3. Assuming that a gallon of water weighs 10 pounds avoirdupois, and that one cubic centimetre of water weighs 15·432 grains, find the number of cubic centimetres in 192 gallons 3 quarts $1\frac{1}{5}$ pints.

4. Find the present worth of £1,000 due 3 years hence at 5 per cent. compound interest.

5. Divide $x^4-\frac{5}{6}x^3+\frac{19}{36}x^2-\frac{5}{36}x+\frac{1}{36}$ by $x^2-\frac{1}{2}x+\frac{1}{4}$

Find without division the remainder when $x^4-3x^3+2x^2-5x+6$ is divided by $x+10$

6. Find the value of $(a+b+c)(a+b-c)(b+c-a)(a+c-b)$ when $a=n^2-1$, $b=2n$, $c=n^2+1$

7. Simplify—

(1.) $\left(\frac{x-y}{x+y}-\frac{x^3-y^3}{x^3+y^3}\right)\left(\frac{x+y}{x-y}+\frac{x^3+y^3}{x^3-y^3}\right)$

(2.) $\left\{\left(1+\frac{a}{b}\right)^m\left(1-\frac{b}{a}\right)^n\right\}\div\left\{\left(1+\frac{b}{a}\right)^m\left(1-\frac{a}{b}\right)^n\right\}$

8. If $a+c=\frac{b}{x}-dx$, and $a-c=\frac{d}{x}-bx$, prove that $\frac{c^2}{(b-d)^2}-\frac{a^2}{(b+d)^2}=1$.

9. Solve the equations—

(1.) $\frac{11}{12x+11}+\frac{5}{6x+5}=\frac{7}{4x+7}$

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

(3.) $\begin{cases}x^2+y^2+2(x+y)=11\\3xy=2(x+y)\end{cases}$

10. Solve the equation $x^2+px+q=0$

Find the sum and the product of the roots, and show what condition must be fulfilled in order that the roots may be real quantities, p and q being real.

Form the equation whose roots are $3+\sqrt{5}$, $3-\sqrt{5}$

11. A man buys a number of sheep for £75, keeps 20 sheep, and sells the remainder for £68, getting two shillings a head more for them than the original price. How many sheep did he buy?

12. A sets out to walk from P to Q half an hour after B, overtakes B half-way between P and Q, and arrives at Q at 2 p.m. After resting $7\frac{1}{2}$ minutes he sets out on his return and meets B in 10 minutes more. At what o'clock did A start from P?

Algebra.—For Class D. Time allowed: Three hours.

1. Find the value of $\frac{(ab+cd)^2+(ac-bd)^2}{(ad+bc)^2+(ad-bc)^2}\div\frac{(a^2+d^2)(b^2+c^2)}{2(a^2d^2+b^2c^2)}$ when $a=-2$, $b=-1$, $c=1$, $d=2$

2. Add together $x^2+y^2-(x^2-y^2)+y^2-x^2$ and $x^2-y^2+[-3x^2-2y^2-(2x^2-3y^2)]$

3. Multiply $4a^4b^2+ab-2a^7b^3$ by $3a^3b^2-a^6b^3-5a^9b^4$

4. Divide $81x^8-16y^8$ by $27x^6+18x^4y^2+12x^2y^4+8y^6$

5. Prove without actual division that $x^8y^5+y^8z^5+z^8x^5-x^5y^8-y^5z^8-z^5x^8$ is exactly divisible by $(x-y)(y-z)(z-x)$

6. Find the factors of—

(1.) x^6+64

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

(3.) $7a^3x^2+49a^2x+84a$

7. Simplify—

$$\frac{\frac{1}{x}-\frac{x+a}{x^2+a^2}}{\frac{1}{a}-\frac{a+x}{a^2+x^2}}+\frac{\frac{1}{x}-\frac{x-a}{x^2+a^2}}{\frac{1}{a}-\frac{a-x}{a^2+x^2}}$$

8. When $x=\frac{a-b}{a+b}$, $y=\frac{b-c}{b+c}$, and $z=\frac{c-a}{c+a}$, prove that $(1+x)(1+y)(1+z)=(1-x)(1-y)(1-z)$

9. Simplify $\frac{x(x+yz)}{(x-y)(x-z)}+\frac{y(y+zx)}{(y-z)(y-x)}+\frac{z(z+xy)}{(z-x)(z-y)}$

10. Solve the equations:—

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

(2.) $\begin{cases}x+ay+a^2=0\\x+by+b^2=0\end{cases}$

(3.) $\frac{5}{(x-1)(x+2)}-\frac{2}{x^2-x-2}=\frac{8}{x^2-1}-\frac{5}{x^2-4}$

11. One barrel contained 48 gallons and another 88 quarts of wine. From the first twice as much wine was drawn as from the second, and the first then contained three times as much wine as the second. How much wine was drawn from each?

12. A number of three digits is in value between 400 and 500, and the sum of its digits is 9. If the digits be reversed, the resulting number will be $\frac{36}{47}$ of the original number. What is the number?

Elementary Mathematics.—For Civil Service Junior. Time allowed: Three hours.

1. Simplify $[(3a^6)\times(-2c)^2]\div[(a^2c)^2\times(\frac{a}{c})^3]$

Each step in the working must be accompanied by a reference to the fundamental law of algebra on which it depends.