10. If two straight lines in a circle cut one another the rectangle contained by the segments of the one is equal to the rectangle contained by the segments of the other.

If one straight line in a circle bisects another, the difference of their squares is equal to the square of the difference of the segments of the bisecting line.

Trigonometry.

1. Taking as unit angle the angle of a regular six-sided figure, find the measure of an angle of a regular twelve-sided figure.

2. As angle increases, its sine sometimes increases and sometimes diminishes; when does it increase? Can the angle's tangent ever diminish as the angle increases?

3. Given the sine of an angle, how can the cosine, tangent, secant, &c., of the angle be found?

4. How would you with ruler and compasses, construct an angle of which the cosine is a given fraction, say $\frac{2}{5}$? If the cosine were $-\frac{2}{5}$, how would you find the angle?

5. Prove that the sine and cosine of an angle are respectively the cosine and sine of the angle's complement.

6. Calculate the sines and cosines of half a right angle and of two-thirds of a right angle.

7. Prove the following:

$$(1) \ (1 + \cos^2 A) \ (1 - \cos^2 A) = 1.$$
$$(2) \ \sec^2 A + \csc^2 A = \sec^2 A \csc^2$$
$$(3) \ \tan^2 A - \sin^2 A = \tan^2 A \sin^2 A.$$

8. Prove formula.
$$\cos (A + B) = \cos A \cos B - \sin A \sin B.$$
Hence find cos 2 A.

9. How long is the shadow cast by a vertical pole 15 feet high, when the sun is 30° above the horizon?

Geometrical and Freehand Drawing.

1. Construct a square of 2 in. side and an isosceles triangle having the same area as the square and a base of 2.5 in.

2. Divide a straight line of 2.5 in. into seven equal parts.

3. Construct a regular octagon of 1 in. inside.

4. Reduce an octagon equal to that in question 3 to a triangle of equal area.

5. Given a point and a straight line, draw a line through the point parallel to the given line.

6. Draw a line tangent to a given circle from a given point in the circle.

7. Make a freehand drawing of the objects before you:
   (a) A cylinder cut to turn a right angle.
   (b) A cube standing on a plinth.

8. Copy to half size the Eogoth exhibited.

NOTE.—No mechanical measurement will be allowed in questions 7 and 8. In the geometrical questions construction lines are to be dotted, and all results are to be obtained by direct construction and not by trial.

Algebra.

1. Multiply the sum of $\frac{1}{4} x^2 + 2 \ xy$ and $\frac{3}{4} x^3 - xy + y^2$ by $x^2 - xy + y^3$.