The fact is the equations are contradictory under this condition. For if $a=ka_1$ and $b=kb_1$, we get on substituting these values in the first equations $a_1x+b_1y=\frac{c}{m}=c_1$, *i.e.* the same quantity equal to two different quantities.

(2) If $\frac{a}{a_1}=\frac{b}{b_1}=\frac{c}{c_1}$, then $a_1b-ab_1=a_1c-ac_1=b_1c-bc_1=0$

$\therefore x=y=\frac{0}{0}$ which is the symbol of indetermination; x and y are indeterminate, and one equation is in reality a multiple of the other, so that in fact we have only one equation between two unknowns. For let $a=ka_1$, $b=kb_1$, $c=kc_1$. Substitute these values in the first equation and it becomes $k(a_1x+b_1y)=kc_1$, a multiple of the second equation.

11. Solve $x^6+4x^5+7x^4+9x^3+7x^2+4x+1=0$

Arrange $(x^3+2x^2+2x+1)^2-x^2(x^2+x+1)=0$

i.e. $(x+1)^2(x^2+x+1)^2-x^2(x^2+x+1)=0$

$\therefore x^2+x+1=0$ or $x=\frac{1}{2}(-1\pm\sqrt{-3})$

$\therefore (x+1)^2(x^2+x+1)-x^2=0$

i.e. $x^4+3x^3+3x^2+3x+1=0$

or $x^4+3x^3+\frac{17}{4}x^2+3x+1=\frac{5}{4}x^2$.

$\therefore x^2+\frac{3}{2}x+1=\pm\frac{x}{2}\sqrt{5}$

or $2x^2+x(3\mp\sqrt{5})+2=0$

$\therefore x=\frac{1}{4}\{-3\pm\sqrt{5}\pm\sqrt{(-2\mp6\sqrt{5})}\}$

which are the other four roots.

12. If m and n are the roots of $x^2+px+q=0$, then p and q are the roots of the equation

$x^2+(m+n)x=mn(x+m+n)$.

Find the quadratic equation which, when reduced to the standard form, has one root for co-efficient of x and another for third term.

(1) We have $m+n=-p$, and $mn=q$. Substitute these values in the second equation and

$x^2-px=q(x-p)$, or

$x^2-(p+q)x+pq=0$. From which by inspection it is plain that p and q are the roots.

(2) Let α and β be the roots, so that the equation is

$ax^2+\alpha x+\beta=0$

Then $\alpha+\beta=-\alpha$, and $\alpha\beta=\beta$, $\therefore \alpha=1$, $\beta=-2$;

and required equation is $(x-1)(x+2)=0$

i.e. $x^2+x-2=0$

13. When we have an expression equated to zero, when is it allowable to strike out a factor and still maintain the equation?

If $a^3+a^2b+ab^2+b^3=0$, then $a+b=0$.

(1) If an equation can be separated into factors, functions of x, the roots, obtained by equating each of these factors to zero, will be roots of the original equation. But if any factor does not involve the variable, x, or if it is necessarily a positive quantity, it will not be allowable to equate this factor to zero.

(2) Expression $=(a+b)(a^2+b^2)=0$

Now, either one of the factors, or both the factors must $=0$, since their product $=0$. But a^2+b^2 is not $=0$ under any circumstances unless $a=0$ and $b=0$; for, being squares, a^2 and b^2 are both positive and $\therefore a^2+b^2>0$, unless each is separately $=0$. In this case therefore we cannot infer $a^2+b^2=0$, except under the conditions $a=0$, $b=0$.

14. For all possible values of x the quantity

$\frac{x^2+2x+3}{x^2+x+1}$ lies between 0 and 4.

Put given fraction $=k$, clear of fractions and arrange in powers of x, and we have

$x^2(1-k)+x(2-k)+(3-k)=0$

Now, in order that x may be possible we must have

$(2-k)^2$ not less than $4(1-k)(3-k)$.

i.e. $3k^2-12k+8$ not >0

Now when $k=4$, left hand member $=8$

and when $k=0$, " " " $=8$ and for all positive values above 4, and all negative values below 0 the expression >8, and it is not <0 for any values except those <4 and >0.

$\therefore k$ lies between 0 and 4 when x is a possible quantity.

15. Show how to find the sum of a geometric series.

If a circle be inscribed in a square, a square in that circle, a circle in that square, and so on *ad infinitum*, show that the area of the original square is equal to the sum of the areas of all the rest; and that the sum of the perimeters of the first two squares is equal to the sum of the perimeters of all the rest.

Let $s=$ side of original square, then, by Euclid I. 47., the series of sides is s, $\frac{s}{\sqrt{2}}$, $\frac{s}{2}$, &c. *ad infinitum*;

and the areas of the squares form the series

s^2, $\frac{s^2}{2}$, $\frac{s^2}{4}$, &c. *ad infinitum*.

Now sum of areas of all squares but first

$=\left(\frac{s^2}{2}+\frac{s^2}{4}+\frac{s^2}{8}\text{ \&c. } ad\ infinitum\right)=s^2=$ area of first square.

Similarly, sum of all perimeters except first two

$=4\left(\frac{s}{2}+\frac{s}{2\sqrt{2}}+\frac{s}{4}+\text{ \&c. } ad\ infinitum\right)$

$=4s\left(1+\frac{1}{\sqrt{2}}\right)=4s+\frac{4s}{\sqrt{2}}$

$=$ perimeter of 1st. $+$ perimeter of 2nd. square.

Special Articles.

THE TEACHER'S INFLUENCE.

BY G. H. BURNETT, RICHIBUCTO, N. B.

Every mind, in a greater or less degree, influences or is influenced by other minds. The mingling of individuals together and the different relations which ensue on this account must put those of greater strength in places of superiority; the weaker give way to the stronger. By personal contact with one another the opinions, wishes, or sentiments of one person affect others in such a way as to have a bearing on their lives and conduct. A single individual may possess in a remarkable degree this power of influencing others, which is mainly inherent but may to a certain extent be acquired. It is known under various names; by some it is called "will-power;" by others "magnetic influence;" by others "force of character." By whatever name it is called it is always *power*.

Instances can be recalled by almost any person who is at all observant of human nature. An incident which came under the writer's notice well illustrates this point. In a small town a religious meeting conducted by young men on Sunday evenings was frequently interrupted by a number of boys, who took a special delight in whistling, groaning, and stamping during the service. This always occurred when a certain gentleman was absent. If he was present no sooner would the noise begin than he would rise from his place, walk down and seat himself in the very midst of the boys. He would never speak to them a single word but his presence had such power that they remained perfectly quiet. It seemed as if they were seized by a magic spell and the greatest confusion was turned into stillness. Probably not another individual in the meeting could have done the same thing.

Now what was the secret of this man's power? It was not his physical strength, for others apparently as muscular as himself would have been hooted at. It was not his personal appearance, for there was nothing extraordinary in it. It was that indefinable something which certain persons possess and which constrains us whenever we are near them to acknowledge them as our superiors. The teacher above all others should possess this power. Many teachers fail on this very point. There is nothing natural to them which commands the respect of others. They cannot gain and hold the respect of pupils and soon leave their profession in disgust. They may maintain order by a forced submission solely on account of their physical strength but they do not influence the lives of those entrusted to their charge.