Algebra

1. Given the equations
$ax+by+cz=d$, $a'x+b'y+c'z=d'$, $a''x+b''y+c''z=d''$
find the relation which must exist among the known quantities in order that the third may be deduced from the other two by multiplication by suitable quantities and addition.

2. When $n+2$ figures of a cube root have been obtained by the ordinary method, n more may be obtained by division only, supposing $2n+2$ to be the whole number.

3. What are the meanings of $a^{\frac{m}{n}}$, a^{-n} & a^{0} and why such meanings are given to them?

4. What are the rules of addition, subtraction, multiplication & division of surds?

5. If two quadratic surds can not be reduced to others which have the same irrational part, their product is irrational.

6. Simplify

$$\frac{2\sqrt[4]{48}\sqrt[4]{18}}{\sqrt{2}\sqrt{12}} \text{ and } \sqrt[3]{40} - \frac{1}{2}\sqrt[3]{320} + \sqrt[3]{135}$$

7. Shew that

$$\left\{\frac{\sqrt[3]{\frac{1}{5}} - \sqrt[3]{\frac{1}{2}}}{\frac{1}{2}\sqrt[3]{5} + \frac{2}{5}\sqrt[3]{2}}\right\}^{2} = \frac{4}{5}\left(2\sqrt[3]{5} - 5\sqrt[3]{2}\right)^{2}$$

by reducing the 1st member to the second.

8. Extract the square root of $\frac{100}{9}$ ...

$10+\frac{25}{}$

$1600-$

$16\overline{)900}\overline{)5}$

$4\left(\frac{30}{4}+7\sqrt{3}\right)$

$\begin{array}{r} 15 \\ 15 \\ \hline 75 \\ 75 \\ \hline 225 \end{array}$

$\begin{array}{r} 14 \\ 3 \\ \hline 42 \\ 14 \\ \hline 28 \end{array}$

5×30

$\begin{array}{r} 69 \\ 9 \\ \hline 17 \end{array}$

$4\overline{)900}\overline{)\begin{array}{r}225\\ 141\\ \hline 99\end{array}}\begin{array}{r}-\frac{99}{141}\\ \\ \\ \end{array}$

$\frac{10}{}$

$4(15+14\sqrt{3})$

Algebra

1. For what values of x the expression ax^2+bx+c has the same sign as a? & for what values of x the different sign?

2. Shew that a factor may always be found which will rationalise any binomial.

3. In any equation $x+\sqrt{y} = a+\sqrt{b}$ which involves rational quantities and quadratic surds, the rational parts on each side are equal and also the irrational parts.

Shew that if $\sqrt{a+\sqrt{b}} = \sqrt{x}+\sqrt{y}$, then

$\sqrt{a-\sqrt{b}} = \sqrt{x}-\sqrt{y}$.

4. What relation must exist among A, A', B, B' for that the expression $\frac{Ax+B}{A'x+B'}$ may have a value independent of x.

5. Find the sums of squares, of cubes, of fourth powers, and of the reciprocals of fourth powers of the roots of the equation $ax^2+bx+c=0$, without solving it.

6. Solve $2x\sqrt[3]{x} - 3x\sqrt[3]{\frac{1}{x}} = 20$

7. Simplify $\left\{\frac{2\sqrt{3}\cdot 2\sqrt[3]{108}}{3\sqrt[3]{72}\cdot 3\sqrt[3]{9}}\right\}^{\frac{1}{2}}$

8. Extract $\sqrt[3]{26-15\sqrt{3}}$

$\alpha^3\beta+\beta^3\alpha$

$\alpha\beta(\alpha^2+\beta^2)$

$\frac{c}{a}+\frac{b^2}{4a^2} = \frac{4ac-b^2}{4a^2}$

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$\frac{26}{15^6}$ $\frac{15}{15}$ $\frac{15}{15^2}$ $\frac{15}{15^2}$ $\frac{15}{15^2}$

$-b\pm\sqrt{b^2-4ac}$

$a\left(x^2+\frac{bx}{a}+\frac{b^2}{4a^2}\right)$

$\frac{a}{2}\left(2x^2+\frac{2bx}{a}\right.$

$\sqrt[3]{x}-3\sqrt[3]{\frac{1}{x}} = \frac{20}{x}$

$\sqrt[3]{x}-\frac{3}{\sqrt[3]{x}}$

$y = x^2 + x^3 + 1$

$3x(x-1)$

$6x^2 - 3x = 2x^2$

$\frac{3x^2}{2x^2}$

$3x^3\left(\sqrt[3]{x} - \frac{1}{\sqrt{x}}\right) = -($

$2x - \frac{3x}{\sqrt[3]{x^2}} = \frac{20}{}$

$2x\sqrt[3]{x} - 3x\sqrt[3]{\frac{1}{x}} =$

$2x\sqrt[3]{x} - 3x^2\sqrt{x} = -x^2\sqrt{x}$