

COMPOTUS ECCLESIASTICUS

ECCLESIASTICAL ACCOUNT

a thirteenth century textbook

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[1. Quid compotus]

Compotus est scientia considerans tempora distincta secundum motum solis et lune. Scientia' ponitur ut genus; per hoc quod additur 'considerans tempora' denotatur compoti materia. Tempus enim est materia circa quam agit compotista, non tamen quolibet modo consideratum; et ideo subiungitur 'distincta secundum motum solis et lune'. Compotus enim considerat tempora mensurata secundum motum istorum duorum planetarum. *Fecit enim Deus duo luminaria magna, luminare maius ut preesset diei, luminare minus ut preesset nocti*; non curat motus aliorum planetarum, unde patet quod compotus differt ab astronomia et astrologia, que considerant motus omnium planetarum. Tempus quod est materia compoti sic describitur a Tullio: Tempus est pars eternitatis annui, mensurni, [U26r] ebdomatici, diurni, nocturnive spatii certa dimensione.

[2. De partibus temporis]

Compotista autem quandoque assumit partes temporis maiores diei, quandoque minores. Partes temporis maiores diei sunt septimana, mensis, annus, lustrum, indictio, seculum et evum. Quid sit unumquodque istorum satis patebit in consequenti. Partes minores diei sunt quadrans, hora, momentum, uncia, athomus. Quadrans est quarta pars diei naturalis, id est sex hore. Hora vero est vigesima [Ba13rb] quarta pars diei naturalis; momentum est quadragesima pars hore; uncia est duodecima pars momenti; athomus est quadragesima septima pars uncie.

[3. De die]

Dierum vero alius naturalis, alius artificialis. Dies naturalis est spatium ab ortu solis ad ortum: 24 horarum. Dies artificialis est quam diu [U27r] sol est in nostro

[1. The nature of compotus]

Compotus is the science which studies time defined according to solar and lunar motion. 'Science' is posited as the genus; 'which studies time' is added to denote the subject-matter of compotus. For although time is the subject-matter that concerns the compotist, it is not studied in every [possible] way; therefore 'defined according to solar and lunar motion' is added. For compotus studies time measured according to the motion of these two planets: 'For God made two great lights, the greater one to rule the day (i.e., the Sun), the lesser one to rule the night (i.e., the Moon).' It takes no account of the motions of the other planets, and so it is clear that compotus differs from astronomy and astrology, which studies the motions of all the planets. [The sort of] time which is the subject-matter of the compotus is described by Cicero in this way: Time is a part of eternity fixed by measure as of a certain length: a year, month, week, day or night.

[2. The parts of time]

The compotist deals sometimes with the parts of time larger than the day, sometimes with [those that are] smaller. The parts of time larger than the day are the week, month, year, lustrum, indiction, century and era. What each of these is will appear sufficiently in what follows. The parts smaller than the day are the quarter, hour, moment, *uncia*, and atom. The *quadrans* is the fourth part of the natural day, i.e., six hours. The hour is the twenty-fourth part of a natural day. The moment is the fortieth part of an hour. The *uncia* is the twelfth part of a moment. The atom is the forty-seventh part of a moment. **MOMENT = 1.5 minutes uncia = 0.125 minutes atom = 0.031915 minutes (nearly 2 seconds)**

[3. The day.]

Days are either natural or artificial. The natural day is the space of 24 hours from sunrise to sunrise. The artificial day is the length of time the Sun spends in our hemisphere.

Note that the natural day has different starting-points according to different [authorities]. Christians begin and end the natural day from midnight, because we read that Our Lord was born at midnight on Sunday. Arabs [begin it] at midday, because the Sun is said to have been created at midday, and they base their study of the natural day on its motion. The Jews [begin it] in the evening, relying on the authority of Genesis: 'And the evening and the morning were one day'. Some, acting upon sense-experience, like the common people, start the natural day from sunrise, because since the Sun rises above our horizon and is the cause of the day, the day ought by rights to begin with the ascent of the Sun.

Note again that the days of the week have different names according to different [authorities]. Philosophers name each day of the week after the planet which holds sway in the first hour of that day. They say that the planets hold sway in turn through the hours. There are seven planets. Their names and the order of their cycles [from the earth] can be remembered by this verse:

Cynthia, Mercury, Venus and the Sun. Mars, Jupiter, Saturn.

Suppose therefore that Saturn governs the first hour of the Sabbath day, Jupiter the second, Mars the third, the Sun the fourth, Venus the fifth, Mercury the sixth, the Moon the seventh, fourteenth and twenty-first, Saturn the twenty-second, Jupiter the twenty-third, Mars the twenty-fourth: since there are no more hours in that natural day, it follows that the Sun governs the first hour of the following day. That day, therefore, is called Sunday. By a similar calculation you will find that the Moon governs the first hour of the day after Sunday, and that is how it gets its name; and so on for the others. According to this [theory] some doctors study whether the planet governing that [particular] hour is benevolent or malevolent when they prescribe medicines or let blood.

Bearing in mind these considerations the following problem can be solved. The days of the week are named after the planets, and there is a certain order in the planets as regards their cycles. Why, therefore, are the days of the week not named according to the order of the planets, so that Thursday [*dies Iovis*] follows immediately on Saturday, and Tuesday [*dies Martis*] straight after that, and so on? The reason is that the 24 hours are shared out among the planets. But there are seven planets: so that if each of them takes three hours for itself, there are three hours left over, which are given to three planets. It is obvious, therefore, that if any day is governed by a particular planet, the following day is governed by the planet which is next but two.

Christians like Bede, Jerome, and other religious men, call the first day of the week the Lord's Day, or the first ferial: the Lord's Day, because on that day Our Lord was born, on that day he rose again, on that day He created the world; ferial, because *feriare* is the same as 'celebrate'; and on the day we call the Lord's Day we ought to refrain from all work of sinning, and even manual [work]. Alternatively, *feria* is derived from bearing [*ferendis*] victims, because at one time on festival days victims and burnt offerings were borne to the temples. The second day of the week they called *feria 2*, and so on with the others. But they did not change the name of the Sabbath, to call it *feria 7*, because on that day Our Lord rested from all the work which He had made, and rested again in the sepulchre. Sabbath means the same as 'rest', and it has therefore retained this name. The Jews have other names for the days. They call the first day of the week the Sabbath, just as we do, because Our Lord rested on

that day. The second day, which we call the Lord's Day, they call Sabbath 1. As the text says: The first morning of the Sabbath, that is, the first day after the Sabbath. The day we call Monday they call Sabbath 2, and so on in order.

The word *dies* is derived from *diis*, 'gods': for some say that the planets are gods, and the days are named after them. Alternatively it is derived from *chyan*, which means 'clear'; or from *dya*, 'two', because the natural day is divided into the artificial day and the night.

[4.] The week.

Note that the weeks, unlike the days, do not have specific names, partly because there are so many of them - there are fifty-two weeks and one day in a year - partly because in one year a period of a week is equivalent to parts of two weeks in another year. This can be demonstrated in this way: if this year a particular festival is on Saturday, next year it will be on Sunday, so that the festival which is at the end of the week this year will be the beginning of another week next year. But the weeks do have these names in common: *ebdomada*, *septimana*, Sabbath. *Ebdomada* is derived from *ebda*, 'seven', and *deas*, 'days', as it were 'having seven days'. *Septimana* is derived from 'seven' and *mane*: 'having seven mornings', that is 'morning times'; here part is used for whole. Sabbath is applied to the week, because we ought to rest from sin throughout the week. As the text says:

I fast twice in the Sabbath, etc.

From this it is evident that [the word] sabbath applies equally to one day of the week and to the whole week.

[5.] The month.

Note that there are three sorts of months, solar, lunar and the month which we [commonly] use. The solar month is the length of time which the Sun spends in travelling through one sign [of the zodiac]. The lunar month is the same as the lunation, of which more later. The month which we use is the number of days which is inscribed in the calendar, and which has been observed from antiquity.

Note, therefore, that Romulus was the first to distinguish months and years, instituting ten months in his year. His reason for this was that this length of time is long enough for a pregnant woman to give birth; or because it is the length of time for which a woman must forgo remarriage after the death of her husband. He called the first of his months after his father Mars; or alternatively from *mars*, 'war', because that was the time when Roman kings were in the habit of going on expeditions. He called the second month April, from *aperiendo* 'opening', because that is the time when the earth's pores open, and the grass and the leaves on the trees come out; or April, as it were from *Afrilis*. For Venus is called

Frodissa from *frodos*, which is the sea-foam from which she is supposed to have been born. She was the first of the line of Romulus through his mother. The third [month] he called May from the *maiores*, 'the elders', the fourth June from the *iuniores*, 'the young men'. Incorporating words expressing numerals he called the following months Quintilis, Sextilis, September, November, December. As Ovid says:

The third month took its name from the old, and the fourth from the young;

The months that trooped after were distinguished by numbers

September is derived as if from *septimus imber* 'the seventh rain', from *imber*, that is 'from a time of rain', just as February is; and the others in the same way. Later, however, Numa Pompilius added two [more] months, that is January and February. As Ovid says:

But Numa overlooked not Janus and the ancestral shades,

And so to the ancient months he prefixed two

January is derived from *ianua* ['door'], because just as entrance is gained to the hall through the door, so entrance to the year is gained through January. Alternatively it is derived from *Janus*, who was two-headed, just as January has two faces, because it looks backwards to the end of the year which terminates with it and forwards to the year which begins from it. February is derived from *Februus*, that is from Pluto, because at that time it was the custom to perform sacrifices for the souls of one's ancestors; alternatively, from *febre* [fever], because at that time people often suffer from fevers [*febricitare*]

Although Numa constructed his year from twelve months, he still left it short, because he took the months [to be] lunar months, one of thirty days and the other of twenty-nine, and so his year consisted of 354 days; and this number is not long enough for the course of the Sun. Following on, therefore, Julius Caesar, applying the last correction [to the calendar], added eleven and a quarter days. And so the Julian Year consisted of 365 days and six hours. However, he added eight moments too many, as will appear below. In Julius Caesar's time the Romans, to flatter Caesar, gave the month which was formerly called Quintilis the name of July, because, as we read, Julius was born at that time. Later in the same way, to flatter Augustus, they gave the name of August to the month formerly called Sextilis..

You can find out which calendar months have more days, which fewer by these verses:

Give thirty to September, November, June and April, one more to the remaining [months].

Unless it is a leap year, let February be less by two.

Every month the Sun is said to enter a new sign - a sign is a certain part of the zodiac [so] designated by the astronomers. And each sign has a special name, as appears in these verses:

There is Aries, Taurus, Gemini, Cancer, Leo, Virgo,

And Libra, Scorpio, the Bow-carrier [Sagittarius], the Goat [Capricorn], the Flagon

[Aquarius], Pisces.

The first sign is Aries, because, as the Church believes, the Sun was created in that [sign], although the Arabs say that the Sun was created in Leo. It is called Aries, ['the ram'], because the ram is an animal which is strong in its front quarters but weak in its hindquarters: so the Sun when it is in that part of the zodiac which is called Aries in winter-time has little strength, i.e., heat and dryness, but in its front part, that is as it approaches summer, it has more strength. Alternatively, as some people say, the ram lies on its left side throughout winter, on its right side during summer; and so the Sun is travelling towards the lower hemisphere throughout the winter, towards the upper, which is, as it were, its right side, in the summer.

The second sign is Taurus ['the Bull'], because it is then that the toiling of the bulls or oxen is to be seen. Alternatively because just as the bull is a stronger animal than the ram, so the Sun's powers are stronger in it than they were.

The third sign is Gemini ['the Twins'], because at that time the power of the Sun is doubled in heat and dryness; alternatively, because just as the Twins are depicted as young men embracing each other, so when the Sun is in that part of the heavens some of the earth-born things embrace each other with their roots and sprout up through the grass.

The fourth sign is Cancer ['the Crab'], because just as the crab is an animal that goes backwards, so the Sun at that time recedes from our hemisphere. For this reason this sign is called tropical, 'turning about', as it were; and in this [sign] is the summer solstice.

The fifth [sign] is Leo ['the Lion'], because just as the lion is an animal of the most fiery disposition and implacable anger, so the Sun when it is in that part of the heavens is at its most fiery and most parching. For this reason is not good to let blood or use purges at this time, because of the lack of fluid in a time of heat and drought.

The sixth [sign] is Virgo ['the Virgin'], because just as a virgin is infertile, so that time is infertile and produces nothing; although what has been produced ripens.

The seventh [sign] is Libra ['the Scales'], because at that time the artificial day is balanced

with the night, and it is the autumn equinox.

The eighth [sign] is Scorpio ['the Scorpion'], because just as the scorpion stings with its tail, so at that time the cold in the morning nips those who not careful enough.

The ninth [sign] is Sagittarius ['the Archer'], because it is then that the arrows of time are loosed against us, stormy weather, that is, showers of rain, hail-storms and that sort of thing.

The tenth [sign] is Capricorn ['the Goat'], because just as the goat climbs when it is grazing, so at that time the Sun ascends from the lower hemisphere towards our hemisphere; and this sign is called the tropic, because it is then that the Sun is turned round towards us; and then is the winter solstice.

The remaining two signs, Aquarius and Pisces ['the Water-carrier' and 'the Fish'], indicate an abundance of water, because when the Sun is in these [signs] then there is a great abundance of rain; and the word Aquarius is derived from '*aqua*' and '*qualitas*' and '*aer*'.

Some say that these signs are named after the position of the constellations, which are [to be found] in those parts [of the zodiac] in the shape of animals.

[6. Calends, nones and ides]

Note that in each month there are three days which have principal names, from which, with the addition of words denoting number, all the other days of the month are named, i.e., the calends, nones and ides. Calends is derived from *colende*, 'worshipping', because the first day of every month was celebrated in honour of Juno. As Ovid says:

The worship of Juno claims Ausonia's calends.

Alternatively, calends is derived from *calo*, 'call', because on the first day of each month the herald used to go up to a prominent place in the city and call out four times if the market was to be four days long, six times if six days. And so [the word] calends is in the plural, because they call out *calo* more than once. Or again, calends is derived from *calon*, which means 'good', because it used to be the custom among friends to exchange gifts on the first day of the month, to ensure good luck for themselves throughout the month.

Nones is derived from *non*, because no god has a festival on the nones. As Ovid says:

The Nones lack a guardian god

Alternatively, [the word] is derived as it were from *nove* ['new'], because at one time among the Romans statutes were instituted and renewed month by month. Or again, it derives from *nundine*

['markets'], because the latter lasted as long as the nones.

Ides is as it were 'divisions', because they divide the months nearly into two equal parts; or because the markets are divided then.

From these days with the addition of words denoting number the other days of the month are named, so that they precede a greater number according to what is greater and a lesser according to what is less. If the question is asked, why we do not say 'second calends', the answer is that this word 'second' comes from the verb *sequor, sequeris*, so that if this day is rightly called 'second', it ought to follow; and so it is better that it is called *pridie*, that is 'the day before the calends'. All the months have eight ides; hence the verse:

All the months in general have eight ides.

But some months have more nones, some fewer; hence:

Give six to March, May, July and October; to the remaining [months] twice two nones.

Knowing therefore how many days each month has as is clear from what has been said above, and how many nones, and how many ides, if the nones and the ides are subtracted the remaining days will be the calends

. [7. Egyptian days]

Note that in each month there are two days which are called sick, unlucky, Egyptian. Sick, because according to the opinions of some, anybody who falls sick on these days never or hardly ever recovers. Unlucky, because it is unlucky to start any task [then] because the constellations are unlucky. Egyptian, because they were discovered by the Egyptians. For as well as the ten well-known plagues many evils befell them, which were marked in their calendars twice in each month. Some [people], indeed, used to sacrifice human blood on these days; so that blood-letting is forbidden [then] in case it appears that sacrifices are being made to an evil spirit. Augustine forbids the observance of these days, saying:

You should not observe the calends of the months nor the Egyptian days.

But because these days cause apprehension, to identify them these verses should be borne in mind:

Augurio decies audito limite clangor

Linguit olent abies coluit colus excute gallum.

In these verses the twelve words stand for the twelve months, the first for January, and so on. To find

the first Egyptian Day in any month the initial letter of the first syllable of the word that stands for that month is selected. Whatever its number in the alphabet count down the same number of days from the beginning of the month. The first Egyptian Day is where you stop counting. To find the second day, take the initial letter of the second syllable of the same word and count upwards from the end of the month, as many days as its number in the alphabet, and you will find what you are looking for; noting beforehand that H is not counted as a letter.

[8.] The year.

We must see what the year is, why it is so called, and where it begins.

Note that there is more than one sort of year. There is the solar year and the lunar year. The solar year is the length of time it takes the Sun to travel from one point of the zodiac, circling the whole zodiac under its own motion and returning to the same point. Hence it was the custom amongst the ancients to depict it as a serpent devouring its own tail, because of the way that time revolves. Year [*annus*] is derived from *an*, which means 'round', and *eo, is* ['to go'], because of this revolving.

The year has different starting-points, according to different [authorities]. Numa Pompilius, indeed, began his year at the winter solstice, because that is when the Sun starts to ascend towards us. As Ovid says:

Midwinter is the beginning of the new Sun and the end of the old one.

Phoebus and the year take their start from the same point -

(not on the same day but at the same time). Romulus began his year from March, round about the spring equinox, because it is then that everything grows green and flowers. According to the theologians the world was created on 18 March, [according to] the Arabs at the summer solstice; it was their opinion that the Sun was created in [the sign of] Leo. Some [authorities] begin it in September, or at the autumn equinox, because of the text in Genesis:

The earth brought forth the green grass yielding fruit after his kind
for autumn is the season of fruits. So they say that the world was created in the autumn. In some way, we imitate [all these] starting-points: for we begin the keys of the terms and the golden number in January, the concurrents and the solar regulars in March, the epacts, lunar regulars and embolisms in September.

Note that there are fifty-two weeks in the year, and one day. This left-over day causes the weeks to vary, and is the reason why Saints' Days vary in separate years and are celebrated on different days of the week; and again, why the Sunday letters vary; and why the calendar begins with .a. and ends with .a.; and it is the origin of the concurrent. That the Saints' Days vary because of this day appears from the following: suppose that a particular festival is on Sunday this year; next year it will be on Monday, or, if it were a leap-year, on Tuesday. There is the same variation in the first days of the months.

[9. The concurrent]

By an ingenious general rule, two numbers have been invented to locate the day with which each month begins, one variable, namely the concurrent, the other invariable, which is called the solar regular.

The concurrent is a number not exceeding seven, resulting from the superabundance of the year divided into weeks. Number, I say, in a general sense, so that one is called a number because sometimes one is the concurrent. Not exceeding seven, I say, because 'the concurrent does not go beyond seven, but returns to one'; for since there are only seven days in a week, and the concurrent and the regular have the function of indicating the first day of the month, neither of them should exceed seven. 'Resulting from,' etc., I say, because the day which is left over and above the weeks is the cause of the concurrent.

I say therefore that the first year of the cycle of concurrents has one for the concurrent, on account of that day, the second two, the third three, the fourth five, with one day added because of the bissextile, the fifth six, the sixth seven, the seventh one, the eighth three because of the bissextile. And you should count in the same way until you get to the twenty-eighth year, where seven is the concurrent, and the year is bissextile: and afterwards exactly the same situation in the formation of the concurrents will return. So that this period of twenty-eight years is called the cycle of concurrents.

These verses indicate the concurrent in any year:

Whatever day of the week the letter .f. will indicate

The concurrent of its equivalent number will serve for the year.

See what day of the week is signified by the first .f. in March: that number is the concurrent for that year. Or the concurrent can be found in this way:

.a. has six, .b. holds five fast, .c. four, and .d.

has three, and .e. two, .f. one, and also .g. has seven.

1
2
3 ly
5
6
7
1 ly
3
4
5
6 ly
1
2
3
4 ly
6
7
1
2 ly
4
5
6
7 ly
2
3
4
5 ly
7

Whenever .a. is the Sunday Letter, six is the concurrent; whenever .b., five; and so on. The concurrent changes in March, because it begins and ends in March. It varies from year to year, but one [concurrent] serves for the whole of one year. And 'concurrent' is derived from *con*, which means 'together,' because it runs together with the regular to show what day with each month begins with.

The solar regular is a number not exceeding seven which, joined with the concurrent, indicates the first weekday of the month. 'Number', I say, in a general sense, as above; 'not exceeding seven', as above. The phrase 'which joined' etc. shows the function of concurrent and regular added together. Each month has now and will always have the same number for regular as the day of the week that it began with at the Creation of the world. The world was created on 18 March, as the Church believes, so that it is there that it is customary to mark the first day of the era, with the Sun in Aries; as the verse has it:

Let the third [Sunday letter] .g. repeat the beginning of the world.

It is accepted that the first day of the era was a Sunday. G therefore was the Sunday Letter. Supposing that it is the Sunday Letter throughout the whole of the following year, it is clear what the first days of the months are, and so also the regulars. March has 5 as regular, and so do all the days belonging to it. Having found one regular, for instance, the regular for March, the others should be formed in this way: take all the days of March and its regular, and join them together, and when you have joined them subtract seven from them as often as you can; one is left over, which is the regular for April. The same method should be followed for all the following months, bearing in mind that if nothing is left over, seven is the regular of the following month. The regulars of all the months can be known through these verses:

Five for November, March; June, February six; April, July one; September and
December seven;

October, two; May and January have three; August has twice two regulars.

or these:

Expugnans alios casus facit aspera dives

Gaudet blandus egens, gaudia cessa ferens

Here are twelve words standing for the twelve months, the first for March and so on. Whatever the number in the alphabet of the initial letter of any particular word, that is the regular for the month that word stands for.

Having established the concurrent and regular, therefore, join them together, and if the result of joining them is seven or less, that is the first weekday of the month whose regular you have taken; if more than seven, subtract seven, and the remainder is the number of the first weekday of the month whose regular you have taken. It is called the regular because it regularly runs with the concurrent to show what the first day of the month is; and it is called solar to distinguish it from the lunar regular.

Note that having found what the first weekday of the month is with the concurrent and the regular, if you do not know the Sunday Letter, it can be located with the following verses:

Altitonans dominus divina gerens bonus exstat

Gratis celi fert aurea dona fidei

In these verses the initial letters of the twelve words show the letters with which the months begin. Having the number of the day which begins any particular month, and also the first letter of the month from the words of these verses, that letter stands for that weekday from which the month begins; then if you count down the letters and the weekdays until you come to day 1, the Sunday letter is immediately revealed. The verses above, furthermore, will tell you how many days each month has, if you were to suppose that each month had twenty-eight days. Then look at the distance between the initial letter of one word to the initial letter of the following word, in such a way however that the former is included, the latter excluded from the reckoning, and the number of units making up that distance is added to 28: this is the number of days of the month which the first word represents. Note that for the month of December, you should include both letters. And this is because the calendar begins with .a. and ends with .a. These verses begin from January.

[10.] The bissextile. The extra day added in a leap year

We must see what it is; why it is called bissextile; where it is intercalated; how it can be found through the Years of Our Lord; what sort of error results if the bissextile is not observed.

It should be noted therefore that Julius Caesar and other learned men perceived the Sun to remain in each sign for 30 degrees and 30 *trientes hore* and 30 *bisse momenti*. A degree is the length of time which the Sun takes to journey through a natural day. And therefore because the Sun remains in each sign for 30 degrees (and there are 12 signs) there will be 12 x 30 degrees, that is, 360, and as a result the same number of days. A *triens* is the third part of any whole number: so 30 *trientes hore* makes 10 hours, and since there are twelve signs, there will be twelve times 10 hours, that is ten times

12, that is five times 24 hours, which is five days. And so we have 365 days made up of degrees and *trientes*. A *Bisse* is two-thirds of any whole number divided into three equal parts, and so 30 *bisse* of a moment make 20 moments, that is, half an hour; and since there are 12 signs, there will be 12 half-hours, that is 6 whole hours. And thus in each year we have 365 days and 6 hours. But because it would be difficult to continue these six hours successively in each year in such a way that, since they are not made into a day, but placed anywhere - ie, according to this [calculation], if the preceding year began in the morning, the second would begin at midday, the third [at six o'clock] in the evening, the fourth at midnight; similarly the Saints' Days would vary, and so the beginning of January would ascend [the calendar] until it was about the [time of] the autumn equinox, or further still, so that the beginning of the year would be in days as long as those of the summer solstice - for this reason it was arranged that the six extra hours in the first year, the six in the second and the six in the third should be transferred to the six hours of the fourth year; and there are 24 hours in the fourth year, i.e., one [complete] day. And this [day], put together from parts in this way, is intercalated in February, because it is the shortest of the months. And because the six hours from which this day is made up result from the *bisse momenti*, the day which is four times these six hours is called bissextile. Alternatively, it is called bissextile because when it is the bissextile year in cathedral churches when reading from the Martyrology they pronounce the sixth calends of March twice, placing two days on the same letter. And it should be understood that when two days are counted on the same letter, St Matthias's's Day should be celebrated on the second day, as these verses record:

Let the sixth calends of March hold fast the bissextile On the following day are celebrated the festivities of Matthias

The reason why the bissextile is intercalated on this day is this: six is the first perfect number. Because therefore this day is as it were the perfecting of the year, it is placed on the day named after the perfect number. A perfect number is a number whose constituent parts, whether multiplied or added together, complete that number exactly. And for this reason, it can be said, it is intercalated in February, because the days of February constitute the second perfect number, that is 28. Whether a year is bissextile or not can be known in this way: take the date of the year and divide it by four: if there is a remainder, it is not bissextile, and the remainder, whether it is one, two or three, shows how many years after the bissextile the year is. If there is no remainder, the present year is bissextile,

'bis sextus' means 'twice the sixth' and refers to doubling 24th February in a leap year. This date is the sixth day before the kalends (1st) March.

as these verses record:

Then it will be bissextile when you can divide the years into four equal parts.

It should be noted, moreover, that if the bissextile is not observed, in 364 years Christmas Day will occur in days which are as long as where at present the Annunciation is celebrated. This is evident because in that number of years, since the fourth year is always bissextile, there are 91 [bissextile] days: this is a quarter of 364 days. From 91 days can be made three months, two of thirty days and one of thirty-one, and these three months are a quarter of a year. If this were to be taken away, the previously-mentioned inconvenience would occur; or perhaps worse, that Christmas Day would be celebrated in those long days where St John the Baptist's Day is celebrated now. This is evident when you think about it if you double 364 years.

[11.] The [solar] cycle.

We have seen what the concurrent and the bissextile are: now for the solar cycle which is as it were the consequence of these.

The solar cycle is the revolution of time which takes account of all the variations in the solar year which are caused, by the concurrent and bissextile; and this cycle is completed when none of the days extra to the year made up of weeks is left (which is the reason for the concurrents), and none of the six hours extra to the separate years (which is the reason for the bissextile). This is a period of twenty-eight years, because in this length of time all these variations are completed, as is depicted in the table of concurrents.

Since a cycle is, as it were, a circle, and you can put the beginning wherever you like in a circle, it is not surprising that the solar cycle begins in different places according to different [authorities]. And so our solar cycle according to the assumption of Dionysius and Church usage does not begin where we and Gerland have established that the beginning should be, but from the twelfth year of that cycle, which has concurrent 1, as in the first year, Sunday Letter F, and which is bissextile. So it is evident that the first year of the cycle according to Gerland begins twelve years before the beginning of the solar cycle according to Dionysius.

You can find out how to distinguish the solar cycle according to Church usage and Dionysius with the aid of these verses:

Fallitur Eva dolo, cibus Ade gaudia finit,

Et cum botrus adhuc germinet; Eva dolet.

Christus bella gerit, finitur eo duce bellum;

Ad grvida fit dux, cuncta beavit ave.

In these verses there are twenty-eight words which stand for the twenty-eight years of the solar cycle, the first for the first year, the second for the second, and so on.

The first use of these verses is for the Sunday Letter to be known. The initial letter of any word is the Sunday Letter throughout the year which that word stands for, unless it is bissextile. If it is bissextile, then it is the Sunday Letter for ten months beginning from March, and the extra letter is the Sunday Letter for the two previous months.

The second use is that if you know the Sunday Letter through [it], you can immediately identify the concurrent by means of this verse:

Place the concurrents beside .f.e.d.c.b.a.g.

Whenever the Sunday Letter is .f., the concurrent is 1; when .e., 2; and so on for the others, observing the order of the letters in the verse.

The third use is to find the bissextile year. Count the 28 years on the seven fingers of the two hands, so that the first year of the cycle is at the tip of the index finger of one hand, the second on the joint next to it, the third on the next, the fourth at the base of the index finger, the fifth at the tip of the middle finger of the same hand; and in this way count down until the cycle is completed. The seven years at the tips of the fingers are therefore, I say, bissextile; the ones on the adjacent joints the first years after the bissextile; and so on. This can be understood by this alphabet - .g.f.e.d.c.b.a. - written backwards. In the above verses, whenever a letter of the alphabet is skipped, the year is bissextile, and the letter which has been skipped will be the Sunday letter for two months, as has been said above. The next letter after the point at which this transition has been made is the Sunday Letter for ten months.

You can also learn whether the year is bissextile with this verse:

Fallit amor cautos extant grave basia dantes.

In this verse there are seven words standing for the seven bissextile years in the whole cycle. Since the

first year of our cycle is bissextile, the first word corresponds to the first year, and *fallit* to *fallitur*; the word following this word *fallit* beginning with .a., stands for the second year, and *amor* corresponds to *ade*; and so on.

By the following device we can find the year of the Dionysian Cycle. Take the date of the year [annos Domini] and add 9:

For when Christ was born it was the tenth year of the sun

Divide the sum by 28. When this division is made, if there is no remainder, we are in the last year of the cycle. If there is any remainder, it shows what year of the cycle we are in.

[12.] The division of the year.

The year is divided into four parts, spring, summer, autumn and winter. Spring [*ver*] is derived from *vireo vires*, because at that time everything is green; summer [*estas*] from *estu* ['heat']; autumn from *automos*, a Greek word of which our equivalent is sickly [*morbidum*] or stormy [*tempestuosum*]: this is because it is a time of cold and drought. Winter [*hiemps*] is derived from *emi*, 'half', because the common people divide the year into winter and summer, with imprecision calling winter half a year. The following verses give the beginnings and endings of these parts:

Clement's Day is the beginning of approaching winter.

Winter recedes backwards with the Feast of Simon Peter's Chair.

Urbanus puts spring to flight, Simphorianus the summer.

Summer and autumn both have 91 days, winter 92, because one day is left over when the year is divided into four parts. Spring has 92 days if [the year] is bissextile: otherwise 91. And if the number of days in the above verses are not assigned to each part as we have just assigned them, this is because the endings and beginnings of the parts we have described are intended to be marked by well-known festivals: it doesn't matter if one or two days of one part are reckoned with the days of another part.

[13. Solstices and equinoxes]

In these four parts or seasons of the year there are two solstices and two equinoxes. They are called 'solstices' not because the Sun stands still at any time, but because it is at its nearest approach to our zenith, or again, at its greatest distance from it. The equinox is when the [length of the] artificial day equals the night.

The following verses give the signs in which the solstices and equinoxes occur:

Cancer and Capricorn make these two solstices

But Aries and Libra make the nights equal to the days.

The summer solstice is around the beginning of Cancer, because at that time the Sun is at its closest to our zenith, or to our habitable region. The winter solstice is around the beginning of Capricorn, since at that time the Sun is at its most distant from our zenith, or from our habitable region. When the Sun moving away from Capricorn towards Cancer comes to a place half-way between, it is the spring equinox; and because it happens in spring it is called the spring equinox, in March, around the beginning of Aries. When the Sun moving away from Cancer towards Capricorn comes to a place half-way between, it is the other equinox; and because it happens in the autumn it is called the autumn equinox, in September about the beginning and the entrance of the Sun into Libra.

There is doubt about the actual days of the solstices and equinoxes, although the computists say that the Sun enters a new sign on the fifteenth calends of the month. As the verse says:

Always on the fifteenth calends are placed the signs

And on the eighth day after that [the Sun] ought to enter the equinox or the solstice. So it is evident that since the Sun enters Capricorn on 18 December [*xv kal. ian.*], and that the eighth day after should be the solstice, the winter solstice will be on Christmas Day, 25 December [*viii kal. ian.*]. In the same way, since the Sun enters Cancer on 17 June [*xv kal. iul.*], the summer solstice will be on St John's Day, 24 June [*viii kal. iul.*]. And similarly with the equinoxes: since the Sun enters Aries on 18 April [*xv kal. apr.*], the spring equinox will be where the Annunciation is noted, i.e., 25 March [*viti kal. apr.*]; and again, since the Sun enters Libra on 17 September [*xv kal. oct.*], the autumn equinox will be on the day of the Conception of John the Baptist, that is 24 September [*viii kal. oct.*]. That the winter solstice used to be on Christmas Day, the summer solstice on St John's Day, seems to be proved by this authoritative text of Matthew [*sic*] concerning St John: 'He must increase, but I must decrease.' For there is a certain gloss which says that when Our Lord was born the days began to increase, when John was born, to decrease. But although this was true at that time, it is not true now; for the equinoxes and the solstices have moved back, because we have attributed more time to the course of the Sun than ought to have been attributed. Inasmuch as the Sun actually remains in each sign for thirty days and 30 *trientes hore* and 29 *bisse momenti*, in each sign there is an overestimation of one *bisse*; and since there are twelve signs, there will be twelve *bisse momenti*, which makes 8 moments, that is a fifth part of an hour. And

so in five years we overestimate by one hour; and since 24 hours make one natural day, in 5x24 years one natural day is found: that is in 120 years. Now, since the birth of Our Lord, 1200 years, or a little more, have elapsed. 1200 is 10x100 and 10x20; and so by now the winter and summer solstices respectively precede Christmas Day and St John's Day by ten days. And the same should be understood about the equinoxes. As the verse says:

The solstice precedes Christ and John by ten days,

The equinox the annunciation of the Mother (of Jesus) and John's day.

[14. Fast days]

Note that in each of the four seasons there is a certain fast of three days. We fast in the spring when everything is flourishing, so that good works may flourish in us at that time; alternatively so that the humour which is associated with spring, i.e. blood, which is hot and wet, may be moderated in us. We fast again in summer so that we may be fervent in charity; or so that the humour which is associated with summer, choler, which is hot and dry, may be moderated in us. We fast in autumn so that we may bring forth the fruit of good works; or so that the humour which is associated with autumn, i.e., melancholy, which is cold and dry, may be moderated in us. We fast in winter so that just as the leaves wither and the grass fades, so vices may wither and fade in us; or so that the humour which is associated with winter, i.e., phlegm, which is cold and wet, may be moderated in us. On which days these fasts should be celebrated is given in the following verses:

Holy Cross Day, St Lucy's Day, Ash Wednesday, Pentecost

Give notice that we should be on our knees on the following Wednesday.

The Vigils of some of the Apostles are marked by fasts, others not. Which these are is shown by the following verses:

Peter and Andrew, Paul with Simon and Jude

And Matthew remind us that we should fast.

There are six Apostles who have Vigils, but only four have days on which we fast, since two of the Apostles, i.e., Peter and Paul, share a [feast-]day, and so do another two, i.e. Simon and Jude. Andrew and Matthew have a day each. If you want to know why we do not fast on the Vigils of the other Apostles, you can find more about the matter in the *Summa* of Master John Belet.

[15. Advent]

Advent varies because of the Sunday Letters and the weekdays which are taken into account in the solar cycle: these verses should be learnt to obtain the right day for Advent:

The Sunday next to St Andrew's Day whether before or after

Celebrates the Advent of Our Lord.

If [St Andrew's Day] falls on that Sunday, it is celebrated at the same time.

Thus briefly where all the dates for Advent should be celebrated appear.

[16.] The lunar year

The lunar year is four-fold. The first is the period of time in which the Moon recedes from one point in the firmament and returns again to the same [point]. The second is the same as the lunation, which is a little greater than the first. The third is the period of twelve lunations, which is called the common year. The fourth is the period of thirteen lunations, which is called embolismal. We will go through these in order.

The first year, therefore, comprises 27 days and eight hours, which can be demonstrated in this way. The Moon remains in each sign of the zodiac for two days, 6 hours, and *bisse hore*. And because it remains in each sign for two days, and there are twelve signs, we have twelve times two days, which is 24 days. And again because it remains for [another] six hours, there will be 3 days. 12 times *bisse hore* is 8 whole hours. And so altogether we have it that while the Moon circles the zodiac, setting out from and returning to the same point, 27 days 8 hours have gone by.

The second year is that period of time in which the Moon having at first been lit up by the Sun travels round its circuit, returning to the same point where it was lit up; but since it does not find the Sun there, because the Sun has journeyed through nearly one sign [since then], it catches up with the Sun in a period of 2 days and 4 hours. So this year comprises 29 days and 12 hours on account of the 2 days and 4 hours which are additional to the first year. And this year is the same as the lunation, or lunar month. From what has been said it appears that each lunation is 29 days 12 hours long; but since the compotist does not reckon in this way, he transfers instead the twelve hours from one lunation to the twelve hours of the other, counting one lunation as 30 days, one as 29. But this is sometimes impeded by the bissextile, the embolism, and the *saltus lune*. Since, therefore, according to the compotist's reckoning, one lunation is 30 days long, the other 29, the lunation made up of even days is attributed to the [solar] month of unequal days. As the verse says:

The uneven lunation is formed in the even month, the even in the uneven.

Moreover, the lunation is said to be the lunation of the month in which it ends. As the verse says:

The lunation is given to the month which is associated with its end.

If two lunations terminate in one month, one will be irregular, or embolismal; i.e., it results from the embolism. There are exceptions to the verses just given because of the bissextile and the embolism.

How the bissextile is an impediment can be demonstrated in this way: the rule is that in the bissextile year the February lunation will always be thirty days long, in the other years 29, because of the extra day in the bissextile year. As a result, there will be three 30-day lunations in succession in a bissextile year, January, February and March.

It should also be noted that whenever the March lunation begins before the place of the bissextile, and if it is a bissextile year, a double inconvenience seems to occur: namely that the March lunation would have 31 days, which is unheard of, and that the February lunation would be only 29 days long, which is contrary to the rule which has just been given. To solve this [problem], note that in this case, when *luna 1* of the March lunation should be pronounced, *luna 30* of the February lunation is pronounced [instead], so that the number which indicates March *luna 1* is understood to be put in the second place. This is marked in some calendars by a special number written additionally from 3 February as far as the bissextile, so that an additional 19 is written against 4 February, then 8 against 5 February and so descending as far as the place of the bissextile. It is the custom to mark this with some oblique lines extending from these same places as far as the place of the bissextile.

[17. The golden number]

To find the age of the Moon for each day, that is from the new Moon, tables were invented first of all by the Romans. Then the Chaldeans invented the golden number and sent it to Rome. The Romans, because it was easy and useful, inscribed it in their calendars in letters of gold; and so to this day it is called the golden number. In the first year of the nineteen-year cycle, therefore, the primations [new Moons] are indicated throughout the calendar by the number 1, in the second by 2, and so on with the others. From this it is clear that since this cycle contains nineteen years' worth of these numbers, the largest number will be 19.

The number 3, therefore, is placed on 1 January, since it is the rule that *luna 1* always falls on 1 January in year 3 of the cycle. From this number all the following numbers are formulated by the addition of 8, in such a way that if the result is larger than 19, 19 is subtracted and the remainder is selected. Alternatively, it can be formulated in this way. If the number in question is 12 or a larger number, 11 is subtracted and the remainder put in the next place; if it is less than 12, add 8. Where the golden number is concerned, almost throughout the calendar a smaller number follows a larger number without a space between them, a larger number a smaller after a space. There are exceptions to this rule in twelve places in the calendar, six places around the beginnings of the six months which are distinguished with even numbers, e.g. the second, the fourth, etc. The remaining six exceptions are around the ends of the six successive months beginning in July. All this is demonstrated in these verses:

The golden number is formed by this well-known device:

The first day of January which is called the gate of the year -

[This day] retains three, lest the following order should waver;

With the previous number eight gives the [number] following.

If you should exceed nineteen in counting in this way,

Subtract ten, and nine as well, and keep the remainder;

If the number twelve or more is the outcome for you,

Subtract eleven and set down there [the number] that is over.

If the number should be less than that twelve,

Add eight, and afterwards write down the addition.

The third place is for the larger number;

If a smaller number follows, it is continuous to the larger one.

In twice six places this rule does not hold:

Three [numbers] are joined together from 2 February;

You should place four [numbers together] under 4 April;

June destroys [the order] by the same amount when it appropriates 2 June;

At the beginning of August you should join three together;

Place four side by side on 1 October;

Then on 2 December of the twelfth month

The line holds thirteen at one and the same time as two.

Take the six months, July first and those following,

Although it is larger than these elevens the addition follows straight on.

Eight, a smaller number, follows but is not continuous.

In this way, therefore, the golden number is explained.

Note that the 19-year cycle and the lunar cycle are of identical length, because each is nineteen years long, but they differ in that our nineteen-year cycle begins three years earlier, because year 1 of the lunar cycle is year 4 of the nineteen-year cycle. The nineteen-year cycle is the one by which we operate in assigning lunations and to which the golden number as it is written in our calendars applies. The lunar cycle is the one by which the ancient Romans operated, assigning the actual primations of the Moon by a complicated process of multiplication and division. It is the custom in some old calendars to note it by a specific number. One is put on 1 January, and then it is formed by the addition of 8 in the same way as the golden number; and so both cycles begin from January. To find what year of the nineteen-year cycle we are in, add 1 to the year of Our Lord and divide the total by 19. If there is no remainder we are in the last year of the cycle. If there is a remainder, that indicates which year we are in. If you want to know what year of the lunar cycle we are in, subtract 2 or add 17 from the Year of Our Lord and divide as before.

[18.] The common year.

Next the third lunar year, that is the common year. It is called common because it has twelve lunations just as the solar year has twelve months; alternatively, because it nearly always happens that two common years come together, as will appear in the collation of the embolisms. But this year comprises 354 days, which can be shown from the fact that it has six lunations of 30 days and six more with 29, which add up to 354. And it is evident that the solar year exceeds this common year by a period of eleven days; so that if the two years begin at the same time, the common year will finish earlier than the solar year, as is obvious when we are in the third year of the cycle. So that if there should be a new Moon on 1 January, on the same day after the revolution of the year it will be twelve days old because of the extra eleven days. There will be a similar variation in the beginning of each month, and indeed, in every day of the year.

To reconcile this, the compotists have invented two [sorts of] numbers, the epacts and the lunar regulars. And to find out how old the Moon is on the first day of the months as a result of this extra eleven days there are some special rules with respect to the past and the future about the age of the Moon. Suppose therefore that the Moon is a particular age today, and you want to know how old it will be on the same day next year, or the year after, or the year after that: add eleven to the age the Moon as it is at the moment: this will be how old it is next year. Add eleven to that again, and that is how old the Moon will be in the year after; and so on *ad infinitum*, only noting that if a number exceeds 30, you should subtract 30 and adopt the remainder as the age of the Moon. If you want to know how old the Moon was this day last year, or the year before, or the year before that, add 19 to the present age of the Moon and you will have the age of the Moon last year; add 19 again, and it will give you the age of the Moon the year before, and so on; noting only that if a number exceeds 30, you should subtract 30 and the remainder will tell you how old the Moon is. As the verses say:

Set down five days plus six for a future day,

And for one that is past twice five plus nine.

[19.] The embolismic year.

This is the embolismal year, which consists of thirteen months, or of 384 days. It thus exceeds the common lunar year by 30 days, and the solar year by 19. It is called the embolismal year from embolism, 'interception', as bissextile is derived from *bissextus*. Let us see what the embolism is, what its origin is, and where in should be intercalated. The embolism, then, is a lunation of 30 days not assigned to any particular month, and it is derived from *embolismos*, which is the same as an increase. This lunation results from the 11 days by which the solar year exceeds the common lunar year. The origin of the embolism will be clearer if you note that the nineteen-year cycle is divided into *ogdoas* and *hendecas*. The *ogdoas* is a period of 8 years, the *hendecas* of 11. There are 3 embolisms in the *ogdoas*, 4 in the *hendecas*, and so there are seven in the whole cycle, which can be demonstrated in the following way. In years 1, 2 and 3 there are an extra 33 days: from which in year 3 therefore is a lunation of thirty days; and there are three days left over. So the third year is called embolismal from the lunation which is thus extra. In years 4, 5 and 6 there are an extra 33 days; from 30 days the embolism, or extra lunation is produced, so year 6 is embolismal. There are three days left over, which added to the three preceding [left-over days] make six. In years 7 and 8 there are an extra 22

days, to which if the 6 above are added there will be 28. To complete this lunation which should occur in the eighth year, two days are borrowed from the next period. So year 8 is embolismal, and so there are 3 embolisms in the *ogdoas*. In years 9, 10 and 11 there are 33 extra days. 30 of these make the embolism, so that year 11 is embolismal. 2 days are cancelled, because they have been borrowed by year 8; there is one day left. In years 12, 13 and 14 there are 33 extra days. 30 make the embolism, so year 14 is embolismal. There are three days left over which added to the one left over above will make four. In years 15, 16 and 17 there are 33 extra days. 30 days make the embolism. So year 17 is embolismal and there are 3 days left over, which added to the 4 above make seven. In years 18 and 19 there are 22 extra days, which added to the seven left-over days above make 29. But because the embolisms are all 30 days long, one day is borrowed from the July lunation in the last year of the cycle to complete the last embolism. So that although in all the other years of the cycle, the July lunation is 30 days long, in the last year it will be 29. The day that is subtracted in this way is called the *saltus lune*: about which more will be said below.

This verse will tell you the month and the day of the month where the embolism is intercalated in the calendar:

12 3 9 14 3 6 1 3 11 2 8 2 3 21
 \ | \ / \ / \ / \ / \ / \ / \ /
Mobilis ibo cifs ace liber habeto coevum

The letters J and X were not present in the mediaeval alphabet

In this verse there are seven words which serve for the seven embolisms, the first for the first [embolism] and so on. The number in the alphabet of the initial letter of any word indicates the month in which the associated embolism is to be found. The initial letter of the second syllable of the same word gives the seat of the embolism. And what year of the nineteen-year cycle is embolismal is indicated by this verse:]

3 6 8 11 14 17 19
 Christus factus homo levat omnia reddita trono

Find the number in the alphabet of the initial letter of the first word: that is the embolismal year.

Note that many errors occur in the calendar as a result of the embolism. They are the errors of vicissitude, termination and variation. The error of vicissitude is when there is a succession of 30-day lunations. The error of termination is when lunations end outside the months to which they are assigned. The error of variation is when one of the uneven months has an uneven lunation, or an even month an even one. Besides these, there is the error which causes the failure of the epacts. in the calendar:

'Vicissitude' means a difficulty discovered in all embolisms (years having an intercalary lunar month)

The first embolism, therefore, begins on 2 December and ends on the last day of the same month. And the error of vicissitude occurs, because the embolism and the January lunation are both of 30 days, and if it is a bissextile year, there are four 30-day lunations - the embolism, January, February and March. Moreover, this embolism is intercalated in year 2 of our cycle, when, in keeping with its origin, it ought to be intercalated in the third. The reason for this is that the cycle of those who invented the embolisms began from September, so that it precedes our cycle, which begins from January, by four months; and so when we are at the end of the second year of our cycle, they have already passed through 4 months of year 3 of their cycle. Accordingly, this embolism is intercalated in the third year of their cycle and in the second of our cycle.

The second embolism begins on 2 September and ends on 1 October. There is an error of vicissitude, because the September lunation and the embolism are both 30 days. Moreover, this embolism is assigned to the fifth year of our cycle, when it ought to be assigned to the sixth. The reason for this is that it is still year 5 of our cycle when year 6 of theirs begins.

The third embolism begins on 6 March and ends on 4 April. There is an error of vicissitude, because the March lunation and the embolism are both 30 days, and if it is a bissextile year, there are four 30-day lunations - January, February, March and the embolism. There is also an error of termination, because the April lunation ends on 3 May, the May lunation on 2 June, the June lunation on 1 July. And in that year the epacts are wrong at the beginning of May and July, as will be explained below. Note also that in the 4th year, since the March lunation begins before the bissextile if it is a bissextile year, the March lunation will seem to be 31 days long and the February lunation only 29. To avoid these errors, as has been touched on above, the March lunation should be postponed by one day, so that *luna 1* of the March lunation is called *luna 30* of the February lunation, and *luna 1* of March is the next day.

The fourth embolism begins on 3 January and ends on 1 February. There is an error of vicissitude, because the January lunation and the embolism are both 30 days, and if it is a bissextile year, there are four lunations - January, the embolism, February and March - all of 30 days. There is also an error of termination, because the February lunation ends in March, and the March lunation in April. This embolism is intercalated in year 11 of both cycles, and so all is well. Moreover, the epact is wrong in that year at the beginning of March, unless it is a bissextile year.

The fifth embolism begins on 2 November and ends on 1 December. There is an error of vicissitude, because the November lunation and the embolism are both 30 days. And note that this embolism is the reason why two [golden] numbers, 13 and 2, are placed on the same line on 2 December; for if 13 was placed on 1 December, there would be a double error: the preceding embolism would be only 29 days long, and the December lunation 30; and the contrary should always happen. Moreover this embolism is intercalated in year 13 of our cycle, year 14 of theirs.

The sixth embolism begins on 2 August and ends on the last day of the same month. There is an error of vicissitude, because the embolism and the September lunation are both 30 days. Moreover, it seems that this embolism is wrongly assigned, because this is year sixteen of both cycles, when this embolism ought to be intercalated in year seventeen in both. This is the reason why: if year 16 were a common year, it would finish its twelve lunations on 1 August. This embolism therefore following immediately after is assigned to year 17, and is, as it were, its beginning. Thence it can thus be assigned to year 17 in both cycles.

The seventh embolism begins on 5 March and ends on 3 April. There is an error of vicissitude, because the March lunation and the embolism are both 30 days, and if it is a bissextile year there are four lunations - January, February, March and the embolism, all of 30 days. There is also an error of termination, because the April lunation ends on 2 May and the May lunation on 1 June. Again, the epacts which should indicate the age of the Moon are wrong at the beginning of May and August. Moreover, since in this year the lunation begins before the place of the bissextile day, if it is a bissextile year, it will be seen to be of 31 days. But this can be dealt with in the same way as in the third embolism. The reason why these seven embolisms are intercalated in the months and days of the month which have been indicated is because if they were put anywhere else there would be more errors and more epacts would be wrong.

[20.] The epacts and the lunar regulars.

The epact is a number not exceeding 30 resulting from the excess of the solar over the common lunar year. 'Not exceeding 30', I say, because since the function of the epact is to show how old the Moon is, and no Moon is older than 30 days, the epact should not be more than 30 either. 'Resulting from the excess' etc., I say, because the epact derives from the same extra 11 days as the embolism.

Year 1 of the nineteen-year cycle had no epact, because there was no preceding year from whose inequality it could derive; alternatively because year 19 of the nineteen-year cycle is, as it were, the one before year 1, and that year has epact 18; there are 11 extra days in that year, plus one from the *saltus lune*, which in total is 30. But 30 is the same as no epact, because when 30 is added to any [lunar] regular it has to be deleted. So year 1 has no epact. Year 2 has epact 11, the third year 22, the fourth 3, because 30 are subtracted; and so on, adding 11 [each time]. The same thing may be learnt through these verses:

Whatever the age of the moon on 20 March [*xi kal. Apr.*]

It shows the number of the epact through each year.

Find how old the Moon is on 22 March: that number is the epact for this year. Alternatively, 11 can be added to the epact of the preceding year:

The first luna 1 in May shows the epact of the next year.

And to find the epact without a calendar these verses should be known:

Subtract one, then add nine, then nineteen.

Year 1 of the cycle is placed at the base of the thumb, year 2 on the middle joint, year 3 at the tip, year 4 again on the base of the thumb, and so you count the years in a circular manner until you come to the year the whose epact you are looking for. This will be either at the base of the thumb, or on the middle joint, or at its tip. If it is at the base, subtract 1; if in the middle, add 9; if at the tip add 19, and you will have the epact of the required year.

Epact is, as it were, *epiaucta*, 'an extra increase', because of the increase described above; alternatively, epacta is as it were *epi adiecta*, because when it is added to the regular it shows how old the Moon is.

The lunar regular is a number not exceeding 30 which added to the epact indicates how old the Moon is on the first day of the month. 'Not exceeding 30': explain as above. But the phrase 'added to the epact' shows the function of both epact and regular. This is the origin of the lunar regulars: each month has, and always will have the same number for regular as was the age of the Moon at the beginning of the composition of the calendar.

To understand this, suppose that we are in year 1 of the cycle, and, placed as it appears, in February or the following 6 months; in year 1 of the nineteen-year cycle 1 is the golden number on *x kal feb*, so that 1 February has *luna 10*. So that it has 10 for regular. In the same way consider the golden number, i.e. 1, before the first days of the other six months [March - August] to find the regulars. But suppose that from September and the following 4 months we are in year 19 of the cycle, which is as it were the one before the first; and according to this, September has 5 for regular. To form all the other [regulars] if you have this one, take the days of September and add its regular; subtract the September lunation, and the remainder is the regular of the following month. And similarly for the others. As the verses say:

Five are given to September, eight to November and December, three times three to January and March;

Let February and April take ten; afterwards, add one to each month.

Alternatively:

After twice E, twice G; after twice I and K the order is kept.

or:

Estuat esurit gramen gravat igne kalendas

Igne kalendarium licet mihi nominis ordo.

Find the number of the initial letter of any word of the last verses, etc. Having found the epact and the lunar regular, you can find how old the Moon is on the first day of any particular month in the following way. Add the epact for the year and the regular for the month: the result will be 30, or a larger or smaller number. If 30 or a smaller number, this is the age of the Moon on the calends of that month the regular of which you are seeking. If larger, subtract 30, and the remainder will show the age of the Moon.

Note that the epact and the lunar regulars, like the embolisms, begin from September. And the epact is a variable number, the regular an invariable number.

The epacts are wrong five times in the whole cycle: twice in year 8, once in year 11 and twice in the last year. As the verse says:

July with May is wrong in the eighth year.

The epacts and regulars tell us that in year 8 the Moon is 28 days old on 1 May; but it is in fact *luna* 27. In the same year they say that the Moon is 30 days old on 1 July, when in fact it is 29. Again, the verse says:

Unless it is a leap-year, the eleventh [year] is wrong in March.

The epacts and regulars tell us that in year 11 the Moon is 29 days old on 1 March, although in fact it is 28. But in a bissextile year two days are counted on 24 February [*vi. kal. mar.*], so that then the epacts are right.

The last year [of the cycle] lets down August, and also May.

Again, in the last year of the cycle, the epacts and regulars tell us that the Moon is 29 days old on 1 May, when it is in fact 28; and 2 days old on 1 August, when it is in fact 3. This happens because of the *saltus lune*, because the August lunation starts a day earlier than it would if there was no *saltus*.

If you want to know what year of the cycle of epacts we are in, use the same device as for finding the year of the nineteen-year cycle (add 1 to the Year of Our Lord, etc.). And note that there is no difference between the two cycles, except that this one starts four months earlier, from September, the other one from January.

[21.] The *saltus lune*. '*saltus lunae*' is Latin for 'leap of the moon'

The *saltus lune* is the subtraction of one day from the July lunation in the last year of the nineteen-year cycle. If this subtraction were not made, after one cycle the Moon would be called *luna iI* where it should be *luna ii*. In the same way, after the completion of 15 cycles the Moon would be called *luna I* where it should be *luna xv*. For the compotists have perceived that more time is attributed to each lunation than ought to be, i.e., 4 moments, 1 *uncia* and 1 atom.

Let us see how one day in the whole nineteen-year cycle is collected together out of these 4 small particles, first reckoning the sum total of the lunations of the whole cycle. In the nineteen-year cycle, therefore, there are 12 common and seven embolismalic years. In 12 common years there are 144 lunations. In seven embolismalic years there are 91 lunations, which added to those above makes 235. If 4 moments are subtracted from each lunation, there will be altogether 940. If this number of moments is divided by 40, there will be 23 hours and 20 moments left over, that is half an hour. Since each lunation has an extra *uncia*, there are as many *uncie* as lunations. If this number is divided by 12, there will be 19 moments and 7 *uncie* over. Since each lunation has an extra atom, there will be as

A 'lunation' is the time from new moon to new moon or full moon to full moon.
What we now call a lunar month.

many atoms as there are lunations. If this number is divided by 47, there will be 5 *uncie*, and no remainder. These five joined with the 7 *uncie* makes one moment. This moment joined with the 19 moments

collected from the *uncie* makes 20 moments, that is, half an hour. If this is added to the 23½ hours collected above, there will be altogether 24 hours, which is 1 natural day.

This one artificially collected day is subtracted from the July lunation, as though from the last 30-day lunation in the last year of those who begin their year from September. It is called the *saltus lune* because in the last year of the cycle *luna 30* of the July lunation is called *luna 1* of the August lunation, and the July lunation has 29 days left, hence there are three 29-day lunations together - June, July and August. But note that although this subtraction has the backing of authority, it is the source of many difficult questions and an admixture of inaccuracy, which will be set right at another place and time.

[22.] The moveable feasts.

There are five moveable feasts: Septuagesima, Quadragesima, Easter, Rogationtide and Pentecost. Septuagesima is derived from seventy, because at that time the Church calls to mind the seventy years in which the children of Israel were in servitude to Babylon. Quadragesima is derived from forty: at that time the Church recalls that Moses fasted forty days and received the law; that Elijah fasted forty days and was rapt up into heaven or into the secret place of God; that Christ also fasted forty days and overcame the temptations of the devil. Thirty-six and a half days is a tenth part of a year, and four added days of fasting [*cinerum*] makes 40. Just as we tithe our possessions, so we should tithe our lives. *Pascha*, *phase*, *transitum* all mean the same ['passing over'], and it is called this either because of the passage of the angel of death in the Old Testament in Egypt; or because Our Lord passed from death to life by His resurrection. The Sunday preceding the Rogation fast is called Rogationtide in the *computus* on account of the following Rogation days. Pentecost derives from *penta*, 'five' and *coste*, 'ten', as it were 5x10, for there are fifty days between Easter and Pentecost, each day included.

Note that many kinds of numbers have been invented to locate these feasts, as will appear below. The days before the feast where numbers of this kind terminate are called terms. It is a rule in *computus* that the term and the feast never coincide, lest we seem to imitate the Jews, who observe the term and the feast on the same day. Alternatively, it is because the Easter term is always the fourteenth

day of the April lunation, but because this fourteenth day is not always on Sunday, the term and the feast cannot coincide. Again, since the term is the fourteenth day of the April lunation, and the nearest Easter to that term is the fifteenth day, the term and the feast cannot coincide.

The reason that the moveable feasts do not have fixed positions in the calendar is because Easter and the other moveable feasts are always celebrated on Sunday; but since Sunday is not always on one and the same date in the calendar, neither could Easter or the other moveable feasts have a fixed position on the calendar.

Some [authorities] say that the Passion of Our Lord was on 21 March [*x kal. apr.*], because it was then, according to Theophilus, Bishop of Alexandria, that He made Adam. For they say that He wanted to suffer to redeem the first man and his issue on the same day that He created that first man. Others, for instance Jerome, say that Our Lord's Passion was on 25 March [*viii kal. apr.*], because it was then that He was born of the flesh of the Virgin, and He suffered in the same flesh to redeem mankind, since in His divinity He could not suffer. But it was laid down in the Old Testament that the Paschal lamb should be sacrificed in the evening after the fourteenth day of the April lunation, that is in the beginning of the 15th day of the same lunation. So the Passion of Our Lord, Who is the true lamb, and Who is symbolized by it, was at the time of the full Moon. For just as at that time light is attributed more abundantly to the night, so through the Passion of His human nature the grace of redemption is more fully revealed. Because the April lunations are sometimes earlier, sometimes later, Easter cannot be assigned to a fixed place in the calendar.

The earliest date for Easter is 22 March [*xi Kal. Apr.*], as can be demonstrated in the following way. The earliest April lunation begins on 8 March [*viii Id. Mar.*], against which 16 is assigned as the golden number. The two lunations immediately before it are embolismal, the two next before them are the March lunations, although the last of these two terminates on 1 April, because of the fourth embolism. If 14 days is counted from the earliest April lunation, which is [marked] opposite 8 March, the first Paschal term will be found there. This will be 21 March, and it can perfectly possibly happen because of the variation of the Sunday letters that Easter can be celebrated on the day after the term, i.e., 22 March [*xi Kal. Apr.*] So that it is the custom to note the first, that is the earliest, Easter there. From what has been said above the following rule holds good:

After the Nones of March [7 March] where at first the first Easter is noted

Complete twice seven days that Easter may follow.

All the lunations of April begin after the 7 March [*Non. Mar.*]. The latest date for Easter is 25 April [*vii Kal. Maii.*]. This can be shown in the following way. The latest April lunation begins on 5 April [*Non. Apr.*] opposite which the golden number 8 is marked, although it actually terminates on 3 May, just as the preceding one terminates on 2 May, because of the third and seventh embolisms. Count 14 days from the [beginning of] the last April lunation: the latest Easter term will be 18 April [*xiv Kal. Maii.*], and it can happen because of the variation of the Sunday letters that that term falls on a Sunday. So Easter Day should be celebrated on the Sunday following, which is 25 April [*vii Kal. Maii.*].

From what has been said it is evident that Easter must always be celebrated on the five Sundays, be they earlier or later, between 22 March and 25 April. As the verse says:

Easter should prevail neither before 22 March [*xi Kal Apr*]

Nor after 25 April [*vii Kal. Maii.*]

These dates are
still correct today.

[23. The keys]

To locate the five moveable feasts some numbers have been invented which are called 'keys', because just as entrance to the hall is gained through the key, so information about the feasts is gained from these numbers. Since there are 19 years in the 19 year-cycle, each has its own key. The key of the first year is 26, and from this is formulated the following keys by the addition of 19, first taking into account that if the result of this reckoning is 40 or a larger number, you should subtract 30, and what remains will be the next key. Or the keys can be formed by the following verses:

If twenty-one or less appears,

hence for the following key add nineteen [$1+(2 \times 9)$]

Subtract eleven if [the number] is twenty-two or more;

What remains will be the next key.

Alternatively, you can find the keys in this way assuming you know the first key. Count through all the joints and finger-tips of one hand, and the last number is the [next] key. Note however that if 40 is the result of this calculation, call it ten, and go on counting in the usual way: the last is the key. If you are looking for the key of any year out of context [*ex abrupto*], these verses should be known:

Twenty-five, thirteen, then thirty-one,

Nineteen, seven on the fingers match the keys.

Count round the tips of the fingers of one hand until you come to the year you are looking for,

beginning from the tip of the thumb. If the required year lands on the tip of the thumb, add 25 to the number of the year; if on the index finger, add 13; if the middle finger, 31; if the ring finger 19; if the little finger 7. In this way the verses given above show the keys, noting that if 40 is exceeded, etc. The starting-point of the keys can be identified by these verses:

In January the first and last G, in March the second

In April the third and last.

Having found the key and its starting-point, if you want to locate the moveable feasts in any particular year, the number of the key of that year is taken, and to find Septuagesima as many days as the numbers the key contains are reckoned from the starting point of the key of Septuagesima: the day where that reckoning finishes is called the Septuagesima term, and the following Sunday will be Septuagesima itself. The same process is used for the other moveable feasts, bearing in mind that to find Septuagesima and Quadragesima in a bissextile year you must add one to the key; otherwise Septuagesima and Quadragesima would sometimes be celebrated by use of the keys 8 days too early.

These verses will give you the Septuagesima term and as a result the other moveable feasts:

From the Epiphany complete by numbering the moon

Forty days and Septuagesima is effected.

If it falls on Sunday, substitute the following one;

If it is a leap year, one day is added to [these] days.

If it falls on the seventh day and it is a leap year,

Leave the first Sunday and retain the second.

From the beginning of the lunation in which Epiphany, or more properly the Feast of the Star falls, whether this is in December or January, 40 days are reckoned counting down: the fortieth day is the Septuagesima term, and the following Sunday will be Septuagesima. In a bissextile year one day is added, as the preceding verses show.

The Easter term should be learned through these verses:

Esse gravem nobis bello karnem kanomius

Bellum sepe gerens etenim puto deicit hostem

Mox anime lucrum invenies cum religiosus.

In these verses there are 19 words which stand for the 19 years of the nineteen-year cycle, the first for the first [year], the second for the second [year], and so on. If therefore you wish to find the Easter term of any year of the nineteen-year cycle, take the word that stands for that year, and if it ends in M, the Easter term will be in March, counting up as many days from the end of March as the number in the alphabet of the initial letter of that word. The Easter term will be the day on which this reckoning finishes. If on the other hand it doesn't end in M, the Easter term will be in April, counting down as many days from the beginning of April as is the number in the alphabet of the initial letter of that word.

These verses will tell you how many weeks there are between the nearest Sunday and Quadragesima (whether it is before or after Christmas):

In gravibus causis hastam gerit improbus hostis,

Laudatur iustus, gladio caret hoste gravatus

Crudeles homines fur incitat hoste carente

In these verses there are 19 words standing for the nineteen years of the nineteen-year cycle, the first for the first [year], the second for the second [year], and so on. If you want to know how many weeks there are between this Sunday and Quadragesima, see what the number in the alphabet is of the initial letter of the word that stands for that year: that will be the number of weeks in the time you are looking for.

[24.] The lustrum, the indiction, the century and the era.

A lustrum is a period of five years which was taken into account by the Romans at the time of the Dictators. It is derived from *lustrum*, *lustras* ['purify'], because at the end and the beginning of such a period of five years the Dictators used to process round the City with wax tapers and candles.

An indiction is a period of fifteen years. It is derived from *indico*, *indicis* ['indicate']. For when the Romans held sway over almost the whole world, they made the different lands tributaries to them; and because of the difficulty of travelling, they ordered the more distant territories to pay gold as a symbol of their domination at the end of the first quinquennium; silver for the wages of the army at the end of the second; and bronze and iron for repairing weapons at the end of the third. Some people call the indiction era from *es* ['bronze'], on account of this bronze paid in the third quinquennium. Because of this [custom], the Romans instituted [the rule] that no privilege, no written contract would be stable or firm unless the indiction was recorded; this was to prevent the time when the taxes were due from being forgotten. We for our part make use of the indiction in three [ways]: in privileges, in the paschal candle, and in the dedication of churches. The cycle of indictions begins in September, because the

abundance of fruits at that time makes it a good time to pay tax.

If you want to know the year of the indiction, add 3 to the year of Our Lord, because Our Lord is said to have been born in the fourth year of the indiction, and divide the sum by 15. If there is no remainder, then we are in the last year of the indiction. Any remainder shows in which year of the indiction we are. Note that 'indiction' is the name given both to the period of fifteen years and to each year of that period or cycle.

A century is a period of 100 years. As the text says:

Many centuries passed by

Seculum also means the universe and the fabric of the universe with all that it contains. An age is said by the computist to be the period of a thousand years. It is the same as *etas* ['age'], so that a man is said to be of a great age [*magne etatis*]. And *evum* means the same as *mora* ['a space of time']. As Boethius says:

Who bids time move from eternity.

Si vero placet scire in quoto anno indictionis [C40va] simus, annis Domini adde .3., quia Dominus dicitur natus in .4.^{to} anno indictionis, et totum divide per .15. Si nichil est residuum, tunc sumus in ultimo anno indictionis. Si aliquid, ostendet in quoto anno sumus. Et notandum quod indictio est equivocum ad [U90r] denominandum spatium 15 annorum et ad quemlibet annum illius spatii sive cicli.

Seculum dicitur spatium centum annorum, unde *multa preteriere secula*.

Seculum autem dicitur mundus et tota machina mundana cum suis contentis.

Evum vero a computista dicitur spatium mille annorum. Dicitur etiam evum idem quod etas, unde *homo magni evi*, id est magne etatis. Et dicitur evum idem quod mora. Unde Boethius:

Qui tempus ab evo ire iubet.

Explicit computus.