SCORE LINE?

By finding the values of the letters a to f, express the ordered pairs numerically. Join the points with straight lines in the order given in each set.

For example: $a = 5 \times 7 \div 35 = 1$
Therefore $(a+3, 2a) = (4,2)$.

$a = 5 \times 7 \div 35$; $b = 0.8 \times 0.5 \times 10$; $c = 1.25\,(2.35 - 1.95)$; $d = 1728 \div 216$; $e = (50 \div 6.25) \times 0.25$; $f = 42.73 + 18.59 - 45.32$

{(b+d, d−a), (d−e, d−a), (e, 3e), (a, 3e), (b−2e, d−a), (b−2e, 3e), (a, a+b), (b+e, 5a), (d−a, d−5c), (d, a+b), (d+e, a), (3b, a), (f, f−2d), (a+f, f−2d), (f−c, a), (3b+a, e), (3b−a, c+e), (3b−a, b), (3b, a+b), (3b, d−a), (3b+a, a+d), (f−3c, a+d), (e+f, d−a), (5b−a, d−a), (e+f, d), (f−a, d+e), (7c+d, f−5c), (7c+d, f−c), (d+e, f), (a+d, f−c), (a+d, f−e), (3e, 6e), (d, d+e), (d, d−a)}

{(a+d, f−a), (d+e, f−a), (3b−a, f−3c), (7c+d, f−5c), (d+e, 3b+a), (d+3c, 3b+a), (a+d, f−5c), (a+d, f−e)}

{(d−e, 3b), (d−c, 3b), (a+d, 5e+c), (5e, 5e), (5e+a, a+d), (5e, a+d), (d, 5e)}

{(5e, d−a), (5e, d−e), (d+3c, b+c)}

{(d, a+b), (5e+a, b)}

{(a, 3e), (e, a+b)}

{(f−a, 5e), (f−3c, a+d)}

{(f−c, a), (f, e−2a)} D.I.B.

ANOTHER CLEVER PLOT

devised by Elizabeth H. Holder of Guildford, Surrey

Plot the following curves on graph paper. Use the same scale on each axis. The x-axis must be from −8 to +8 and the y-axis from −10 to +12.

1. $(x+3)^2 + (y-4)^2 = 1$
2. $y = \frac{1}{8}x^2 - 9 \quad (-8 \leqslant x \leqslant +8)$
3. $x = 3, y = 4$ (draw a large point)
4. $y = \frac{1}{4}x^2 - 1 \quad (-1 \leqslant x \leqslant +1)$
5. $y = \frac{1}{2}x + 9 \quad (-8 \leqslant x \leqslant +2)$
6. $y = \frac{1}{4}(11 + 6x - x^2) \quad (\frac{1}{2} \leqslant x \leqslant 5\frac{1}{2})$
7. $(x-3)^2 + (y-4)^2 = 1$
8. $x = -3, y = 4$ (as for 3)
9. $y = \frac{1}{4}x^2 - 5 \quad (-3 \leqslant x \leqslant +3)$
10. $y = \frac{1}{4}(11 - 6x - x^2) \quad (-5\frac{1}{2} \leqslant x \leqslant -\frac{1}{2})$
11. $y = \frac{1}{4}(x+3)^2 + 3 \quad (-5 \leqslant x \leqslant -1)$
12. $y = 10 - 6x - x^2 \quad (-5 \leqslant x \leqslant -1)$
13. $y = \frac{4}{3}(11 - x) \quad (2 \leqslant x \leqslant 8)$
14. $y = 10 + 6x - x^2 \quad (1 \leqslant x \leqslant 5)$
15. $y = \frac{1}{4}(x-3)^2 + 3 \quad (1 \leqslant x \leqslant 5)$

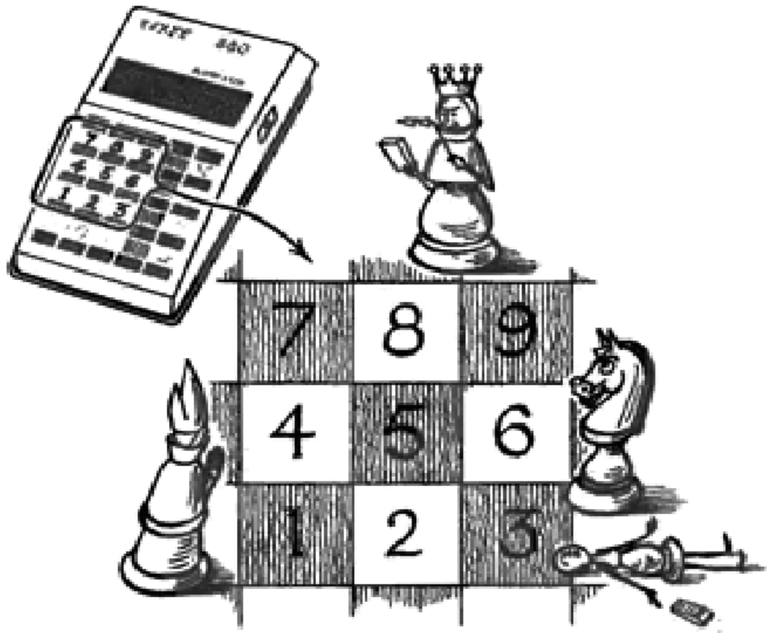
Can you face all this plotting? Ed.

MATHEMATICAL PIE

No.93 *Editorial Address :* **West View, Fiveways, Nr. Warwick** **SUMMER 1981**

A CALCULATOR PROBLEM

One day, I was using my calculator to do a series of long addition sums; it occurred to me that at times with certain combinations of digits, my fingers were following various patterns. This lead me to the following puzzle.



These nine squares are in the central part of a chess board but you will also notice that they are numbered in the same way as the keyboard of the calculator.

Now suppose any one of the chess pieces reaches any one of the squares shown. It then moves to as many of the squares as is permitted by the rules of chess. As it rests on a square, add the number to the sum of the numbers of previously occupied squares, but you may not rest on the same square twice.

What is the largest sum you can get for each piece. Suppose you start with a pawn which can move forward one square at a time. If it started on 5 and moved to the 8, the sum would be 13. Where must the pawn start and how will it move to obtain the largest total?

After the pawn try with the bishop, then the rook, the queen, the king and the most interesting of all, the knight.

When you have completed the game, extend it into the duodecimal system where we must find symbols for ten and eleven before using 10 for twelve. R.H.C.

TRUNK LINES!

On graph paper, set out a grid with a horizontal axis from − 6 to + 7 and a vertical axis from − 4 to + 5. Mark the following points and join them with straight lines in the order given.

{(− 4, − 3), (− 4.5, − 2), (− 5, 0), (− 5, 2), (− 4, 4), (− 4, 4.5), (− 3, 4.5), (− 2, 5), (− 1, 4), (− 0.5, 3), (− 2, 2), (− 2.5, 1.5), (− 3, 1.5), (− 3, 2), (− 4, 1.5), (− 4.5, − 1), (− 4, − 2.5), (− 4, − 3)}

{(− 5, 1), (− 6, 0), (− 5, 1.5)}

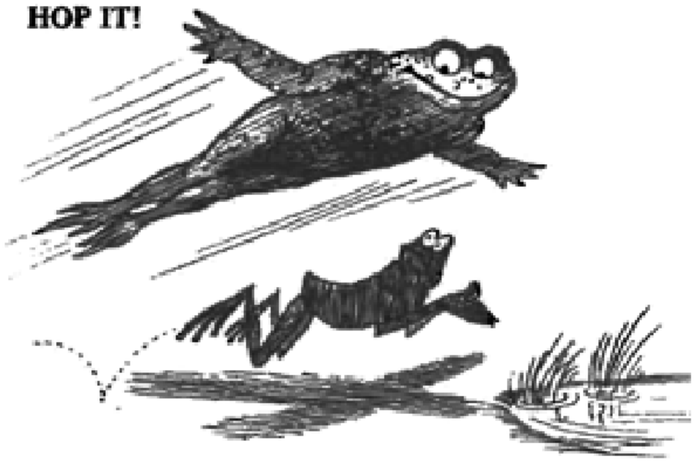
{(− 1.5, 4.5), (1, 4), (3, 4.5), (4, 4), (5, 3), (5.5, 2), (5.5, 0), (5, − 1), (5, 0.5), (4.5, − 1), (4.5, − 2), (4. − 4), (3, − 4), (3.5, − 3), (3.5, − 2), (3, − 1), (1, − 0.5), (− 0.5, 0), (− 1, 0.5), (− 2, − 2), (−2, − 3.5), (− 3.5, − 3.5), (− 2, 2)}

{(− 0.5, 0), (0.5, − 3), (0, − 3.5), (1.5, − 3.5), (1, − 0.5)}

{(4.5, − 1.5), (6, − 3.5), (6.5, − 3), (5, − 1)} D.I.B.

HOP IT!

A frog and a toad are each 1 metre from the edge of a pond, they start at the same time jumping towards the pond making one leap every second. The toad jumps half the remaining distance each time. The frog jumps half the total distance, followed by one third of the total distance, followed by one quarter, then one fifth, one sixth, etc. Which is the first to get wet? C.B.A.



IT'S A FACT!

It is an established biological fact that many animals will vary a behaviour pattern according to the temperature they are experiencing.

A cricket chirps faster or slower as the temperature increases or decreases in accordance with the formula $t = \frac{1}{4}C + 37$, where t is the temperature in degrees Fahrenheit and C is the number of chirps per minute.

What is the temperature when he is chirping at 48 chirps per minute.

On the other hand, a study of ants leads to the formula $t = 11s + 37$ where t is the temperature in degrees Fahrenheit and s is the speed of the ant in inches per second.

If the ant is running at a speed of 1 foot every 18 seconds, what is the cricket doing? R.H.C.

CHARLIE COOK STRIKES AGAIN

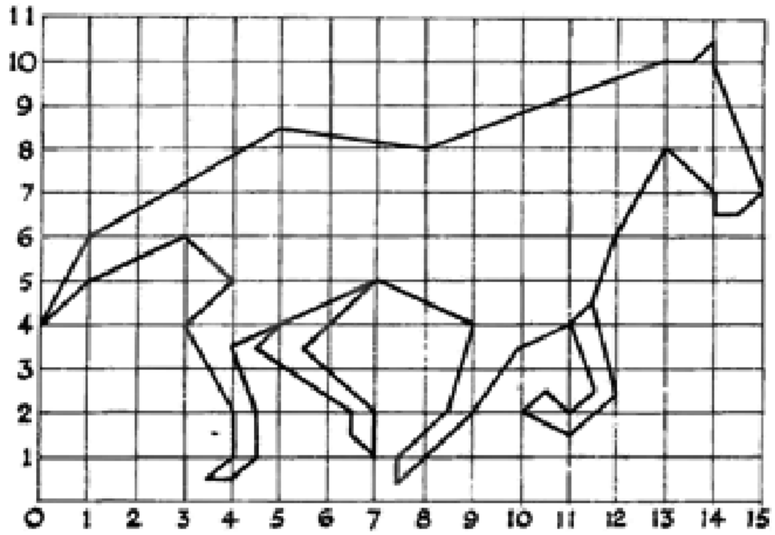
When asked to work out 21 x 24, Charlie Cook could not do it as he did not know his 21 times table nor how to do long multiplication. Instead he found the product 12 x 42 as he knew his 12 times table. The answer is correct, but why? C.B.A.

A point to point

SOLUTIONS TO PROBLEMS IN ISSUE No.92

Parallelagram problem Use the cosine rule twice and remember that cos A = − cos (180 − A).

1981 All the dates are palindromic when the year is written as 81 but the eighteenth of June has rotational symmetry when written 1861981.



A weighty problem A cube balances a cone and a sphere.

In days of old The bill comes to 10s.6d. or ½ guinea, so the change will be the same.

Topological excursion The routes cannot be traversed as there are 4 odd nodes.

Season's greeting Counting A as 1, B as 2, etc, Merry Christmas is 189 and A Happy New Year is 156.

A let down The answer to the second question would be correct although the method is false. The last question would lead to an incorrect answer.

Chew on this 8 cows could feed for 8 days.

Inflation at work 6 shillings were 30 pence nowadays. The profit is 546p or 1 820%.

Junior cross-figure No. 69 Clues across: 1. 63; 3. 12; 4. 108; 6. 888; 7. 176; 8. 512; 10. 484; 12. 11; 13. 24.

Clues down: 2. 360; 3. 138; 5. 812; 6. 864; 9.121; 11. 802 and the + sign should have been a division sign.

Alignment Construct a series of equilateral triangles.

A Lewis Carroll problem The total distance walked was 24 miles. The speed on the level must be $\frac{2xy}{x+y}$ m.p.h. B.A.

JUNIOR CROSS-FIGURE No.70

fig. 1

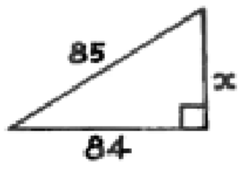
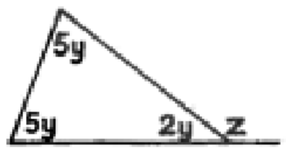
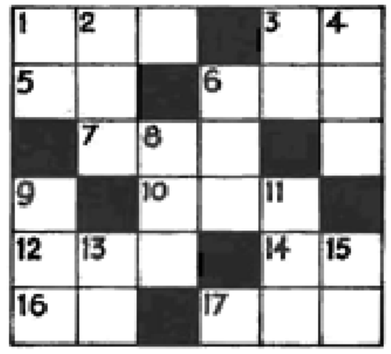


fig. 2





Clues Across

1. Area of square of side x (fig.1)
3. The sum of two consecutive numbers whose product is 132.
5. The mid-point of the line joining (5,6) to (11,2)
6. Jumbo?
7. The volume of a cube whose surface area is 384 cm^2.
10. Three consecutive numbers whose sum is 18.
12. One-third of a complete turn, in degrees.
14. The value of y in fig.2.
16. The length of x in fig.1.
17. The area of the triangle in fig.1.

Clues Down

1. One-fifth of a right angle, in degrees.
2. 17 across with its digits reversed.
3. Two dozen.
4. $\sqrt{(625 \times 225)}$.
6. The surface area of a cube whose volume is 1 331 cm^3.
8. The value of z in fig.2.
9. $(ab)^2 - ab^2 + b$ given $a = 4$ and $b = 3$.
11. The point of intersection of the lines $y = 2x$ and $y = x + 7$.
13. The average of 17, 21 and 31.
15. The product of two consecutive numbers whose sum is 15.

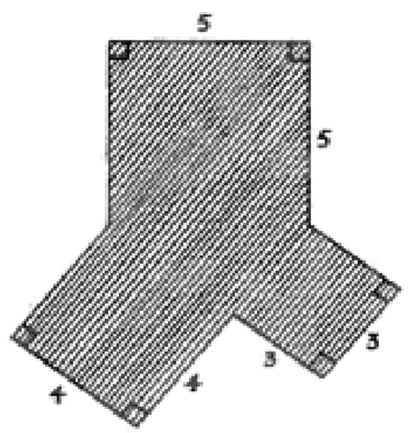
E.G.

CUTIE PIE AND THE CYCLE TOUR

Cutie Pie went for a ride on her cycle to see her friend. In the first hour, she rode ½ way there + ½ km. In the second hour she covered half the remaining distance + ½ km. In the third hour she rode three quarters of the remaining distance + ¾ km when she arrived at her journey's end. What was her average speed for the whole journey?

C.B.A.

Whose Shadow?



Can you find the area of this shape?

KEEP YOUR DATES

If you were given more than one diary this year, do not despair. The dates of 1981 are exactly repeated in 1987, so keep one diary and change the final digit from 1 to 7 which is quite easy.

Note 1980 will not be repeated until 2008, 1982 in 1993 and 1983 in 1994. Old diaries that may be useful are 1977 for 1983, 1974 for 1985 and 1978 in 1989.

C.B.A.

A DOUBLE DEAL IN BOATS

suggested by Angela Ross, Form 4S, The City School, Lincoln

A man recently bought two boats but found they did not fulfil the purpose for which he wanted them. He sold the boats for £600 each, making a profit of 20% on one boat and a loss of 20% on the other.

Did he make a profit, loss or no change on the whole transaction?

INFLATION AGAIN

When the original penny black post was introduced in 1840, how many letters could you send for a sovereign?

How many letters can you send for a new sovereign now?

R.H.C.

LADIES IN MATHEMATICS 4
GABRIELLE-EMILIE, MARQUISE DU CHATELET

This lady was born in 1706 into the glittering social life of Paris. She married the marquis Florent du Chatelet when she was nineteen, but his military career took him away from her for long periods. She turned to her friends for comfort in her loneliness. One of these was Voltaire, who stayed for some time at the marquise's chateau at Cirey in Champagne. They pursued their writing and scientific discussions here, and in 1738 both wrote essays on the nature of fire, competing for a prize offered by the Academie of Sciences. The marquise did not win, but her work was later published by the Academie. Her brief life ended in 1749 when she died in childbirth at Luneville.

A.M.A.

WEIGHT IN ORDER

Alan, Brian, Charles and David were weighed. Alan and Brian together weigh the same as Charles and David. Alan and Charles together weigh more than Brian and David. Charles weighs less than David. Arrange the four in order of their weights.

C.B.A.

FLIGHT PATH

Four aeroplanes were flying in a straight line. The third was 6 km from the first. The fourth was 4 km from the second and the third was 1 km nearer to the fourth than it was to the second.

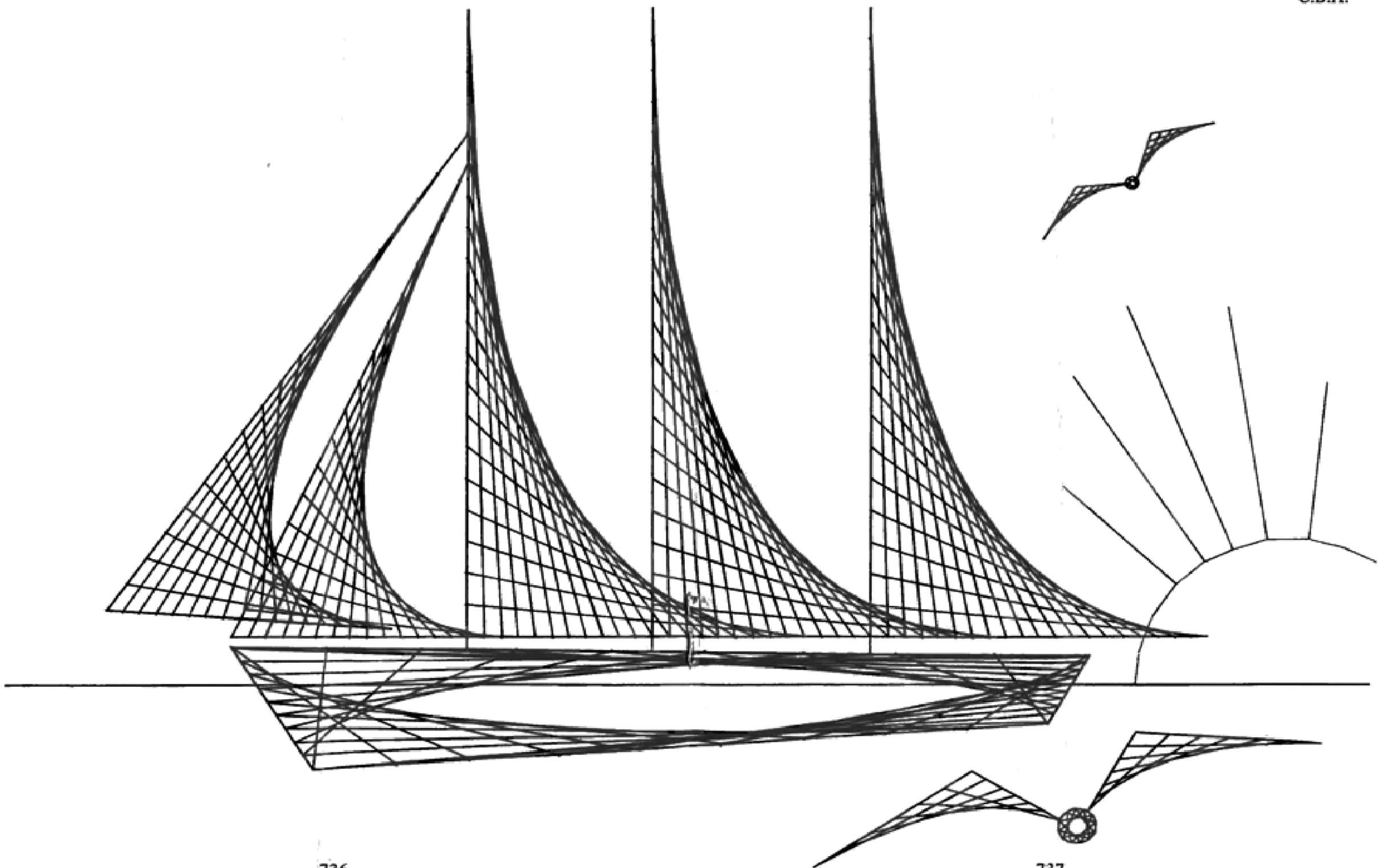
How far apart are the first and fourth planes?

C.B.A.

THE STITCH CRAFT

The yacht shown below looks complex but, in fact, is quite straight forward to make. The three main sails are drawn so that each vertical axis is twice the length of the horizontal axis and there are the same number of pins on each. The other two sails are made in the same way but using an acute angle between the axes instead of a right angle. The hull is a quadrilateral with the pins four times as far apart on the horizontal axes as they are on the other two axes. The 'sewing' is then completed in the normal way for parabolic curves. The scale of the picture can be adjusted to suit the material available. The original from which the drawing was made was almost 1½ metres in length. Background details can be added such as sky, clouds, seagulls, etc.

C.B.A.



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737