ARTS DEPARTMENT.

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UNIVERSITY OF TORONTO,

Junior Matriculation.

MATHEMATICS.—PASS.

Solutions by WILBUR GRANT, Toronto Collegiate Institute. (See C. E. MONTHLY for July-August, 1881.)

8. Solve the equations

$$(4)\quad \begin{cases} xy-yz=18. & (1)\\ x^2+z^2=4y^2+2xz. & (2)\\ x^2-8=2xy+2xz. & (3)\end{cases}$$

(1) gives $(x-z)y=18$.

(2) " $(x-z)^2=4y^2$,

which give $y=3$,

(2) − (3) $z^2+8=4y^2-2xy$.

Substituting from (1) for $2xy$

$$z^2+2yz+44=4y^2.$$

Substituting value of y and solving as quadratic in z we get $z=-2$ or -4,

$$\therefore\ x=4 \text{ or } 2$$
$$y=3.$$

9. There are two vessels, A and B, each containing a mixture of water and wine, A in the ratio of $2:3$, B in the ratio of $3:7$. What quantity must be taken from each in order to form a third mixture which shall contain 5 gallons of water and 11 of wine?

Let x=quantity of water taken from A.

a= " wine " A.

y= " water " B.

b= " wine " B.

$$\frac{x}{a}=\frac{2}{3}\quad \frac{y}{b}=\frac{3}{7}\quad \begin{matrix} x+y=5\\ a+b=11,\end{matrix}$$

from which four equations we get

$x+a=2$ galls. = quantity from A,

$x+b=14$ " = " B.

10. A straight line AD is divided into three equal parts by the points B and C; on AB, BC, CD are described equilateral triangles AEB, BFC, CGD respectively; shew that the three straight lines AE, AF, AG, can form a triangle equal in area to the equilateral triangle AEB.

$AB=BC=CD \triangle ABE=\triangle BCF$

$=\triangle CDG$ in all respects,

$\therefore$ FG is parallel to AD;

but $\angle DCG=\angle CBF$,

$\therefore$ CG is parallel to BF;

$\therefore$ BG is a parallelogram and $\triangle BFC$

$=\triangle CFG$; but $\triangle FAG=\triangle FCG$,

$\therefore$ $\triangle FAG=\triangle ABE$.

PROBLEMS.—HONORS.

1. If a straight line terminated by the sides of a triangle be bisected, no other line terminated by the same two sides can be bisected in the same point.

BE is bisected at F. Suppose GH bisected at F also, join AH.

Because $BF=FE$,

$\therefore$ $\triangle ABF=\triangle AFE$.

Because $AE>AH$,

$\therefore$ $\triangle AEF>AHF$,

$\therefore$ $\triangle ABF>AHF$.

But since $GF=FH$,

$\therefore$ $\triangle AFG=\triangle AFH$.

But $\triangle ABF>AFH$,

$\therefore$ $\triangle ABF>AGF$,

$\therefore$ $AB>AG$, which is impossible,

$\therefore$ no line but BE can be bisected at F and terminated by sides.

2. If two equal circles be described cutting