

4. (1) $A = 28^\circ 21' 20''$. $L \cos A = \log \cos A + 10 = \log \sin A \cot A + 10 = \log \sin A \tan (90 - A) + 10$; $\therefore L \cos 28^\circ 21' 20'' = \log \sin 28^\circ 21' 20'' + \log \tan 61^\circ 38' 40'' + 10 = 9.94481$.

(2) $L \sin 128^\circ 18' 80'' = \log \sin 2(61^\circ 39' 15'') + 10 = \log 2 \sin 61^\circ \&c. \cos 61^\circ \&c. + 10 = \log 2 + \log \cos 61^\circ \dots \tan 61^\circ \dots + \log \sin 28^\circ 20' 45'' + 10 = \log 2 + \log \sin 28^\circ 20' 45'' + \log \tan 61^\circ 39' 15'' + \log \sin 28^\circ 20' 45'' + 10 = 9.922066$.

(8) $10.055478 = L \sec A = \log \frac{1}{\cos A} + 10 = -\log \cos A + 10$; $\therefore L \cos A = 9.944531$. Now by (1) $L \cos 28^\circ 21' 20'' = 9.944491$; also it may be shewn in the same way that $L \cos 28^\circ 21' = 9.944514$; $\therefore$ difference for $20'' = 28$, and $A = 28^\circ 20' 45''$.

$$5. (8) = \frac{\cos^2 \theta - \sin^2 \theta}{\sin^2 \theta \cos^2 \theta} = \frac{4(\cos^2 \theta + \sin^2 \theta)(\cos^2 \theta - \sin^2 \theta)}{4 \sin^2 \theta \cos^2 \theta} \\ = \frac{4 \cos 2\theta}{\sin^2 2\theta} = \frac{4}{\tan^2 2\theta \sin 2\theta}$$

7. From Theory of Quadratics $\tan A \tan B = 1 - 8n$, $\tan A + \tan B = 4n$, $\therefore \tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B} = \frac{4}{8}$.

$$\text{Also since } \tan(A+B) = \frac{2 \tan \frac{A+B}{2}}{1 - \tan^2 \frac{A+B}{2}}; \therefore \tan \frac{A+B}{2} \\ = \frac{-1 \pm \sqrt{1 + \tan^2(A+B)}}{\tan(A+B)} \\ = \frac{1}{2} \text{ or } -2; \text{ and } \frac{A+B}{2} = \tan^{-1} \frac{1}{2} \text{ or } \tan^{-1}(-2).$$

$$8. (8) \text{ True if } \frac{\cos DAE}{\sin \frac{1}{2} A} = \frac{b+c}{a}, \text{ if } \frac{\sin ADB}{\sin DAB} = \frac{b+c}{a}, \\ \text{if } \frac{C}{BD} = \frac{b+c}{a}, \text{ if } \frac{a}{BD} = \frac{b+c}{c}, \text{ if } \frac{DC}{BD} = \frac{b}{c}.$$

$$9. (1) a=509.74 \{ \text{use } a = \sqrt{(c+b)(c-b)} \}, A=78^\circ 81', B=11^\circ 29'. \\ (2) A=68^\circ 42', B=19^\circ 80', c=416.64.$$

$$10. (1) a-b = \left(-2 \cos \frac{\alpha+\beta}{2} + 2 \sin \frac{\alpha+\beta}{2} \right) \sin \frac{\alpha-\beta}{2} \\ a+b = \left(-2 \cos \frac{\alpha+\beta}{2} + 2 \sin \frac{\alpha+\beta}{2} \right) \cos \frac{\alpha-\beta}{2}; \text{ and divide.}$$

$$(2) a^2 - b^2 = -\cos 2\beta + \cos 2\alpha + 2 \sin(\alpha-\beta) \\ = -2 \sin(\alpha-\beta) \sin(\alpha+\beta) + 2 \sin(\alpha-\beta) \\ a^2 + b^2 = 2 - 2 \sin(\alpha+\beta); \text{ divide}$$

11. From triangle formed by drawing a line from bottom of staff parallel to the hill $\frac{x}{60} = \frac{\sin 54^\circ}{\sin 80^\circ}$

$$\therefore x = \frac{1(1+\sqrt{5})}{2} \times 60 = 56.050 \dots$$

Practical Department.

HOW CHILDREN SHOULD BE TAUGHT TO READ.

MR. EDITOR,—Believing that no subject is so badly taught in the schools of Ontario as Reading, I propose, with your permission, to conduct a discussion in your columns on the methods of teaching it with a view of learning which of them is the simplest and most philosophical. During the past two years, I have had the honor of advocating at the Provincial Teachers' Convention, and at several County Conventions, a self-consistent phonic system; that is, a system which gives the child the sounds and powers of the letters at once, and at first gives it but ONE SOUND FOR EACH. During the past year, Professor Meiklejohn, of the University of

St. Andrews, has published a little work, advocating precisely the same system. This *One Sound System* I purpose to expound and defend.

With reference to other systems of teaching reading, my position will be friendly to the various phonetic methods; respectful to a sentence method as an introduction to the process of learning to read; indifferent to the alphabetic method (if there can be such a thing) and decidedly antagonistic to the word method as understood and taught in Ontario.

I hope that every statement I make may be fairly criticized, and if necessary corrected. I desire to reach the truth, and I am quite willing to be hurt a little while climbing.

JAMES L. HUGHES, P. S. Inspector.

[We will gladly open the columns of the JOURNAL for the discussion of the subject proposed by Mr. Hughes.—Ed.]

Before attempting to explain the method by which I think the Phonic System should be taught, I think it desirable to deal with the

OBJECTIONS

which are urged against it. This will, I hope, lead many of my readers to enter upon the consideration of the subject unprejudiced by the misrepresentations which have been made concerning it. It is held,

1. *That it cultivates the ear rather than the eye.*

This objection is urged through a misconception of the system, resulting from its name. The Phonic System does not cultivate the ear at the expense of the eye, but in harmony with it. The eye is used as much by the Phonic System as by any other system. Whatever may be the method by which reading is taught, the forms of the letters and of the words they make, must be conveyed to the brain in some way; and the most convenient way for all but blind persons is through the eye. The eye must be thoroughly trained to see accurately, and to distinguish slight differences in form readily, in order that rapid progress may be made in learning to read by any system. That the Phonic and Phonetic systems do not depend for their success upon mere cultivation of the ear is clearly shown by the fact that deaf mutes are taught to read aloud by these systems.

It is surely not a weakness of the Phonic System, however, but a strong point in its favor, that it cultivates the ear in addition to the eye. No one will attempt to maintain that to strengthen one faculty will weaken another, or that to render one acute will blunt the other, providing that both have sufficient exercise. Childhood delights in the exercise its faculties, because by activity these faculties attain their growth and power. The more of its faculties called into action by any work or play, the more intense and lasting will be the interest of the child. In fact, the eye, the ear, the hand, and every mental and physical power of the child should be used as far as possible in teaching to read.

2. *"There are so many irregularities in the Notation of the English Language that a child must be confused by the Phonic System."*

As the Phonic System has generally been taught, this is a valid objection, so far as teaching how to read the English language is concerned. There are "two malformations which infest our speech" to such an extent that neither the eye nor the ear can become a reliable guide in reading it. If a child is even introduced to a primer which contains only the words which he speaks correctly, and whose meaning he fully understands, he will find the same letter representing so many sounds, and the same sound represented by so many letters, that he must be perplexed beyond measure by the incongruous mixture. Professor Meiklejohn, in his remarkable little work, "The Problem of Teaching to Read," published by Chambers, sums up a bill of indictment against our English notation as follows: