

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

- Find the value of $\frac{abc+bcd}{3(a+b)} + \frac{ab}{d} + \frac{(b+c)d}{b}$, when $a=0$, $b=-1$, $c=3$, $d=2$, and of $\frac{x^3+y^3-z^3}{yz+zx-xy} - \frac{\sqrt{x+y+z}}{2(y+z-x)}$, when $x=4$, $y=3$, $z=2$.
 - Find the value of p and q , so that in the product of x^2+x+1 and x^3+px^2+qx+r the coefficients of x^4 and x^5 may vanish.
 - Find the factors of a^3+8b^3 , $a^3+3ab+2b^3+bc-c^2$, $x^4+\frac{1}{x^4}+1$, $x^3+y^3+z^3-3xyz$.
 - Prove by means of the last result, or otherwise, that
$$\frac{a^6(b^2-c^2)^3+b^6(c^2-a^2)^3+c^6(a^2-b^2)^3}{a^3(b-c)^3+b^3(c-a)^3+c^3(a-b)^3} = abc(a+b)(b+c)(c+a).$$
 - Simplify—
 (a.)
$$\left\{ \frac{a^2-ab+b^2}{a-b} - \frac{a^2+ab+b^2}{a+b} \right\} \div \frac{a^3}{a^2-b^2}.$$

 (b.)
$$\left\{ \frac{a^2-bc+c^2}{a} + \frac{a^3}{b+c} - \frac{3}{\frac{1}{b} + \frac{1}{c}} \right\} \times \frac{\frac{2}{b} + \frac{2}{c}}{\frac{1}{bc} + \frac{1}{ca} + \frac{1}{ab}} + (a+b+c)^2$$
- If $p = \frac{a\sqrt{a}}{\sqrt{a+b}}$, $q = \frac{a\sqrt{b}}{\sqrt{a+b}}$, find in terms of a and b the value of $\frac{(b-a)pq}{aq^3+bp^3}$
- ✓ 6. Solve—

$$3(x+a)(x-b)+2(x-a)(x+b)=5x^2$$

$$\frac{9}{x-4} + \frac{3}{x-8} = \frac{4}{x-9} + \frac{8}{x-3}$$
- ✓ 7 Solve—

$$\begin{cases} 3.4x - .02y = .01. \\ x + .2y = .6. \end{cases}$$

$$x + \frac{ay}{a-b} = b = y + \frac{ax}{a+b}$$

8. A man started on a bicycle at the rate of 9 miles an hour, and intended to be back in two hours, at a certain point the bicycle broke down, and he walked back from that point at the rate of 3 miles an hour, arriving at his starting-point forty minutes late. Find how far the man travelled.

9. Two travellers start simultaneously, the one from A towards B, and the other from B towards A. They meet at a place 24 miles distant from A, and when one arrives at B the other is $13\frac{1}{3}$ miles from A. Find the distance between A and B.

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

1. What do you understand by the words definition, axiom, postulate? Define circle, segment, semicircle, rhombus, polygon, and gnomon.

2. If two triangles have two sides of the one equal to two sides of the other, each to each, and have also the angles contained by those sides equal, then the triangles shall be equal in all respects.

Under what other conditions does Euclid show that two triangles are equal in all respects?

3. If one side of a triangle be produced, then the exterior angle shall be greater than either of the interior opposite angles.

4. State the axiom on which the theorems on parallel straight lines depend.

If a straight line fall on two parallel straight lines, then it shall make the interior opposite angles equal, and the exterior angle equal to the interior opposite angle on the same side.

If the straight line bisecting the exterior angle of a triangle be parallel to the base, show that the triangle is isosceles.

5. Parallelograms on the same base and between the same parallels are equal in area.

Describe a rhombus which shall be equal to a given parallelogram and which shall have its side equal to one of the sides of the parallelogram. In what case is this impossible?

6. If the square described on one side of a triangle be equal to the sum of the squares described on the other two sides, then the angle contained by these two sides shall be a right angle.

If two triangles have two sides of the one equal to two sides of the other, and each have a right angle opposite to one of these sides, then the triangles are equal in every respect.

7. If a straight line is bisected and produced to any point, the rectangle contained by the whole line thus produced and the part of it produced, together with the square on half the line bisected, is equal to the square on the straight line made up of the half and the part produced.

Given the difference of two lines, and the rectangle contained by them, find the lines.

8. To divide a given straight line into two parts, so that the rectangle contained by the whole and one part may be equal to the square on the other part.

Euclid.—For Senior Civil Service. Time allowed 3 hours

1. The opposite sides and angles of a parallelogram are equal, and a diagonal bisects it.

If the parallelogram be a rhombus, show that its angles are bisected by the diagonals.

2. On a given straight line describe a square.