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Introduction

Remarks on prehistory

Long before written records were kept, people were concerned with the seasons, important in agriculture, and the sky, which permitted them to read off the passage of time. Everyone knows that the *year* is the time it takes the sun to complete its orbit about the earth. (Copernicus notwithstanding, mathematical readers will see nothing wrong with placing the origin of the coordinate system at the center of the earth.) Also, a *month* is supposed to be the time it takes the moon to go around the earth; at least, this was the case before the lengths of the months were laid down by law. But what about the *week*? Theological explanations aside, it is the smallest period, longer than a day, that can be easily observed by looking at the sky: the time it takes the moon to pass from one phase to another, from new moon to half moon, from half moon to full moon, etc.

The days of the week are named after the sun, the moon and the five planets visible to the naked eye: Mars (French *mardi*), Mercury (French *mercredi*), Jupiter (French *jeudi*), Venus (French *vendredi*) and Saturn (English *Saturday*). The English *Tuesday, Wednesday, Thursday* and *Friday* are named after the Teutonic deities which supposedly correspond to the Roman gods after whom the planets were named.

In Hindu astronomy there are nine planetary deities, the *graha*. In addition to the seven associated with the days of the week, there are two others, *rahu* and *kebu*, alleged to be associated with the so-called 'nodes'. These are the points where the orbits of the sun and the moon, when traced out

on the firmament, intersect. (See Freed and Freed [1980].) The importance of the nodes is that an eclipse of the sun or the moon can only occur when both sun and moon fall on the nodes, to within 10°; according to an ancient rule of thumb, this was supposed to happen once in about 18.6 years.

At Stonehenge in England there is an imposing prehistoric monument, dating from about 2,500 BC. The huge standing stones of the monument were presumably used to sight the points on the horizon where the sun and the moon, and perhaps Venus, rise and set at certain dates (Hawkins [1965]). They are surrounded by a circle of 56 holes in the ground, and Fred Hoyle [1977] has proposed the ingenious hypothesis that these were used as a calendar and to calculate the dates of possible eclipses.

According to Hoyle, the idea was to move a *sun marker* two holes in 13 days, a *moon marker* two holes each day, and two *nodal stones* three holes per year. The sun marker would thus complete an orbit in 364 days; the discrepancy could be fixed by appropriate adjustments at midsummer and midwinter. The moon marker would complete an orbit in 28 days, that is, four weeks. Of course, this should really be 29.5 days, so adjustments might have to be made each full moon and each new moon. The nodal stones would take 56/3 years to perform a complete orbit. On those occasions when both sun marker and moon marker were about to catch up with the nodal stones, the presiding priest could risk predicting an eclipse.

Foreword on history

Even so-called 'primitive' societies may be engaged in some fairly sophisticated mathematical activities, for example, the calculations involved in kinship descriptions. (How many students can tell on the spot what exactly is a *second cousin three times removed*?) For interested readers, we recommend two recent books: *Africa Counts* by Claudia Zaslovsky and *Ethnomathematics* by Marcia Ascher.

Mathematics, as usually conceived, begins with the development of agriculture in the river valleys of Egypt, Iraq, India and China. If we pay more attention to the Near East than to the Far East, this is because the former has provided us with more accessible records and because modern mathematics can be traced back directly to it. We possess written records concerning the state of mathematics in Egypt and Mesopotamia (Iraq) from as early as about 2000 BC. Around 500 BC, mathematical knowledge spread to the Greek world. This included not only modern Greece, but also the coast of Asia Minor (modern Turkey) and Magna Grecia (southern Italy and Sicily). About 300 BC, the center of mathematics moved from Athens to Alexandria in Egypt, where it was to remain for the next 800 years; for it was in Alexandria that all the books were kept.

Around 500 AD, mediterranean civilization finally came to a stop, per-