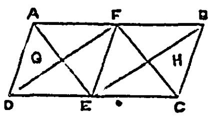
ing and appreciation of it will greatly help them in determining how to deal best with their own boys at the age when the mind is "wax to receive and marble to retain," and the characters of most men take the bent and impress which they never lose in after-life.

ARTS DEPARTMENT.

[NOTE.- We publish this month Solutions to the Algebra Problems which appeared in the April issue; also several problems contributed by Mr. D. Forsyth, B.A., of Berlin, and the Honor Problems from the University of Toronto Examination Papers. ARCH'D. MACMURCHY, M.A., Math. Ed., C. E. M.]

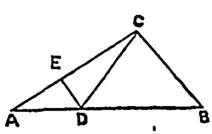
SOLUTIONS TO PROBLEMS IN APRIL NUMBER.

I. Let $ABCD$ be a parallelogram having the side AB double of AD. Let the angles be bisected, then the diagonals of the rectangle formed by the bisectors are each equal to the shorter side of the original parallelogram. Let the angle BAD be bisected by AE meeting CD in E, then the angle FAE is equal to the angle EAD; but FAE is equal to AED, AB being parallel to CD; therefore, DAE is equal to DEA: therefore DE is equal to DA; therefore E is the middle point of CD.



In the same manner it may be shewn that that the straight line bisecting the angle B will pass through E, and the straight lines bisecting the angles C and D meet in F, which is the middle point of BA. Let AE, DF cut at G, and BE, CF at H. Join FE, then FE, AD are equal and parallel, because they join equal and parallel straight lines towards the same parts; and since $FGEH$ is a rectangle, the diagonals are equal; therefore the other diagonal GH is also equal to AD. Wherefore if &c.

II. ACB is a right-angled triangle, ACB being the right angle; AD is one-third of AB. It is required to prove that the square on CD is equal to the square on AD, together with one-third the square on AC.



Draw DE parallel to BC, and therefore at right angles to AC. Join CD; then the square on $CD=l$ squares on DE, EC, and the square on $AD=l$ squares on DE, EA; but, because AD is parallel to BC, $AD:DB::AE:EC$; but AD is one-third of AB, therefore AE is one-third of AC; therefore the square on $CD=l$ squares on DE and on $\frac{2}{3}AC$, that is, the square on DE and $\frac{4}{9}$ square on AC; therefore the difference between the squares on CD, AD is $\frac{1}{3}$ the square on AC, that is, the square on $CD=l$ square on AD, together with $\frac{1}{3}$ the square on AC.

VI. In an A. P., $s=\frac{n}{2}(l+a)$, where $s=$ sum, $n=n^o$ of terms a, l, first and last terms; but $l+a=2m$ where $m=$ middle term. $\therefore s=nm$, but $n=2p+1$ and $m=2p+1$. $\therefore s=(2p+1)(2p+1)=4p^2+4p+1$.

VII. $\sin 3\theta=\cos 2\theta$; but $\sin 3\theta=3\sin\theta-4\sin^3\theta$, $\cos 2\theta=1-2\sin^2\theta$.

$\therefore 3\sin\theta-4\sin^3\theta=1-2\sin^2\theta$, *i.e.*, $4\sin^3\theta-2\sin^2\theta-3\sin\theta+1=0$.

$(\sin\theta-1)(4\sin^2\theta+2\sin\theta-1)=0$; $\sin\theta-1=0$; $\sin\theta=1$; $4\sin^2\theta+2\sin\theta-1=0$.

$\sin\theta=\frac{-1\pm\sqrt{5}}{4}$. $\theta=18^\circ$, 162°, 90°, 216°, 324°.

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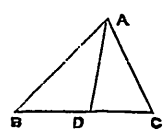
III. First, if $AD > BD$, then $AD > DC$, and the angle $B > BAD$, and angle $C > DAC$.

$\therefore$ angles $B+C > A$, that is, . is less than $\frac{1}{2}$ the sum of the angles of a Δ, that is, $\angle \frac{1}{2}$ of 2 right angles, that is, $\angle$ one right angle;



$\therefore$ the angle at A is acute.

Similarly, if $AD \angle BD$, then A is obtuse.