

THE DOZENAL JOURNAL



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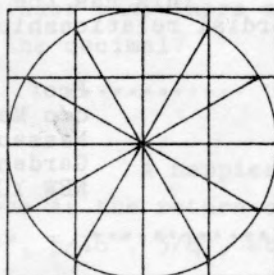
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EDITORIAL

PURE SPITE...

THE PUNIC WARS ended with a total victory for Rome. The conquered city of Carthage was finished as a threat to the Roman Empire and its citizens could have been left to piece their lives together without more disruption. Instead, the Romans slaughtered most of them and left "not one stone standing upon another" in the city: an act of calculated vindictiveness. We see something of the same spirit now in the Napoleonic pretensions of the EEC - now becoming the EC - which is intent upon entire elimination of non-decimal measures in this country. In this, sadly, they are aided and abetted by our own denary-crazed administrators who have by the Single European Act made our Parliament and Courts subject to the Continental power.

One sees the signs everywhere: I used to think that the distance-to-junction figures on the motorways of two-thirds and one-third of a mile were pleasant assertions of rational tradition until I realized that they are positioned in readiness to be changed to 1 km and 500m at some future date; one notes that BR's new electric trains designed to supersede the InterCity 125s (125mph) will be called Inter-City 225 because their maximum speed will be 225 kilometres per hour. Why? Does it really matter if we use statute miles, and drink milk and beer by the pint? Or are the metricators apprehensive lest the continuation of even a few rational units may be a constant reminder that there are elegant alternatives to the rigid rule of the decimal?

.....

EVEN SO...

A happier note is struck by two recent discoveries: one is the return of carriage-bolts made to inch-based sizes (1/4", 5/16", 3/8", etc.) in local DIY shops;

The last ditch agreement over farm prices at last week's Brussels summit was seen as clearing the way for swift progress towards the single market by 1992, but Mr Hurd's warning is evidence of some of the problems still to be resolved if it is to become a reality.

Mrs Thatcher has already made it clear that the Government will block tax harmonisation proposals that would impose VAT on food, fuel and children's clothing.

The Government is also trying to stall on an EEC demand that pints and miles be phased out in the cause of metrication.

DAILY TELEGRAPH 15.2.88

the other is an excellent tyre-pressure gauge - a dial type with movable red and green pegs to mark correct pressures for the owner's vehicle - which is calibrated solely in Lb/in² (the first I have seen like this in years). Available from: Kenrick Enterprises, 255 Oakdale Road, Nottingham NO4 1BP, it costs £5.95 (or £5 19s. if you prefer!).

RESPONSE..

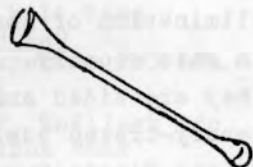
There has been a modest, but very welcome, increase in the correspondence from members this year. Well done...And please keep writing! Letters are a vital feedback and can often give rise to articles by inspiring others to take-up points raised. This way we progress.

ENLIGHTENMENT!

Those of you who might have been wondering just how long a yard is need look no further than the sketch at right.

I give you my word that I did not make it up.

A colleague found it in a catalogue of their products published by the Cumbria Crystal Glass Company.



Yard of Ale 92 cms.

THOSE GALLONS...

Arthur Whillock seems to have disposed comprehensively of the question of the US gallon in this issue. He points out that the whole thing is based on cubic inches and the rationalized approximation of π at 22/7. Nothing to do with sea-water, says Arthur. It still bugs me, however, that the mean density of sea-water is sixty-four pounds to the cubic foot. Not just accidental.....Is it?

KEEPING THE LANTERN LIT..

We are often accused of living in the past. Not so! Proud to be custodians of hard-won wisdom which our rulers are intent upon obliterating, we yet remain free of the denary straitjacket and, if there is to be a rational future, we number ourselves among its precursors.

Best wishes for 1198!

The Editor.

MEMBERS' NEWS

Michael King-Beer, BSc., who is an information scientist, has become Project Director of the Breakthrough Trust, which develops and operates telecommunication between deaf and deaf/blind people. Mr. King-Beer has been deaf himself since birth. From equipment based on acoustic-coupled teletype machines, the Trust has progressed to a portable visual-telephone system - Vistel - which is now compatible with other computer terminals, with the benefits this allows.

A voluntary organization, the Breakthrough Trust is recognized by the Department of Trade & Industry and by British Telecom. Some 2000 units are in operation in Britain, and the network is being extended into Europe. Further information can be obtained from:

Charles W. Gillet Centre,
Selly Oak Cottages Birmingham B29 6LE.

Fred Newhall, of the DSA, has completed an index of DSA and DSGB publications to date. It is a detailed listing of everything that has been put forward on both sides, divided into Articles (*18pp), Names of Authors (*16pp) and Subjects (*20pp); and should prove invaluable to anyone wishing to improve on old ideas or to air something new.

Mr. Newhall invites suggestions, corrections or additions and is willing to supply complete copies or single sheets at 15¢ per sheet. His address is: 51 Ridge Road, Smithtown, Long Island, NY 11787. Or, contact the Information Secretary, DSGB.

Our Information Secretary, Arthur Whillock, has been awarded a Fellowship by the DSA, for which - congratulations!

Miss Mary Arbuthnot, one of our staunchest supporters for many years, is afflicted with arthritis of a severity which requires in-patient hospital treatment at intervals. We offer our sympathy and our fervent hope that she may recover soon from this cruel disease.

Mr. S.R. Dalton has made the somewhat radical suggestion that we should use the word "ten" always to mean the number "10", whatever the base. For the number following nine, he argues for the use of the DSA's DEK (or our DECIM?). This would allow, of course, the continued use of all the existing number-names - wouldn't it?

TO HAVE AND TO HOLD

A member has written asking for suggestions as to a suitable repository for his collection of dozenal material - papers and artifacts. There must be other keen dozenists who have acquired books on calculation and measurement who would be pleased to think that such items were not going to be dispersed or become unavailable for study by interested people.

The DSA, under Gene Zirkel, has a room set aside in Nassau Community College for its material which could eventually be integrated with the main library. DSA also has copies of all our publications. Further contributions from this side would be welcome, but effectively lost to us.

Continuity of holding could be provided by a semi-private collection of social/scientific material, such as the Pitt-Rivers museum at Oxford or the Horniman museum at Dulwich (which has a collection of national measures). For books only the London Library might co-operate; the Priaulx Library in Guernsey has a good assembly of socio-historical material, but is a little remote.

The Gladstone library in Somerset has residential facilities where one can go for an undisturbed read, and might welcome an expansion of subjects. Universities are a possibility. Our founder-member Professor Aitken held a chair of mathematics at Edinburgh; Bristol has been given the Pitman papers which are thus available for reference.

Perhaps members could make offers or positive suggestions before any tentative approaches are made?

AFW.

QUOTATION

"He (Man) has imposed order by means of measurement. In order to get his measurement he has taken his pace, his foot, his elbow or his finger. Imposing the order of his foot or his arm, he has created a unit which regulates the whole work; and this work is on his own scale, to his own proportion, comfortable for him, to his measure. It is on the human scale. It is in harmony with him: that is the main point.

Le Corbusier

Towards a New Architecture (1927)

Is your subscription due? Look for "D" on the address label..

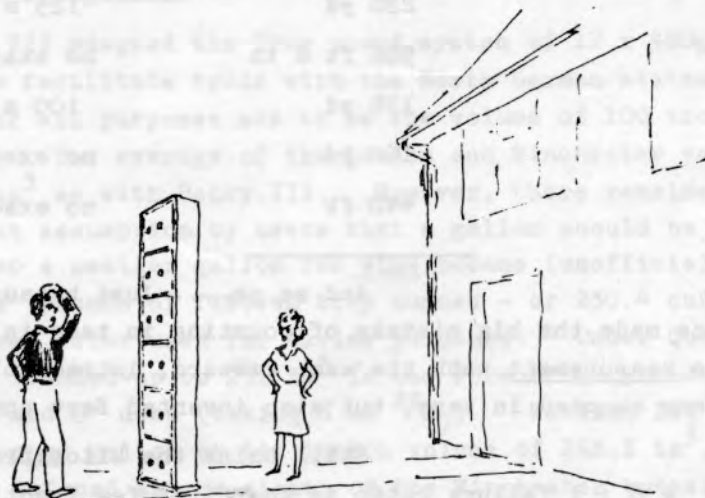
Television weather forecasters, always in the public eye (and even more so since the notorious failure to warn of the hurricane-force winds last October), seem to have come-up with a gem in the form of a statement by Mr. Ian McGaskill, who has provided a novel justification for the partial metrication of measurements used in meteorology.

Mr. McGaskill averred, at the time of his televised forecast on December 15, that a mixed system - here metric, there Imperial - helps to avoid confusion when, for instance, static tends to obfuscate a radio-transmitted forecast, by announcing cloudbase altitude in feet but horizontal visibility in metres. So also is justified cloud-cover in octets but temperatures in degrees Celsius, rainfall in inches but pressure in millibars; while allowing us to keep our wind speeds in miles-per-hour and wind direction in compass points.

Is not this argument a little disingenuous?

By the same token, no doubt, when we are knocking-up a cupboard, we have to buy our boarding by the foot but its framework of battens in millimetres so that we can tell them apart.... The last time I bought curtain material I had to buy a width expressed in inches but a length in metres; no doubt that was to prevent my hanging the curtains sideways!

More than a little logic-defying and thought-contorting?



" 'Don't worry!', he says, 'I'll get the chap down the road to make it', he says, 'I'll tell him $1\frac{1}{2}$ metres wide and 3 feet high, and that way there won't be any mistakes', he says...."

METRIC FACTS FOR THE PEOPLEThe MILE and the KILOMETRE

"How silly," say the metricators, "to have a distance of 1760 yards, or 5280 feet! The absurd British and Americans should adopt modern ideas, move with the times, and use kilometres, which are a nice, easy 1000 metres." Well, apart from the fact that the kilometre is not exactly new, having been ignored by the British and Americans for over 180 years (why?), the mile is a land measure; and land measures need to be subdivided. Let us compare:

<u>FRACTION</u>	<u>of a MILE</u>	<u>of a KILOMETRE</u>
1	1760 yd	1000 m
$\frac{1}{2}$	880 yd	500 m
$\frac{1}{3}$	1760 ft	no exact answer
$\frac{1}{4}$	440 yd	250 m
$\frac{1}{5}$	352 yd	200 m
$\frac{1}{6}$	880 ft	no exact answer
$\frac{1}{7}$	no exact answer	no exact answer
$\frac{1}{8}$	220 yd	125 m
$\frac{1}{9}$	586 ft 8 in	no exact answer
$\frac{1}{10}$	176 yd	100 m
$\frac{1}{11}$	160 yd	no exact answer
$\frac{1}{12}$	440 ft	no exact answer

And so on.... Just because the human race made the big mistake of counting in tens is no reason to saddle measurement with the same awkward, intractable base! (The Romans counted in tens, but also invented feet and inches.)

Still think the kilometre is better? A 6 : 1 failure ratio in the first few fractions sounds pretty poor, from a practical point of view....

(Members may like to try their skill by converting the mile fractions into dozenal numeration. Use feet.)

GALLONS Galore!

Arthur Whillock

QUESTIONS regarding English and American gallons were raised in Dozenal Journal No. 5, and require answering. There have been several changes to volumetric measures since Norman times, but the principle has been to relate them to the weights of commodities being retailed. The gallon was to be eight pounds of either wine or corn, so that its pint had a 1 : 1 relationship with the pound.

Statutory weights have changed for various politico/economic reasons and, with them, the gallon. The first recorded definition was in Henry III's ordinance of 1266, authorizing a wine gallon of eight merchants' pounds, each pound comprising fifteen Tower ounces of 450 grains, which suited trade with the South German states. It had a volume of 216 cubic inches and there was a corresponding corn gallon of 270 in³ (1 $\frac{1}{4}$ times as large) to suit the lower-density commodity.

When Edward III introduced the 'averdepois' weight system (literally, 'goods-of-weight') for the important wool crop, eight of its pounds defined the Guildhall wine gallon of 224 cubic inches; its related corn gallon of 280 in³ later became the Tudor ale gallon.

Henry VII adopted the Troy pound system of 12 x 480gr. ounces to facilitate trade with the North German states and a gallon for all purposes was to be the volume of 100 troy ounces of wheat. The average of the London and Winchester variants was 270 in³ as with Henry III. However, there remained a persistent assumption by users that a gallon should be eight pounds; so a smaller gallon for wine became (unofficially) eight merchants' pounds of fifteen troy ounces - or 230.4 cubic inches - which was later used for excise purposes. Under Queen Anne this was rounded-up to 231 in³ in the form of a cylinder 7" diameter and 6" deep (taking π as $\frac{22}{7}$). William III stabilized the corn gallon at its London volume of 268.8 in³, which could be defined as one-eighth of the Winchester bushel, a cylinder 18 $\frac{1}{2}$ " diameter and 8" deep. Accurate copies of these wine and corn measures were sent to the American colonies and adopted in 1863 by the United States as legal liquid and dry-goods measures.

Our present Imperial gallon (for all purposes) was defined in 1824 to be the volume of ten pounds of distilled water at 62°F. Commissioners in 1818 found that a standard pint of the time of Elizabeth I contained exactly twenty ounces of water (the ounce being unchanged since her time). Thus, tradition played its part in a tentative step towards decimalization happily tempered by a retention of binary division... As the school mnemonic has it: "A pint of pure water weighs a pound and a quarter."; but a pint of wheat weighs a pound, which was the original intention.

(This note is a condensed version of a wider study of the subject, a copy of which can be obtained from the Information Secretary)

....and from Berriman's 'Historical Metrology':

" 'Be it further enacted... that any round vessel (commonly called a cylinder) having an even bottom and being seven inches diameter throughout and six inches deep from the top to the inside of the bottom or any vessel containing two hundred and thirty-one cubical inches and no more shall be deemed and taken to be a lawful wine gallon and it is hereby declared that two hundred and fifty-two gallons consisting each of two hundred and thirty-one cubic inches shall be deemed a tun of wine and that one hundred and twenty-six such gallons shall be deemed a butt or pipe of wine and that sixty-three such gallons shall be deemed an hogshead of wine.'

Act of Parliament 1700.

"This traditional 252-gall. rating for the ancient tun supports the hypothetical 10-troy-lb rating for the wine-weight of the Excise gallon, for it can be interpreted as $10 \times 252 = 36 \times 70$ troy lb. = 36×80 librae = 36 Roman amphorae = 32 Greek cubic feet.

In 1824, a gallon having a water-weight of 10 lb. averdupois became the legal standard and thereafter, in England, the Old Wine Gallon became a memory with its past fame enshrined in the friendliness of its present title, but elsewhere it is not dead yet, for long ago it began a new life in the New World and there it flourishes with undiminished prestige as the standard gallon of the United States."

(Sent in by Shaun Ferguson)

* * * * *

Walk with me for a Perch and a Rood

Pam Ayres

I don't want metrication, friends,
The milligramme and litre,
I work in feet and inches,
I do not trust the metre.
I cannot calculate it,
I don't know where I am;
Give me half a hundredweight
And you can have a gramme.



Metrication? I can't learn it,
I am too long in the tooth;
My schooldays they are over,
Gorn! With the bloom of youth.
I work in eighths of inches,
The furlong and the chain,
The rood and pole, the six-foot hole;
I like it nice and plain.



I like it by the furlong
And I like it by the acre;
I liked the baker's dozen
And I also liked the baker.
I liked the bushel basket
And a peck's all right by me;
Metrics put the prices up
As far as I can see.



I didn't want the decimals,
I don't want metrication,
I wouldn't know a litre
If you poured it in a basin.
I'll have my pints and gallons
As long as I am able,
My glass I'll fill with a sixth of a gill
And I'll see you under the table!



MEASUREMENT IN DESKTOP PUBLISHING

One of the newer developments in the use of computers is desktop publishing. It uses a desktop computer and a laser printer or sometimes a high-quality dot-matrix printer. Also a program which allows text in a variety of type styles and sizes, together with illustrations, graphs, decorative borders etc, to be "set up" or composed on the screen as they will appear on paper.

A magazine which deals, in part, with this subject, and which is also produced in this way, is called The Wordsmith. In the September/October 1987 issue the editor, David Hewson, made some interesting comments:

"NOW HERE'S progress for you. In the course of producing this august journal, I have had cause to meet more technological and production gremlins than one would wish on a worst enemy. Perhaps the most annoying, partly because it occurs so often, concerns something very simple: units of measurement.

In this brave new world it's hard to find two people who agree on what ruler to use when assembling a page. Some use inches, some centimetres. And then there are pica inches, decimal inches, picas, points and even (heaven preserve us from its attentions) the cicero.

The one you use seems to depend purely upon your background. If you come from one section of publishing you can't think of a page unless it's expressed in points; if your education is less esoteric, you don't even know what a pica is and want things set down in plain, simple inches. (If you do, I will place a sizable bet that your first advertiser will ring to say, 'Yes, but what size is a quarter page in centimetres?', and be less than delighted when you say 12.567 by 10.699).

I wrestled with this from issue to issue until, one day, I decided to experiment. From that moment on - until the experiment collapsed - everything, but everything, would be dealt with in the most old-fashioned unit of them all, the point, 1/72nd of an inch. This is an extremely odd size in which to work; what is even more odd is that the experiment, far from collapsing, has proved an enormous success.

Suddenly, things which had puzzled me before - oddities about line spacing and the way page elements interacted with each other - became obvious. I was made aware that the page, which every computer would have you believe is a blank canvas on which you may produce your words however you please, is much more constricting than I had previously understood. Underneath it all lies an invisible grid which, if you do not conform to it, will surely bounce out your calculations somewhere along the line. And the grid is measured in... picas and points, not the rulers they teach you at school.

It's rather heartening to discover one's microchips work better when fed such ancient fodder. According to Collins, the term pica is derived from the Latin for magpie, and was used originally for lists of ecclesiastical regulations. Given that printing largely began with the church, it is understandable that the clergy should have added a few terms to the process. And don't forget the musical connections too - such as composition at the keyboard. I rather like the idea of being latter-day Victorian composers, sweating over our machines and shouting, 'Which key do I press for a mutton?', and chatting about screeds and slugs (though I fear I shall never again hear my favourite printing word, flong, part of that dying process, the stereo).

Whatever one thinks about technological progress in publishing, it surely becomes more obvious by the day that the skills of the business do not disappear when the computer arrives; in reality they are more in demand than ever - and it is there for all to see when they are absent.

I have one confession, however: I have yet to come to grips with the cicero which seems to me a deliberate archaism." [Etc.]

THE WORDSMITH is published by Mandarin Publishing, The Old House, Church Road, Kennington, Ashford, Kent TN24 9DQ. The annual subscription (six issues) is £8 UK, £12 Europe, £14 elsewhere.

Robert Carnaghan

EDUCATIONAL COMMENTS

More brainwashing, this time from 'SHIPS & SEAFARERS' in the DISCOVERERS series from Methuen.

"In 1628, in Stockholm, the finest ship of the 17th century was under construction. She was called the WASA after the Swedish royal family. She was 70 metres long, 12 metres wide, and carried 64 bronze cannon..."

Metres? In 1628?

"1 knot is about 1.9 kilometres per hour."

Or, of course, 1 nautical mile, or minute of arc, per hour (not mentioned). Are children supposed to think that someone decided that 1.9 km was a good number to use?

In the same book, the French liner NORMANDIE is extolled as 'breaking all records for a transatlantic crossing'. The British QUEEN MARY, which beat Normandie and captured the Blue Riband, is not even mentioned...

End of the GCE

Last November saw the very last General Certificate of Education 'O' Level mathematics exam.

Paper 1 carried one question on binary numbers, which was just a matter of selecting which out of four choices represented the fifth power of two. No questions about common fractions.

Paper 2 carried a number-base question, using bases 2, 3 and 8; and one question on multiplication of fractions.

Paper 3 (Modern) carried no questions about number-bases or fractions.

Little enough, you might think; but the new GCSE syllabus for mathematics, which I have before me, although still including the 'four rules' for fractions (but conversions only from fraction to decimal, not back again) has no stipulation for number-base work of any kind.

The first topic given is training in the use of the calculator.

Quotation

From the description of a new GCSE textbook, "Woodwork Technology" (age range 13 - 16) by Strefford and McMurdo:

"Metric units are used where possible but some Imperial sizes are retained where necessary for reference during the phasing out of the traditional system of measurement."

- Yet the DES denies that any educational directive has been issued on this matter!

DEAR ME....!

The Glossary reproduced below is photocopied from 'The Kids' Book of Metrics', by Helene Silverman, published by Tempo Books, New York.

Glossary

area: The measure of the surface covered by a polygon (a closed figure consisting of straight lines joined end to end) and its interior

base unit: A unit of measure from which other units are formed

centi: A prefix meaning hundredth

centimeter: A unit of length equal to 1/100 parts of a meter

deci: A prefix meaning 1/10

degree Celsius: A unit of measure of temperature on the celsius scale

gram: A unit of mass (weight) equal to 1/100 parts of a kilogram

kilo: A prefix meaning thousand

kilogram: The base unit of mass (weight): the mass of 1 cm³ water

kilometer: A unit of length equal to 1,000 meters

length: How long something is

liter: A unit of capacity equal to the capacity of a cube that is 10 centimeters on each side

mass: The measure of the amount of matter something is made of

meter: The base unit of length

Metric System: a decimal system of measurement based upon the meter

milli: A prefix meaning 1/1000

milligram: A unit of mass (weight) equal to 1/1000 gram

milliliter: A unit of capacity equal to 1/1000 liter: capacity of a cube that is 1 cm³

square centimeter: A unit of area equivalent to the area of a square region which is 1 cm on each side

temperature: A measure of how cold or hot something is

thermometer: An instrument used to measure temperature

weight: A measure of the force of gravity: how heavy something is

"Fool your friends!" , says the blurb, "Bamboozle your parents! Astonish your teachers!".

Those of a cynical turn of mind might be tempted to add: "And thoroughly confuse yourself at the same time!".....

.....and more:

Stacking-plugs, which are single-pin banana plugs for attachment to the ends of connecting-cords for experimental work and temporary electronic rigs, are packed in fives as a catalogue item (by RadioSpares, a British firm). As Arthur Whillock would say: 'Just right for two-and-a-half cords'...which might connect, I suppose, one-and-a-quarter power-supply units to the board. Dear me!

By delightful contrast, a German electric fretsaw (Hegner Multicut) is supplied to schools with blade-length specified in inches, sawing-capacities of various models in inches and, best of all, packs of spare blades by the gross or quarter-gross!

DECIMALS ARE EASY?

From a series of performance assessments commissioned by the Department of Education and Science, the one on decimal arithmetic makes sad reading and completely contradicts the claim above.

The authors say that links between the decimal and metric systems are not seen by many pupils. Place-value is frequently confused with fractions: $\frac{4}{100}$, for instance, is thought to be 4.100 by a third of eleven-year-olds and it is not until the age of fifteen that most can get it right (probably by rote, since at that age the value of a decimal number is still commonly related to the number of digits it contains).

Not surprisingly, pupils are happier with real-life situations. Asked to divide thirteen by two, only a quarter of eleven-year-olds will manage to do so; but if told that a 13cm chocolate-bar is to be cut in half and asked the length of each piece the children's success rate goes up to 81%. Money seems to be the best medium (as long as decimal fractions are avoided by converting all sums to new pence and so involving whole numbers only).

No doubt similar difficulties over place-value would occur in any numbering system; but the better this relates to practical situations without involvement of too many long or non-terminating fractionals the more readily might the principles be assimilated.

Decimals: assessment at age 11 and 15. £1.45
 NFER - Nelson.
 Darville House Oxford Road East
 WINDSOR SL4 1DF.

"D" on the address label means "Subscription is Due"..

1, 2, 3, ... PLENTY!

Troy

YEARS AGO, I read somewhere that primitive Bushmen were able to count to three, but no further: all quantities in excess of three were defined as 'plenty'. Obviously, these chaps had no intention of getting themselves bogged-down in any more arithmetic than was absolutely necessary - who can blame them? - but had decided that it was needful to get as far as three. After all, the human identities - I, you, he (or she!) - which the Bushmen recognized are still indispensably with us, expressed as first-, second- and third-persons in all our verbs, the very mortar of language.



THE DEVELOPMENT OF VERBS...

It requires no deep grammatical analysis to establish that three is both the maximum and the minimum number of 'persons' needed for the formation of verbs, the telling of stories and the wording of such as the car-insurance policies which decorate our modern society.

Of course, as we all know, the simple, sylvan world of the Bushmen and their contemporaries, which gave us language, was overtaken by the then new technology of Counting by Fingers; and arithmetic had arrived. Even so, the numerical domination by fives and tens thus given by this accident of Nature (and eagerly adopted by officials, scribes and tax-collectors) was still tempered by those of a practical bent, who insisted upon measurements - of time, length and weight - that accommodated three, despite evident

awkwardness with the decimal base. Thus we got the twelve-hour clock, based on the sexagesimal Babylonian system (which also evolved the ninety-degree right-angle division), the Roman foot of twelve uncia (despite the Romans' being extremely decimal-minded) and, for that matter, the troy pound of twelve ounces.

This basic conflict between decimal counting-house and rational workplace had to be resolved somehow as trade, whereby things had to be paid-for - rather than bartered, pillaged or made by slaves - became customary. The solution lay in what we might now call the interface system: money. Originally decimal, and so incompatible with weights and measures, the coinage was ingeniously modified in the time of Charlemagne to work in two bases simultaneously: twelve denarii to equal one solidus and twenty solidi to equal one libra - pounds, shillings and pence (£sd). This splendid piece of pragmatism endured in the West until the late eighteenth century generally and in Great Britain until the late twentieth century, when Carolingian wisdom was cast aside and the bureaucrats finally seduced a softened, bemused people into selling their birthright for a mess of decimal pottage (aptly called 'p') in 1971. So much for education!

*
* *

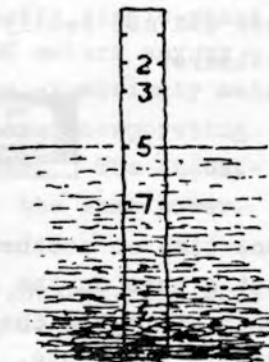
It is easy to see why the early enumerators favoured fives and tens, since it was all a matter of fingers; and, if one is concerned only with linear counting, almost any radix will do. Moreover, those doing the counting (and accounting) were the ones whose possessions were numerous enough to need counting: the kings, sultans, chiefs and sundry officials more concerned with controlling people who worked than with actually working themselves. Such persons were the first to keep records and render accounts; and hence imposed their denary system as the norm.

Less easy to understand, perhaps, especially by the young in these days of metric enforcement, is the resistance to decimalization, so vigorously put up in olden times and still maintained by many (including dozenists, of course!). Why did the Romans keep a twelve-inch foot? Why

design the clock-dial thus? Why the historical preference, so unfashionable in these decimal times, for three as a factor rather than five?

Primes: small is beautiful!

One-half is such a useful fraction that it has been described as an honorary whole number; and there would be wholesale objections to the introduction of unhalvable units such as an eleven-inch 'unfoot', or subdividing a metre into thirteen parts. Alienating the prime-factor two from everyday practical - and mathematical - use would be rightly regarded as complete lunacy: two is the most important prime factor of all. Yet three is its companion: two and three are the fundamental primes which together not only control the positions of all other primes (see Journal 5), but which also emerge accessibly into the real world. If we imagine all the primes to be listed on a sort of depth-gauge, only two and three would be clearly above the surface of a sea of clouded depths: five would be just at the surface, perhaps, with the rest quite rapidly vanishing into depths of increasing opacity.



Five has some mathematical significance - mainly angular - and seven (apart from its religious and social cachets) has been sighted by the author as being involved in the moment-of-inertia of a torus; and it must be admitted that seventeen not only appears in a conundrum about Arab horses, but is also a Gauss/Fermat number of parts into which a circle may be divided equally by classic construction in the plane.... Not many people, as Mr. Caine would say, know that. Nor need they. What is needed is a restored awareness of the fundamental role of three, together with the will to accommodate it.

Let us remind ourselves of some of the functions of this number in the spheres of human perception and universal truth.

Three: necessary and sufficient?

We have already noted that language depends on three grammatical 'persons' for its verbs: fewer would be inadequate and more superfluous. There are other examples of such essential triples.



A colour TV receiver has three electron-guns, each of which activates its own set of phosphor dots to produce the picture - in full colour. The primary colours of light - red, green, blue - are not only all that are needed, in various combinations and proportions, to produce the entire spectrum of visible light, but are also the least number required: remove one primary and the balance is gone. The same rule applies, of course, to colour film, with its three emulsion layers (two-colour cinematography was tried, but did not really work properly). Human vision is in three colours.



Everyone has had to endure, at one time or another, the tedium of hearing somebody picking-out a tune on the piano using one finger; and the aural relief when at last a chord is played is considerable. Play C alone and it is a note. Play C and G, and it's better, but still something is missing. Play C, G and E together, and the major chord sounds, firm and full. Exactly three different notes are needed for the basic major (and minor) chords: adding other notes, unless they are octaves of the originals, to CGE can make many, often desirable, musical augmentations; but such chords will no longer be C-major.

(Question for psychologists: why are so many simple, yet satisfying, tunes - including the Blues - founded on just the three basic chords?)

Round and round....

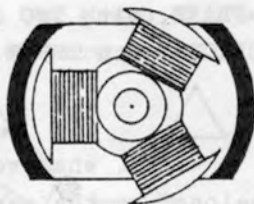
Hold a pencil between two adjacent fingers and try to rotate it. Impossible, of course: the pencil can be oscillated, but not rotated. Now bring the

thumb into play and continuous rotation can at once be achieved. The thumb and fingers still oscillate only: it is the 'threeness' (ternacy?, trinarity?) that enables the pencil to be turned. This little experiment demonstrates perfectly the reason why power-stations generate 3-phase AC: with the phases one-third of a turn apart, it is exactly right for driving the innumerable AC electric motors of industry. Two phases, a half-turn apart, would give oscillation, as does a single phase, of limited use; but three phases give a rotating pattern of impulses (which can also be reversed by changing-over two of the phases). The current in the windings still oscillates (alternates); it is the sequence of three that achieves the rotary effect.



Of course, domestic single-phase AC is used for motors, but these are either DC motors anyway - which will run on any sort of current, but are expensively made with commutators and brushes - or bulky devices incorporating capacitors/inductors to produce a delayed phase. The industrial 3-phase motor is about half the size for the same power, is ruggedly reliable and cheap to manufacture.

(Very small DC motors - the kind used for toy trains, school experiments, etc. - employ a permanent-magnet field (2 poles), but an armature with three poles. This arrangement enables the motor to start from any position, which a two-pole motor could not.)



May I have the pleasure?

There is, if I may put it so, a human measure of these things: using pairs of legs - which, in common with all of Nature's moving-parts, can oscillate but not rotate - men and women danced (and still dance) to the giddy music of Strauss (et al). The whirling, wonderful waltz revolutionized dancing in its time; with steps of three to rotate the happy couple about their centre and around the floor... Nearly all dancing of the kinds understood and practised by ordinary people is to rhythms based on 2, 3, 4, 6 or 8. Have you ever tried dancing to five-beat time? Trained dancers can, perhaps; but it seems fearfully difficult even to play music to a five-based rhythm, let alone dance to it. Twos and threes come naturally and with pleasure.



*
*
*

Two's company, three's a ... triangle.

Two points in space will make a pair -

One is here, the other there -

And, with two points in our design,

Between them we can draw a LINE.

Three points will give three pairs; and here

A TRIANGLE will now appear;

Whose three line-segments bound a PLANE

And so a new dimension gain.

(There is more of this, but I shall be merciful.)

TWO points can define a line, with ONE dimension (length);

THREE points can define a PLANE, with TWO dimensions (area);

FOUR points can define a SPACE, with THREE dimensions (volume):

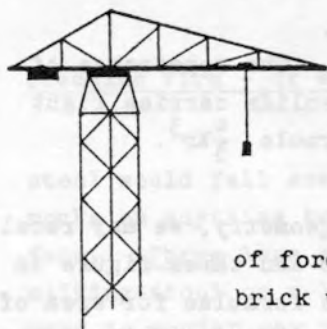


- and, whatever strange spins and

so on may be termed 'dimensions' by the particle-physicists, everyday practical space - and every physical object - has three linear dimensions. Three is again the 'necessary and sufficient' number.

How things stand.

Talk of dimensions leads naturally to considerations of geometry, that oldest and most practical of mathematics. The only inherently rigid plane frame is a trigon (and so, of course, the only rigid space frame is the triangular pyramid, or tetrahedron). All structures, man-made or natural, maintain their shapes solely by virtue of triangles, whether explicit in lattice girders, roof trusses or sand dunes, or implicit in the invisible lines of force which describe ghostly trigons within all brick walls, concrete slabs, bones or mountains.



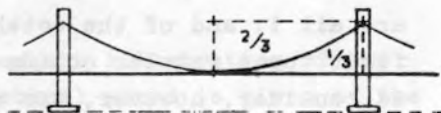
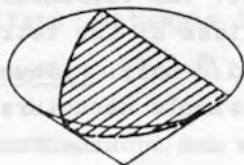
The centre-of-gravity (or centre-of-area, or centroid) of this most basic of shapes is, moreover, one-third of its altitude taken from any side.



We cannot erect buildings, bridges or anything else of fixed shape without heeding the third number. (Even the arch itself is a simple chain of elements satisfying triangulation at each joint.)

Conic section.

Slicing through a cone with a plane parallel to its sloping surface may seem like a wholly academic exercise; yet the curved profile so produced - parabola - is the shape of such as headlamp reflectors, suspension-bridge cables and the path followed by spacecraft escaping from Earth. This critical curve, the graph of $y = x^2$, divides a containing rectangle based on its zero point in the proportions one-third : two-thirds.



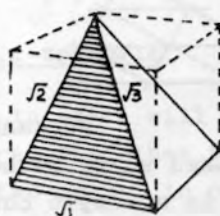
The cone is a pyramid and we should, of course, remind ourselves here that any pyramid (and pyramids are basic structures) occupies precisely one-third of its containing prism; hence the volume of a pyramid is:

$$\frac{1}{3}(\text{base area} \times \text{height}).$$

The appearance of three as a denominator in this family of solids carries right through to the sphere, with its volume formula $\frac{4}{3}\pi r^3$.

Roots of the matter?

Still with geometry, we may recall from Journal 5 how the square roots of two and three figure in plane mensuration, with $\sqrt{3}$ featuring in the formulae for area of equilateral triangle and regular hexagon. This number appears again in the unit cube: its length-of-edge is 1 (or $\sqrt{1}$); the diagonal of each square face is $\sqrt{2}$; and the solid diagonal of the cube itself is $\sqrt{3}$.



UNIT CUBE AND
ITS PYRAMID...

The skew pyramid shown naturally takes up one-third of the cube (three such skew pyramids can be made from cardboard and will assemble into a cube, making an excellent demonstration model for school use).

$\sqrt{1}, \sqrt{2}, \sqrt{3}, \dots$. These are all the possible lengths between the vertices of a cube. It seems that a variation of Bushman counting is still relevant!

In the matter of regular solids, two others are structurally significant: the tetrahedron and the octahedron. The lengths-between-vertices of the tetrahedron are all 1; and of the octahedron, 1 and $\sqrt{2}$ only. Thus, the first three regular solids are fairly simple structures. When we consider, however, the dodecahedron and icosahedron (not to mention the re-entrant solids), the factor 5 appears; and at once the diagonals become so remote and complicated that I, for

one, have never found the time to work them out (perhaps some reader has?): the diagonal of a unit regular pentagon, for example, is:

$$\sqrt{2 - 2\sqrt{5}}$$

- and that's just the start!

Standing firm - or walking.

A two-legged stool would fall over and a four-legged one rocks on anything but a perfectly flat surface. Three legs are just right for a milking-stool or a laboratory tripod. I used to wonder why insects evolved with six legs before realizing that quadrupeds and bipeds can manage the trick of walking only by virtue of the internal skeleton and its complex arrangements of multiple joints and controlling muscles available in toes, feet, ankles and hips. The exoskeleton of insects does not permit dynamic deformations on this scale; and so the insect balances on three legs (tripod) while moving the other three forwards. The system works so well that I believe engineers in the US are experimenting with six-legged walking machines as possible vehicles for rocky ground, either on Earth or on other planets.

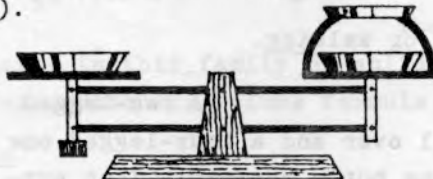


Very little seems to be known about the triskelion device which features in the Arms of the Isle of Man, except that it is supposed to say: "Throw me as you will, yet shall I stand." It dates from the tenth century, when it appeared on coins of the Norse King Anlaf Cuaran. (Indulging in a brief flight of fancy, however, I can well imagine that motto to be a retort from the number three to the decimalists' attempts to diminish its significance.)

Balancing-act.

A pleasant illustration of how two and three connect with the practical world is given by the simple weighing-balance, or kitchen scales. If we use one pan for weights and the other for whatever is to be weighed, the

least number of different weights necessary go in order of the powers of two: 1, 2, 4, 8, ... units will combine to give all the intermediate weights (hence the avoirdupois oz/lb system with just one of each different weight; and the inefficiency of decimal-metric weight-sets, which always have to duplicate the 2, 20 and 200 sizes).



To achieve the ultimate economy, though, we should arrange to place weights on either side of the balance: we could then use powers of three (1, 3, 9, ...) and could weigh up to forty (threezen-four) ounces with just four different weights!

It is also possible (see Journal 1) to use a two-pan balance to divide a given amount of loose material into two or three equal shares. (Journal 1 also shows how to fold paper into thirds - accurately.)

The stuff of Life.

The very proteins of which we, and all living things, are made comprise chains of amino-acids, called polypeptide chains. Each chain has a particular sequence of amino-acids to form a particular protein; and to assemble such chains correctly, instructions are carried by giant molecules of a substance (messenger-RNA) which is itself a chain of organic bases (four of them: adenine, guanine, cytosine and uracil) which combine in different ways to form groups, or words known as codons. Each codon specifies a particular amino-acid to be made, and the sequence of codons thus determines the protein being synthesized, just like an instructional sentence (there are even codons which signal "start" and "stop").

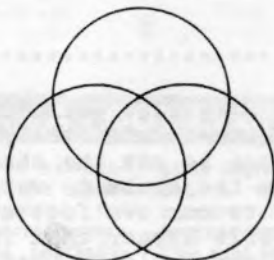
In the course of work in this field (arduous, painstaking years of work to which many microbiologists contributed, and still contribute, heroic efforts) a fundamental conjecture was: how many bases are needed to make a codon? One base at a time would allow four different possibilities. Not enough. Similarly, two bases at a time

would give $4^2 = \cdot 14$ different, which is still insufficient. Three bases per codon, however, give $4^3 = \cdot 54$ (decimal sixty-four) combinations from four elements, which comfortably meet the requirements and allow some spare capacity (evolution may need it at some time!). Subsequent research has verified that codons are indeed triplets of the organic bases. Nature thus finds three letters to be both necessary and sufficient for the words of life.

*
* *

This, then, is my case: three is fundamental to the Universe and our comprehension of it and shares with two the distinction of being a paramount prime. By failing to grasp that fact - obvious to the Bushmen - and allowing ourselves to be seduced by facile finger-counting, we long ago lurched-off along the path to an inferior arithmetic. The brilliant discoveries of zero and place-value numeration were tied to a base partly incompatible with reality. While such an error in the distant past may be excused, its present perpetuation cannot: the imposition of a decimal metric system designed to obliterate those rational measures evolved in an effort to minimize the problems caused by ten-count owes everything to politics and nothing to rational progress.

At the very least, we need a counting-base that will accept the most important, indispensable primes, two and three, as factors. The square factor four is also of major importance, with six only slightly less so. There is only one choice, only one radix that will do - but that's plenty!



* * * * *

THE JAPANESE CONNECTION

Arthur Whillock

It has been observed that, however different the condition or mores of this or that society, similar problems engender similar solutions. Thus, decimal-metrication is a world-wide phenomenon because it offers a facile means of regulating volume production and distribution. The fact that each culture has evolved satisfactory means of dealing with its measurement needs is of no account in the drive for uniformity; but unless such customary methods are suppressed by law the 'new' standards, so suitable for bureaucratic control, would be ignored.

Mr. Rokosuke Ei, who runs an industrial design company - Creation Promotions, Inc. - has been defending his national measures with considerable vigour. He has sent us a copy of his book of *190 pages which presumably deals with all aspects of the subject and which would make interesting reading if only it were possible!

I have managed to obtain a rough translation of the cover, which has a cartoon of the author holding the artisans' and dry goods shakus and defending them with a builder's square. The captions say, in effect:

Measures for sale! Demand a change from being made a victim by the Measurement Units Act!

The key section of the Act is no. 10 (shown at right).

'No other measurement units except the measuring units in the Act may be used for the quantity and quality of materials described in Sections 3 and 5 for the sale or description of a material... There are made exceptions regarding measurement units for import and export goods.'

計量法

第一条 この法律は、計量の基準を定め、適正な計量の実施を確保し、もつて経済の発展及び文化の向上に寄与することを目的とする。

第十条 第三条及び第五条に規定する物量の状態の量については、法定計量単位以外の計量単位は、取引上又は証明上の計量（物量の状態の量の表示を含む。以下この条中同じ。）に用いてはならない。但し、輸出する貨物の計量及び貨物の輸入についての計量については、この限りでない。

As noted in the NEW SCIENTIST article reproduced in Journal 3, Japanese architects officially design in metric while contractors continue to use the shaku-sun system. This is feasible because the shaku is very close to 300mm at 303 (and even closer to our own foot at 304.8) and if the building turns out a trifle larger than intended no-one is likely to notice. Our own building trade uses a 'metric foot' of 300mm (whilst pretending not to!). An adjustment to both national measures could unify three major measuring systems.



IT'S OFFICIAL . . . A FOOT IS ONLY 11.8 INCHES

ONE OF the more bizarre extravagancies at the BBC is the little-known unit of measurement, the BBC foot. The vast architecture department has to have specially-made rulers, squares and tape measures because the BBC foot is only 11.8in.

The reason, to the BBC mind, is

quite logical. After a furious internal debate on whether or not the corporation should go metric an elegant compromise was achieved. The foot would stay. But it would be a metric foot of 300 millimetres. Nobody seemed to mind that the 'metric' yard, therefore, was 4in short of a metre.

Print metric?

Thank you for your letter of 17 October regarding my research into Metric Typographic Mensuration.

As you will see from the enclosed outline of the study, although it starts out with a presumption that a uniform metric system is needed, all aspects of the topic are being taken into consideration and material relating to the merits of a duodecimal system and indeed any other proposals is being gathered and studied.

It is hoped therefore that the result of the study will present a balanced appraisal of the situation, giving due weight to theoretical arguments and aspects of implementation and use. To this end I would very much appreciate information regarding your Society's arguments for the use of duodecimal systems generally and in typography in particular.

P. Pavey BA MSTD
Napier College
Edinburgh.

(Note article by Robert Carnaghan in this issue. -Ed.)

* * *

Various thoughts.

Thank you for your letter of 7 June. I certainly agree with you in deploring the phasing-out of the teaching of number-base work in schools. I believe in Victorian times it was quite common for number-base work to be taught in elementary arithmetic. The alteration of history texts and historical novels is just plain silly. One might just as well cut out all references to stage-coaches as being outside the experience of children today.

My point was, however, that there is a danger in letting people think that dozenists are just harking back with some sort of nostalgia for the past rather than looking forward to a more rational numerical future.

Some years ago, before decimalization, I heard a member of Parliament being interviewed on the radio when he suggested the re-introduction of the groat, not because of its historical associations but simply because it would be useful to have a coin which was exactly a third of a shilling. This is the sort of approach I commend.

On the other hand, I don't think that the educational situation is entirely bad. Because of the importance of computers, more and more children are being taught about the binary system and the use of hexadecimals. This at least will get rid of the unthinking assumption that ten is the only possible number-base.

Incidentally, did you know that the American writer, Frederick Pohl, has written a couple of articles suggesting a change-over from decimals to the binary system for general use?

I had thought of writing an article on the possible effects of a computer based on a ternary instead of a binary system. I

believe there have been experiments with such a computer which would be vastly more powerful than those we have at present.

Talking of computers, one of the main difficulties of the system used in Britain for writing dozenal numbers is that they cannot be written in an ordinary computer using an ordinary keyboard without substantial modifications, whereas the system used in the USA can be so written; and would make things such as simple dozenal conversion programmes possible.

S.R. Dalton
LEEDS.

Clock and calendar.

I was pleased to see Shaun Ferguson's thoughts on the calendar; I believe he is correct in his approach. A further concern of mine (although very few others share it, I've noticed) is the reckoning of years and months. When should a dozenal calendar begin its counting (and presumably begin with a year 0, which is lacking in the Christian calendar)?

The problem of varying lengths of months seems solvable: *10 months, each with *26 days. What is needed is a reasonable way to disperse the remaining 5 or 6 days throughout the year. I propose that in non-leap years the 5 days occur every *10 weeks and in leap years the 6 days occur every 2 weeks. Others have suggested that the extra days be bunched together at year-end, but this is astronomically inelegant and confusing. Implied in all this, of course, is a week of 6 days.

Professor Valevsky says there is nothing wrong with hourly divisions as we have them now. But there is: why have 2 dozen anything in the day when 1 dozen provides a complete dozenal-metric approach for time? Much of what Mr. Morley (Journal 5) dislikes in digital clocks is in fact owing to the combination of three number-bases in the current counting of time. In my system (which I was far from the first to suggest) the day consists of *1000 units, and a dozenal digital clock with four digits enables one to observe time passing every $4 \frac{1}{6}$ seconds. I agree with Mr. Morley about the general value of having hands and an analogue clock, but until someone develops a 3- or 4-handed dozenal model, we will have to be content with (and at least try out) a digital version. Although I mentioned some time ago that such a clock was forthcoming, the building of it is still not quite finished; but the end is nigh: a dozenal digital clock will be available shortly. The prototypes run perfectly.

Robert Carnaghan's remarks on creating the dozenal digits for ten and eleven are certainly valuable. However, users of the Macintosh computer, made by Apple in California, know that many of the difficulties Mr. Carnaghan discusses vanish. With the Macintosh and a font editing programme (about £30) one merely designs the new characters in a font (character set) and loads the changed font into a programme application or the system file. The new characters appear on the screen without further effort. The procedure takes about ten minutes!

Paul Rapoport McMaster University
HAMILTON Ontario Canada.

Great minds...

...I favour a *10-month year having five six-day weeks in each month, with the five remaining days reserved as global holidays to mark the seasons with an additional holiday at New Year's. One would work four days and have a two-day weekend. Even though this would give only two dozen and eight working hours in a week there would be eight extra weeks in a year, so the annual amount of work would be about the same. In all probability, more work would be accomplished because morale would be higher. That would imply that we would get more pay, have eight more weekends and five extra holidays. All by simply organizing our calendars better!

Jerry Brost
GAINESVILLE
Florida.

* * *

Metric mongrels?

Have just read the magazine for 1197. The articles on 'creeping metrication' are particularly relevant at this time.

I would like to point out a further, and I believe greater, threat than those mentioned. This concerns the increasing trend in certain major areas of technology (aircraft, for instance) to participate in 'collaborative' manufacturing schemes. No prizes for guessing which system of measurement will be chosen as the norm.

Politicians and economists are obviously hooked by the doubtful claims made for the advantages of these deals (design by committee usually means disaster). I would be interested in other opinions on this as to whether it is really cheaper to make fuselages in W. Germany, wings in G.B., tails in Italy, etc., not to mention the problems that could arise militarily. Or are they so loved by industrialists, bureaucrats and politicians because they force Britain to 'think European'? Don't discount it.

In a local DIY store recently, I saw plumbing fitments marked 15mm ($\frac{1}{2}$ ") or 28mm (1"). Not only inaccurate but non-linear too. Still, accuracy is a secondary requirement now, is it not?

Robin Hancock
FOWNHOPE
Herefordshire.

Mr. Hancock cannot be blamed for assuming that the metric standards for water-pipes would be based on common-sense! But, whereas the British standard sizes were internal diameters, which, one might have thought, are the basic dimensions, metric sizes are external diameters..... Anyone care to write an article on this mess? -Ed.

* * *

More from Mr. Dalton.

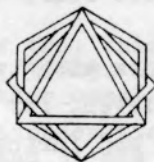
My only criticism of the late Mr. Pendlebury's proposals is based on linguistics rather than mathematics. For example, 'levzen' sound too much like 'eleven'. Far worse is the potential confusion between the words 'ten' and 'zen'. Here

we should follow the American usage. We should use the word 'ten' to mean the figure 1 followed by a zero (e.g. the 'ten' of the binary system is two and the 'ten' of the hexadecimal system is sixteen, etc.). We would then have to use another name for the digit which follows 9, such as the American use of 'dek'.

May I also suggest that we adopt some simple logo for the Society, perhaps a clock-face or, even simpler, a triangle inscribed in a square?

S.R. Dalton
LEEDS

DSA uses a clock-face; and does our present logo not go some way towards the latter suggestion? -Ed.



. . .

Romans again.

May I take this opportunity of reminding those who, like myself, need to use Roman numerals for chapters, genealogical tables, etc., how easily they can be put into dozenal form? This may seem very like carrying the war into the enemy's camp - and so much the better - but the Roman numeral does have its uses.

All that needs to be done is to insert a numeral before IV and IX, or before XL and XC, and so on. This creates the sequence as follows:

I, II, III, IIV, IV, V, VI, VII, VIII, IIX, IX, X, etc., and X, XX, XXX, XXL, XL, L, LX, LXX, LXXX, XXC, XC, C, etc.

The additions may be applied for D (500) and M (1000) as well.

I have also begun to look into the possibility of modifying a simple, basic electronic calculator to function in dozenals and, before pursuing this further, would be very interested to know if I am thereby duplicating work which has already been done by another member?

James de la Mare
LONDON.

. . .

1 2 3 4 5 6 7 8 9 2 L 0

MATHEMATICAL SECTIONPALINDROMIC PRIMES

Shaun Ferguson

A palindrome is usually a word (or sentence) which reads the same whether read normally or backwards: for example, "Madam, I'm Adam" (or her reply, "Eve").

We can also have palindromic numbers, such as 121 or 14641. The prime numbers always provide a field of interest. While playing with number-bases in general I have found that some palindromic primes are palindromic in more than one base. A good example (the most prolific so far) is 565 in base eight: it has the forms 11311 in base four, 454 in base nine and 373 in base ten.

There are also some which work with two-way notation: 131 in base eight is 13̄1 in base eleven, for example.

Here is a list for interest and further investigation; I have gone as far as base nine in my initial researches.

Base

Three	111, 212 (111 is 11 base twelve)
Four	101, 131, 323
Five	111, 131, 232, 313, 414 (232 = 151 base six) (414 = 131 base nine)
Six	11, 101, 111, 141, 151, 515, 525 (515 is 191 base ten and 232 base nine)
Seven	131, 212, 313, 515, 535, 616 (313 = 111 base twelve) (515 = 10001 base four)
Eight	111, 131, 141, 161, 323, 343, 373, 535, 565, 717, 737, 747, 767 (343 = 272 base nine)
Nine	131, 151, 212, 232, 272, 414, 454, 515, 737, 757, 838, 858, 878 (858 = 10301 base five, 232 = 191 base ten, 454 = 373 base ten, 212 = 20102 base three)

Other oddments to mull over: 131 base nine = 13̄1 base twelve,

$$141 \text{ (eight)} = 1\bar{4}1 \text{ (twelve)}$$

$$323 \text{ (eight)} = 2\bar{3}2 \text{ (eleven)}$$

$$2\bar{2}1 \text{ (eleven)} = 221 \text{ (ten)}$$

$$113 \text{ (ten)} = 1\bar{1}3 \text{ (eleven)}$$

* * *

Quite a range of amusements for anyone wanting to play with numbers and number-bases!

SF

PRIMES - some other ideas

Shaun Ferguson

113, 131 and 311 are all prime in base ten, and the same numbers are also prime in base nineteen.

116, 161 and 611 are prime in base twelve.

117, 171 and 711 are all prime in base eleven.

These are described as 'cyclic primes' in a book I found recently. The same book gave 3793 as a 'superprime' in base ten, since 379, 37 and 3 are primes in base ten (but 93 and 793 are not).

Can anyone find a 'superprime' (in any base) where, the prime being abcd, a, ab, abc and abcd are all prime? Or is it possible to find such a prime where any combination of the digits (1, 2, 3 or all 4 at a time) is always a prime in a given base?

There is also 19937 in base ten; this is prime even when 'circulated': 19937, 99371, 93719, 37199, 71993. Any examples in base twelve? Or any other base?

'Prime reversals' provide another field rich for number theorists. Base ten: 13 and 31 are prime, as are 17 and 71, 37 and 73... What about base twelve? Other bases?

Prime reversals

In base twelve and in base eight, 15 is a prime and so is its reversal, 51. If we express these in two-way notation, base eight, however, the forms 23 and 131 are not reversals.

In base ten we have the pair of primes 79 and 97; in two-way notation these become 121 and 103. These same two-way forms in base eight happen to provide another pair of reversals: 57 and 75.

Whether this leads us very far is another matter (and one which some might like to investigate further); but on comparing bases it struck me that in an odd-number base there are many more prime reversals than in an even-number base (in an even base, any prime beginning with an even digit cannot have a prime reversal).

Here, for example, is the list of primes below 100 (base eleven) which have prime reversals:

12, 21; 16, 61; 18, 81; 27, 72; 29, 92; 34, 43; 36, 63;
49, 94; 56, 65; 67, 76; 89, 98; 96, 69.

When these are expressed in two-way notation, we have:

14, 41; 12, 21; 25, 52; 23, 32; 34, 43; 34, 43; 151, 151;
142, 241; 135, 531; 131, 131; 122, 221; 124, 421; 113, 311;
111, 111; 113, 311.

Question: can we count 14 and 41 since they are not really 'reversals' as defined, but 'negative reversals'?

. . .

BOOK NUMBERING

All publishing houses have devised methods of numbering for their outputs in the past, but with the advent of computer-controlled warehouses to cope with increasing outputs and markets there emerged a clear need for a numbering system that would be unique for every item. A British scheme worked out in 1967 was expanded by the Documentation Section of the International Standards Organization so that any country could use it. ISO Recommendation No. 2108 outlined the principles.

A book number, preceded by the letters ISBN, comprises ten digits divided into four sections: (a) a group identifier, which may be from one to five digits long, for national, language, geographic or other area of publication; (b) a publisher identifier, from one to seven digits in length; (c) a title number for name, volume or edition, which can be up to six digits depending on the number allocated to (b); and (d) a check digit. Sections (a), (b) and (c) must always total nine digits, leaving the tenth space for the check figure, which is determined as follows.

Each number in the three main sections is multiplied in succession by 'weight' numbers from ten to two and the products summed. The check digit is then added to make the total divisible by the modulus eleven without remainder. (Of interest to us is that to limit the complete ISBN to ten digits the number ten itself, when required as a check digit, is replaced by a Roman X).

In a stock control programme the first step is to check that the book number presented is a valid one. TGM was given the number 0 9502724 1 8. The 0 is a UK/English language group and the seven figures our identifier, with one first publication. The check goes as follows:

$10 \times 0 + 9 \times 9 + 8 \times 5 + 7 \times 0 + 6 \times 2 + 5 \times 7 + 4 \times 2 + 3 \times 4 + 2 \times 1$,
a total of 190, which requires + 8 for divisibility by eleven.

Despite the vast number of permutations available the possibilities are not unlimited. A dozenal numeration would last longer but, with accessions to the British Library increasing at the rate of two miles of shelving a year, some revision will eventually be needed.

A number in the present system is allotted without charge by the Standard Book Numbering Association Ltd. at 12 Dyott Street, London WC1A 1DF, who also issue a booklet, ISBN 0 949999 05 9 (Price £2, cash with order) which gives a full description and rules for use.

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LET'S END WITH.... The new 'Fixed Penalty' scheme for Traffic Offences. All you miscreants will be pleased to know that the fines are: £12 for non-endorsable offences and £24 for the endorsable variety! Is this new thinking in high places...?