we have $\left(\frac{b^3-c^3}{a^3}+\frac{c^3-a^3}{b^3}+\frac{a^3-b^3}{c^3}\right)=$

$$-\frac{(b^3-c^3)(c^3-a^3)(a^3-b^3)}{a^3b^3c^3}.$$

Given expression

$$=\frac{1}{a^3b^3c^3}[a^3(a^3-b^3)(a^3-c^3)+\text{etc},]$$

$$=\frac{a^9+b^9+c^9-a^6(b^3+c^3)-b^6(c^3+a^3)-c^3(a^3+b^3)+3a^3b^3c^3}{a^3b^3c^3}$$

$$=(a^3+b^3+c^3)^3-4a^6(b^3+c^3)-4b^6(c^3+a^3)$$
$$-4c^3(a^3+b^3)-3a^3b^3c^3,$$

introducing the condition $a^3+b^3+c^3=3abc$, this becomes $24-4a^3(b^{-3}+c^{-3})-4b^3(c^{-3}+a^{-3})-4c^3(a^{-3}+b^{-3})=36-4(a^3+b^3+c^3)(a^{-3}+b^{-3}+c^{-3})$.

2. If $(z+x-y)(x+y-z)=ayz$

$$(x+y-z)(y+z-x)=bzx$$
$$(y+z-x)(z+x-y)=cxy$$

prove $(abc)^{\frac{1}{2}}+a+b+c=4$.

Let $lx=y+z-x$, $my=$etc., $nz=$etc., (1)

we get $mn=a$, $nl=b$, $lm=c$,

$\therefore al=bm=cn=(abc)^{\frac{1}{2}}$.

Eliminating xyz from (1) we have

$$\begin{vmatrix} l+1, & -1, & -1 \\ -1, & m+1, & -1 \\ -1, & -1, & n+1 \end{vmatrix}=0,$$

substituting for l, m and n in the determinant $(abc)^{\frac{1}{2}}+a+b+c=4$.

3. Solve the equations

$$(z+x-y)(x+y-z)=ax$$
$$(x+y-z)(y+z-x)=by$$
$$(y+z-x)(z+x-y)=cz.$$

Let $p=y+z-x$, $q=$etc., $r=$etc., then $2qr=a(q+r)$ etc.,

whence $\frac{1}{p}=\frac{1}{b}+\frac{1}{c}-\frac{1}{a}$, $\frac{1}{q}=$etc., $\frac{1}{r}=$etc.,

$$\therefore x=\frac{q+r}{2}=\frac{1}{a}\div\left(\frac{1}{a}+\frac{1}{b}-\frac{1}{c}\right)\left(\frac{1}{a}+\frac{1}{c}-\frac{1}{b}\right),\text{ etc.}$$

SEE FEBRUARY NO., 1882.

Answers by Wilbur Grant, T. C. I.

1. $\frac{1892}{7395}$.
2. 494·550.
3. $4\frac{1}{2}$.
4. 504 grammes.
5. 9, 9, 9, 9, 9, 9.
6. (*a*) $(x\pm 1)(x^2\pm x+1)$;

   (*b*) $\overline{x+1}\quad\overline{x+2}\quad\overline{x+3}\quad\overline{x+4}$.
7. (*a*) $\frac{x+b}{bx+1}$;

   (*b*) $\frac{x+y+z}{(x^2+y^2+z^2)+(xy+yz+zx)}$.
8. Ratio of 1 : 4 or 4 : 1.
9. The problem as stated is incorrect.
10. £30; £40; £24; £6.

SELECTED PROBLEMS.

1. If O be the centre of the circle described about the triangle ABC and AO, BO, CO, be produced to meet the opposite sides in D, E, F, the circle in D', E', F', respectively, prove that $\frac{DD'}{AD}+\frac{EE'}{BE}+\frac{FF'}{CF}=1$.

2. If $x+y+z=x^{-1}+y^{-1}+z^{-1}=0$,

prove $\frac{x^6+y^6+z^6}{x^3+y^3+z^3}=\frac{x^9+y^9+z^9}{x^6+y^6+z^6}=xyz$,

and $x^3+y^3+z^3=0$.

3. If $x=bz+cy$

$$y=cx+az$$
$$z=ay+bx,$$

prove $\frac{x^2}{1-a^2}=\frac{y^2}{1-b^2}=\frac{z^2}{1-c^2}$,

$$\frac{\sqrt{1-a^2}}{a}+\frac{\sqrt{1-b^2}}{b}+\frac{\sqrt{1-c^2}}{c}=\frac{\sqrt{1-a^2}\cdot\sqrt{1-b^2}\cdot\sqrt{1-c^2}}{abc}.$$

4. If $yz+zx+xy=1$, show that

$$\frac{x}{1-x^2}+\frac{y}{1-y^2}+\frac{z}{1-z^2}=\frac{4xyz}{(1-x^2)(1-y^2)(1-z^2)}.$$

5. Show that $\left(\cos\frac{\pi}{8}\right)^8+\left(\cos\frac{3\pi}{8}\right)^8+\left(\cos\frac{5\pi}{8}\right)^8+\left(\cos\frac{7\pi}{8}\right)^8=\frac{17}{16}$.