EXAMINATION FOR ADMISSION TO THE BRITISH TRAINING COLLEGES, DECEMBER, 1884.

ALGEBRA AND MENSURATION.

THREE HOURS ALLOWED FOR THIS PAPER.

Candidates are not permitted to answer more than *nine* questions in Algebra, nor more than *three* in Mensuration.

The solution must be given at such length as to be intelligible to the Examiner, otherwise the answer will be considered of no value.

ALGEBRA.

1. Prove that the cube of the sum of any two quantities exceeds the sum of the cubes by three times their product multiplied by their sum.

Point out the completeness of the algebraical proof in comparison with the arithmetical result obtained by substituting numbers for letters.

Find the value of—

$$\frac{x^2+2xy+y^2-z^2}{x^2+2xz-y^2+z^2} \text{ where } x=3,\ y=2,\ z=1.$$

2. Multiply $a^{\frac{4}{3}}+4ab^{\frac{1}{3}}+12a^{\frac{2}{3}}b^{\frac{1}{3}}+16a^{\frac{1}{3}}b^{\frac{1}{2}}+16b^{\frac{2}{3}}$ by $a^{\frac{2}{3}}+4a^{\frac{1}{3}}b^{\frac{1}{3}}+4b^{\frac{1}{3}}$.

3. Resolve into elementary factors—

$(3x-y)^2-(a-3y)^2$

and $x^4-(a+b)x^3+ab(a+b)x-a^2b^2$.

4. Simplify—

$$\left(\frac{1}{x}+\frac{1}{y}\right)\left\{1+\frac{1}{\frac{x}{y}+1}\right\}\left\{1+\frac{1}{\frac{x}{y}-1}\right\}-\frac{y+4x}{4y(x-y)}$$

show that—

$$\frac{(x-b)(x-c)}{(a-b)(a-c)}+\frac{(x-c)(x-a)}{(b-c)(b-a)}+\frac{(x-a)(x-b)}{(c-a)(c-b)}=1.$$

5. Find the square root of—

$x^2(p-q)x^3+(p^2-2pq+3q^2)x^2-2(p-q)q^2x+q^4$.

6. Find the G. C. M. of—

$x^3-2x^2-3x^2+14x-16$ and $x^5+2x^4-3x^2+2x+16$.

7. Solve the equations—

(a) $\frac{3x-(a+b)}{4x-(c+d)}=\frac{3x-(a+c)}{4x-(b+d)}$.

(b) $\frac{x-3}{x-6}-\frac{x-6}{x-3}=\frac{5}{6}$.

8. Find the p^{th} term and the sum of p terms of an arithmetical progression, of which the first term is a and b is the common difference.

In an arithmetical progression of $2n+1$ terms the sum of the odd terms $=\frac{n+1}{n}$ times the sum of the even terms.

9. A ratio of greater inequality is diminished by adding the same quantity to each term.

A takes $(n+p)$ steps in a minute, B takes (n) steps, but $(n-p)$ of B's steps $=n$ of A's steps; find the number of his own steps by which B will beat A in a run that lasts (n) minutes.

10. A manufacturer sells goods at a profit of 25 per cent. on his outlay; by doubling his outlay he produces twice as much, but owing to a fall in prices he makes the same actual profit as before; find the reduction per cent. in price.

MENSURATION.

[The answers need not be carried beyond two places of decimals.]

[Figures explanatory of the solution should be drawn.]

1. To paint the outside of a cistern 6 feet long, 5 feet wide, 4 feet deep (including the cover) at 6d. per square foot costs 4s. 11d. more than to paint the inside, find the thickness of the cistern.

2. What proposition of the first Book of Euclid enables us to find the area of a triangle?

The area of an isosceles triangle 8 feet high is 48 square feet; find the lengths of the sides and the base.

3. A circular target has a central spot, surrounded by three concentric rings of such breadths that the area of each=the area of the central spot; show that the radius of the central spot is equal to one-half the radius of the target.

4. Draw a plan and find the area of a field from the subjoined notes taken from the field book, which gives the measurement in links.

	to D	
	1775	
to C 200	775	
	600	to E 320
to B 225	225	
	From A	

Practical Department.

BAD EFFECTS OF CHEAP BREAKFASTS ON HUNGRY SCHOOL BOYS.

The London Educational *Times* refers as follows to one phase of the results of the cheap breakfasts now being provided for starveling pupils.

A contemporary comments on a letter showing that even a Board school teacher is recovering his natural humour. He makes "serious complaint" against the new-fangled feeding scheme.

"It is, it appears, exerting a very serious influence on school discipline. Here, for example, 'is one of my "small pupils" who has not been used to a liberal diet. Usually he has a free breakfast of air, and sits with a pale face, and never stirs or speaks the whole morning long.' A perfect model of a quiet, orderly schoolboy was this youngster until he began to go to these demoralizing hot breakfasts, and now he has taken to smiling and chatting, and has to be cautioned with respect to his unruly behaviour several times in the course of a morning. Alfred, it seems, is seven years old, and his father has been out of work for many months. 'He is the boy,' observes the teacher, 'who in reply to my question, "what is a holy place?" said, "it is where the draught comes in." He was evidently thinking of his jersey.' Hitherto the holy places in his garments and the empty condition of his stomach have been effectual in keeping down any useful exuberance of spirits, and have rendered him a small person of a meek and quiet demeanour. These free breakfasts, however, seem to be operating like beans upon a young horse, and this we are given to understand is but a fair illustration of what is observed wherever this new movement is in operation. Those good folk who have so long and so dismally been lifting up their voices against the extravagance of our Board school system would do well to look to this. Depend upon it, this hearty breakfasting means more expense. One teacher obviously cannot manage half so many children if all the good and quiet ones are to be metamorphosed in this troublesome fashion. Cautioned several times in a morning, indeed! and merely because the little ragamuffin has had a breakfast that has rendered him easy and comfortable. Why, what would such children become if they were to get three or four good hearty meals a day? Can there be a doubt that the teaching staff would have to be largely augmented."

CHOREA AND ITS CAUSES.

A most able and temperate article appears in the *Lancet* of last week, which it would be well if every elementary teacher, especially every teacher of girls, should carefully ponder. It refers to the cases of St. Vitus' dance, which have come under the observation of Dr. Sturges, of the Hospital for Sick Children, and to the part which schooling may be suspected to play in the development