TRIGONOMETRY.

1. Express the values of—

$$\begin{aligned} &\text{Sin}(A+B)= \\ &\text{Cos}(A+B)= \\ &\text{Sin}(A-B)= \\ &\text{Cos}(A-B)= \end{aligned}$$

2. Show that—

$$\begin{aligned} \text{Sin}A &= 2\,\text{Sin}\tfrac{1}{2}A\,\text{Cos}\tfrac{1}{2}A. \\ 1+\text{Cos}A &= 2\,\text{Cos}^2\tfrac{1}{2}A. \\ 1-\text{Cos}A &= 2\,\text{Sin}^2\tfrac{1}{2}A. \end{aligned}$$

3. Show that $\text{Tan}\,\overline{A+B+C} = \dfrac{\text{Tan}A+\text{Tan}B+\text{Tan}C - \text{Tan}A\,\text{Tan}B\,\text{Tan}C}{1-\text{Tan}A\,\text{Tan}B-\text{Tan}A\,\text{Tan}C-\text{Tan}B\,\text{Tan}C}$.

Show also that the sum of the tangents of the three angles of a plane triangle is equal to their product.

4. Given the base, the vertical angle, and the sum of the sides of a plane triangle, to find the sides.

5. Write down the general value of θ which satisfies both $\text{Sin}\,\theta = -\frac{1}{2}$ and $\text{Cos}\,\theta = -\frac{\sqrt{3}}{2}$; also the value of θ when $\text{Sec}^2\theta = 2$.

6. Express the logarithms of 9900, ·0099, 9900^2, $\sqrt{\cdot 0099}$.

7. The vertical angles from the opposite shores of a lake to a mountain-top 2,730 ft. above its level were 5° 17′ 30″ and 7° 19′ 45″: what is the breadth of the lake and the distance of the mountain from its furthest shore, the height of the eye at each station being 5 ft. above the lake?

8. The diameters of two concentric circles are 150 ft. and 100 ft.: what is the area of the ring included between their circumferences?

9. In the triangle ABC, the angle A is 34° 28′, the angle C = 91° 52′, and the side AC = 266: what are the sides AB and BC?

10. In the triangle ABC, if AB = 610, BC = 1063, and the angle B = 30° 29′, what are the angles A and C, and the side AC?

ALGEBRA.

1. Reduce to its simplest form $(a-x)-(2x-a)-(2-2a)+(3-2x)-(1-x)$.
2. Find the G.C.M. of $x^2-7x+10$ and $4x^3-25x^2+20x+25$.
3. Simplify $\dfrac{2\frac{1}{4}-\frac{1}{3}x}{\frac{3}{8}x-1\frac{1}{2}}$ and $\dfrac{x-\frac{5}{2}(3x-2)}{3}$.
4. Divide $\dfrac{a^2-b^2}{(a-b)^2}$ by $\dfrac{a^2+ab}{a-b}$.
5. Extract the square root of $\dfrac{x^2}{y^2} - 2 + \dfrac{y^2}{x^2} + \dfrac{2x^2}{y} - 2y + x^2$.
6. Multiply $3\sqrt{(a-b)}$ by $4\sqrt[3]{(a-b)}$; and from $5\sqrt{(a-x)^3}$ take $2a\sqrt{(a-x)}$.
7. Solve the following equations:—

$$\left.\begin{aligned} \frac{x}{a}+\frac{y}{b}&=p. \\ \frac{x}{c}-\frac{y}{d}&=q. \end{aligned}\right\}$$

$$\left.\begin{aligned} \tfrac{1}{3}x-\tfrac{1}{4}y+\tfrac{1}{2}z&=5. \\ \tfrac{1}{4}x+\tfrac{1}{3}y-\tfrac{1}{5}z&=3. \\ 2x-\tfrac{1}{5}y+\tfrac{1}{10}z&=17. \end{aligned}\right\}$$

8. By selling goods for £56 a man gained as much per cent. as they cost him: what did they cost him?
9. The tenth part of the sum of two numbers is equal to the fourth part of their difference, and one of them is as much greater than 10 as the other is less than it. Find them.
10. Expand $(a-b)^6$, and explain the process you adopt.

GEOMETRY.

1. Define the terms *axiom, corollary, hypothesis, converse proposition, problem, theorem.*
2. If two triangles have two sides of the one equal to two sides of the other, each to each, and have likewise the angles contained by those sides equal to each other, they shall likewise have their bases or third sides equal, and the two triangles shall be equal, and their other angles shall be equal, each to each, namely, those to which the equal sides are opposite.
3. Through a given point on either side of a straight line of unlimited length draw the perpendicular and the parallel of the line.
4. If two straight lines be divided into any number of parts, the rectangle contained by the two straight lines is equal to the rectangles contained by the several parts of one line and the several parts of the other respectively.
5. If one circle touch another internally in any point, the straight line which joins their centres, being produced, shall pass through that point of contact.
6. From a given circle cut off a segment which shall contain an angle equal to a given rectilineal angle.
7. In a given circle inscribe a triangle equiangular to a given triangle.
8. If from a point without a circle any number of straight lines are drawn to the circumference, show that only two of them can be equal to each other, and that, if produced, neither of any of the pairs of equal lines will pass through the centre.