Solution of the Quartic.

PERHAPS the following semi-graphic solution of a quartic equation may be of some interest to your readers.

Suppose the parabola $x^2 - y = 0$ is drawn, once for all, on a sheet of squared paper. Take an equal parabola, and place it with its vertex at the point (a, b) and axis parallel to OX so that its equation, in this position, is

$$(y - a)^2 = x - b.$$

Then the abscissæ of the intersections of the parabolas are the real roots of

$$x^4 - 2ax^2 - x + (a^2 + b) = 0 \quad \dots \dots (1)$$

Now the general quartic is at once reducible to the form

$$x^4 + \phi x^2 + qx + r = 0,$$

and if we put

$$x = -z \sqrt[4]{q},$$

this becomes

$$z^4 + \frac{\phi}{q^{\frac{3}{4}}} z^2 - z + \frac{r}{q^{\frac{5}{4}}} = 0.$$

This is identical with (1) if

$$a = -\frac{\phi}{2q^{\frac{3}{4}}}, \quad b = \frac{4r - \phi^2}{4q^{\frac{5}{4}}};$$

so we can calculate a, b , then place the movable parabola in position, read off the real values of z , and finally take

$$x = -z \sqrt[4]{q}.$$

G. B. MATHEWS.

10 Menai View, Upper Bangor, N. Wales.

Rural Education.

I AM very glad to learn from my friend, Prof. Meldola, that the school of which I previously wrote is so well known. The frequent reference to Bigods as an experiment, and as the first attempt to give a systematic training in science in a purely rural district, led me to imagine that people were not generally aware of Sexey's Trade School. It seemed therefore that some mention of its success might act as an encouragement to others, but obviously the fact that this work has been successfully carried on for some years in Somersetshire in no way detracts from the value of what is now being done in Essex. I may observe too that, while the latter has had to depend mainly upon the generosity of Lady Warwick and the enthusiasm of Prof. Meldola, the former enjoyed certain advantages in the way of endowment.

At Bruton the outlay in capital has amounted to 5140*l.* (cost of site 640*l.*, buildings and equipment 4500*l.*). This sum is made up of grants from the County Council amounting altogether to 1100*l.*, and of 4040*l.* derived from endowment, income account and donations. The County Council Building grants were thus distributed: in 1891 250*l.* for building and equipment, in 1892 450*l.* for a similar purpose, in 1894 250*l.* for new class-rooms and metal work, in 1897 150*l.* for a new physical laboratory, &c.; in all 1100*l.* Nothing under this head has been contributed by the Science and Art Department. Since 1893 a capitation grant of 2*l.* for day scholars and 3*l.* for boarders has been paid by the County Council to all approved schools in Somersetshire. At Sexey's Trade School this amounts to about 225*l.* a year. These grants go towards the salaries of science and technical teachers, and the school is open to inspection by the County Director of Technical Education. The total annual income of the school is about 1200*l.* Since 1894, pupils from the school have obtained 21 out of 36 County Intermediate Scholarships, and 5 out of 11 Senior Scholarships.

The school was opened with fifty pupils in temporary premises in April 1891. At Easter 1892 the new buildings were opened with sixty pupils. The cost of the buildings so far was nearly 3000*l.*, towards which, as stated above, the County Council contributed 700*l.* and the Governors subscribed 120*l.* Some of the classes were registered in connection with the Science and Art Department in the autumn of 1892, and the first examinations were held in May 1893. The school buildings were enlarged in 1897, when two new class-rooms, a metal workshop and gymnasium were erected. In 1895 the new regulations of the Science and Art Department for organised science schools were issued. The school appears to have been

working for three years on similar lines to those laid down by the Department, and I am told that the conversion of the school into an "organised science school" was accomplished with practically no change of curriculum or method. The first grant of 260*l.* under the new regulations was received in 1896. Since then the grant has been very high, almost maximum grants for chemistry and physics having been awarded. The grant this year was 385*l.* and the number of pupils presented was fifty-seven. The grants from the Department have been as follows:—1893, 57*l.*; 1894, 104*l.*; 1895, 96*l.*; 1896, 260*l.*; 1897, 384*l.*; 1898, 355*l.*; 1899, 385*l.*. To comply with the requirements of the Department, a new physical laboratory and other buildings were provided in 1897, and this year a new museum and additions to the master's residence are being undertaken at a cost of nearly 400*l.*

I regret that I can furnish no information as to the constitution of the Technical Instruction Committee of the Somersetshire County Council, but doubtless these particulars can be ascertained from its annual report.

JOHN C. MEDD.

Stratton, near Cirencester, October 29.

I SHOULD like to add to the above interesting statement by Mr. Medd that a rural school of science, which is even more akin to Bigods' than Sexey's Trade School, has been at work for some years at Bakewell in Derbyshire. I referred to this in my address at Bigods in 1898. The resemblance in constitution and function is due to the co-education of boys and girls, and it would add to the value of the present discussion if some information could be given as to the working of the Bakewell school.

R. MELDOLA.

IN addition to Sexey's Trade School, Bruton, the visitors of Sexey's Hospital recently (and in this case also at the instance of Mr. Hobhouse) have established a dual school of the same general type as the Bruton school in the village of Blackford, five or six miles from the nearest railway station, and in the midst of a purely agricultural district. New buildings have been erected at a cost of about 4000*l.*, towards which the County Education Committee has contributed 1000*l.*, in addition to 250*l.* in aid of the equipment of the laboratory and workshop. The Blackford school has been carried on for about one year in unsuitable temporary premises, but nevertheless attracted more than fifty pupils. The new buildings were opened at the end of September by Sir Henry Roscoe. The school has now between seventy and eighty pupils, a considerable proportion being boarders. The school will receive from the County Education Committee an annual grant of at least 120*l.*

C. H. BOTHAMLEY.

County Education Office, Weston-super-Mare, November 2.

Birds Capturing Butterflies.

WITH reference to Mr. O. H. Latter's note in NATURE (September 28, p. 520) on the capture of butterflies by the sedge warbler, it may be of interest to note that Sweet, whose work on keeping warblers in captivity is incorporated with Bechstein's "Cage-birds" in Bohn's edition of that work, recommends a living butterfly as a bait for this very species, and for several other warblers, when it is desired to trap adult birds.

I may mention that not long ago I saw here in Calcutta a common Mynah (*Acridotheres tristis*) with a white butterfly in its bill, which it had no doubt obtained in repose, as the day was dull, and the Mynah is not very expert at catching insects on the wing. I remember also once seeing at Dehra Dun a Dhyal or Magpie-robin (*Copsychus saularis*) take a disabled *Catopsilia* I threw out for it, though I have seen the same bird disregard a specimen flying at no great distance. Evidently the birds wait their opportunity, and, though too wise to waste their energies in the pursuit of these evasive insects on the wing, are always ready to snap them up when they can take them at a disadvantage. In this way it can hardly be expected that attacks by birds on butterflies will be often noticed, unless a naturalist will undertake to watch individual insectivorous birds for whole days at a time.

Similarly, one does not in India see kites and crows pursuing sparrows, though a dead one flung out will be greedily snapped up

by either species, and no doubt fledglings perish in numbers by these ever-watchful enemies.

F. FINN.

Indian Museum, Calcutta, October 19.

MR. FINN's letter is interesting as giving support to the opinion that it is when at rest that butterflies are chiefly attacked by birds. The injuries to be noticed on the wings of the insects very frequently are symmetrical on the right and left sides, and can only have been inflicted when the wings were folded in repose. I can only recall one occasion on which I have witnessed a bird attack a butterfly in flight, and then the attempt was unsuccessful.

OSWALD H. LATTER.

Charterhouse, Godalming, November 7.

THE EFFECT OF WEATHER ON EVERY-DAY LIFE.¹

SOME time since, a distinguished member of the Cotton Exchange asked my assistance to solve a problem connected with the variation of prices in "futures." He remarked that these prices varied almost from hour to hour without any apparent cause, such as a knowledge of the state of the crop or of the condition of the American market, which would explain these fluctuations. He was tempted to look for a subjective cause, and thought it might be found in the state of the weather exercising a powerful but unrecognised influence on the dispositions of purchasers and speculators, inducing them to buy or sell as they were alternately swayed by hopefulness or despondency. I was therefore invited to compare the movement of the cotton market with the variations in the weather, with the view of detecting the hidden relation, and was further stimulated to exertion by the assurance that if the origin of the fluctuation could be discovered "wealth beyond the dreams of avarice" would be at my command. Unhappily I failed to trace in the fickle weather the hidden springs that underlie the motives of speculators; and that fortune is still to be made by some one, possessed it may be of greater ingenuity or greater application, and to such an one I present the idea without hope of reward or acknowledgment.

Mr. Dexter's book reminded me of this experience, for he, too, has apparently embarked on an inquiry as difficult, but with a motive more noble, and let us hope with a reward more certain. Mr. Dexter wishes to trace the influence of weather on human conduct in general, and to see how far man's emotional state is affected by meteorological conditions. His reward is the attainment of a degree of Doctor of Philosophy, and the inquiry which he has instituted has apparently been undertaken with a view to meet the requirements of the authorities of Columbia University. One may sincerely hope that Mr. Dexter will have his ambition gratified, for to say that he has not spared himself in the labour of the inquiry is to say little. What is much more to the purpose he has not spared others. Teachers and superintendents of schools, wardens of prisons, superintendents of asylums for the insane, officials of the Weather Bureau and many others have been laid under contribution, by having submitted to them a "questionnaire" to completely satisfy whose interrogations involved not a little labour. Apart from the inconvenience which such a process might cause individuals, we doubt whether the plan adopted is the most trustworthy that could be found. Personal influence rather than climatic conditions is likely to introduce a systematic error into the final result. It is open to question whether the authorities consulted have satisfactorily eliminated the effect of weather from their own

systems and mental states. The power of punishment rests with the authorities who have been consulted, and it may happen that those under their care are the victims of an irritability, engendered in the supervisors from causes with which the weather has absolutely no concern. To judge therefore mainly by the infliction of punishments seems of rather doubtful wisdom. This obvious objection has, of course, not escaped the author, and in one place he certainly recognises that the emotional state of the teacher is a not unimportant factor in the result. Indeed, he says, it may be the teacher we are studying more largely even than the pupil. The frankness with which this admission is made is more to be approved than is the reasoning by which it is set aside.

And now we are tempted to record a fact of which Mr. Dexter is entitled to make the fullest use. The temperature is 78°, the sky is cloudy, the wind is east, the velocity about three miles an hour, and under these conditions we find it much easier to present the facts at which Mr. Dexter has arrived than to criticise his results or carp at his methods. We notice that the author has studied, grouped, and commented on no less than fourteen classes of empirical data, embracing more than a quarter of a million separate facts. These fortunately can be grouped under fewer heads than the elaborate method pursued by the author admitted, and we hope we shall do him no injustice by the curtailment. First we have the registration and the behaviour of children in public schools (which we should probably call Board Schools in England) in New York City and at Denver, Colorado, two very widely different climates it will be remarked. Then we have a large amount of information drawn from police reports, which include assault and battery, discipline in penitentiaries, arrests for insanity and reported suicides. To these are added a few more or less fancy matters, in which the numbers involved are necessarily small, such as the clerical errors discovered in the records of certain of the national banks in New York City, maximum strength tests in gymnasia, and lastly "a study in discrimination carried on in the Psychological Laboratory of Columbia University." The discussion, it will be seen, is very wide, and one fact that will strike the reader prominently when he considers the variety of occupations into which the author has thought it judicious to push his investigations is the length to which this kind of inquiry can be carried when once we are bound hand and foot by the demon of statistics. Possibly the weather has no more to do with a clerk's mistakes than has the quantity or the quality of his supper the night before, but given a nicely ruled sheet of paper, and a system of rectangular coordinates, it is impossible to forgo the delight of plotting results to a scale. This is a harmless amusement; but when we begin to draw conclusions and to build theories, we may go as hopelessly astray as did the famous witness who connected the high tides with the building of a steeple. The author endeavours to meet any criticism of this nature in a passage which we may quote at length, to serve both as an example of his style of writing and his method of argument.

"The meteorological conditions are the essential causes of certain general physiological or mental states, some of which seem to be fertile fields for the action of immediate causes which are, from the standpoint of this problem, accidental. To be concrete, on a certain morning Johnny could not have what he wanted for breakfast, and went to school with the sulks, with a consequent disastrous effect upon his deportment. Most certainly the disappointment at home had a causal relation to his demerit, and no excuse from the weather is sought. But if we take the record of 200 Johnnies for 600 different days, and find that on certain days more of them are out of sorts than on other days, we look for a constant con-

¹ "Conduct and the Weather: an inductive study of the mental effects of definite meteorological conditions." By Edwin Grant Dexter, A.M. (New York and London: The Macmillan Co. *Psychological Review* Memoir.)