4. Solve the equations—

(i.) $\frac{2}{3-x}+\frac{3}{9-x^2}=\frac{1}{x+3}$

(ii.) $\begin{cases}17x+23y=5\\23x+17y=35\end{cases}$

(iii.) $x^2+\frac{36}{x^2}=13$

5. A train travelling at the rate of 45 miles an hour (66 ft. a second) takes 5 seconds to pass a man walking in the same direction, but would have taken only 3 seconds to pass him if he had been walking in the opposite direction at the same rate: find the length of the train.

6. Two triangles are congruent if two angles and a side of one triangle are respectively equal to two angles and the corresponding side of the other.

The bisectors of two angles of a triangle meet in a point which is equidistant from the sides.

7. Parallelograms on equal bases, and between the same parallels, are equal to one another.

If A B C D is a quadrilateral having B C parallel to A D, and if E is the middle point of D C, then the triangle A E B is half the quadrilateral.

8. In any right-angled triangle the square described on the side that subtends the right angle is equal to the squares described on the sides that contain the right angle.

If a quadrilateral has its diagonals at right angles to each other, the sum of the squares on two opposite sides is equal to the sum of the squares on the other two sides.

9. Describe a square that shall be equal to a given rectilineal figure.

If the perimeter of a rectangle is constant, its area is greatest when its sides are equal.

No. 35.—Elementary Mathematics.—For Class D.

Time allowed: Three hours.

1. Write out, with appropriate illustrations and examples, as if explaining to a class of beginners, the proof of the fundamental theorems $a-(-b)=a+b$ and $a\times b=b\times a$.

2. Multiply $a^5-5a^3+2a^2-1$ by $a^5+5a^3-2a^2+1$, and check the result for the case $a=1$. Divide a^6-b^6 by $a^3-2a^2b+2ab^2-b^3$.

3. Factorise—

(i.) $4x^2-7x+3$ (ii.) $12ax-9ay-8bx+6by$

(iii.) a^4+a^2+1 (iv.) $abxy+b^2y^2+acx-c^2$

4. Solve the equations—

(i.) $\frac{3x-3}{4}-\frac{3x-3}{3}=\frac{15}{3}-\frac{27+4x}{9}$

(ii.) $\frac{9x+20}{36}-\frac{x}{4}=\frac{4x-12}{5x-4}$

(iii.) $\begin{cases}\frac{3x}{5}+\frac{7y}{4}=10\\\frac{2x}{7}-\frac{y}{5}=\frac{22}{35}\end{cases}$

(iv.) $3x^2+5x=8$

Illustrate the solution by graphs wherever possible.

5. A started from home on a bicycle at 7 a.m., going at the rate of eight miles an hour; when he had ridden a certain distance the machine broke down, and he was compelled to return afoot, and reached home at 6.30 p.m.: how far did he ride if he walked back at the rate of three and a half miles an hour?

6. Show how, by means of ruler and compasses, to draw a straight line through a given point in the straight line A B at right angles to A B.

Prove that the following is a correct method for erecting a perpendicular from a point A in a line A B: With A as centre, describe an arc of a circle; with the same radius, and B as centre, describe a second arc intersecting the first at O; with O as centre, and the same radius, describe a third arc; join B O, and produce it to meet the third arc in D; then A D is the perpendicular required.

7. If two triangles have a side and two adjacent angles of one equal to a side and two adjacent angles of the other, the two triangles are equal.

Through a given point draw a straight line such that the perpendiculars on it from two given points may be equal.

8. Triangles on equal bases and between the same parallels are equal in area. Show that a trapezium is bisected by the straight line that joins the middle points of its parallel sides.

9. If a straight line is divided into any two parts, the square on the whole line is equal to the sum of the squares on the two parts, together with twice the rectangle contained by the two parts.

If a straight line is divided into any three parts, the square on the whole line is equal to the sum of the squares on the three parts, together with twice the rectangles contained by each pair of those parts.

Prove both the proposition and the rider algebraically as well as geometrically.