4. Reduce to their simplest forms—

$$3a-2\{a-2(b+4c)+3(2a-b)\}+4(a-\overline{2b-c});$$

$$\frac{2a-3b}{5}-\frac{1}{3}\left[3b-\frac{3a-c}{2}-\left\{2a-\frac{3b-2c}{5}-\frac{2b-(a-2c)}{3}\right\}\right].$$

5. Find the highest common factor of $4a^4-9a^2b^2+30ab^3-25b^4$ and $6a^3+5a^2b-6ab^2+35b^3$

6. Simplify—

$$\frac{x}{1+\frac{x}{y}}-\frac{y}{1-\frac{y}{x}}-\frac{2x}{1-\frac{x^2}{y^2}};$$

and

$$\frac{\frac{1-b}{1+b}-\frac{1-a}{1+a}}{1+\frac{(1-a)(1-b)}{(1+a)(1+b)}}.$$

7. Solve the equations,—

$$3x-\{2x+8-(3x-10)\}=6x+4-\{3x-4-(16-2x)\};$$

$$\frac{4x-5}{7\frac{1}{2}}-\frac{5x-8}{8\frac{1}{2}}=\frac{x-5}{9\frac{1}{2}};$$

$$\frac{b+c-a}{ax+bc}=\frac{c+a-b}{bx+c}.$$

8. A man possessed £2,500; he invested part of it in the 4-per-cent. stock at 96, and the remainder in the 6-per-cents at £117. If his income was £116 13s. 4d. per annum, find how much he invested in each kind of stock.

9. In a school the number of boys bears to the number of girls the ratio of $a$ to $b$; if the number of boys be increased by $b$, and the number of girls by $a$, the ratio is that of $c$ to $d$. Find how many boys and how many girls there are in the school.

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*Algebra.—For Senior Civil Service. Time allowed: 3 hours.*

1. If $a=1,\ b=2,\ c=3$, find the values of—

(1.) $\sqrt[3]{a^3+b^3+3abc}$;

(2.) $\sqrt{\dfrac{a^2+c^2-b^2}{2a^2+2c^2+b^2}}+\sqrt{\dfrac{4b^2+c^2-a^2}{2b^2+2c^2-2a^2}}$

2. State the rule of signs in multiplication. Prove it by the example of the multiplication of $a-b$ into $c-d$.

Multiply $2x^4-3x^3+x^2-1$ by $2x^4+3x^3-x^2-1$.

3. Prove the rule for finding the highest common factor of two algebraical expressions. Find the highest common factor of

$$2x^3+5x^2-x-6 \text{ and } 2x^4+3x^3-2x-3.$$

4. Reduce to their simplest forms—

(1.) $\dfrac{2x^3+5x^2-x-6}{2x^4+3x^3-2x-3}$;

(2.) $\dfrac{a^3}{(a-b)(a-c)}+\dfrac{b^3}{(b-a)(b-c)}+\dfrac{c^3}{(c-a)(c-b)}$;

(3.) $\left(\dfrac{a+b}{a-b}+\dfrac{a-b}{a+b}\right)\div\left(\dfrac{a+b}{a-b}-\dfrac{a-b}{a+b}\right)$.

5. Prove that, if a rational integral algebraical expression of the form $ax^4+bx^3+cx^2+dx+e$ have the value zero, when $x$ has the value $p$ the expression must be exactly divisible by $x-p$.

Find the factors of—

(1.) $a^2(b-c)+b^2(c-a)+c^2(a-b)$;

(2.) $a^3(b-c)+b^3(c-a)+c^3(a-b)$.

6. Solve the equations,—

(1.) $\dfrac{2x+5}{7}+\dfrac{5+3x}{5-3x}=\dfrac{6x+8}{21}+\dfrac{13}{3}$;

(2.) $\dfrac{x-3}{x-4}+\dfrac{x-6}{x-7}=\dfrac{x-4}{x-5}+\dfrac{x-5}{x-6}$.

7. Solve the equations,—

$$\begin{cases} ax+by=c, \\ a'x+b'y=c', \end{cases}$$

and from your result, or otherwise, find the values of $x$ and $y$ which satisfy the equations $7x+4y=37,\ 15x-7y=17$.

8. Two men, A and B, run a race over a given course. If A have ten yards start, they arrive at the end of the course together. If they start together from the beginning of the course, B will arrive at the end $\frac{12}{7}$ seconds before A does. Find how many yards A can run in a minute. If it be also given that B can run the whole course in five minutes, find the length of the course, and B's rate of running.

9. A certain fraction becomes $\frac{1}{3}$ if its denominator be increased by 8, while if its numerator be doubled, and its denominator increased by 3, it becomes unity.