$\therefore \frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2} = \left\{\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)\right\}^2$.

(2) $x^3+2y^3-3xy^2 = (x-y)^2(x+2y)$
$= (a^2+b^2+c^2-ab-bc-ca)^2(a+b+c)^2$
$= (a^3+b^3+c^3-3abc)^2$.

(3) By addition $a+b+c = x+y+z$; squaring and adding $2(a^2+b^2+c^2)$
$= (x^2+y^2+z^2+xy+yz+zx)$.
$\therefore$ Expression
$= (x+y+z)^2-(x+y+z)$
$(x^2+y^2+z^2+xy+yz+zx)$
$= (x+y+z)(xy+yz+zx)$.

VII. Find a value of a which will make the quantities $\frac{(a+b)(a+c)}{a+b+c}$ and $\frac{(a+c)(a+d)}{a+c+d}$ equal to one another. *Ans.* $a = -c$.

VIII. Solve the equations,

(1) $\sqrt{x+3}+\sqrt{x+2}=5$.

(2) $\frac{5-x}{3}+\frac{5-2x}{4}+\frac{x+1}{3}-\frac{2+5x}{2}=0$.

(3) $(x+a+b)(c+d) = (x+c+d)(a+b)$, where $c+d$ is not equal to $a+b$.

Ans. (1) $1\frac{1}{4}$. (2) $\frac{8}{9}$. (3) 0.

IX. One side of a right angled triangle exceeds the other by 3 ft., neither being the hypothenuse, and its area is 18 sq. ft. What are the sides?

Ans. $\frac{1}{2}(\sqrt{17}-1)$, $\frac{1}{2}(\sqrt{17}+1)$.

X. A cistern with vertical sides is h feet deep. Water is carried away from it by one pipe $\frac{1}{n}$ as fast as it is supplied by another. Find at what point in the side the former pipe must be inserted that the cistern may fill in twice the time it would did water not flow from it at all. *Ans.* $\frac{1}{2}h$.

ARITHMETIC.

1. Add together $\frac{1}{3}$ of £13, $\frac{1}{8}$ of $\frac{1}{2\frac{1}{2}}$ of $\frac{1}{3}$ of £2 12*s.*, and $\frac{1}{4}$ of 9*d.* *Ans.* £5 15*s.* $8\frac{1}{4}d$.
Reduce 13*s.* $4\frac{1}{2}d$. to the decimal of 19*s.* 6*d.* *Ans.* .68589743.

2. Find by Practice the value of 8596 lbs. at £10 18*s.* $7\frac{1}{2}d$. each. *Ans.* £93965 0*s.* 6*d.*

3. A person borrows $500 on April 10th and on June 22nd pays his debt with $510 20. At what rate per cent. per annum was he charged interest? *Ans.* $10\frac{1}{2}$ per cent.

4. A man having a certain sum of money to invest has an opportunity of purchasing 7 per cent. stock at 95, but delays until it has risen to 110. What per cent. is his income less than if he had purchased at the first price? *Ans.* $13\frac{1}{11}$ per cent.

5. At an international exhibition one country was awarded 5 gold, 9 silver and 11 bronze medals; and another, 4 gold, 15 silver and 10 bronze. Find a ratio of values for such medals that these countries may be regarded as equally fortunate.

6. In a box there is a certain number of sovereigns, three times as many guineas, and twice as many marks (13*s.* 4*d.*) as guineas. The entire amount in the box is £815. How many coins of each kind are there?
Ans. 100 sovs.; 300 guis.; 600 mks.

7. Find when first after 2 o'clock the hour and minute hands of a clock make an angle of 60 degrees with each other. *Ans.* $21\frac{9}{11}$.

8. For each of three succeeding months the population of a north-west town rose 50 per cent.; and at the end of the third month was 2,700. What was the population at the beginning of the time? *Ans.* 800.

9. Leap year is omitted once in every century, except those centuries whose number is divisible by 4. What is the average length of a year? *Ans.* 365 dys. 5° 49′ 12″.

10. A cube is formed of a certain number of pounds avoirdupois of a substance, and the same number of pounds Troy of the same substance. What proportion will a side of the cube bear to a side of a cube formed of the same number of pounds as before, but all avoirdupois? (175 lbs. Troy = 144 lbs. avoirdupois.) *Ans.* 319 : 350.

Second Class Teachers.

ARITHMETIC.

I. Prove that $\frac{1}{2}$ of $\frac{1}{3}=\frac{3}{2\cdot 3}$.
Simplify $(2\frac{2}{3}$ of $3\frac{1}{7}\frac{1}{8})+\frac{1}{2}-(1\frac{1}{3}$ of $1\frac{1}{7}\frac{1}{8})-(1\frac{2}{3}$ of $4\frac{1}{7}$ of $\frac{1}{7}\frac{3}{8})$. *Ans.* $3\frac{3}{4}\frac{7}{2}$.