

6. Extract to five terms the square root of $a^2 - \frac{1}{2}ab$.
 7. Solve the following equations:—

$$(a.) \quad \frac{b}{x-a} + \frac{a}{x-b} = \frac{a+b}{x}$$

$$(b.) \quad a^2x + ay = bx - b^2y = ab$$

$$(c.) \quad \frac{1}{x} - \frac{1}{y} = \frac{1}{y} - \frac{1}{z} = \frac{2}{x} - \frac{3}{z} = 1$$

8. A person bought oranges at the rate of thirty for a shilling. He found forty of them to be unsaleable, but he sold the rest at the rate of sixteen for a shilling, gaining $66\frac{2}{3}$ per cent. on his outlay. Find the number of oranges bought.

9. At an election the successful candidate polled $\frac{1}{m}$ of the whole constituency, obtaining majorities of a and b votes respectively over the other two candidates. Supposing that $\frac{1}{n}$ of the electors refrained from voting, find the number of votes recorded for the successful candidate.

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

1. Carefully explain Euclid's definitions of a point, a line, a straight line, and a plane. Mention any practical method of testing (a) whether a line is straight, (b) whether a surface is plane. What is meant by an axiom? Can exception be taken to any of Euclid's axioms?

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 to one another, the triangles are equal in every respect.

A and B are any two points on opposite sides of the straight line EF: find a point P on EF such that the straight lines AP and BP shall be equally inclined to EF.

3. At a given point in a given straight line make an angle equal to a given angle. Construct a triangle, having given the base, one of the angles at the base, and a line equal to the sum of the sides of the triangle.

4. If two triangles have two angles of the one equal to two angles of the other, each to each, and one side equal to one side—namely, either the sides adjacent to the equal angles or the sides that are opposite to the equal angles in each—then shall the other sides be equal, each to each, and also the third angle of the one shall be equal to the third angle of the other.

5. The straight lines that join the extremities of two equal and parallel straight lines towards the same parts are themselves equal and parallel.

The straight lines that join the extremities of two equal and parallel straight lines towards opposite parts bisect each other.

6. If a straight line be 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 that is made up of the half and the part produced.

7. In every triangle the square on the side subtending an acute angle is less than the squares on the sides containing that angle by twice the rectangle contained by either of these sides and the straight line intercepted between the perpendicular let fall on it from the opposite angle and the acute angle.

8. ABC is a triangle and D is the middle point of BC; a straight line EDF is drawn through D and cuts the sides AB, AC, produced if necessary in E and F so as to make AE equal to AF: prove that BE is equal to CF.

Euclid, Books I-IV.—For Senior Civil Service. Time allowed: 3 hours.

1. Classify triangles (1) with respect to their angles, (2) with respect to their sides. Specify and define the different kinds of quadrilateral figures.

2. All the interior angles of any rectilineal figure, together with four right angles, are equal to twice as many right angles as the figure has sides.

Show that a square, a regular hexagon, and a regular dodecagon will fill up the space round a point.

In any right-angled triangle the square which is described upon the side subtending the right angle is equal to the sum of the squares described upon the sides containing the right angle.

If one of the acute angles of a right-angled isosceles triangle be bisected, the opposite side will be divided by the bisecting line into two parts such that the square on one part will be double of the square on the other.

4. In obtuse-angled triangles the square on the side opposite the obtuse angle is equal to the sum of the squares on the other two sides increased by twice the rectangle contained by either of those sides and the projection on it of the other side.

The base of a triangle is 63 ft., and the sides 25 ft. and 52 ft.: find the area of the triangle and the parts into which the base is divided by a perpendicular from the vertex.

5. In equal circles the angles which stand upon equal arcs are equal to one another, whether they be at the centres or at the circumferences.

If a tangent to a circle be parallel to a chord, the point of contact will be the middle point of the arc cut off by the chord.

6. If from a point without a circle two straight lines be drawn, one of which cuts the circle and the other touches it, the rectangle contained by the whole line which cuts the circle and the part of it without the circle shall be equal to the square of the line which touches it.