2. State and prove Horner's method of Synthetic Division.

Apply this method to find the value of $x^6 - 7x^5 + 16x^4 - 3x^3 - 9x^2 + 13x + 4$ when $x = 3$.

3. Find the highest common divisor of $x^4 + x^3 - 20x^2 - 7x + 24$ and $2x^4 + 3x^3 - 13x^2 - 7x + 15$.

4. Find the continued product of the following quantities:

$x - a\sqrt{-1}$; $x + a\sqrt{-1}$; $x + \frac{a}{2}(\sqrt{3} + \sqrt{-1})$;

$x + \frac{a}{2}(\sqrt{3} - \sqrt{-1})$

$x - \frac{a}{2}(\sqrt{3} + \sqrt{-1})$ and $x - \frac{a}{2}(\sqrt{3} - \sqrt{-1})$

and prove that

$$\sqrt[3]{4 + 3\sqrt{-20}} + \sqrt[3]{4 - 3\sqrt{-20}} = 6.$$

5. Solve the equations

(1) $x^3 - 7 = \sqrt{x^2 - 42x + 89}$

(2) $x^3 + x\sqrt[3]{xy^2} = 208$

$y^3 + y\sqrt[3]{x^2y} = 1053$

6. State the laws governing the reduction of inequalities, and prove that

$$abc > (a+b-c)(b+c-a)(c+a-b) < \left(\frac{a+b+c}{3}\right)^3$$

a, b and c being any positive numbers whatever.

7. Find the limiting values of $\frac{x^2 + ax + b}{x^2 + cx + d}$.

8. Find the limit of the sum of a geometrical series whose first term is given, the common ratio being less than unity.

The first term of a geometrical series is $\frac{3}{4}$, and the common ratio $\frac{1}{4}$, find the limit of the sum of the series.

9. Find the number of permutations of n letters, of which p are a's, q are b's, r are c's, etc.

How many different permutations can be made of the letters in the word mammalia taken all together?

10. Write down the expansion of $(1+x)^n$ and deduce that of $\frac{1}{\sqrt{1-x^2}}$, and prove that

$$1 + 3\left(\frac{2n+1}{2n-1}\right) + 5\left(\frac{2n+1}{2n-1}\right)^2 + \ldots (2n-1)\left(\frac{2n+1}{2n-1}\right)^{n-1} = n(2n-1)$$

n being an integer.

11. Find the greatest term in the expansion of $(1+x)^n$ whenever possible.

What is the number and magnitude of the greatest term in the expansion of $(1-x)^4$ when $x = \frac{1}{3}$.

EUCLID—HONOURS.

Examiner—T. W. Wright, B.A.

1. The greater side of ever triangle is opposite to the greater angle.

In a scalene triangle, compare the sums of the altitudes and of the meridian lines.

2. Write out the geometrical meaning of the following identical equations, drawing the necessary figures:

$$a(a+b) + b(a+b) \quad (a+b)^2.$$

$$(a+b)^2 + (a-b)^2 = 2a^2 + 2b^2.$$

3. Show that two circles may have four, three, two, one, or no common tangents, and explain how to draw the tangents in the possible cases.

4. Inscribe a square in a quadrant of a circle, and also in a semicircle, and compare their areas.

5. Write a short essay on Euclid's doctrine of proportion.

6. Divide a triangle into two equal parts:

(1) By a line parallel to a given line.

(2) By a line perpendicular to the base of the triangle.

7. Find the arithmetic, geometric and harmonic means between two given straight lines.

From your figures infer the relative magnitudes of the three means.

8. Construct a triangle, being given:

(1) The middle points of the three sides.

(2) The three altitudes.

9. Inscribe a square in a given pentagor.

10. Similar polygons may be divided into the same number of similar triangles, which are to each other as the polygons themselves, and the polygons are to one another as the squares of their homologous sides.

If a square inch on a drawing represents a surface of 484 square yards, what is the scale of the drawing?

11. Of the three squares which can be inscribed in a given triangle give the greatest.