by No. 3, keeping each side of equation by itself, etc. *Ans.* $x = \frac{9}{8}$.

(*b*) Either add or subtract the equa'ions, etc. *Ans.* $x = \frac{cp+dq}{ac-bd}$; $y = \frac{aq+bp}{ac-bd}$.

3. Resolve into factors :

(*a*) $a^2+b^2-c^2-d^2-2ab+2cd$.

(*b*) $4x^4+6x^3+72x-576$.

(*c*) x^8-7x^4-144.

3. (*a*) *Ans.* $=(a-b-c+d)(a-b+c-d)$.

(*b*) Write $4(x^4-144)+6x(x^2+12)$, etc. *Ans.* $=2(x^2+12)(2x^2+3x-24)$.

(*c*) *Ans.* $(x-2)(x+2)(x^2+4)(x^4+9)$.

4. Solve the equations :

(*a*) $x+\dfrac{5}{2x}=3\frac{1}{2}$.

(*b*) $3x^2-2x+\sqrt{3x^2-4x-6}=18+2x$.

4. (*a*) *Ans.* 2 or $\frac{1}{4}$.

(*b*) Transpose $2x$ from right to left, then diminish each side by 6 ; thus $3x^2-4x-6+\sqrt{3x^2-4x-6}=12$ .. .. .. (2) place $\sqrt{3x^2-4x-6}=a$, then substitute thus, $a^2+a=12$, ... (3) Solve this quadratic, and substitute value of a in (2). *Ans.* $x=3$ or $=\frac{5}{3}$.

5. Shew that

(*a*) $\dfrac{b-c}{1+bc}+\dfrac{d-a}{1+ad}=0$, if $\dfrac{a-b}{1+ab}+\dfrac{c-d}{1+cd}=0$. (*b*) If $x=\dfrac{b-c}{a}$, $y=\dfrac{c-a}{b}$, $z=\dfrac{a-b}{c}$, then $xyz+x+y+z=0$.

5. (*a*) Suppose $\dfrac{b-c}{1+bc}+\dfrac{d-a}{1+ad}=0$, then $b+abd-c-acd+d+bcd-a-abc=0$. If $\dfrac{a-b}{1+ab}+\dfrac{c-d}{1+cd}=0$, then $a+acd-b-bcd+c+abc-d-abd=0$. Since this latter is zero we may subtract it from the former without changing the value, and upon doing so we find the former is zero.

(*b*) In $2yz+x+y+z=0$, substitute the values given for x, y, z, etc.

6. (*a*) Solve the equation, $ax^2+bx+c=0$, and thence find the conditions for equal roots.

(*b*) If the roots of $x^2-px+q=0$ are a and β, and if $a^2=q\beta$, find the value of a in terms of β.

6. (*a*) Book-work.

(*b*) Since a and B are the roots $\therefore (x-a)(x-B)=0$, or $x^2-x(a+B)+aB=0$. $\therefore$ In the original equation $(a+B)=p$, $aB=q$, and $a^2=qB$ (bypo). $\therefore a=p-B$, $a=\frac{q}{B}$. $\therefore \frac{q}{B}=p-B$. $\therefore q=pB-B^2$, But $q=\frac{a^2}{B}$. $\therefore a^2=pB^2-B^3$. $\therefore a=B\sqrt{p-B}$. $\therefore a=B\sqrt{a+B-B}=B\sqrt{a}$ $\therefore a=B^2$ *Ans.*

7. Solve the following equations :

(*a*) $x+y=5$, $x^3+y^3=65$.

(*b*) $2x^2-xy=6$, $2y^2+3xy=8$.

7. (*a*) Cube (1) Find difference between this result and (2) Substitute, etc. $x=4$ or 1.

(*b*) Multiply (1) by 4, and (2) by 3, subtract results, and factor, thus $(8x+3y)(x-2y)=0$, etc. $y=\pm 1$, etc.

8. (*a*) If $3x=2b+2c-a$, $3y=2a-b+2c$ and $3z=2a+2b-c$, shew that $x^2+y^2+z^2=a^2+b^2+c^2$ and $xy+xz+yz=ab+ac+bc$.

(*b*) Prove that $x^4-px^3+qx^2-rx+s$ divided by $x-a$ gives $a^4-pa^3+qa^2-ra+s$ as remainder.

8. (*a*) Add three quantities, square result, thus we find $x^2+y^2+z^2+2xy+2xz+2yz=a^2+b^2+c^2+2ab+2ac+2bc$. Then multiply first and second, second and third, first and third, collect, etc.

(*b*) Put $x=a$, substitute, etc.

9. If a ship requires 40 hands, a schooner 15, and a steamer 10 ; if on a given day 36 vessels arrive in port manned in all by 750 men ; and if the hands on the ships were sufficient to supply all the schooners and twice the number of steamers, how many vessels of each kind arrived that day ?

9. Let x = number of ships, y = number of steamers, $36-x-y$ = number of schooners, etc. *Ans.* 11, 13, 12.

10. The difference of two numbers is to the less as 4 is to 3, and their product multiplied by the less is 504 ; find the numbers.

10. Let x = greater. y = lesser, etc. *Ans.* 14.6.