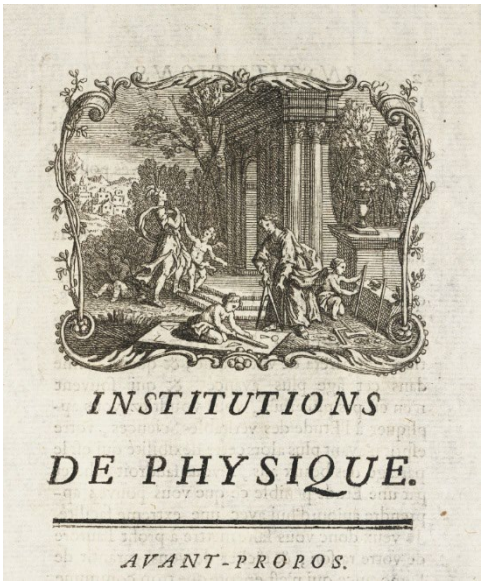
M. DCC. XLI.

The frontispiece is interesting. It shows a person (possibly Émilie) climbing to reach a glorious temple occupied by "Truth" depicted as a naked woman. Cherubs hold portraits at the top of the page, possibly representing Descartes, Leibniz, and Newton.

[larger pictures are public domain pictures of Descartes, Leibniz, and Newton]

Each chapter begins with a delightful graphic exhibiting mathematics or science in some way. For example, Chapter 14 on the phenomena of gravity has a picture of a device used to demonstrate Galileo's law of natural motion. The paraboloid apparatus involves dropping balls on a spiral track to show that each turn of the spiral is traveled in the same amount of time (isochronism). According to the virtual Galileo Museum there are only two such devices currently known to be in existence. The picture below is at the Galileo Museum [link http://www.museogalileo.it/en/visit.html] in Florence, Italy, that I took while on the 2012 MAA Study Tour.

In her biography of Émilie du Châtelet, Judith P. Zinsser questions whether these chapter opening graphics tie in with the fact that Émilie wrote the book to teach her son the fundamentals of physics, since “many of the decorative illustrations at the beginnings of the Institutions’s chapters show a young boy at games and activities demonstrating one or the other law of motion: lacrosse, billiards, balancing on a seesaw, shuttlecock, riding, shooting a gun.” [Zinsser, p. 165] Images of several of these illustrations follow.

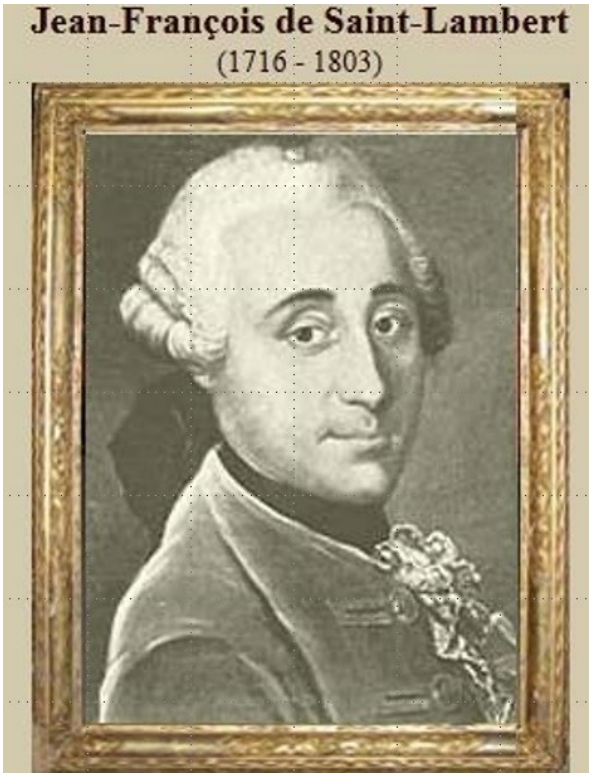


CHAPITRE XX.

Des Forces Mortes, ou Forces Preſſantes, & de l'Equilibre des Puiſſances.

CHAPITRE XXI.

De la Force des Corps.



[https://commons.wikimedia.org/wiki/Jean_Fran%C3%A7ois_de_Saint-Lambert#/media/File:Jean-Fran%C3%A7ois_de_Saint-Lambert.jpg]

The fame of her book on Leibniz spread, but then the unthinkable happened. After a fling with Saint-Lambert, she was 42 and pregnant, at a time when it was an accomplishment to live through your 40's. She was determined to finish her scientific work and she worked with a passion to accomplish her goal. According to Bodanis (p. 281), "Voltaire couldn't get her to slow down: He wrote, "She believed that death was striking… all she thought about was how to

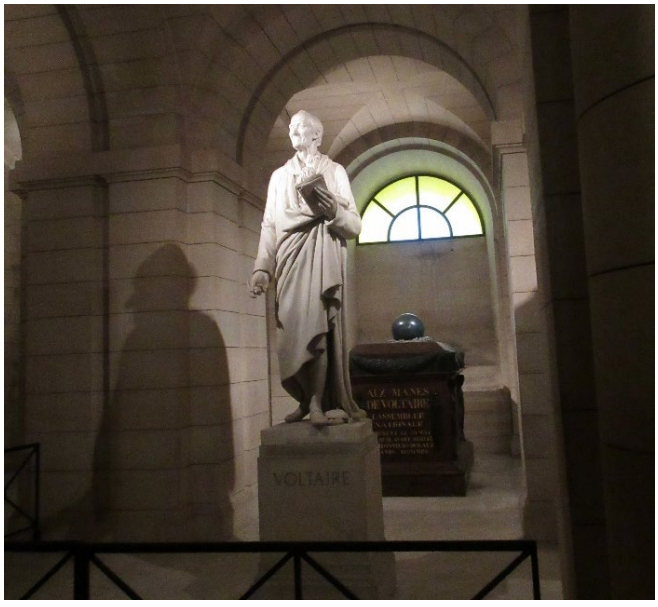
use the little time she had left, to deprive death of taking what she felt was the best part of herself."

[Public Domain, https://commons.wikimedia.org/w/index.php?curid=7745287]

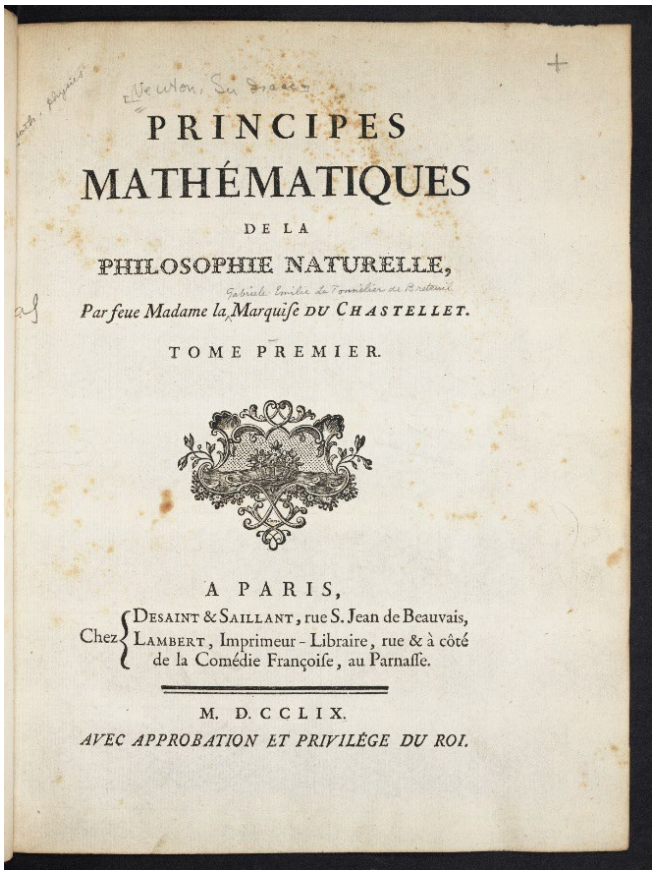
Emilie du Chatelet gave birth on the night of Sept 3, 1749. She died on Sept 10 of infection stemming from the labor; the child – a girl – died soon after. … Her husband, Voltaire, and the baby's father were all with her when she died.

[http://archieturbanisme.canalblog.com/archives/2014/10/16/28398328.html]

Voltaire was bereft: I've lost the half of myself – a soul for which mine was made." Months later, his personal secretary would find him wandering at night in the apartments he'd shared with Emilie, plaintively calling her name in the dark. Voltaire lived until 1778. His tomb is in the Pantheon in Paris. Below is a picture that I took in 2016.



The following image is the title page of volume 1 of Émilie du Châtelet's *Principes Mathématiques de la Philosophie Naturelle*, published in 1759 in French in Paris, a two volume translation and commentary of Newton's Principia. It is considered her greatest achievement. The complete work was published ten years after her death, and still is the only complete French translation available. According to the Dictionary of Scientific Biography, "her work contributed to the great progress made by Newtonian science in the middle of the eighteenth century." Bodanis wrote, "Her translation and commentary on Newton's Principia became fundamental to key 18th century developments in theoretical physics, laying the groundwork for much of contemporary science. Page one of volume 1 begins with Definitions.

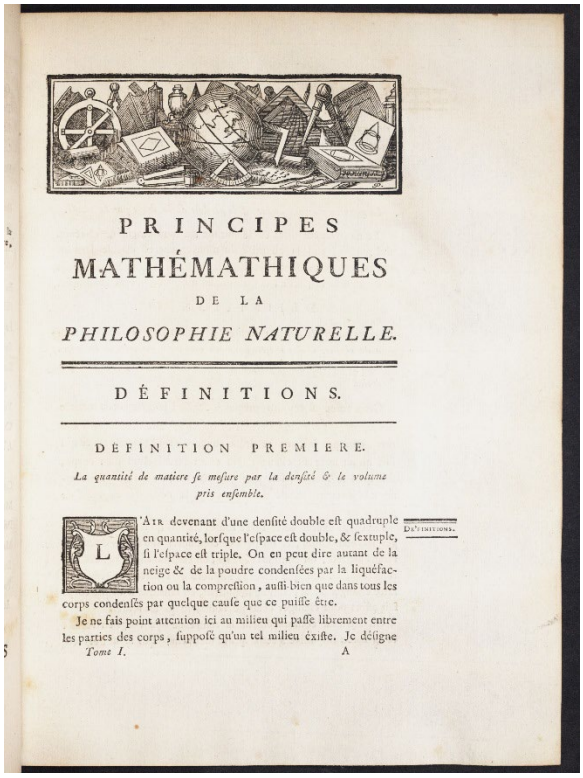


PRINCIPES
MATHÉMATIQUES
DE LA
PHILOSOPHIE NATURELLE,
Par feue Madame la Marquise DU CHASTELLET.

TOME PREMIER.

A PARIS,
Chez { DESAINT & SAILLANT, rue S. Jean de Beauvais,
LAMBERT, Imprimeur-Libraire, rue & à côté de la Comédie Françoise, au Parnasse.

M. D. CCLIX.
AVEC APPROBATION ET PRIVILÉGE DU ROI.



PRINCIPES
MATHÉMATHIQUES
DE LA
PHILOSOPHIE NATURELLE.

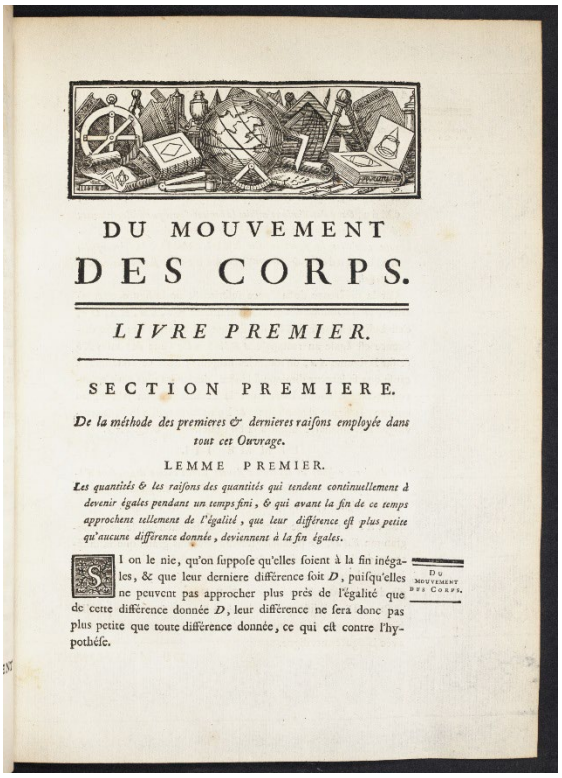
DÉFINITIONS.

DÉFINITION PREMIERE.

La quantité de matiere se mesure par la densité & le volume pris ensemble.

L'Air devenant d'une densité double est quadruple en quantité, lorsque l'espace est double, & sextuple, si l'espace est triple. On en peut dire autant de la neige & de la poudre condensées par la liquéfaction ou la compression, aussi bien que dans tous les corps condensés par quelque cause que ce puisse être. DÉFINITIONS.

Je ne fais point attention ici au milieu qui passe librement entre les parties des corps, supposé qu'un tel milieu existe. Je désigne



DU MOUVEMENT
DES CORPS.

LIVRE PREMIER.

SECTION PREMIERE.

De la méthode des premieres & dernieres raisons employée dans tout cet Ouvrage.

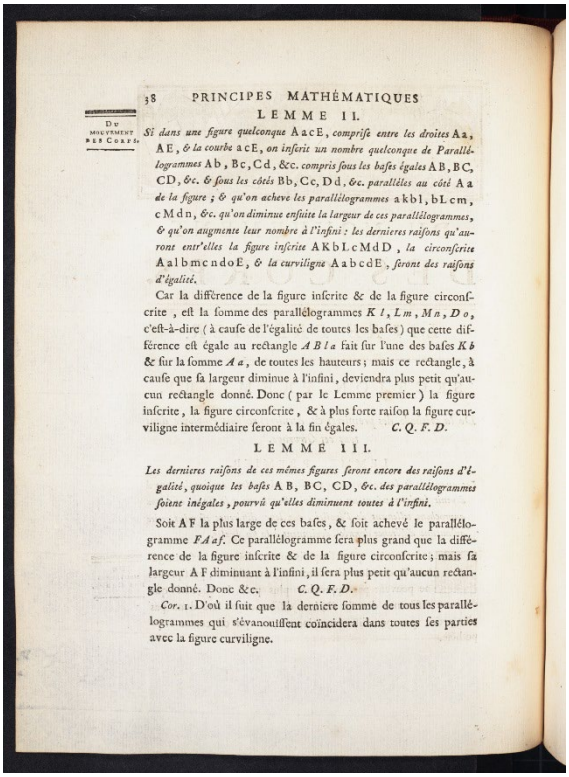
LEMME PREMIER.

Les quantités & les raisons des quantités qui tendent continuellement à devenir égales pendant un temps fini, & qui avant la fin de ce temps approchent tellement de l'égalité, que leur différence est plus petite qu'aucune différence donnée, deviennent à la fin égales.

Du Mouvement des Corps.

Si on le nie, qu'on suppose qu'elles soient à la fin inégales, & que leur derniere différence soit *D*, puisqu'elles ne peuvent pas approcher plus près de l'égalité que de cette différence donnée *D*, leur différence ne sera donc pas plus petite que toute différence donnée, ce qui est contre l'hypothèse.

Lemma 1 (page 37) is related to the notion of a limit and roughly translated states that if two quantities are tending towards being equal in such a way that their difference can be found to be less than any given difference, then the quantities are equal.



38 PRINCIPES MATHÉMATIQUES

Du Mouvement des Corps.

LEMME II.

Si dans une figure quelconque AacE, *comprise entre les droites* Aa, AE, *& la courbe* acE, *on inscrit un nombre quelconque de Parallélogrammes* Ab, Bc, Cd, &c. *compris sous les bases égales* AB, BC, CD, *&c. & sous les côtés* Bb, Cc, Dd, *&c. parallèles au côté* Aa *de la figure ; & qu'on acheve les parallélogrammes* akbl, bLcm, cMdn, *&c. qu'on diminue ensuite la largeur de ces parallélogrammes, & qu'on augmente leur nombre à l'infini : les dernieres raisons qu'auront entr'elles la figure inscrite* AKbLcMdD, *la circonscrite* Aalbmcndo E, *& la curviligne* AabcdE, *seront des raisons d'égalité.*

Car la différence de la figure inscrite & de la figure circonscrite, est la somme des parallélogrammes *Kl*, *Lm*, *Mn*, *Do*, c'est-à-dire (à cause de l'égalité de toutes les bases) que cette différence est égale au rectangle *A B l a* fait sur l'une des bases *Kb* & sur la somme *A a*, de toutes les hauteurs ; mais ce rectangle, à cause que sa largeur diminue à l'infini, deviendra plus petit qu'aucun rectangle donné. Donc (par le Lemme premier) la figure inscrite, la figure circonscrite, & à plus forte raison la figure curviligne intermédiaire seront à la fin égales. *C. Q. F. D.*

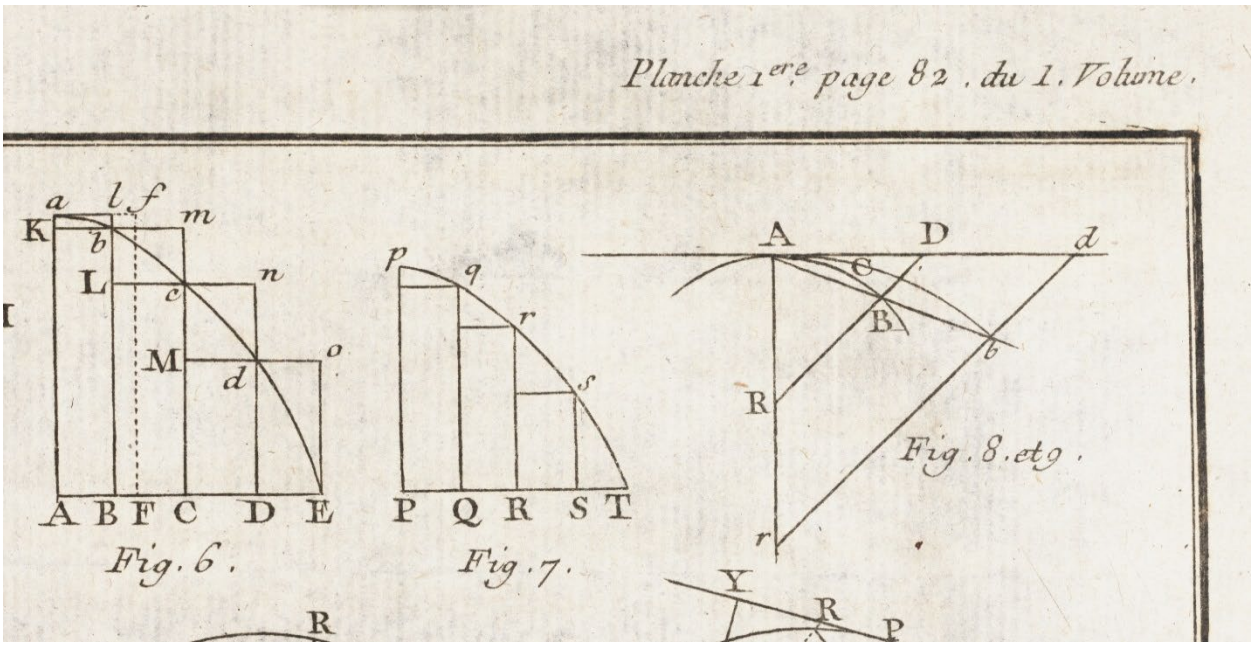
LEMME III.

Les dernieres raisons de ces mêmes figures seront encore des raisons d'égalité, quoique les bases AB, BC, CD, *&c. des parallélogrammes soient inégales, pourvû qu'elles diminuent toutes à l'infini.*

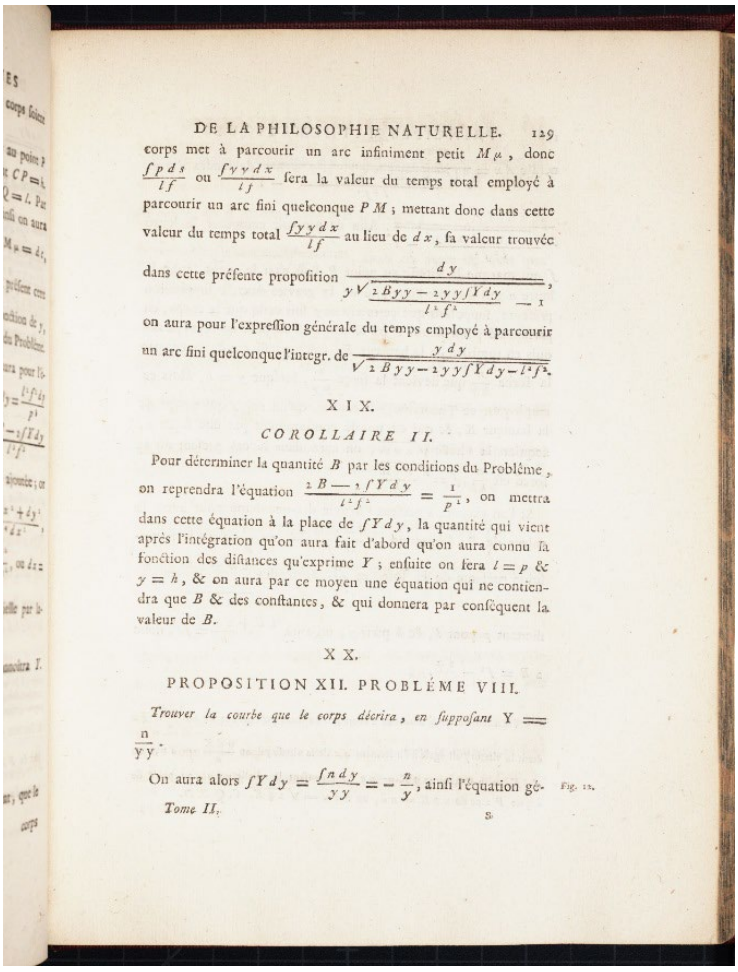
Soit AF la plus large de ces bases, & soit achevé le parallélogramme *FAaf*. Ce parallélogramme sera plus grand que la différence de la figure inscrite & de la figure circonscrite ; mais sa largeur AF diminuant à l'infini, il sera plus petit qu'aucun rectangle donné. Donc &c. *C. Q. F. D.*

Cor. 1. D'où il suit que la derniere somme de tous les parallélogrammes qui s'évanouissent coïncidera dans toutes ses parties avec la figure curviligne.

This is followed by Lemma 2 (page 38 and Figure 6 on a foldout after page 82), using inscribed and circumscribed parallelogram (rectangles) to find the area under a curve.



Du Châtelet used Leibniz's notation for differentials and integrals as demonstrated on page 129 of Volume 2.



DE LA PHILOSOPHIE NATURELLE. 129

corps met à parcourir un arc infiniment petit $M\mu$, donc $\frac{fp\,ds}{lf}$ ou $\frac{fy\,y\,dx}{lf}$ fera la valeur du temps total employé à parcourir un arc fini quelconque PM ; mettant donc dans cette valeur du temps total $\frac{fy\,y\,dx}{lf}$ au lieu de dx, fa valeur trouvée dans cette préfente propofition $\frac{dy}{y\sqrt{\frac{2By\,y - 2\,y\,y\int Y\,dy}{l^2 f^2}} - 1}$, on aura pour l'expreffion générale du temps employé à parcourir un arc fini quelconque l'integr. de $\frac{y\,dy}{\sqrt{2By\,y - 2\,y\,y\int Y\,dy - l^2 f^2}}$.

XIX.

COROLLAIRE II.

Pour déterminer la quantité B par les conditions du Problême, on reprendra l'équation $\frac{2B - 2\int Y\,dy}{l^2 f^2} = \frac{1}{p^2}$, on mettra dans cette équation à la place de $fY\,dy$, la quantité qui vient après l'intégration qu'on aura fait d'abord qu'on aura connu la fonction des diftances qu'exprime Y ; enfuite on fera $l = p$ & $y = h$, & on aura par ce moyen une équation qui ne contiendra que B & des conftantes, & qui donnera par conféquent la valeur de B.

XX.

PROPOSITION XII. PROBLÉME VIII.

Trouver la courbe que le corps décrira, en fuppofant $Y = \frac{n}{yy}$.

On aura alors $fY\,dy = \frac{fn\,dy}{yy} = -\frac{n}{y}$, ainfi l'équation gé- Fig. 12.

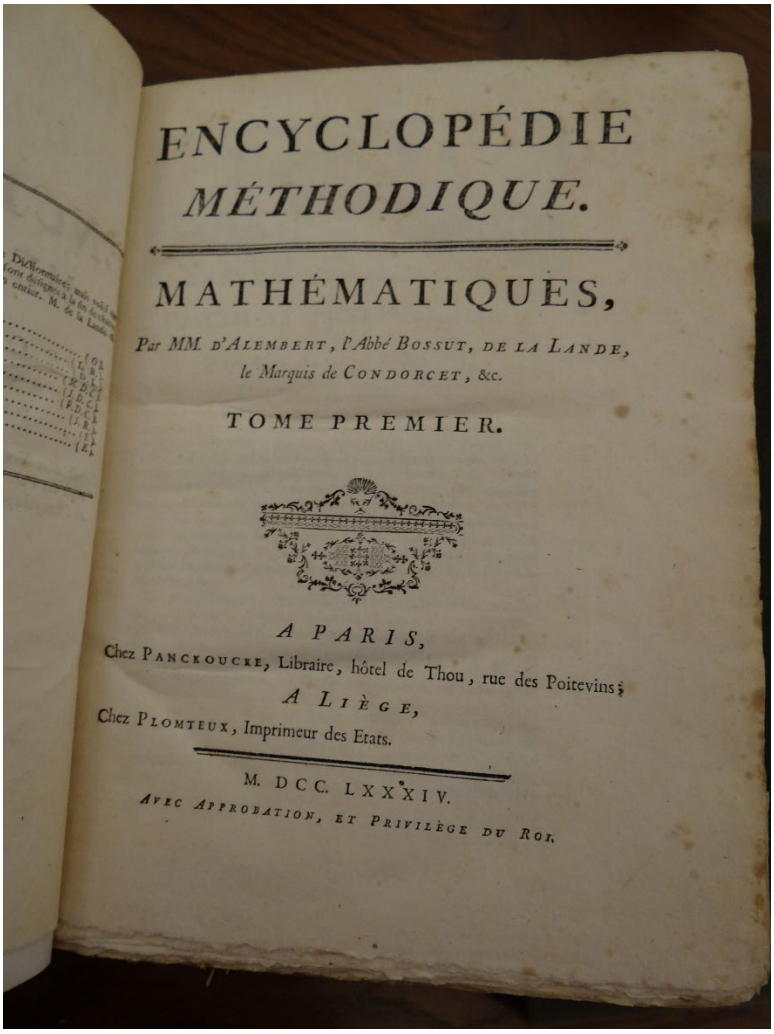
position $\frac{dy}{y\sqrt{\frac{2Byy - 2yy\int Y dy}{l^2 f^2}}}$, — I

n générale du temps employé à parcourir

integr. de $\frac{y\,dy}{\sqrt{2Byy - 2yy\int Y dy - l^2 f^2}}$.

There were many consequences of the work of Émilie. More technical aspects of her work played a great role in energizing the French school of theoretical physics, associated with Lagrange and Laplace, whose formal achievements, such as the Lagrangian and Laplacian stability calculations, ended up as fundamental working tools in subsequent science, from Faraday and Maxwell's field theory of the 19th century to quantum theory and relativity in the 20th century. English researchers, lacking the advantage of seeing Newton's work clearly brought out with Emilie's more modernized notation, stuck to Newton's cumbersome original notation, which slowed their progress for over 2 generations. The picture to the left is me next to a statue of Lagrange outside the apartment building where he was born in Turin, Italy.

In 1748 she'd carefully helped an obscure Parisian investigator with questions he'd had about the equations for the air resistance faced by a moving pendulum….. It turned out this was Diderot, who called her thoughtful, encouraging reply one of the "two sweet moments" of his life. When Diderot was imprisoned in 1749 for something he wrote, Émilie, 8 months pregnant, interrupted her own writing to use family connections to make sure he was treated well. He went on to be the main developer on the grand, 28 volume Encyclopedie, which built on Cirey's approach of sharing and analyzing all knowledge, extending it for future generations.



ENCYCLOPÉDIE
MÉTHODIQUE.

MATHÉMATIQUES,

Par MM. D'ALEMBERT, l'Abbé BOSSUT, DE LA LANDE,
le Marquis de CONDORCET, &c.

TOME PREMIER.

A PARIS,
Chez PANCKOUCKE, Libraire, hôtel de Thou, rue des Poitevins;
A LIÈGE,
Chez PLOMTEUX, Imprimeur des Etats.

M. DCC. LXXXIV.
AVEC APPROBATION, ET PRIVILÈGE DU ROI.

Émilie du Chatelet, born into a family with ties to French court, had a passion for life and mathematics resulting in applications to physics, and a long lasting commentary and translation of Newton. In addition, she influenced many important researchers, and along with Voltaire, was influential in spreading the ideas of the Enlightenment and changing the world.
