SCHOOL WORK.

MATHEMATICS.

ARCHIBALD MACMURCHY, M.A., TORONTO, EDITOR.

PROBLEMS.

Proposed by D. F. H. WILKINS, B.A., Bac. App. Sci., Math. and Sci. Master, Mount Forest H. S.

43. Prove $(x+y)(y+z)(z+x)-x^3-y^3-z^3=4\{(a+b)(b+c)(c+a)+2abc\}$

if $x=a+b$, $y=b+c$, $z=c+a$; and $=12\{a(b^2-c^2)+b(c^2-a^2)+c(a^2-b^2)\}$

if $x=a-b$, $y=b-c$, $z=c-a$.

44. Wishing to know the weight of some auriferous quartz, a mineralogist floats a metal cylindrical cup of radius r inches, height h inches, in pure water, and finds that it floats with $\frac{1}{n}$th of its height out of water. On adding the mineral it descends till $\frac{1}{m}$th of its height is out of the water. Given the weight of a cubic inch of matter, $\frac{1}{1}\frac{2}{7}\frac{5}{8}$ oz., show that the quartz weighs $\frac{1}{1}\frac{2}{7}\frac{5}{8}\pi r^2 h\left(\frac{m-n}{mn}\right)$oz.

SOLUTIONS.

(*See January number.*)

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24. (1) $\Sigma \sin(\alpha\pm\beta\pm\gamma\pm\delta)$
$=\Sigma \sin(\alpha\pm\beta\pm\gamma+\delta)+\Sigma \sin(\alpha\pm\beta\pm\gamma-\delta)$
$=2\Sigma \sin(\alpha\pm\beta\pm\gamma)\cos\delta$.

(2) $\Sigma \cos(\alpha\pm\beta\pm\gamma\pm\delta)$
$=\Sigma \cos(\alpha\pm\beta\pm\gamma+\delta)+\Sigma \sin(\alpha\pm\beta\pm\gamma-\delta)$
$=2\Sigma \cos(\alpha\pm\beta\pm\gamma)\cos\delta$.

Resolving $\Sigma \sin(\alpha\pm\beta\pm\gamma)$ and $\Sigma \cos(\alpha\pm\beta\pm\gamma)$ in the same way, we ultimately obtain $2^{n-1}\sin\alpha\cos\beta\cos\gamma\cos\delta$ a $2^{n-1}\cos\alpha\cos\beta\cos\gamma\cos\delta$ respectively.

JAMES MILLER, Math. Master, Bowmanville H.S., and MILES FERGUSON, Math. Master, Niagara Falls South H. S.

29. Exp. nx^{n+1} etc., divided by exp. x^n - etc., gives quot. $nx-(n+1)$ and remainder $n(x^2-2x+1)$.

Now $x^n-nx+n-1=x^n-1-n(x-1)$
$=(x-1)\{x^{n-1}+x^{n-2}+\ldots\ldots+1-n\}$
and if we put $x=0$, the exp. in 2nd brackets $=0$, $\therefore (x-1)^2$ is a factor of $x^n-nx+n-1$ $\therefore (x-1)^2$ is the G. C. M.

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30. Let M denote the point where they meet, and x the number of hours they travel before they meet. Now A. travels from O to M in x hours, and from M to C in a hours.

$$\left.\begin{array}{l}\therefore OM:MC::x:a\\ \text{and } OM:MC::\beta:x\end{array}\right\}\therefore x=\sqrt{a\beta}$$

$$\left.\begin{array}{l}\therefore \sqrt{a\beta}+a=u\\ \text{and } \sqrt{a\beta}+\beta=v\end{array}\right\}\therefore a:\beta::u^2:v^2$$

which is the correct result.

Messrs. MILLAR and FERGUSON.

31. Multiplying, etc., we obtain

$$c^2x+a^2y+b^2z=0$$
$$b^2x+c^2y+a^2z=0$$

$$\therefore \frac{x}{a^4-b^2c^2}=\frac{y}{b^4-a^2c^2}$$
$$=\frac{z}{c^4-a^2b^2}=\frac{1}{p}\text{ say,}$$

and substituting in any equation, we find $p^2=a^6+b^6+c^6-3a^2b^2c^2$, whence $x=\frac{a^4-b^2c^2}{p}$ with similar values for y and z.

[It is gratifying to find our mathematicians taking such lively interest in this department of the magazine. Several solutions are unavoidably held over.]