find the number of different arrangements that can be made with them, each set being kept intact, though the order of books in it may be changed.

Bookwork.

Treat each set as one book, then we have 13 books, which may be arranged in $\underline{|13}$ different ways; if, however, each set may be in order, either from right to left or from left to right, result is $2^3 . \underline{|13}$, ∵ each set may be arranged two ways; now, keeping the sets, the volumes of first set may be arranged among themselves in $\underline{|5}$ ways, and so for the others; final result being $2^3 . \underline{|13} . \underline{|5} . \underline{|3} . \underline{|2}$.

8. Two equal circles touch a straight line at A and B, and do not intersect, and on each of them at equal intervals are situate $2n+1$ points, A and B being such points. The only lines that contain more than two of the points are those that are parallel to AB. Find the number of triangles that can be formed by joining these points, both circles being utilized for each triangle.

Take a, or $A, a_2, a_3 \ldots a_{2n+1}$; b, or B, $b_2, b_3 \ldots b_{2n+1}$; as the points of division; by hypothesis and symmetry of the figure no straight line can be drawn containing more than two points except the n lines parallel to AB, each containing four points. Total number of triangles that can be formed with a_n say on the A circle and any two points on the B circle is $C(2n+1, 2)$, the same being true for every one of the $2n+1$ points on each circle; total number of triangles is $2(2n+1)\ C(2n+1, 2)$; this result however is attained on the assumption that no straight line contains more than two points, but all lines parallel to AB contain four points. Above result diminished ∴ by $4n$ gives

$$2(2n+1)\frac{(2n+1)2n}{\underline{|2}}-4n$$

or $2n[(2n+1)^2-2]$ as the number of triangles.

9. Shew how to determine the greatest term in the expansion of $(a+x)^n$.

Bookwork.

10. (1) The coefficient of x^r in the expansion of $(1-x)^{-\frac{3}{2}}$ is $\dfrac{\underline{|2r+1}}{(\underline{|r})^2}\cdot\dfrac{1}{2^{2r}}$.

(2) If a_r be the coefficient of x^r in the expansion of $(1+x)^n$, then, n being a positive integer,

$$\frac{a_1}{a_0}+\frac{2a_2}{a_1}+\frac{3a_3}{a_2}+\ldots+\frac{na_n}{a_{n-1}}=\tfrac{1}{2}n(n+1).$$

(1) Coefficient of x^r

$$=\frac{\frac{3}{2}(\frac{3}{2}+1)(\frac{3}{2}+2)\ldots(\frac{3}{2}+r-1)}{\underline{|r}}$$

$$=\frac{3\cdot5\cdot7\ldots(2r+1)}{\underline{|r}}\cdot\frac{1}{2^r}$$

$$=\frac{1\cdot2\cdot3\cdot4\ldots(2r+1)}{\underline{|r}\ \underline{|r}}\cdot\frac{1}{2^r\cdot2^r}$$

$$=\frac{\underline{|2r+1}}{(\underline{|r})^2}\cdot\frac{1}{2^{2r}}.$$

(2) $\dfrac{a_1}{a_0}=n,\ \dfrac{2a_2}{a_1}=n-1$, etc.=etc.

$$S=n+(n-1)+\ldots+3+2+1=\frac{n(n+1)}{2}.$$

EUCLID.

1. Where would the difficulty in the theory of parallel lines present itself, if they were defined to be such that a transversal falling on them made the alternate angles equal?

2. If there be two straight lines the rectangle contained by their sum and one of them is equal to the square on that one together with the rectangle contained by the two straight lines.

3. In any triangle the squares on the two sides are together double of the squares on half the base and on the straight line joining its bisection with the opposite angle.

If a point be taken such that the sum of the squares on the lines joining it to the an-