

2. Find the value of $\{2x(x+3) - [x(x+2) - 3x+4]\} - (x-13)$, when $x = -2$.

Show that this expression may be exhibited in the form of a perfect square.

3. Divide $80a^3b^3 + 60a^2b^2(a^3+b^3) + 25ab(a^4+b^4) + 4(a^6+b^6)$ by $2(a^3+b^3) + 4ab$.

4. Resolve into their elementary factors a^3+b^3 ; $a^3+a^2b+ab^2+b^3$; $a^4+a^2b^2+b^4$; and hence find their lowest common multiple.

5. Reduce to a single fraction $\frac{1}{2(x-1)^2} + \frac{1}{2(x-1)} - \frac{x}{2(x^2+1)}$;

and also $\frac{a^2(a+b)}{a^2b-b^3} + \frac{a^2-ab}{(a+b)b} - \frac{2ab}{a^2-b^2}$.

6. Substitute $x + \frac{1}{x}$ for a , and $x - \frac{1}{x}$ for b , in the expression $\frac{a^2+b^2}{4} - \frac{ab}{a^2-b^2}$

7. Solve the equations—

$$\frac{4x+9}{7} - \frac{2x+5}{5} = \frac{1}{10}(x+10).$$

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

8. A body starting from rest, and falling freely for t seconds, will fall through $16t^2$ feet: find through how many feet it will fall in the first, the second, and the third seconds of its motion respectively.

9. A wine merchant has two sorts of wine, one worth a shillings a quart and the other worth b shillings a quart. He wishes to make a mixture of n quarts which he can sell without loss or gain for c shillings a quart. How much of each must he take?

CLASS D.—EUCLID (Optional).

Time allowed: Three hours.

1. What are the classes into which triangles are divided with respect to their sides, and with respect to their angles?

Mention the cases in the First Book in which triangles are proved to be equal in all respects; and also the cases in which they are proved to be equal in area only.

2. If two triangles have two sides of the one equal to two sides of the other, each to each, and have likewise their bases equal, the angle which is contained by the two sides of the one shall be equal to the angle contained by the two sides equal to them of the other.

3. If two straight lines cut one another, the vertical or opposite angles shall be equal.

Show that the lines which bisect two vertically opposite angles are in the same straight line.

4. The opposite sides and angles of a parallelogram are equal to one another, and the diameter bisects it.

Prove that a rhombus is a parallelogram, and that its diagonals bisect one another at right angles.

5. To a given straight line to apply a parallelogram which shall be equal to a given triangle, and have one of its angles equal to a given rectilineal angle.

6. If a straight line be divided into two equal and also into two unequal parts, the rectangle contained by the unequal parts, together with the square of the line between the points of section, is equal to the square of half the line.

Show that, of all rectangles having the same perimeter, the square has the greatest area.

7. In obtuse-angled triangles, if a perpendicular be drawn from either of the acute angles to the opposite side produced, the square of the side subtending the obtuse angle is greater than the squares of the sides containing it, by twice the rectangle contained by the side upon which, when produced, the perpendicular falls, and the straight line intercepted without the triangle between the perpendicular and the obtuse angle.

CLASS D.—CHEMISTRY (Optional).

Time allowed: Three hours.

1. Show, by two equations for each, how the following gases are made:—*Oxygen, hydrogen, chlorine, carbon dioxide* (carbonic acid), *hydrosulphuric acid* (sulphuretted hydrogen).

2. Explain fully, giving equations, how *phosphorus* is made, and state its uses.

3. In what respects does *ozone* differ from *oxygen*?

4. What weight of each of the products is obtained by the combustion of 100 lb. of a substance containing 80 per cent. of carbon and 20 per cent. of hydrogen?

5. Show, by equations, the action of *sulphuric acid* on *potassic nitrate* (saltpetre), and on *sodium chloride* (table-salt).

6. What are the halogens? How do they differ from and resemble each other?

7. What are the constituents of atmospheric air? Is it a mixture or a compound? How is its composition affected by plants and animals?

8. How is *ammonia* made from gas liquor?

9. State what you know of *chloride of lime* (bleaching powder) under the following heads: (a) its composition; (b) its properties; (c) its uses; (d) the action of acids on it.

10. Write down the names and symbols (formulae) of the *oxides* of the following elements:—*Nitrogen, phosphorus, hydrogen, chlorine, sulphur, carbon, silicon.*

11. Describe experiments showing the properties of *carbon dioxide* (carbonic acid), *oxygen, sulphur, phosphorus.*

12. Describe as fully as you can the process for the manufacture of *sulphuric acid*.