

4. Solve the equations

(i.) $10^{(x-1)(2-x)} = 1000$.

(ii.)
$$\left. \begin{aligned} \frac{1}{\sqrt{x-a}} - \frac{1}{\sqrt{y-b}} &= \frac{1}{2ab}, \\ \sqrt{\frac{a-x}{c+x}} \times \sqrt{\frac{c+x}{b-y}} &= \frac{b}{2a}. \end{aligned} \right\}$$

(iii.)
$$\left. \begin{aligned} x+y-z &= 0, \\ x^2+y^2+z^2+2xy &= 8, \\ xz-y^2 &= 1. \end{aligned} \right\}$$

5. If $\frac{a}{b} = \frac{c}{d} = \frac{e}{f}$, prove that each of these

ratios $= \frac{a+c+e}{b+d+f}$.

If $a = \left(\frac{1-e}{1+e} \right)^{\frac{1}{2}}$, then shall

$$\frac{1-a}{1+a} = \frac{e}{1+\sqrt{1-e^2}}.$$

6. (a) Having given the first term (a), the last term (l), and the number of terms (n) of an arithmetical series, find the common difference and the sum of the series.(b) If a = first term, r = common ratio, and S_n = sum of n terms of a geometrical series, find S_n , and prove that

$$aS_{2n} = S_n(S_{n+1} - rS_{n-1}).$$

7. Sum to n terms and to infinity the series

(i.) $1 + (1 - \sqrt{3}) + (1 - \sqrt{3})^2 + (1 - \sqrt{3})^3 + \dots$

(ii.)
$$\frac{1}{\sqrt{3}(1+\sqrt{3})} + \frac{1}{(1+\sqrt{3})(2+\sqrt{3})} + \frac{1}{(2+\sqrt{3})(3+\sqrt{3})} + \dots$$

8. The number of combinations of n things taken r together is the same as the number of combinations taken $n-r$ together.

In how many different ways can nine persons occupy four places at a round table?

9. Find the 8th term of $(1-5x)^{\frac{1}{5}}$.

Show that

$$\frac{1+x}{(1-x)^3} = 1 + 4x + 9x^2 + 16x^3 + \dots$$

10. Lead weighs 11.34 times as heavy as water; cork weighs $\frac{1}{8}$, and fir $\frac{1}{10}$ respectively of the weight of an equal volume of

water. How much cork and lead must be combined together so that the mass may be equal to 80 pounds, the weight of a beam of fir timber of the same magnitude?

Matriculation.

ARITHMETIC AND ALGEBRA.—MEDICINE, HONORS.

Examiner—F. Hayter, B.A.

1. Subtract $\frac{1}{3}$ of $\frac{3\frac{3}{4}}{\frac{1}{4}}$ of $33\frac{3}{4}$ + $\frac{1}{2}$ of $\frac{\frac{3}{4}}{1 + 1\frac{3}{4}}$ + $\frac{\frac{3}{4} \times \frac{1}{4}}{\frac{1}{2}}$ of $7\frac{1}{2}$ from 101 times the sum of $\frac{1}{4}$ and $\frac{1}{2}$ of $\frac{1}{4}$ of $\frac{1}{2}$.

Find the value of

$$\frac{2.6 \times 2.8\dot{3}}{6.2 \times .857142} + \frac{4\frac{5}{8} \times 4.0\dot{3}\dot{6}}{3.75 + 1.7}.$$

2. What must be the gross produce of an estate in order that after paying a 10 per cent. income tax, and a rate of $12\frac{1}{2}$ cents on the dollar on the residue, there may remain \$1612?3. A person shooting at a target at a distance of 545 yards hears the bullet strike the target 4 seconds after he fired. A spectator equally distant from the target and the shooting-point hears the shot strike $2\frac{1}{2}$ seconds after he heard the report. Find the velocity of sound.

4. Simplify

$$\frac{2c}{a^2 - b^2} + \frac{3b}{a^3 + b^3} - \frac{a^2 + b^2}{a^4 + a^2b^2 + b^4}.$$

5. Show that the value of

 $2x^6 - 17x^5 - 127x^4 + 1298x^2 + 30x + 54$, when $x = 13$ is equal to the remainder when that expression is divided by $x - 13$, and find the remainder by Horner's method.

6. Simplify

(i.)
$$\frac{x^3 + 12x^2 + 44x + 63}{2x^3 + 13x^2 + 33x + 27}.$$

(ii.)
$$\frac{a^4 + b^4 - c^4 + 4a^3b + 6a^2b^2 + 4ab^3}{(a^3 + b^3 + c^3)(a^2 + b^2 + c^2) - 3abc(a^2 + b^2 + c^2) + 2ab(a^3 + b^3 + c^3) - 6a^2b^2c}.$$

7. Solve

(i.)
$$\frac{x+1}{x-1} + \frac{x+2}{x-2} = 2 \cdot \frac{11x+18}{11x-18}.$$

(ii.)
$$(x^2 - 5)^{\frac{1}{2}} + (x^2 + 7)^{\frac{1}{2}} = 9.$$