and (v)   find a value of x which shall make the expression—

$$\frac{x^2 - 4x + 6}{x - 4} + \frac{x^2 - 2x + 3}{x - 2} - \frac{2x^2 + 9}{x}$$

equal to 0

12. A rectangular field contains 30 acres, and if it were 44 yards longer and 30 yards narrower its area would be the same : find its length and breadth.

Algebra.—For Civil Service Senior (Old Regulations).   Time allowed : 3 hours.

1. Divide $\frac{15}{4} x^5 - \frac{11}{3} x^4 - \frac{15}{16} x^3 + \frac{14}{9} x^2 - \frac{1}{2} x + \frac{1}{18}$ by $\frac{5}{4} x^2 - \frac{3}{2} x + \frac{1}{3}$

2. Simplify—

(i.) $\dfrac{9a^3 + 6a^2b - 12ab^2 - 8b^3}{18a^3 + 9a^2b - 5ab^2 - 2b^3}$

(ii.) $\dfrac{11(x + 2)}{6x^2 + 7x - 3} + \dfrac{11x + 12}{12x^2 - 13x + 3} + \dfrac{11x - 30}{8x^2 + 6x - 9}$

3. If $a + b + c = 0$, prove $a^3 + b^3 + c^3 = 3abc$

Find the factors of—

(i.) $4a^2b^2 - (a^2 + b^2 - c^2)^2$

(ii.) $a^4 + 4$

(iii.) $x^3 - 8x^2 - x + 8$

(iv.) $x^3 - 4x^2 + x + 6$

(v.) $(y + z - 2x)^3 + (z + x - 2y)^3 + (x + y - 2z)^3$

4. Solve the equations—

(i.) $\dfrac{x - 5}{x - 6} - \dfrac{x - 6}{x - 7} - \dfrac{x - 1}{x - 2} + \dfrac{x - 2}{x - 3} = 0$

(ii.) $4abx^2 + 2x(a - b)^2 - (a - b)^2 = 0$

(iii.) $(x^2 - 5x + 2)^2 = x^2 - 5x + 22$

(iv.) $\begin{cases} 14x^2 - 5xy - 13y^2 + 22 = 0 \\ 3x^2 + 5xy - 4y^2 + 12 = 0 \end{cases}$

5. If a and β are the roots of the equation $x^2 - px + q = 0$, and a and γ are the roots of the equation $x^2 - Px + Q = 0$, find a, β, γ.

6. Describe the method of proof called " Mathematical Induction."   Employ it to prove—

$$1^3 + 2^3 + 3^3 + \ldots + n^3 = \left\{ \frac{n(n + 1)}{2} \right\}^2$$

7. Simplify—

(i.) $\dfrac{12x^7y^2 - 4x^6y^3 - 23x^5y^4 + 9x^4y^5 - 9x^3y^6}{8x^5y^3 - 14x^3y^5 - 9xy^7}$

(ii.) $\dfrac{\left(\dfrac{x}{x - y}\right)^3 + \left(\dfrac{y}{x + y}\right)^3}{\left(\dfrac{x}{x - y}\right)^2 - \left(\dfrac{y}{x + y}\right)^2} \times \dfrac{\dfrac{x}{x - y} - \dfrac{y}{x + y}}{\left(\dfrac{x}{x - y}\right)^2 - \dfrac{xy}{x^2 - y^2} + \left(\dfrac{y}{x + y}\right)^2}$

8. Solve the equations—

(i.) $\dfrac{(x - 1)^2}{4} + \dfrac{(x - 2)^2}{2} = x^2 - \dfrac{(x - 9)(x - 8)}{4}$

(ii.) $\dfrac{x + m}{x^2 + mx + m^2} - \dfrac{x - m}{x^2 - mx + m^2} = \dfrac{m^4}{x(x^4 + x^2m^2 + m^4)}$,

(iii.) $\begin{cases} x = 2y \\ \dfrac{4x + 7y}{5} - 1 = \frac{2}{3}(4x - 6y + 1) \end{cases}$

(iv.) $\begin{cases} \dfrac{x - a}{p} = \dfrac{y - b}{q} = \dfrac{z - c}{r} \\ l(x - a) + m(y - b) + n(z - c) = 1 \end{cases}$

(v.) $\sqrt{x} + \sqrt{9 + x} = 9$

9. A can do a piece of work in a hours, B in b hours, and C in c hours : how long will they take all working together ?

10. Two bodies move in the same direction round a circle 999 ft. in circumference, and are together every 37 seconds : if the velocity of one is four times that of the other, what are their velocities ?

Algebra.—For Class D, and for Civil Service Junior.   Time allowed : 3 hours.

1. Find the value of—

$$\left\{ \left(\frac{x^2}{y^3} + \frac{1}{x}\right) \div \left(\frac{x}{y^2} - \frac{1}{y} + \frac{1}{x}\right) \right\} \times \frac{-y}{x + y}$$

when $x = \frac{1}{2}$, $y = \frac{1}{3}$.

2. Find the sum of—

$$3(a + b) - 4(a + b)^2 + 5(a + b)^3; \ (a + b)^2 - 2(a + b)^3$$
$$- (a + b)^3 + 2(a + b)^2 - (a + b)$$

in its simplest form.