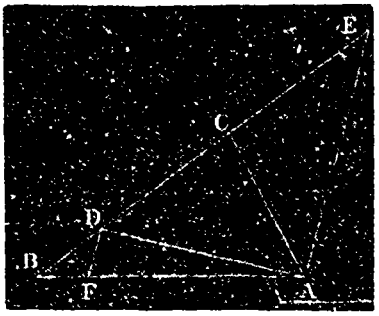
Or $\cos(A + B) = \cos A \cos B - \sin A \sin B$.

By projecting in a similar manner on a line perpendicular to OC, we may show that $\sin(A + B) = \sin A \cos B + \cos A \sin B$. By exactly analogous methods we may obtain the expressions for $\sin(A - B)$ and $\cos(A - B)$.

Geometrical Proof of $\tan \frac{1}{2}(A - B) = \frac{a-b}{a+b} \cot \frac{1}{2} C$.



Let ABC be the triangle and let a be greater than b. From CB cut off CD equal to CA. Produce DC to E making CE equal to CD or CA. Join EA, and through D draw DF parallel to EA.

Hence DAE is a right angle, and therefore also ADF. We have $BAD = A - CAD = A - CDA = A - (B + BAD)$; $\therefore BAD = \frac{1}{2}(A - B)$. Also $E = \frac{1}{2}C$.

Then $\tan \frac{1}{2}(A - B) = \tan BAD = \frac{FD}{DA} = \frac{FD}{AE} \cdot \frac{AE}{DA} = \frac{BD}{BE} \cdot \frac{AE}{DA}$, (by similar triangles BDF, BEA) $= \frac{BD}{BE} \cot E$

$$= \frac{a-b}{a+b} \cot \frac{1}{2} C.$$

SOLUTIONS SENT IN.

Solutions of Problem 6 ("A Farmer") have been sent in by "Teacher," of Caradoc, Mr. L. Nutting, of Kinsale, J. Anderson, of Dixie, G. Shaw, of Kemble, and Chas. L. Burton, of Gilford. The following is one of them:

Let $A\ B\ C\ D$ be the rhomboid, whose sides AB, AD are 12 and 7 respectively, and whose diagonal DB is 11. From D draw DE perpendicular to AB.

$$\text{Then } AC^2 = AB^2 + BC^2 + 2\,AB.\,AE.$$
$$\text{Also } BD^2 = AB^2 + AD^2 - 2\,AB.\,AE.$$
$$\therefore \quad AC^2 = 2\{(AB)^2 + (BC)^2\} - (BD)^2.$$
$$AC = \sqrt{265} = 16.27.$$

[In saying that there are two solutions, one Algebraic and one Geometrical, "Farmer," if we understand his meaning, is seeking to draw a distinction where none exists. The question is an example of the application of the science of numbers to Geometrical magnitude, and both Geometry and Arithmetic (or Algebra) must enter into the solution. A Geometrical *construction* may be obtained for AC as follows: From A and B as centres describe circles with radii 7 and 11. Through D their point of intersection draw DC parallel to AB, and through B draw BC parallel to AD, then AC is the other diagonal.]

J. A. Your solution of 2 was incorrect. The log of $2^n + 8^{n+1}$ is not $n \log 2 + (n + 1) \log 8$.

G. S. Will you try 7 (March number) again in the form in which we have put it?

SOLUTIONS ASKED FOR.

"Subscriber" asks for solutions of the following (1, 2, 3):

1. In a certain factory were employed men, women and boys. The boys received 3 cents per hour, the women 4 cents, and the men 6 cents. The boys work 8 hours per day, the women 9 hours, and the men 12 hours. The boys received $5 as often as the women received $10, and the women received $10 as often as the men received $24. How many of each were there, the whole number being 59?

SOLUTION. Each boy gets 24 cts. per day, each woman 36 cts., and each man 72 cts. $\therefore$ their daily earnings are as $2 : 3 : 6$. And the total amounts received by each class are as $5 : 10 : 24$. Hence their numbers must be as $\frac{5}{2} : \frac{10}{3} : \frac{24}{6}$. Dividing 59 in this ratio, we find 15 boys, 20 women and 24 men.

2. Two partners, A and, B gained $700 in trade. A's money was 8 months in trade and his gain was $300 less than his stock. B's money, which was $250 more than A's, was in 5 months. Find A's stock.

SOLUTION. Let $x = A$'s stock. $\therefore x + 250 = B$'s. And the profits are to be divided in ratio $x \times 8 : (x + 250) \times 5$. Hence we have the equation $\frac{8x}{8x + 1250} \times 700 = x - 300$. Whence $x = \$500$.

3. Find a decimal multiplier that will convert Troy ounces per inch into tons per mile.

Answer. $\frac{480}{7000} \times \frac{1}{2000} \times \frac{12 \times 3 \times 5\frac{1}{2} \times 40 \times 8}{1}$ converted into a decimal.

Mr. H. J. Emery, Bellrock, asks for the solution of the following problem:

A train left Cambridge for London with 40 more 2nd class passengers than 1st class, and 7 of the former would pay 2s. less than 4 of the latter. The fare of all was £55. When half way they took up 35 more 2nd class and 5 more 1st class passengers, and the whole fare was then $\frac{1}{5}$ more than it was before. Find the 1st class fare, and the whole number of passengers at first.

SOLUTION.—Let x = No. of 1st class passengers at first. Then $x + 40$ = No. of 2nd class passengers at first. Also let y = 1st class fare in shillings. $\therefore \frac{4y-2}{7}$ = 2nd class fare. Then from fact that total fare was £55, we have the equation

$$xy + (x + 40)\frac{4y-2}{7} = 1100.$$

And since additional half-way passengers paid £11,

$$5\frac{y}{2} + 35\frac{4y-2}{14} = 220.$$

Whence $y = 18$, and thence $x = 25$. $\therefore$ Ans. 18s. and 65 passengers.

"LINKAGE."—There are articles on the subject scattered through back numbers of some magazines. Cannot lay our hands on them just now, but think they have not as yet been collected into book form. On pages 49, 50, 51 of the book you speak of you will find authorities referred to.

Practical Department.

MISTAKES IN TEACHING. VI.

BY JAMES HUGHES.

It is a mistake to punish without explanation.—Teachers sometimes say, "Smith, take a misdemeanor mark," or "Mary, stay in at recess," or "Brown, hold out your hand," etc., without taking time to explain why the mark or the prohibition or the whipping should be given. "It would waste too much time; I could do very little else in my school" is the justification given for such a course. The answer given is likely to be correct in schools in which such a method of punishment is adopted. The teacher who adopts such a course will soon have sufficient reason to conclude from his standpoint that explanations would "waste time."