'ROUND TABLE TALKS.

G. B. C.—(1) If the increase in the number of male and female criminals is $2\frac{1}{2}$ per cent, while the decrease in the number of males alone is $7\frac{1}{2}$ per cent, and the increase in the number of females is $10\frac{1}{4}$ per cent; compare the antecedent number of male and female prisoners.

(2) If three fluids, whose volumes are 3, 7, 12, and their specific gravities ·95, 1·15 and 1·36, be mixed together, what will be the specific gravity of the compound?

(3) In the figure of Euclid II, 11, show that if BE and CH meet at O, AO is at right angles to CH.

(4) In the figure of Euclid II, 11, show that the lines BG, DF, AK are parallel.

(1) $2\frac{1}{2}$ per cent of the males + $2\frac{1}{2}$ per cent of the females are equal to $10\frac{1}{4}$ per cent of the females − $7\frac{1}{2}$ per cent of the males.

∴ 10 per cent of the males $= 7\frac{3}{4}$ per cent of the females.

40 " " " $= 31$ " "

There are therefore 31 males for every forty females.

(2)

$$\begin{aligned} 3 \times ·95 &= 2·85 \\ 7 \times 1·15 &= 8·05 \\ 12 \times 1·36 &= 16·32 \\ \hline 22 \text{ volumes} \quad & \quad 27·22 \end{aligned}$$

$$\text{Specific gravity} = \frac{27·22}{22} = 1·2372\ldots$$

(3) Since EF = EB, therefore angle EBF = angle EFB. And in the triangles OBL, CFL, we have the angles OLB, CLF right angles, therefore the angle FCL = the angle BOL = the angle EOC.

Therefore EO = EC = EA, and the angles EAO, ECO = the angles EOA, EOC = the angle AOC. Therefore the angle AOC must be equal to a right angle as it is equal to one-half of the three angles of the triangle AOC.

(4) Produce FG and DB to meet at M. Then by the converse of I. 43, since the square FH = the rectangle HD, H lies on the diagonal CM. Join GD and FB. Then the triangle FGB = the triangle GBD (Ax. 7) and GB is parallel to FD (I 39).

K. E. O'Brien.—(1) Three men bought a grindstone four feet in diameter, paying equal sums. The first ground off his share, the second an equal share, and likewise the third. If one-fourth of the grindstone was left, what was the thickness ground by each?

(2) Show that ${}^{n+1}C_r = {}^nC_r + {}^nC_{r-1}$

(3) Produce a given straight line so that the rectangle contained by the whole line thus produced and the part produced may be equal to the square on another given line.

(1) The areas of the concentric circles will be to each other as the squares of their diameters.

It is evident that each man uses one-fourth of the grindstone. To find the diameter of the unused part: (Diameter in inches).

$$4 : 1 :: 48^2 : \text{diam.}^2$$
$$48^2 = 4 \text{ diam.}^2$$
$$24 = \text{diameter of the unused part.}$$

To find the part used by the third man:

$$2 : 1 :: 48^2 : \text{diam.}^2$$
$$1152 = \text{diam.}^2$$
$$33.94 = \text{diam.}$$

$$\therefore \text{ the third man uses } \frac{33.94 - 24}{2} = 4.97 \text{ in.} = .41 + \text{ ft.}$$

To find the part used by the second man:

$$4 : 3 :: 48^2 : \text{diam.}^2$$
$$3 \times 48^2 = \text{diam.}^2$$
$$41.56 = \text{diam.}$$
$$\therefore \frac{41.56 - 33.94}{2} = 3.81 \text{ in.} = .31 + \text{ft.}$$

To find the part used by the first man:

$$\frac{24 - 41.56}{2} = 3.22 \text{ in.} = .26 + \text{ft.}$$

[Note.—The answers given in the book are wrong.]

(2)

$$\begin{aligned} {}^nC_r + {}^nC_{r-1} &= \frac{\underline{|n}}{\underline{|r}\,\underline{|n-r}} + \frac{\underline{|n}}{\underline{|r-1}\,\underline{|n-r+1}} \\ &= \frac{\underline{|n}}{\underline{|r}\,\underline{|n-r+1}} \left\{ n - r + 1 + r \right\} \\ &= \frac{(n+1)\,\underline{|n}}{\underline{|r}\,\underline{|n-r+1}} \\ &= \frac{\underline{|n+1}}{\underline{|r}\,\underline{|n+1-r}} \\ &= {}^{n+1}C_r \end{aligned}$$

(3) Let AB and X be the given line. Bisect AB in P. From B draw BC at right angles to AB, making BC = X. Produce PB to Q, making PQ = PC. Then $AQ.QB + PB^2 = PQ^2$ (II, 6) $= PB^2 + X^2$.

Therefore $AQ.QB = X^2$.

L. O. W.—(1) If through a point O within a parallelogram ABCD two straight lines are drawn parallel to the sides, and the parallelograms OB, OD are equal, the point O is in the diagonal AC.

(2) If two right-angled triangles have the hypotenuse and one side of the one equal respectively to the hypotenuse and one side of the other, the triangles are equal in all respects. Prove this by Prop. E., Hamblin Smith's Geom.

(1) If O be not in AC, let it lie on the side of AC nearest to B, and let the line drawn through O parallel to BC cut AC in P. Through P draw another line parallel to CD. Then the parallelogram BP = parallelogram PB. Therefore parallelogram OB is less than the parallelogram OD, which is contrary to the hypothesis. Similarly it may be shown that O does not lie on the side of AC nearest to D; and therefore O will be in AC.

(2) This theorem cannot be a corollary of Prop. E, unless we assume II, 32.