

## A Method

For finding the Number of the Julian Period for any Year assign'd, the Number of the Cycle of the Sun, the Cycle of the Moon, and of the Indictions for the same year, being given; together with the Demonstration of that Method.

IN these *Transactions*, N<sup>o</sup> 18. p. 324. is a *Theorem* for finding the Year of the *Julian Period* by a new and very easie Method, which was taken out of the *Journal des Scavans*, N<sup>o</sup> 36. as it had been propos'd and communicated by the Learned Jesuit *De Bill*.

Multiply the  $\left. \begin{array}{l} \text{Solar} \\ \text{Lunar} \\ \text{Indiction.} \end{array} \right\} \text{Cycle}$  by  $\left. \begin{array}{l} 4845. \\ 4200. \\ 6916. \end{array} \right\}$  Then divide the

sum of the Products by 7980 (the *Julian Period*) the Remainder of the Division, without having regard to the Quotient, shall be the Year inquired after.

Some Learned Mathematicians of *Paris*, to whom the said *P. de Billy* did propose this Problem, have found the Demonstration thereof as the same *Journal* intimates.

There being no further Elucidation of the said *Theorem* since publish'd, Mr. *John Collins*, now a Member of the *Royal Society*, communicated what follows, *viz.*

That the *Julian Period* is a Basis, whereon to found *Chronology* not liable to Controversie, as the Age of the world is: And 'tis the Number above said, to wit, 7980, which is the Pro-

duct of  $\left. \begin{array}{l} 28 \\ 19 \\ 15 \end{array} \right\}$  the  $\left. \begin{array}{l} \text{Solar} \\ \text{Lunar} \\ \text{Indiction.} \end{array} \right\} \text{Cycle}.$

Concerning this *Julian Period*, the late Archbishop of *Armagh*, *Usher*, in the Preface to his Learned Annals, advertiseth, that *Robert Lotharing*, Bishop of *Hereford*, first observed the Conveniencies thereof; 500 years after whom, it was fitted for Chronological uses by *Joseph Scaliger*, and is now embraced by the Learned as such a limit to *Chronology*, that within the space of 7980 Years, the Number of the Sun's Cycle, the Prime, and the year of the *Roman Indiction* (which relates to their ancient Laws and

and Records) can never happen alike. And these Remarques being given, the year of the *Julian Period* is by the former Rule infallibly found.

This *Period* is used by the said Archbishop in his *Annals*, and is by him accounted to exceed the Age of the *World* 709 years. Those that desire further satisfaction about *Era's*, *Epocha's*, and *Periods*, may repair to many Authors, and among them to *Gregory's Posthuma* in English, *Helvici Chronologia*, *Aegidii Strauchii Breviarium Chronologicum*, who is one of the latest Authors.

Now as to the *Problem* it self, it may be thus proposed :

*Any number of Divisors, together with their Remainders after Division; being proposed, to find the Dividend.*

This thus generally proposed is no *new Problem*, and was resolved long since, by *John Geysius*, by the help of particular Multipliers, such as those above-mentioned, and publish'd by *Alstedius* in his *Encyclopædia* in *Ann.* 1630. and by *Van Schooten* in his *Miscellanies*.

We shall clear up, what Authors have omitted concerning the *Definition* and *Demonstration* of such fixed Multipliers, &c. And therefore say, that each Multiplier is relative to the Divisor, to which it belongs, and thus define it;

*It is such a Number, as divided by the rest of the Divisors, or their Product, the Remainder is 0; but divided by its own Divisor, the Remainder is an Unit.*

We require the Divisors proposed to be *Primitive* each to other, *i. e.* that no two or more of them can be reduced to lesser terms by any common Divisor: For if so, the Question may be possible in it self, but not resolvable by help of such Multipliers, such being impossible to be found. The reason is, because the Product of an Odd and Even Number is always Even, and that divided by an Even Number, leaves either Nothing, or an Even Number.

28 } Divisors 19 } 15 }	The Multipliers relative thereto are	{ 4845 { 4200 { 6916
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The *Definition* affords light enough for the discovery of these Numbers. To instance in the *first*: The Product of 19 and 15 is

is 285, which multiply by all numbers successively, and divide by 28, till you find the Remainder required. Thus twice 285 is 570, which divided by 28, the remainder is 10; also thrice 285 is 855, which divided by 28, the remainder is 15. Thus if you try on successively, you'll find, that 17 times 285, which is 4845, is the Number required, the which divided by 28, the Remainder is an *Unit*. Hence then we shall find, that

$$\left. \begin{array}{l} 4845 \\ 4200 \\ 6916 \end{array} \right\} \text{is equal to the Solid or Product of } \left\{ \begin{array}{l} 19, 15, 17. \\ 28, 15, 10. \\ 28, 19, 13. \end{array} \right.$$

More easie ways of performing this *postulatum*, are to be found in *Van Schooten's Miscellanies*, and *Tacquet's Arithmetick*, which perchance are not so obvious to every understanding.

For illustration of the *Rule* proposed, take this Example.

In the	<i>Cyclus Solis</i>	25	}	The	}	Pr-	}	121125		
year	<i>Cyclus Lunæ</i>	16		Multi-				4845	ducts.	67200
1668.	<i>Indictio</i>	6		pliers.				4200		41496
								229821		

The Sum of the Products

The which divided by 7980, the remainder is 6381, for the year of the *Julian Period*; from which subtracting 709, there remains 5672, for the Age of the World, according to Archbishop *Usher*.

For DEMONSTRATION of this *Rule* we thus argue:

1. Each *Multiplier* multiplied by its *Remainder*, is measured or divided by its own *Divisor*, leaving such a *Remainder* as is proposed.

For before, each *Multiplier* was defined to be a *Multiplex* of its own *Divisor*, plus an *Unit*: Wherefore multiplying it by any *Remainder*, it doth only render it a greater *Multiplex* in the said *Divisor*, plus an *Unit*, multiplied by the *Remainder*, which is no other than the *Remainder* it self; but if 0 remain, that *Product* is destroyed.

2. The *Sum* of the *Products*, divided by each respective *Divisor*, have the *Remainder* assigned.

For concerning the first *Product*, it is by the first *Section* measured

fur'd by its own Divisor, leaving the remainder propos'd; and if we add the rest of the Products thereto, we only add a *Multiplex* of its own Divisor, which in Division enlargeth the *Quote*, but not the *Remainder*.

Particularly the second Multiplier is  $28 + 15 + 10 + \text{Remainder}$ , all which is but a *Multiplex* of 28.

And so the third Product is  $28 + 19 + 13 + \text{Remainder}$ .

And what hath been said concerning the sum of the Products, being divided by the first Divisor, and leaving the Remainder thereto assign'd, may be said of each respectively.

3 *The sum of the Products divided by the solid of the three Divisors, leaves a Remainder so qualified as the said Sum.*

For concerning the said Sum, 'tis evident by the *second* hereof, that it is no other than the first Product; increas'd by adding a just *Multiplex* of the first Divisor, that thereby we did only enlarge the *Quote*, not alter the *Remainder*. By the like reason, the subtracting a just *Multiplex* thereof, doth only alter the *Quote*, not the *Remainder*; but the Solid of all three Divisors, multiplied here by the *Quote*, as there by the *Remainder*; is no other than a just *Multiplex* of the first Divisor. Wherefore the Remainder, after this Division is perform'd, is of the same Quality as the sum of the Products, and divided by the first Divisor; leaves the Remainder proper thereto. And the like may be said concerning each Divisor.

**A**S in the Method hitherto deliver'd, we requir'd the Divisors be *Primitive* to each other; so, if we take the *Problem* as generally propos'd, in the Preface to *Helvicus* his *Chronologia*, we are told, common Arithmetick fails in the solution thereof, and *Tacquet* denies it to be performable by the *Regula Falsi*, and being unlimited, we must do it by Tryals. Wherefore,

*When any two Divisors with their Remainders are propos'd, try the Multiplices of one of them, increased by its Remainder, and divide by the other: If you find such Remainders as are not for the purpose, and that they are repeated, the Problem is impossible.*

Example.	Divisors	6.	3.
	Remainders	8.	5.

The Multiplices of 8, }  
 increased by 5, are . . . } 13. 21. 29. 37. 45. 53.

Those divided by 6, }  
 the Remainders are . . . } 1. 3. 5. 1. 3. 5.

Here you see 21 and 45 for the purpose, and take the Progression, adding the common Difference 24 (which is the least Dividend measured by 6 and 8) and you have 21. 45. 69. 93. 117. 141.

Admit, the Question had concerned these three Divisors:

6 }  
 8 } the Remainders being } 3 | Then dividing the former Pro-  
 9 } } 5 | gression by 9, the Remainders  
 } } 6 | are 3. 0. 6. 3. 0 6.

Wherefore I conclude, that the third and sixth of these Numbers are those sought, to wit, 69 or 141, and so on progressively; whereas, if you had propounded the Remainder of 9 to have been any other Number than 3, 0, 6, the *Problem*, as concerning all these, had not been possible.

### *Some easie Cases of the Problem are these :*

When the Remainder of some Divisor is 0, and of each of the rest of the Divisors, an *Unit*, or less by an *Unit*, than the Divisor.

In which Cases you are to find such a *Multiplex* of the Product or least Dividend measurable by those Divisors that have Remainders, which increas'd or diminish'd by an *Unit*, may be a just *Multiplex* of that Divisor that hath no Remainder. These Cases are handled by *Tacquet*, and *Bachet* in his *Problemes plaisans & delectables*.

## P R O B L E M.

*To find the Year of the Julian Period for any year of our Lord proposed.*

It is necessary to be furnished with the *Sun's Cycle*, the *Prime Number*, and the Number of the *Roman Indiction*, which the industrious Mr. *Street* thus performs :

*When*

When 1. 9. 3. to the Year hath added been,  
Divide by 19. 28, fifteen.

The Remainders are the Numbers sought. And hereby we found them for the year 1668. in the former Example

The use of the *Prime* is, to find the *Epact*, and thereby the *Moons Age*, time of *High Water*, &c.

A farther use of the *Suns Cycle* is, to attain the *Dominical Letter*, and thereby to know the *Day* of the *Week*, on which any *Day* of the *Month* happens. But this is more easily and with less caution obtain'd, by finding on what *Day* of the *Week* the first of *March* happens for ever, according to such *Rules* and *Verses* as I have elsewhere published. In brief thus:

To the Number . . . . . 2.  
Add the Year of our Lord, suppose 1669.  
And its even 4<sup>th</sup> part, neglecting }  
what remains, if any . . . } 417.

The Sum . . . . . 2088. Divide by 7, noting the Remainder, which shews the Number of the *Day* of the *Week*, accounting *Sunday* first. If 0 remain, the first of *March* falls on a *Saturday*. In this Example there remains 2, shewing the first of *March* to fall on *Monday*.

If it were required to perform this for years preceding our *Saviour's Nativity*, then take this *Rule*:

To the Year add its even fourth part, the Sum divide by 7, the Remainder shews the *Day* of the *Week*, accounting *Sunday* first, *Saturday* second, and so backward.

## P R O B L E M.

To find what day of the Month in the first week of each Month, happens to be on the same day of the week as the first of March.

Use the (plain) following *Verses*, in which the twelve Words relate to the twelve Months of the Year, accounting *March* the first:

*Ask endless Comfort, God enough bestows,  
From Divine Axioms Faith confirmed grows.*

The Alphabetical Number of the first Letter of the word, proper to the Month proposed, is the Answer.

*Example.*

If the Month were *April*, the word proper thereto is *Endless*, and *E* is the fifth Letter in the Alphabet. Wherefore conclude, That the first of *March* and *fifth* of *April* do for ever happen on the same day of the Week; which for the year 1669. will be on *Monday*.

P R O B L E M.

To find on what day of the Week the first day of each Month happeneth.

Supposing the first of *March* known, it might be reckoned from the former *Problem*, but the following *Verse*, beginning with *March*, as the former, is more ready for the purpose:

*A dreadful Fire, Beholders daily Gaze,  
Chastized England. Ah cruel fatal Blaze.*

*Explication.*

In the Year 1669, the first of *March* is *Monday*; I would know on what day of the week the first of *October* happens. The word proper to the Month is *England*; then count Alphabetically to *E*, viz. *A. Monday, B. Tuesday, C. Wednesday, D. Thursday, E. Friday*, which is the day sought. Whence conclude; that the 1st, 8th, 15th, 22th, 29th days of *October* are all *Fridays*. Thence it is easie to reckon, on what day of the Week any day of that Month happened; and so for all other Months.

P R O B L E M.

To find on what Day of the Month the Sun enters into any Sign of the Zodiack.

For this, *ex super abundantia*, we give the following Verse:

*Charles brought Content, divers Effects ensue,  
Envy, Fear, Dolour, Danger, bids adieu.*

Here again the twelve Words relate to the twelve Months; *March* being the first.

To the number of the Letter of the *Alphabet* the word begins with, add 7.

Example. *E*ar is the word for *October*, and *F* the sixth Letter: Wherefore the Sun enters into the 8th Sign, to wit, *Scorpio*, on the 13th of *October*.

An Account of some Books.

I. PETRI LAMBECHII LIB. PRIMUS PRODROMI  
HISTORIÆ LITERARIÆ, &c. —

THE Author of this Book is now the *Historiographer* and *Library-keeper* to the Emperour. He publish'd this Volume some few years ago at *Hamburg*, the place of his Birth, (whence an Exemplar was but lately sent to the *Publisher*.) He was excited to this Work by the complaint made by the illustrious Lord *Verulam*, (*Lib. 2. cap. 4. de Augm. Scientiarum*) of the want of a compleat *History of Learning*, that might give a *satisfactory* Account of the Rise, Progress, Transmigrations, Interruptions, Declinations, and Restorations of all kind of Learning, Sciences, Arts, and Inventions; together with the *occasion* of Inventions through all Arts; the *method* of teaching, and the *manner* of improving and advancing them: Adding the various *Seçts*, and the most famous *Contröversies* among the Learned; the *Encouragements* they received; the chief *Writings* they composed; their *Schools*, *Academies*, *Societies*, *Colledges*, *Successions*, *Orders*, and whatever belongs to the *state* of Learning.

This grand *Desideratum* our Author undertakes to supply the World with, and in order thereunto, hath given us the *first* Book of the *Prodromus* of this History, and with it the *four first* Chapters of the *Second* Book, together with an *Appendix*, containing a *Summary* of the chief *Persons* and *Things* he intends more fully and accurately to treat of in the remaining 32 Chapters, designed for the same *second* Book: To which, he subjoins two Tables of *Universal Chronography*, in the first whereof he exhibits the succession of all Ages from the Creation of the World to the beginning of the common *Christian* Account; in the *other*, a Continuation of them from the beginning of the said Account unto this present Age: In which *Tables* he gives a general *Idea* of the Connexion of all Ages, as they are computed in respect of the