1968

Nomography

Scotty Andrews
Ouachita Baptist University

H 517
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NOMOGRAPHY

SPECIAL STUDIES

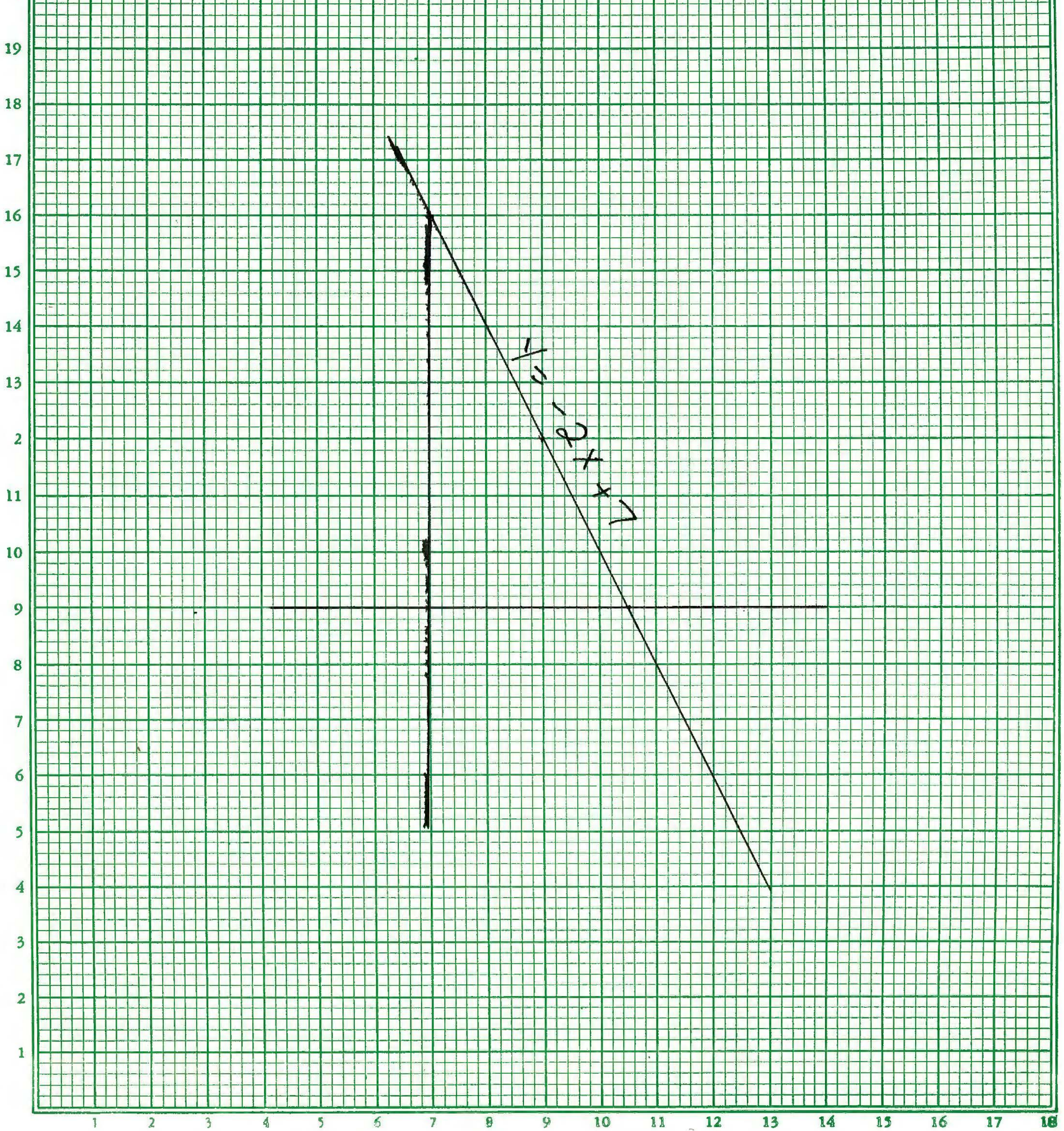
H 491

Scotty Andrews

CARTESIAN CO-ORDINATE REPRESENTATION

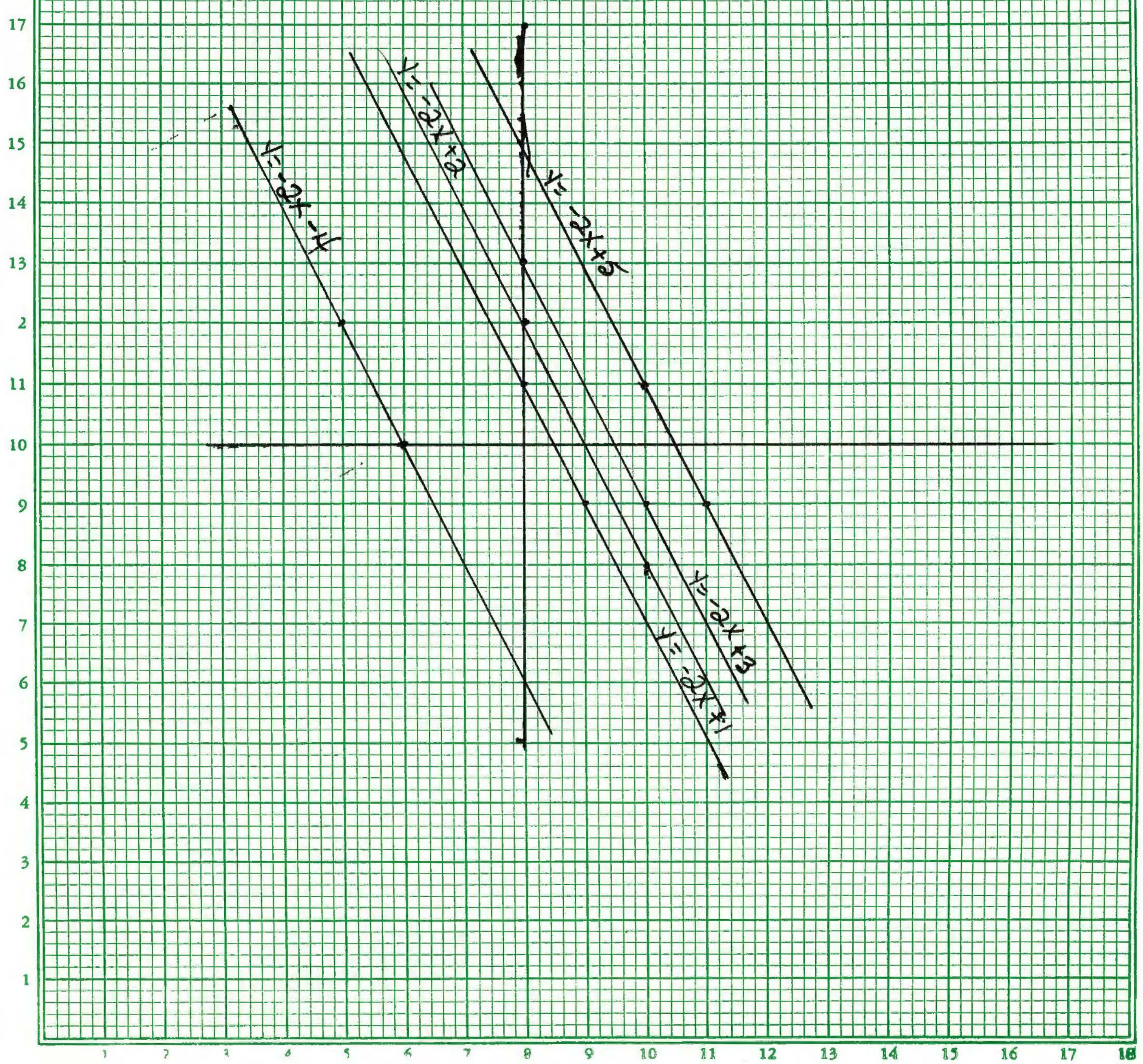
OF

$$\boxed{Y = MX + B}$$



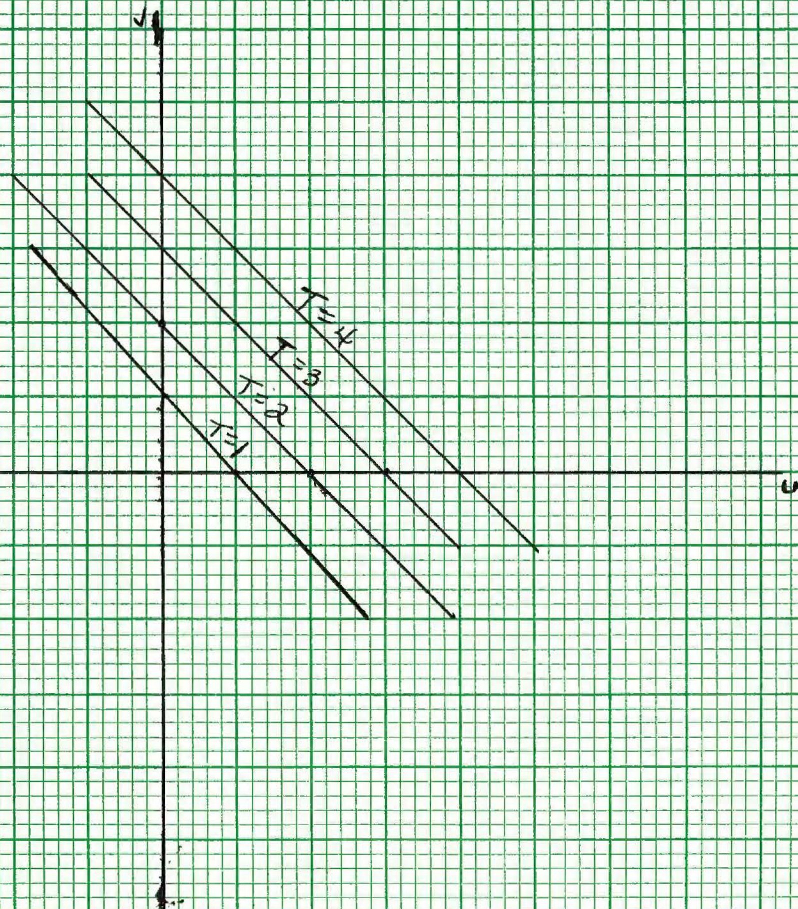
CARTESIAN CO-ORDINATE REPRESENTATION OF

$\boxed{Y = MX + B}$



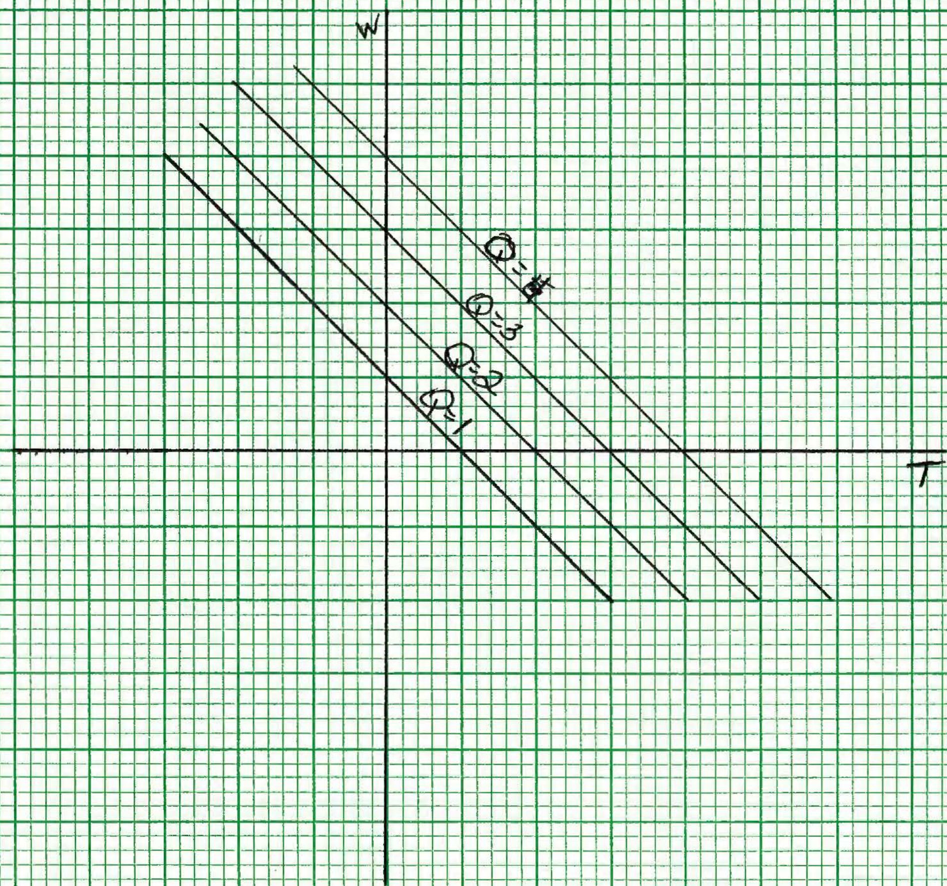
CARTESIAN CO-ORDINATE REPRESENTATION OF

$$\boxed{U + V = T}$$



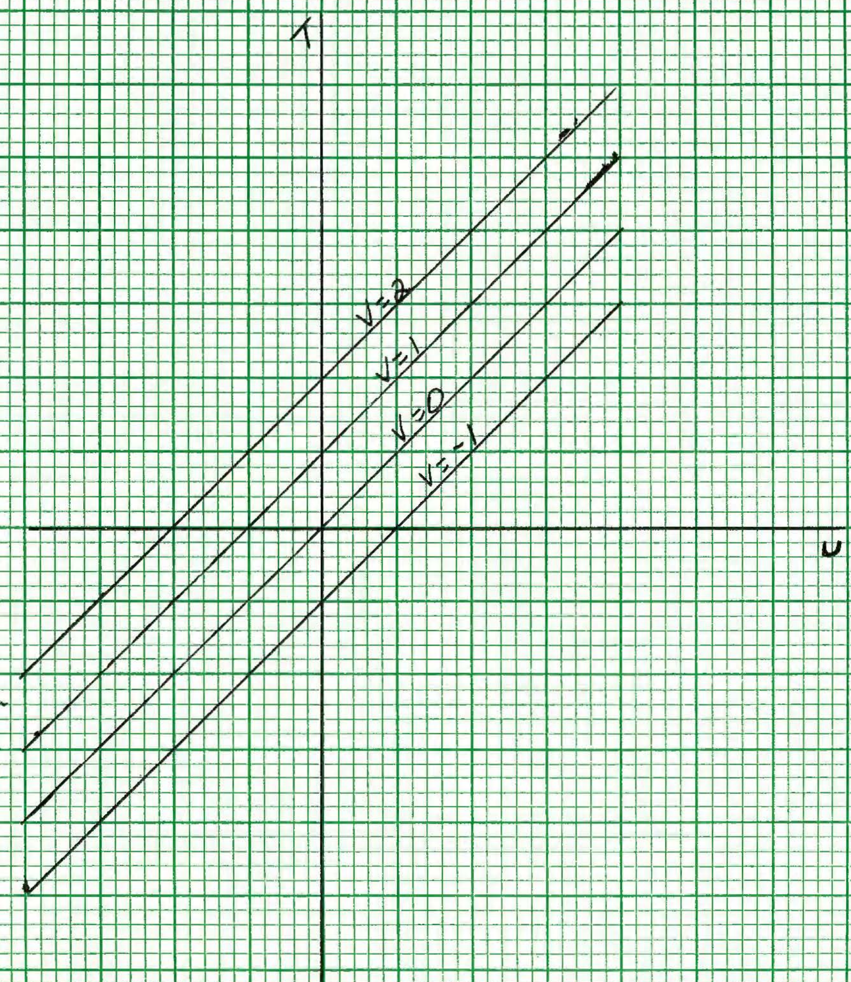
CARTESIAN CO-ORDINATE REPRESENTATION OF

$$\boxed{T + W = Q}$$



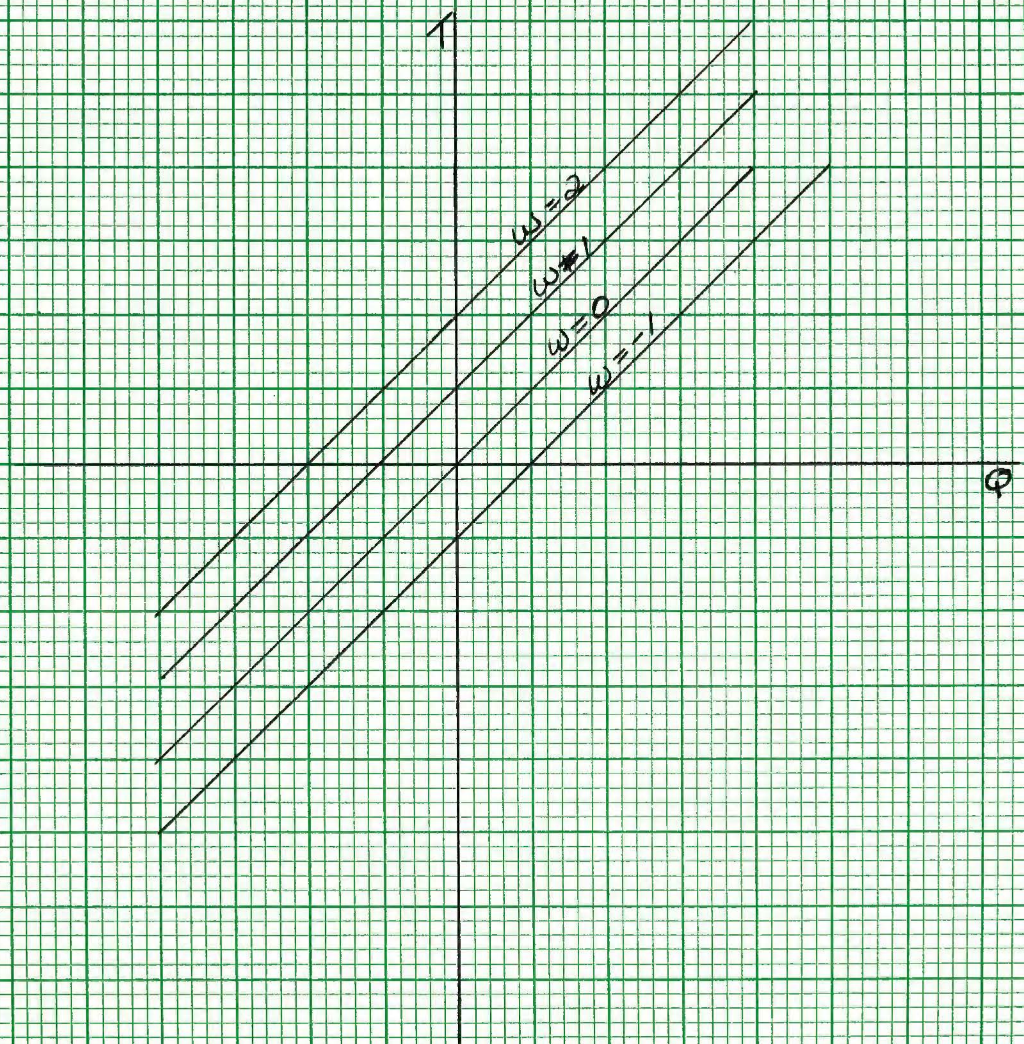
CARTESIAN CO-ORDINATE REPRESENTATION OF:

$$\boxed{T = U + V}$$



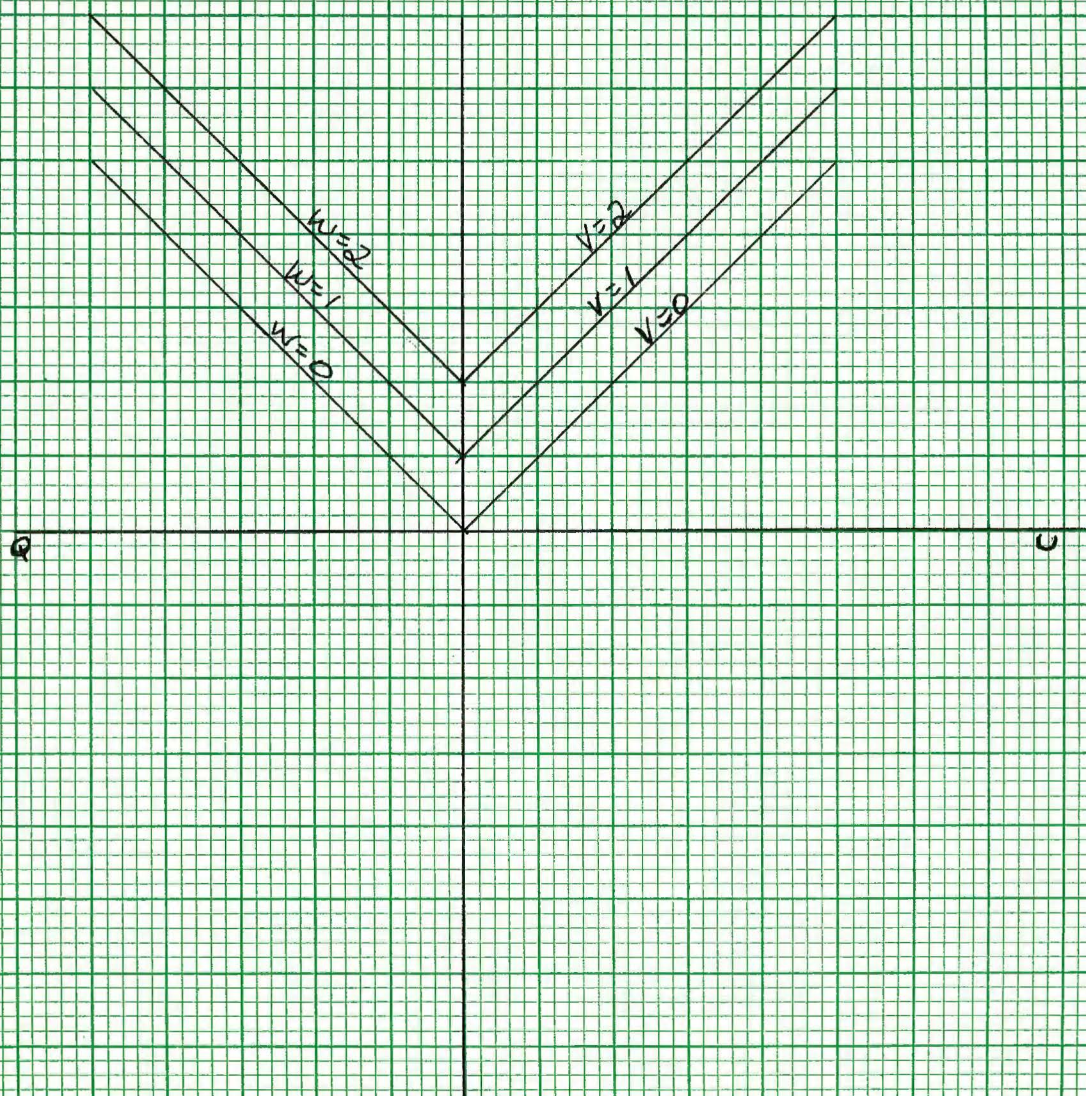
CARTESIAN CO-ORDINATE REPRESENTATION OF:

$$\boxed{T = Q - W}$$



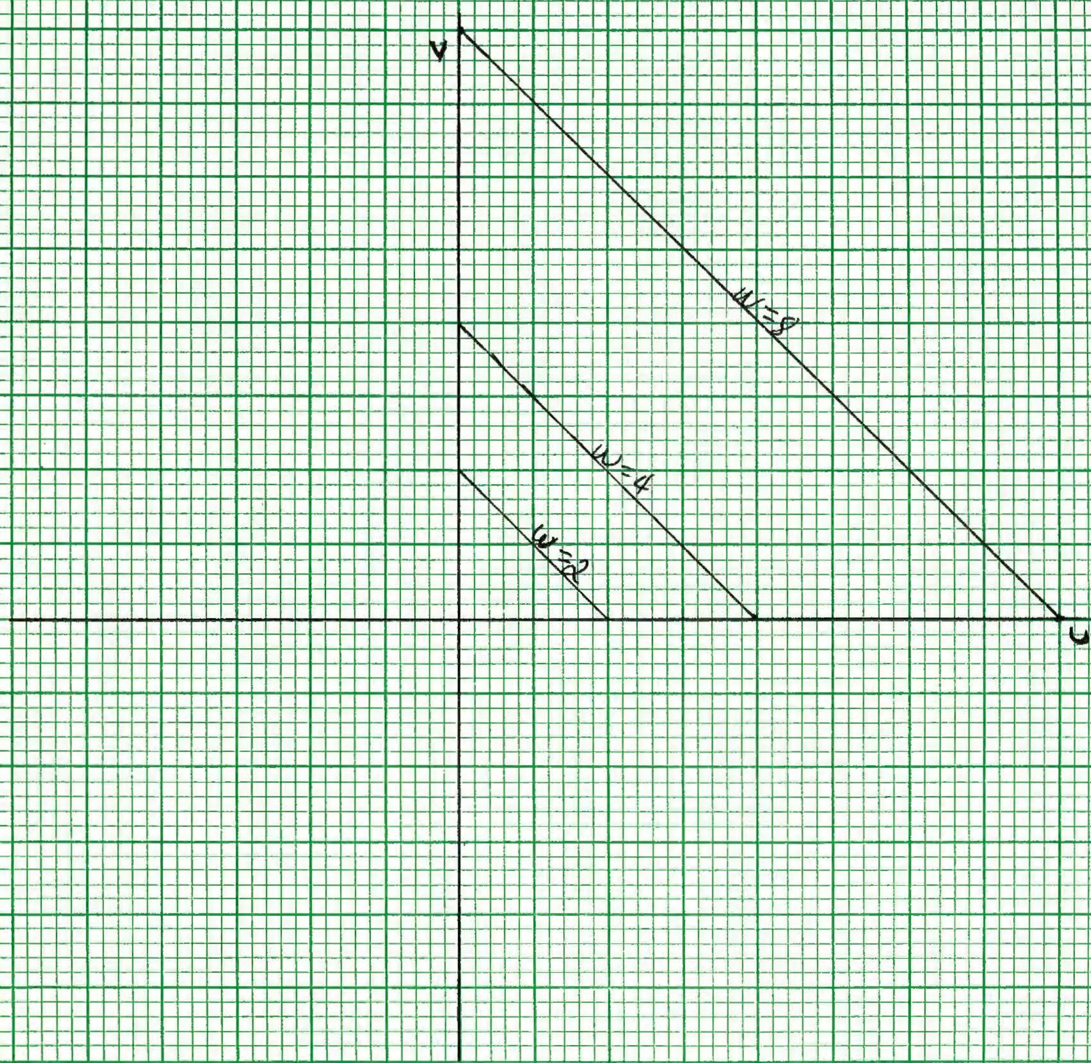
CARTESIAN CO-ORDINATE REPRESENTATION OF:

$$\boxed{U + V + W = Q}$$



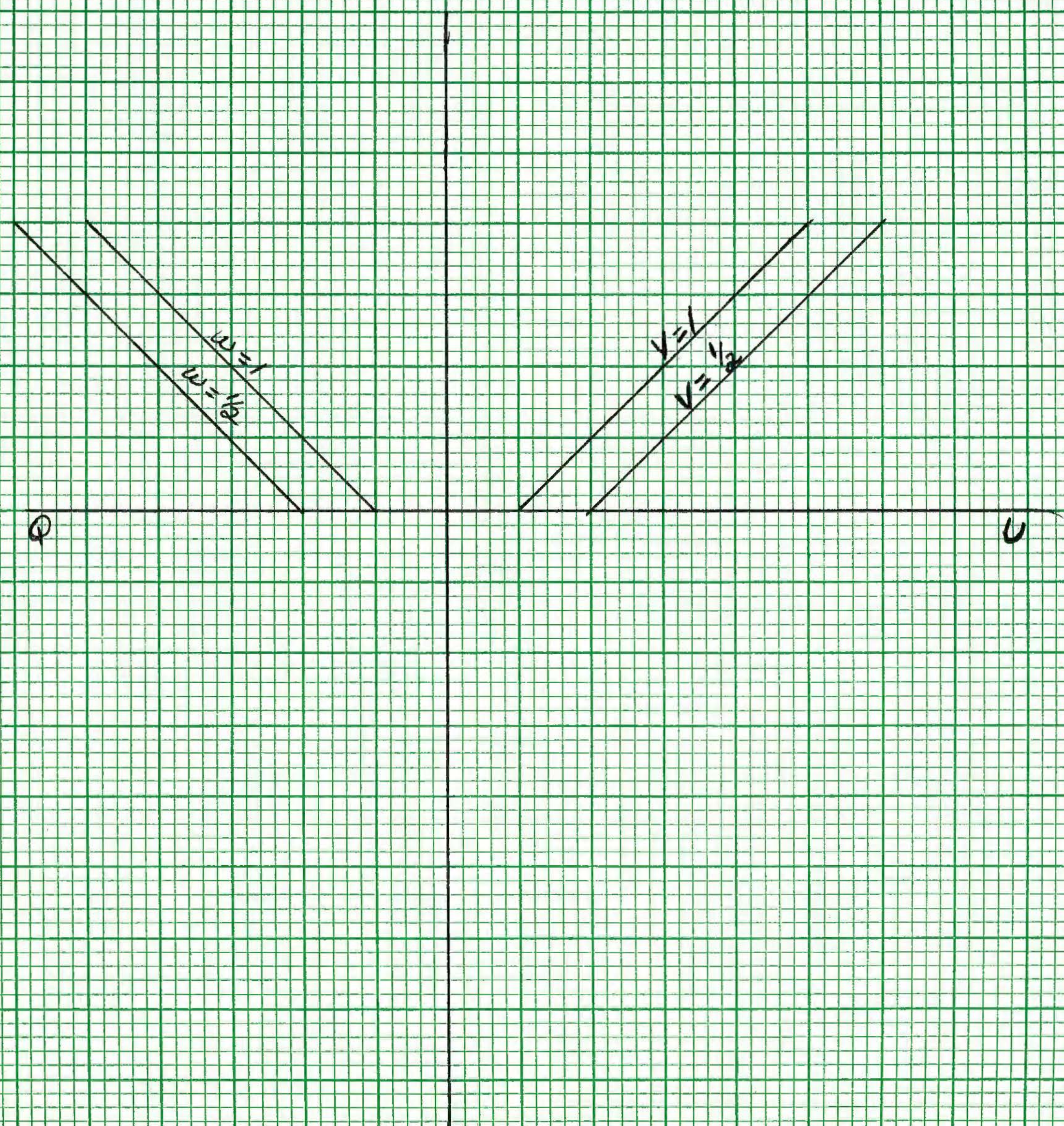
CARTESIAN CO-ORDINATE REPRESENTATION OF:

$$\boxed{UV = W}$$



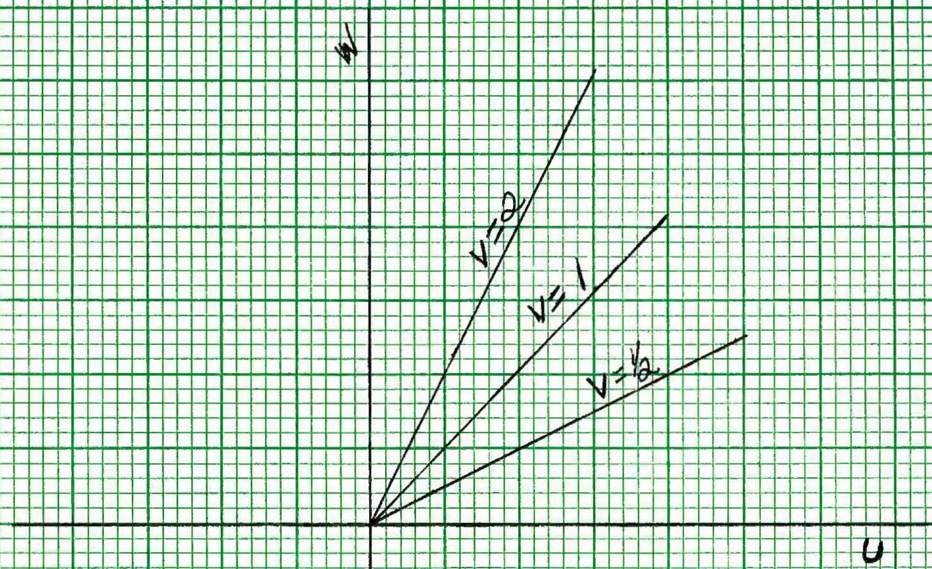
CARTESIAN CO-ORDINATE REPRESENTATION OF:

$\boxed{U\ V\ W = Q}$



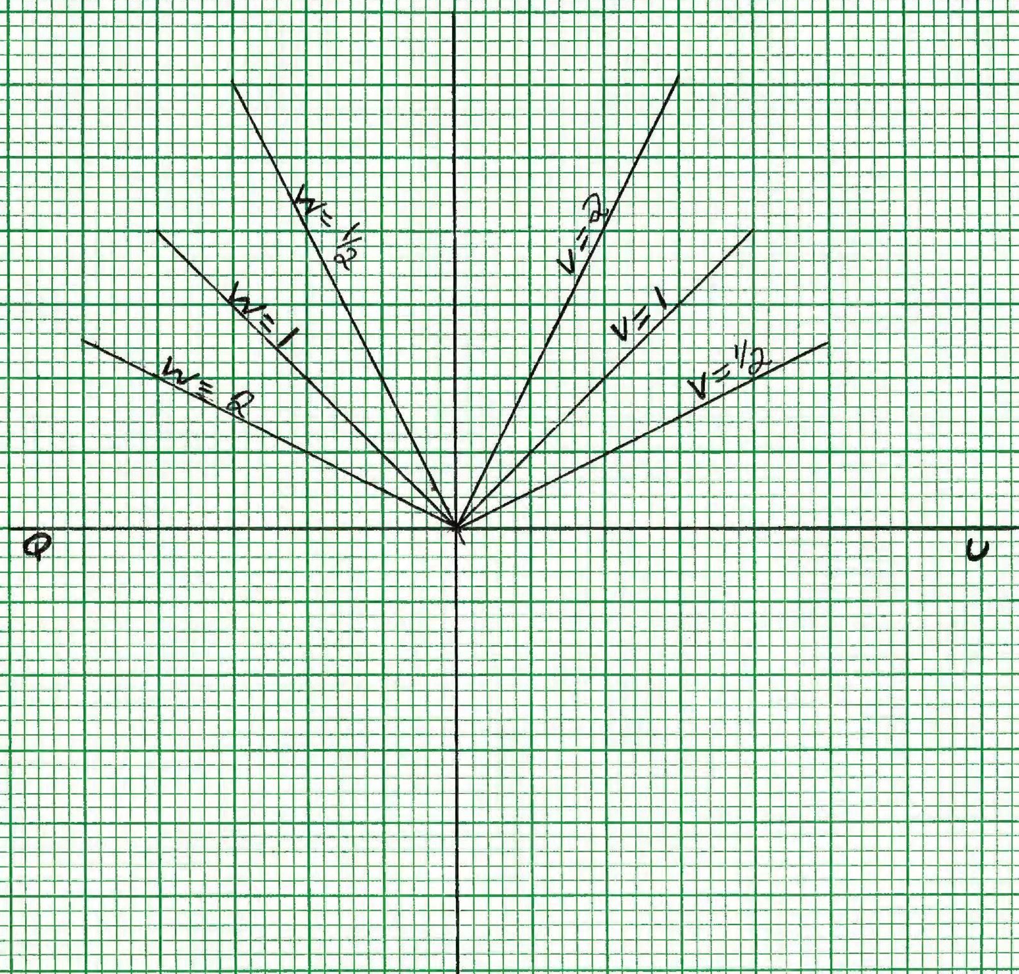
CARTESIAN CO-ORDINATE REPRESANTATION OF:

$$\boxed{UV = W}$$



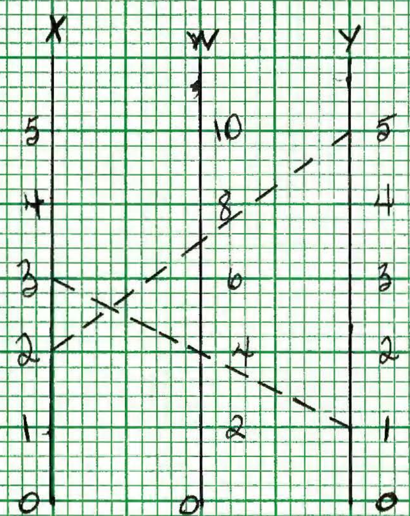
CARTESIAN CO-ORDINATE REPRESENTATION OF:

$$\boxed{UVW = Q}$$



ALIGNMENT CHART

$\boxed{X + Y = W}$



FUNCTIONAL SCALE

$$\boxed{f(u) = \sqrt{u}}$$

when u varies from 0 to 100, scale length approx. 6 in.

$$m_u = \frac{6''}{\sqrt{100} - \sqrt{0}} = \frac{6}{10} \qquad x_u = 0.6\sqrt{u}$$

FUNCTIONAL SCALE

$$\boxed{f(u) = \frac{1}{u^2}}$$

where u varies from 1 to 3, scale length 6 inches.

$$m_u = \frac{6}{\left[\frac{1}{1^2} - \frac{1}{3^2}\right]} = 6.75 \qquad x_u = 6.75\left[\frac{1}{u^2} - \frac{1}{1^2}\right]$$

FUNCTIONAL SCALE

$$\boxed{f(u) = \log u}$$

where u varies from 2 to 10, scale length 7 inches

$$m_u = \frac{7}{\log 10 - \log 2} = \frac{7}{\log 5} = 10$$

$$x_u = 10(\log u - \log 2)$$

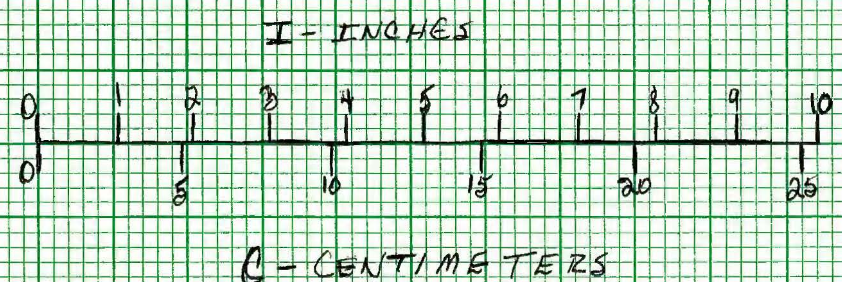
ADJACENT SCALES FOR SOLUTION OF

$$\boxed{f_1(u) = f_2(v)}$$

Consider the relation $2.54\,I = C$, where I is inches and C is centimeters. Let I vary from 0 to 10; scale length 6 inches

$$I = \frac{C}{2.54} \qquad X_I = m_I I, \text{ or } 6 = m_I 10$$

$$m_I = 0.6 \qquad X_I = 0.6\,I$$



NON-ADJACENT SCALES FOR SOLUTION

OF

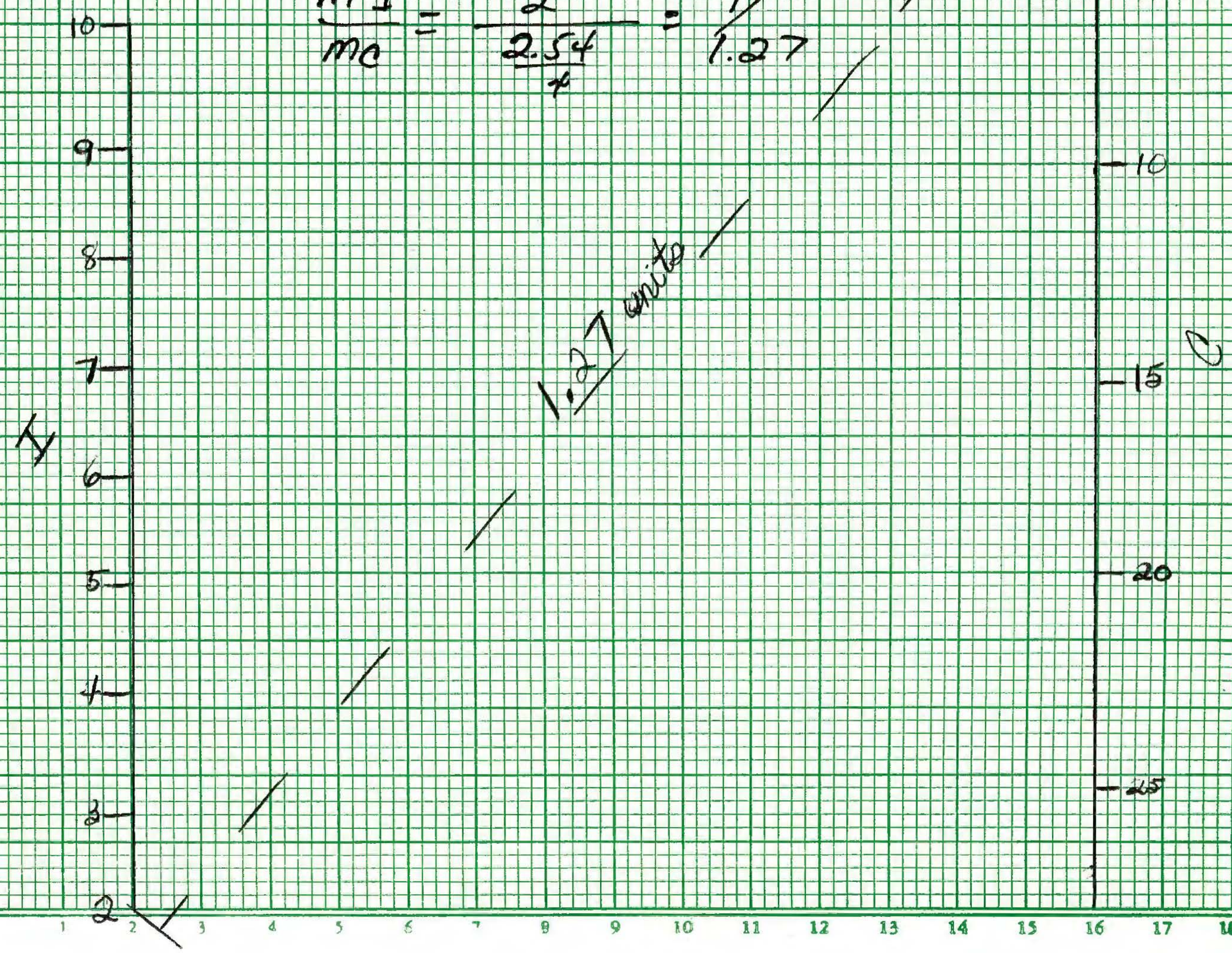
$$\boxed{f_1(u) = f_2(v)}$$

Let $X_u = m_u f_1(u)$ and $X_v = m_v f_2(v)$

Consider the equation $2.54\,I = C$

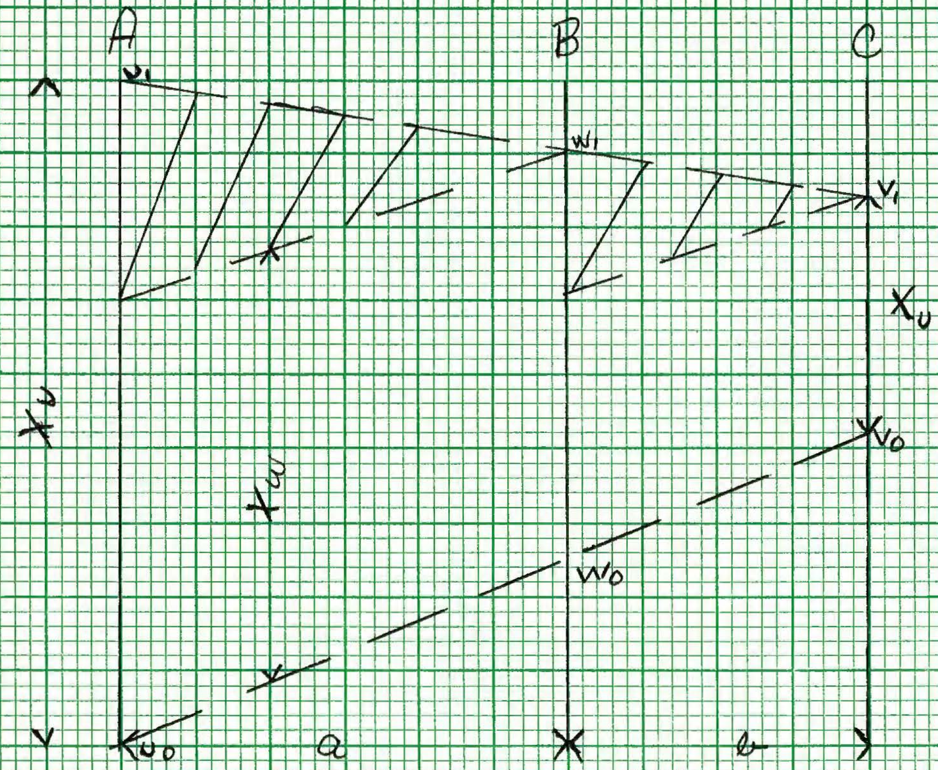
Let $X_I = \frac{1}{2} I$; $X_C = \left(\frac{2.54}{4}\right)\left[\frac{C}{2.54}\right] = \frac{C}{4}$

$$\frac{m_I}{m_C} = \frac{\frac{1}{2}}{\frac{2.54}{4}} = \frac{1}{1.27}$$



ALIGNMENT CHART

$$\boxed{f_1(u) + (f_2(v) = f_3(w)}$$



$f_1(u) + f_2(v) = f_3(w)$ EXAMPLE

$$I = \frac{1}{12} b d^3$$

Where I is moment of inertia of a rectangle about its axis parallel to b, where b is width and d is the height.

Let b vary from 1 to 10 inches, d from 1 to 10 inches.

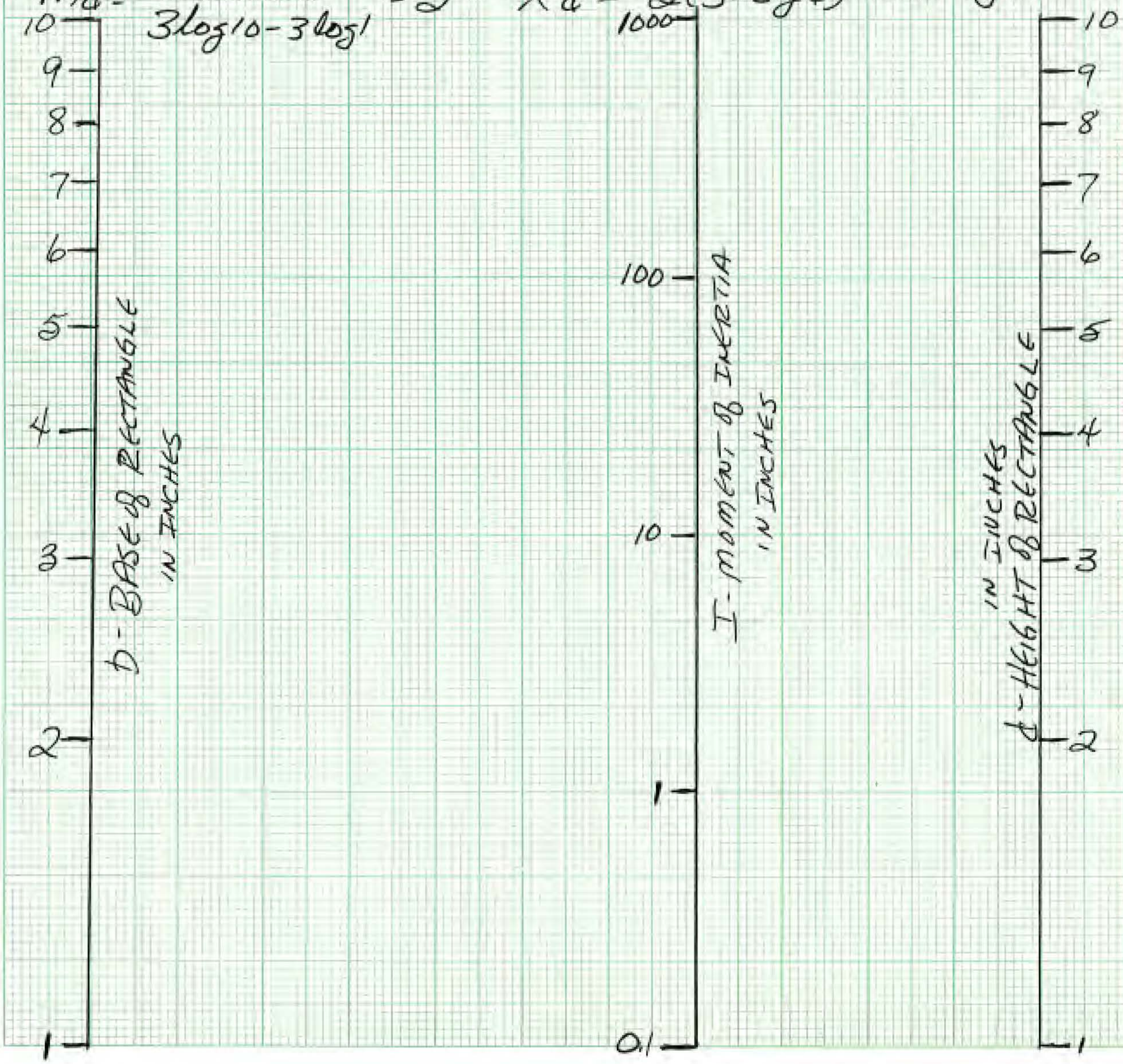
Length of scales, 6 inches

The equation, which may be written $bd^3 = 12 I$, is put in the type form by taking logarithms; thus we obtain

$$\log b + 3 \log d = \log I + \log 12$$

$$m_b = \frac{6}{\log 10 - \log 1} = 6 \qquad X_b = 6 \log b$$

$$m_d = \frac{6}{3 \log 10 - 3 \log 1} = 2 \qquad X_d = 2(3 \log d) = 6 \log d$$



$f_1(u)+f_2(v)=f_3(w)$ EXAMPLE

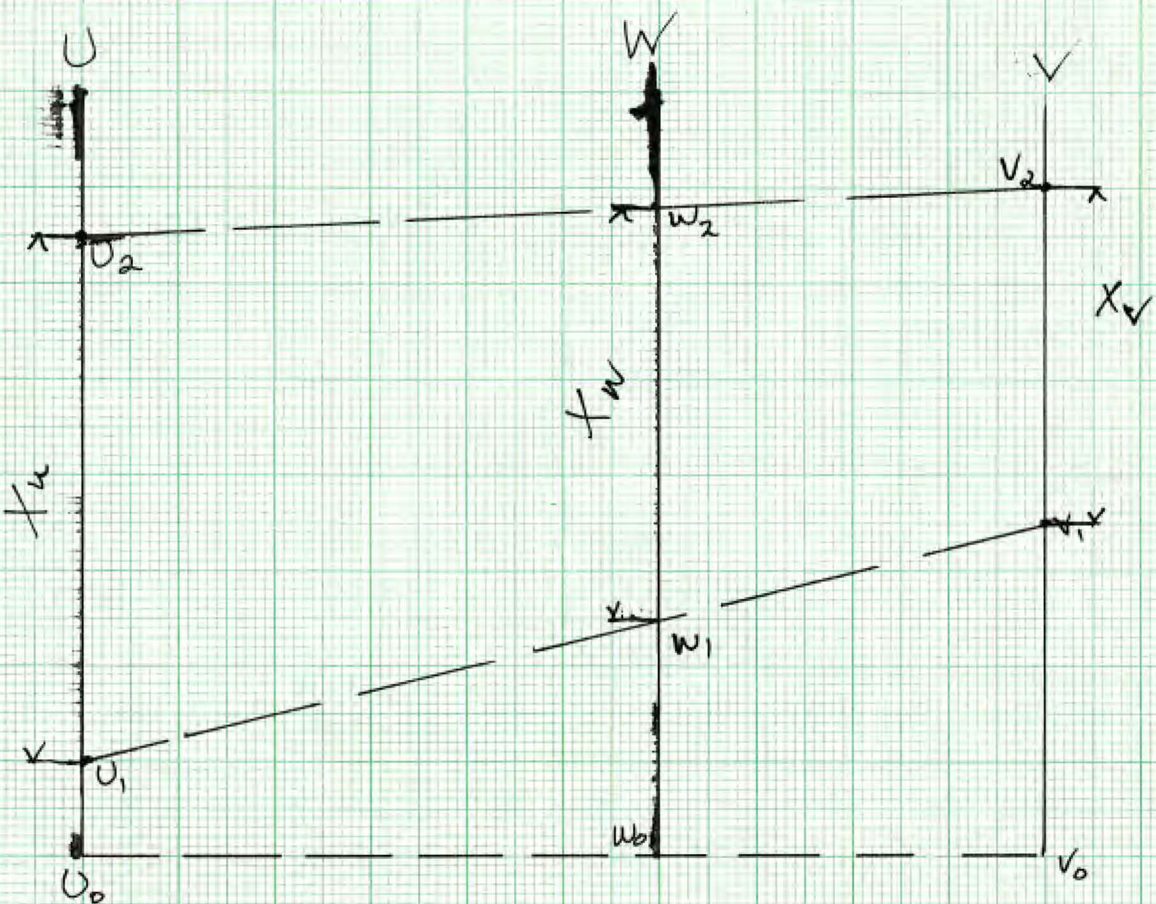
$U+V=W$

Let U vary from 0 to 10; let V vary from 0 to 15.
Suppose the scale lengths are to be six inches.

Now $m_u = 0.6$ $X_u = .6u$

and $m_v = 0.4$ $X_v = 0.4v$

and $m_w = \frac{.6 \times .4}{.6 + .4} = 0.24$ $X_w = 0.24w$



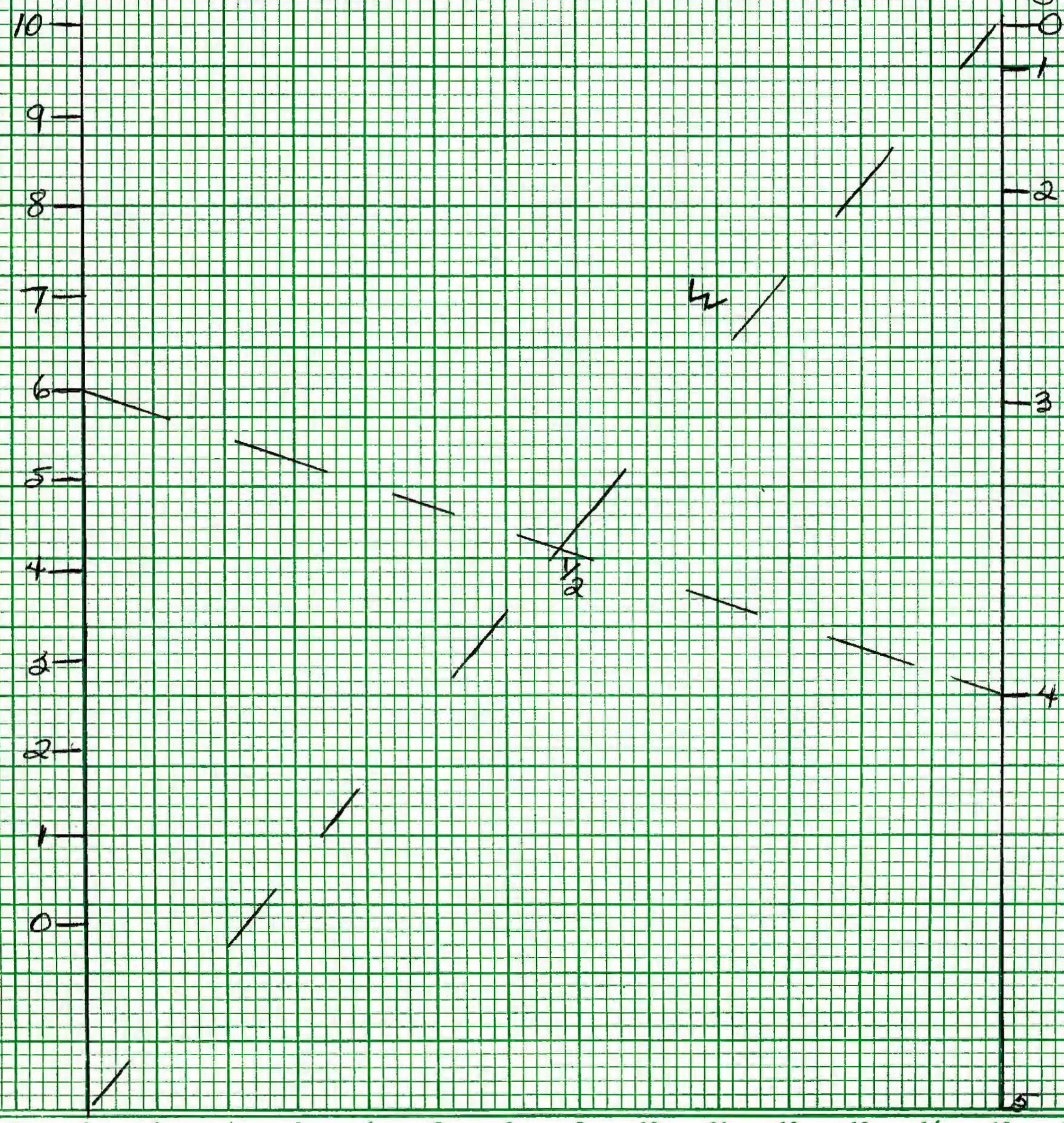
ALIGNMENT CHARTS (Z CHARTS)

$$\boxed{f_1(u) = f_2(v)\cdot f_3(w)}$$

Consider equation $(u+2) = v^2 w$. Suppose u varies from 0 to 10, and V from 0 to 5. Scale length approx 6 inches.

$$M_u = \frac{6}{(10+2)-(0+2)} = 0.6 \qquad M_V = 0.24 \text{ (use } 0.25\text{)}$$

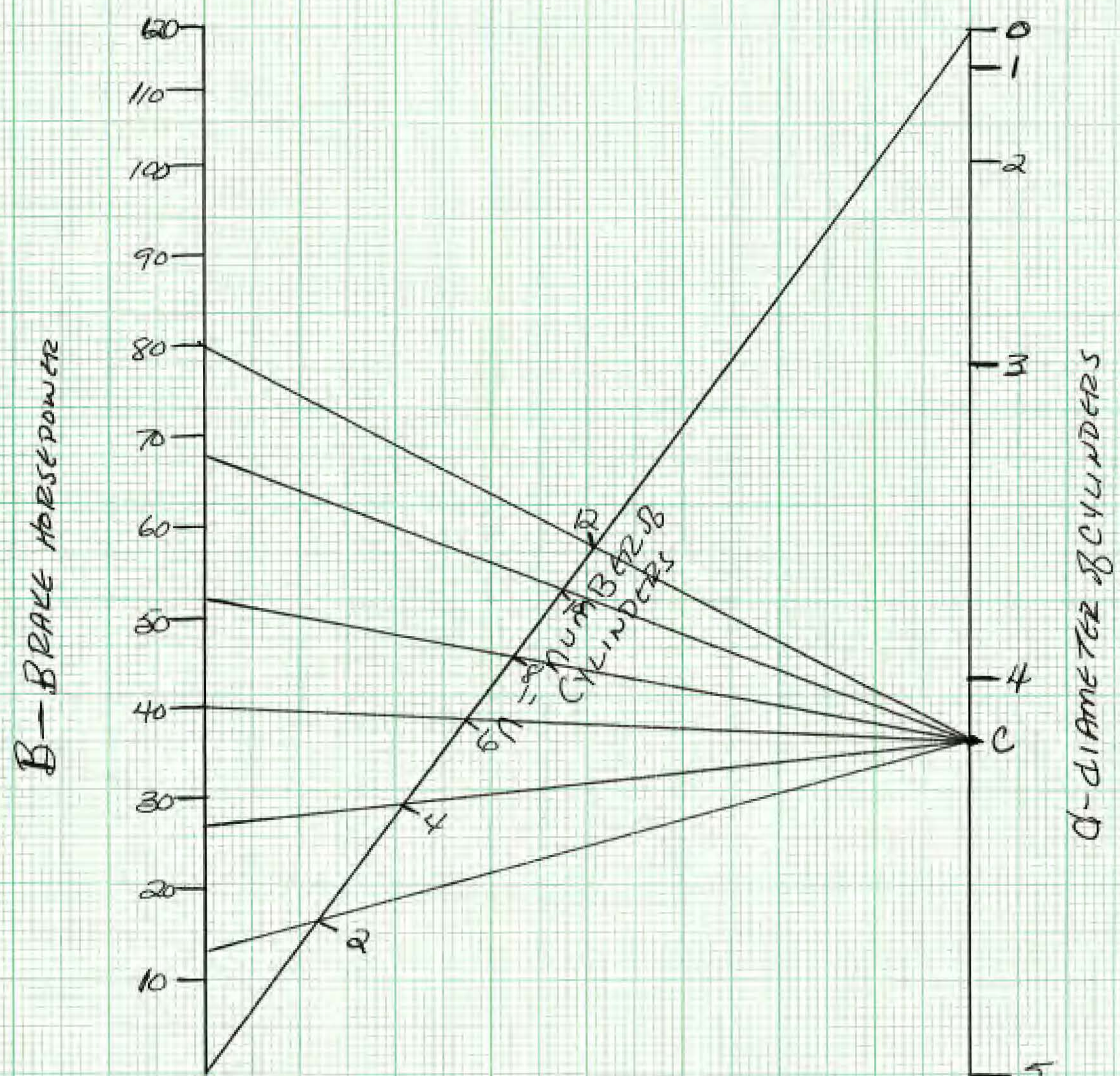
$$X_u = 0.6(u+2) \qquad X_V = 0.25V^2 \qquad X_W = \frac{10}{\frac{0.6w}{0.25}+1} \equiv \frac{10}{\frac{12w}{5}+1}$$



$f_1(u) = f_2(v) \cdot f_3(w)$ EXAMPLE

$$B = \frac{d^2 n}{2.5}$$

where B is brake horsepower, d (0 to 5 inches) the diameter of the cylinder in inches, and n (2, 4, 6, 8, 10, 12) the number of cylinders. The maximum value of B = 120. Suppose the lengths of the parallel scales, B, and d, are 7 inches.

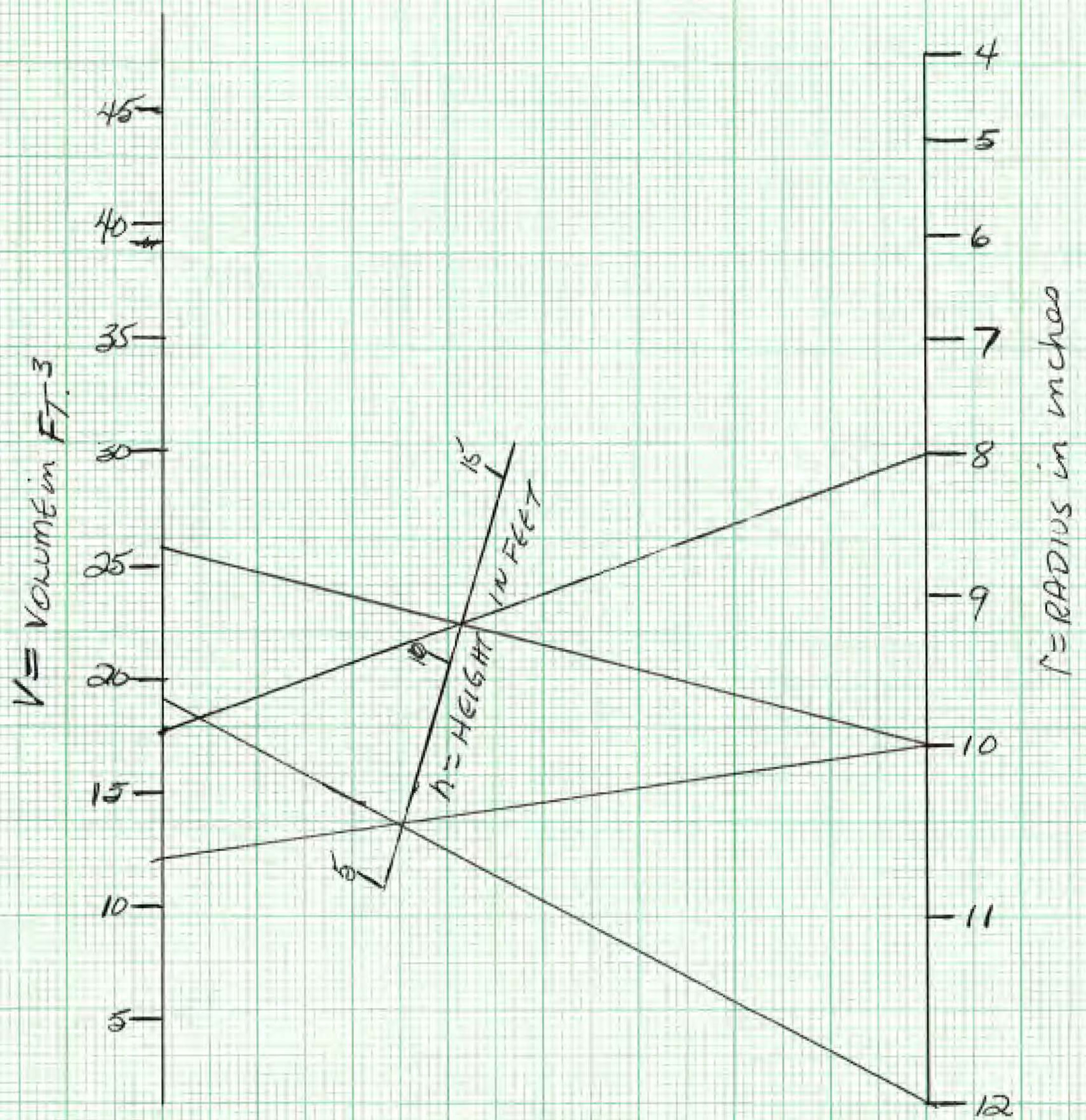


$f_1(u) = f_2(v) \cdot f_3(w)$ EXAMPLE

Let us consider the equation of the volume of a right circular cylinder, $V = \frac{\pi r^2 h}{144}$ where V is volume in cubic feet, r is radius of the base circle, in inches (4 to 12), and h is height of cylinder in feet (4 to 15). We may write the equation:

$$KV = r^2 h \quad \text{where } K = \frac{144}{\pi}$$

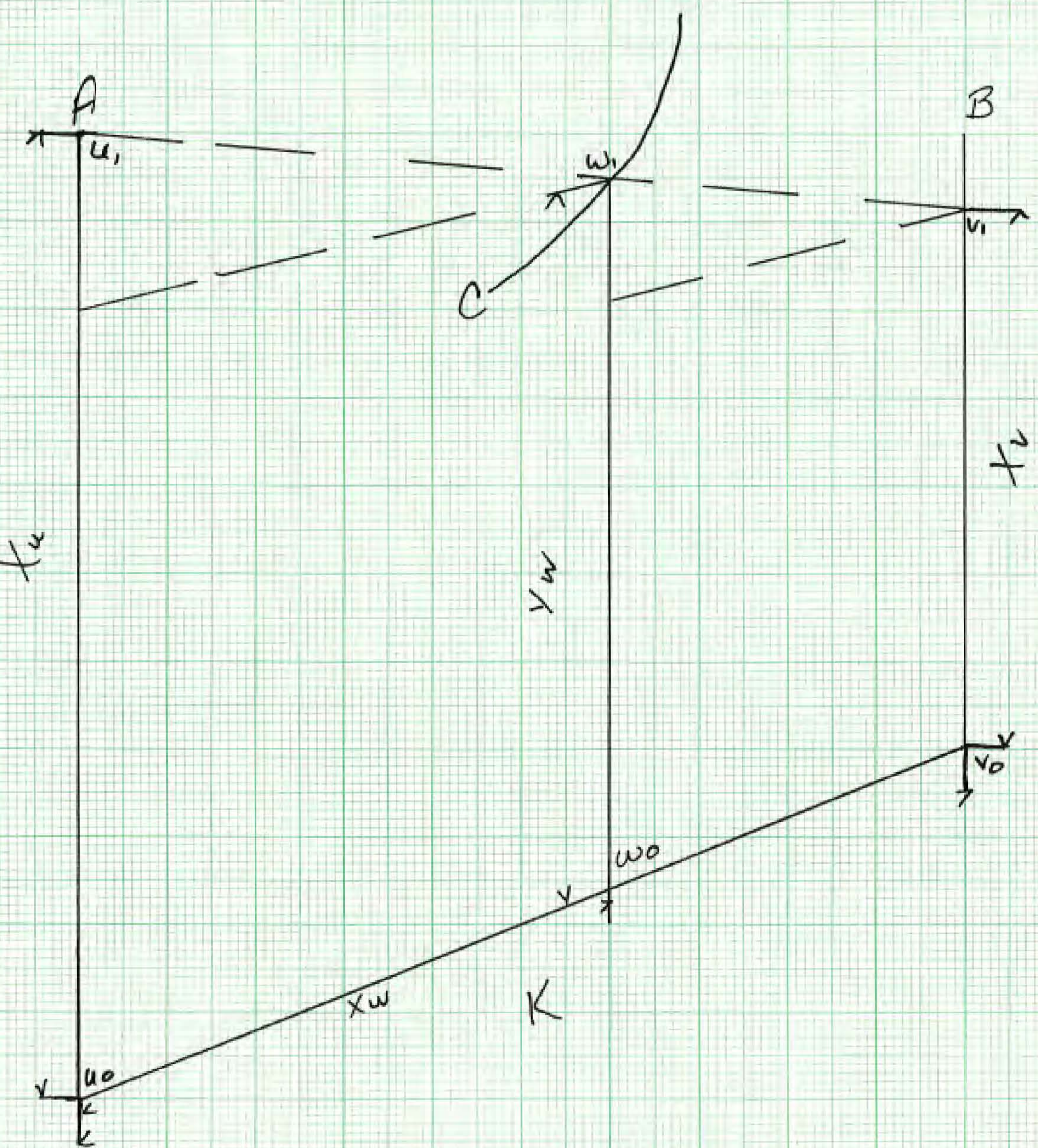
Then range of V is determined from ranges of r & h.



ALIGNMENT CHART FOR SOLUTION OF

$$\boxed{f_1(u) + f_2(v) \cdot f_3(w) = f_4(w)}$$

$X_u = m_u f_1(u)$
$X_v = m_v f_2(v)$



PROPORTIONAL CHARTS OF THE FORM

$$\boxed{f_1(u)+f_2(v)=\frac{f_3(w)}{f_4(\phi)}}$$

Let $f_1(u)+f_2(v)=T$ and $T=\frac{f_3(w)}{f_4(\phi)}$ (Z CHART)

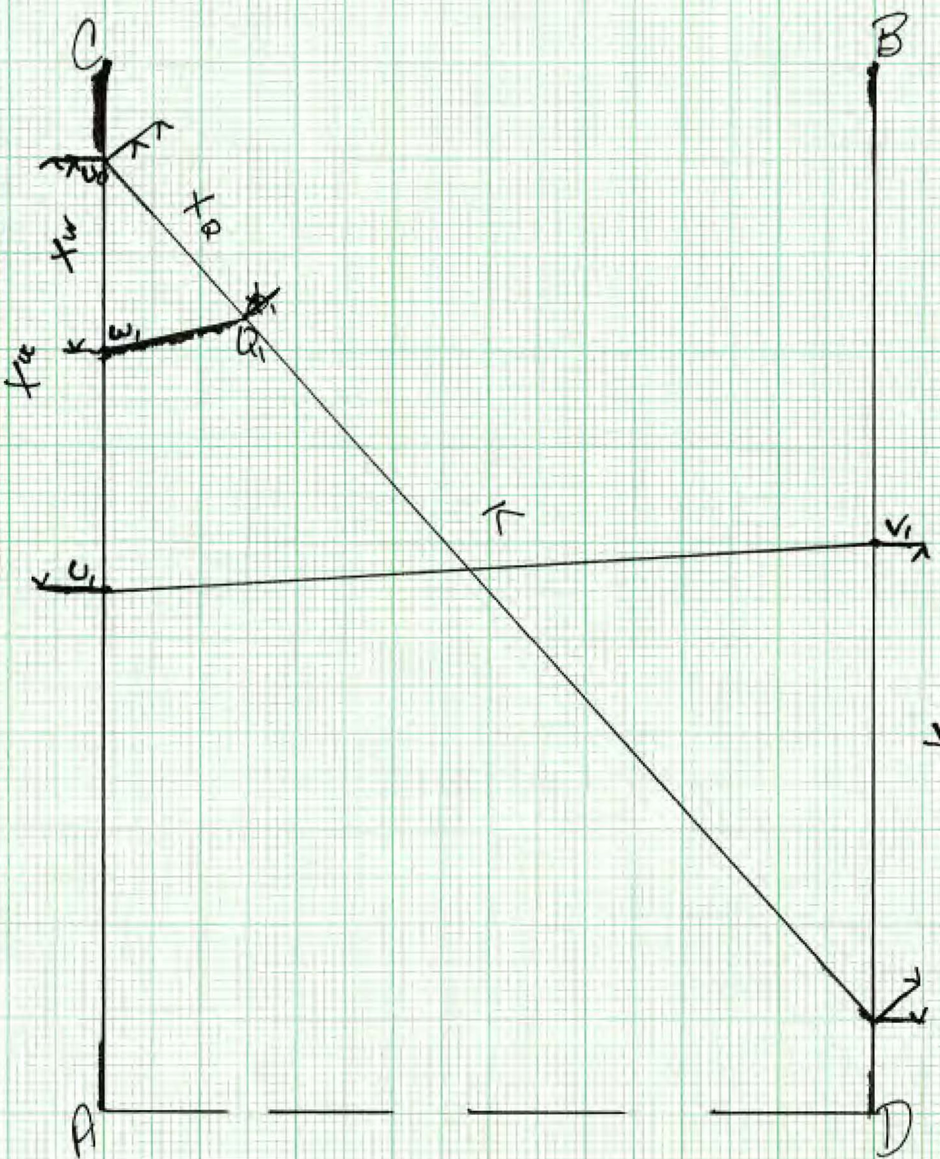
or $f_3(w)=Tf_4(\phi)$

$X_u=m_u f_1(u)$

$X_v=m_v f_2(v)$

$$\frac{X_u+X_v}{K}=\frac{X_w}{X_\phi}$$

$$m_\phi=\frac{Km_w}{m_u}$$



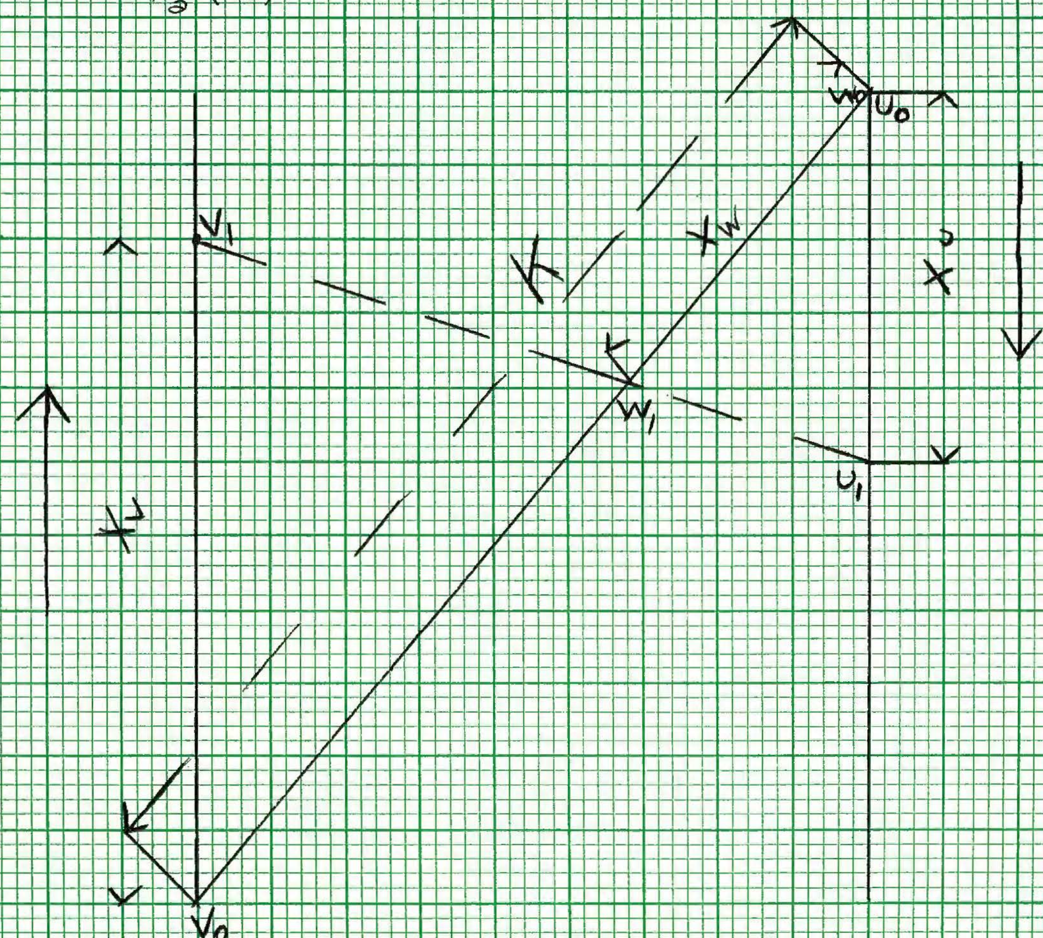
'Z' CHART

$$\boxed{f_1(u) + f_2(v) = \frac{f_1(u)}{f_3(w)}}$$

$X_u = m_u f_1(u)$

$X_v = m_u f_2(v)$

$X_w = K f_3(w)$



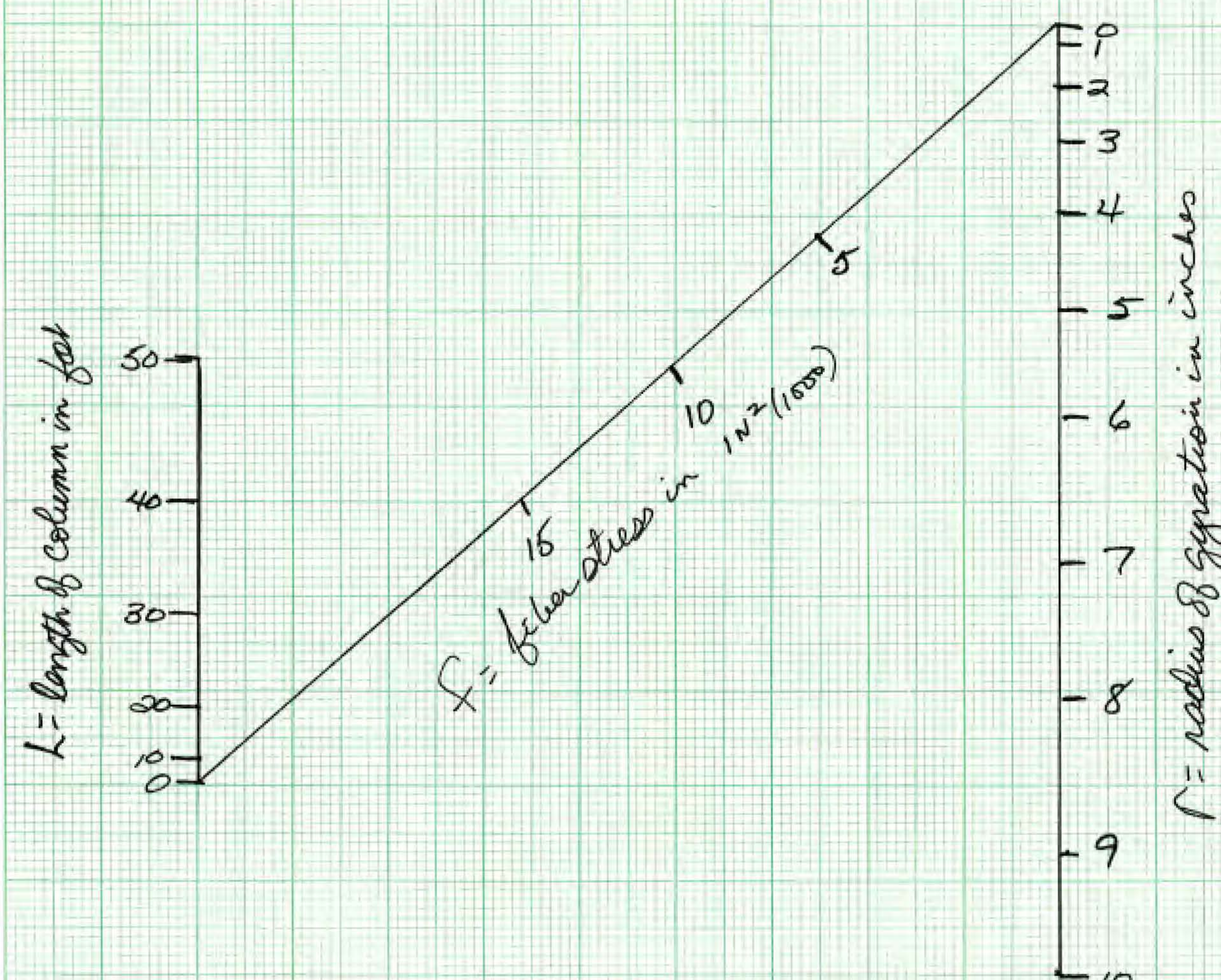
$f_1(u) + f_2(v) = \dfrac{f_1(u)}{f_3(w)}$ EXAMPLE

$$f = \frac{20,000}{1 + \dfrac{144L^2}{9000R^2}}$$

L (0 to 50 ft)
r (0 to 10 inches)

or

$$r^2 + 0.016L^2 = \frac{r^2}{\dfrac{f}{20,000}}$$



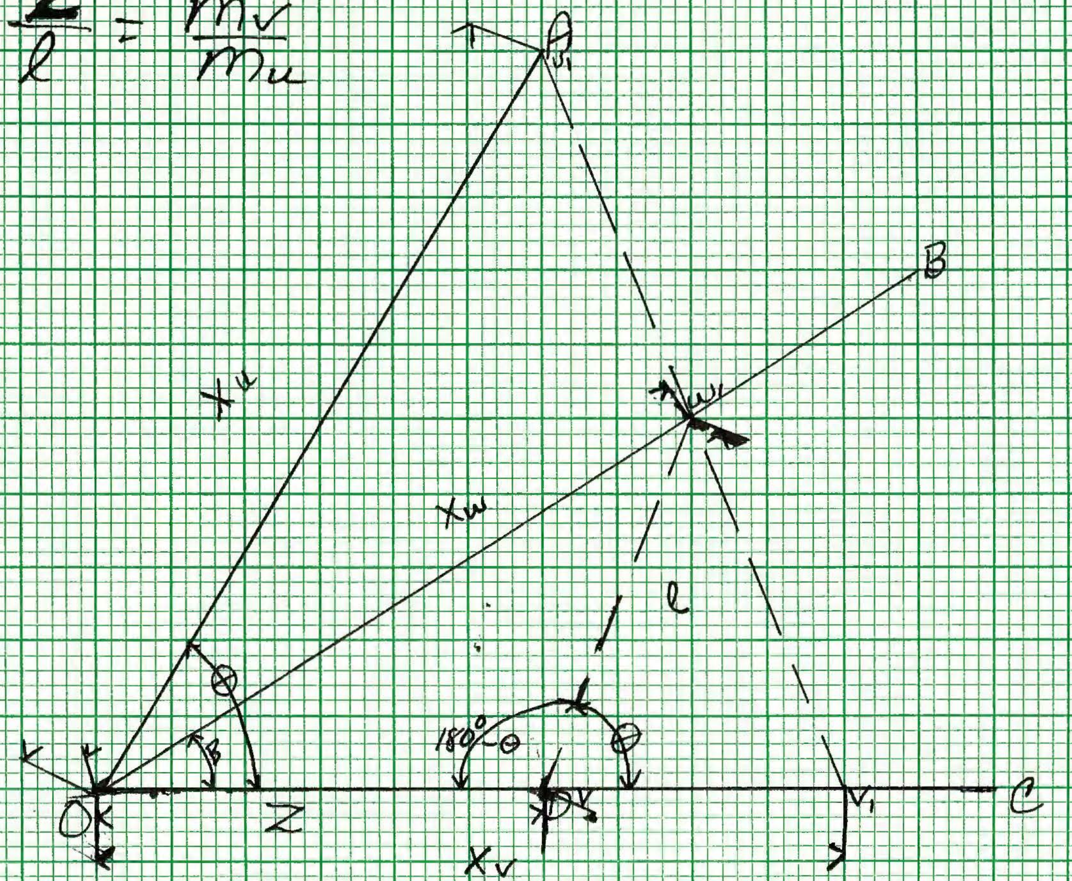
GORDON COLUMN FORMULA

ALIGNMENT CHART

$$\boxed{\frac{1}{f_1(u)} + \frac{1}{f_2(v)} + \frac{1}{f_3(w)}}$$

$X_u = m_u f_1(u) \qquad X_v = m_v f_2(v)$

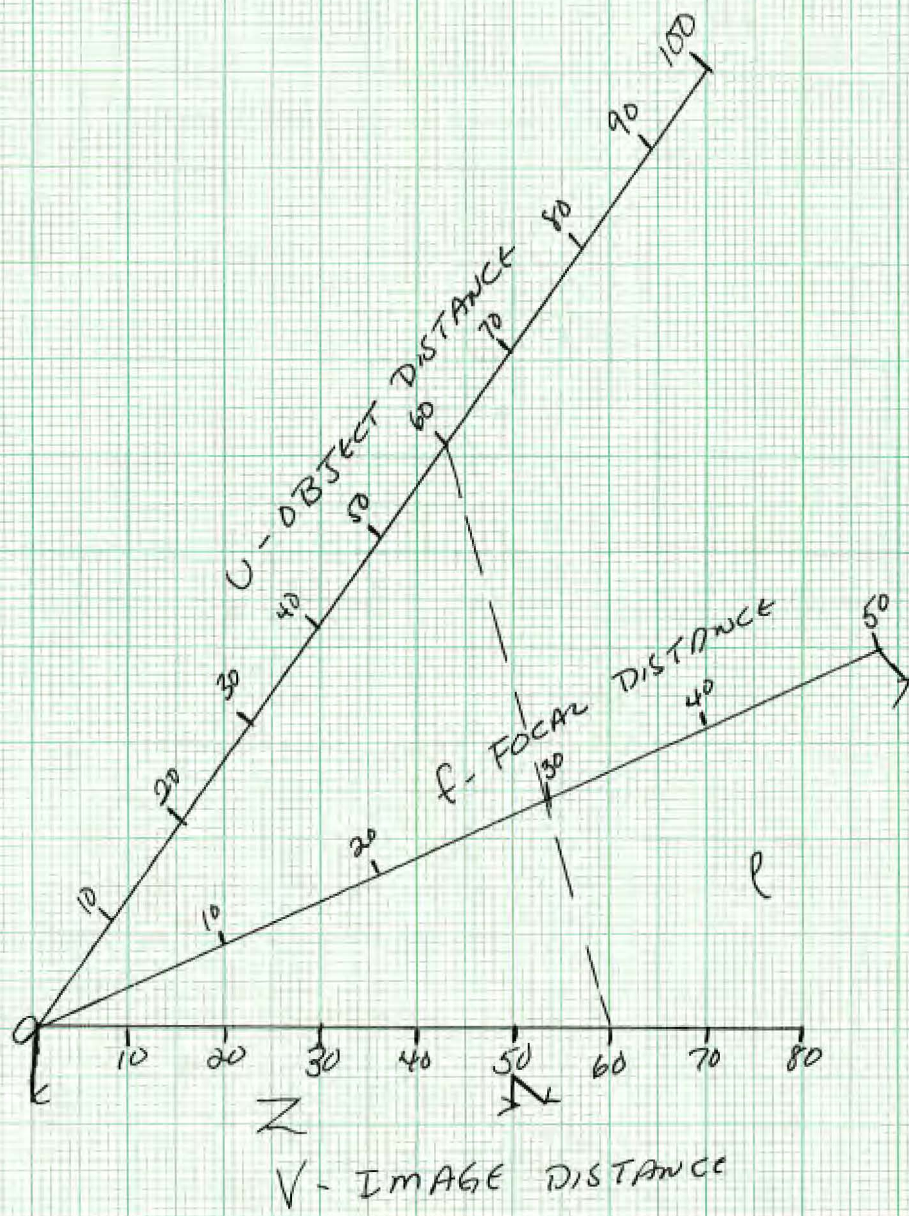
$$\frac{z}{l} = \frac{m_v}{m_u}$$



$\frac{1}{f_1(u)} + \frac{1}{f_2(v)} = \frac{1}{f_3(w)}$ EXAMPLE

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

where u = object distance (0 to 100), v = image distance (0 to 80)
f = focal distance (0 to 50)
$X_u = m_u(u)$; $m_u = \frac{6}{100}$ $X_u = 0.06u$
$X_v = m_v(v)$; $m_v = \frac{4}{80}$ $X_v = 0.05v$



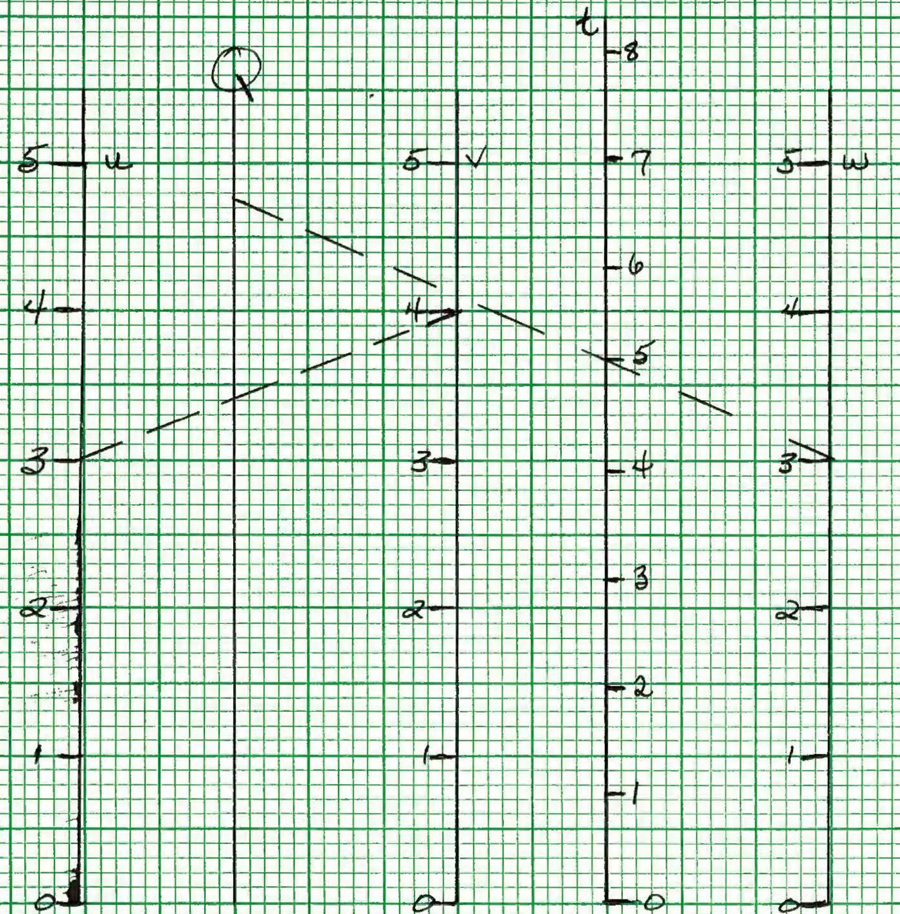
ALIGNMENT CHART

$$\boxed{f_1(u) + f_2(v) + f_3(w) \cdots = f_{(4)}(Q)}$$

Let us consider this relation: $u + 2v + 3w = 4t$

Let $u + 2v = Q$ $\therefore$ $Q + 3w = 4t$

$X t = \frac{1}{6}(4t) = \frac{2}{3} t$



PROPORTIONAL CHART

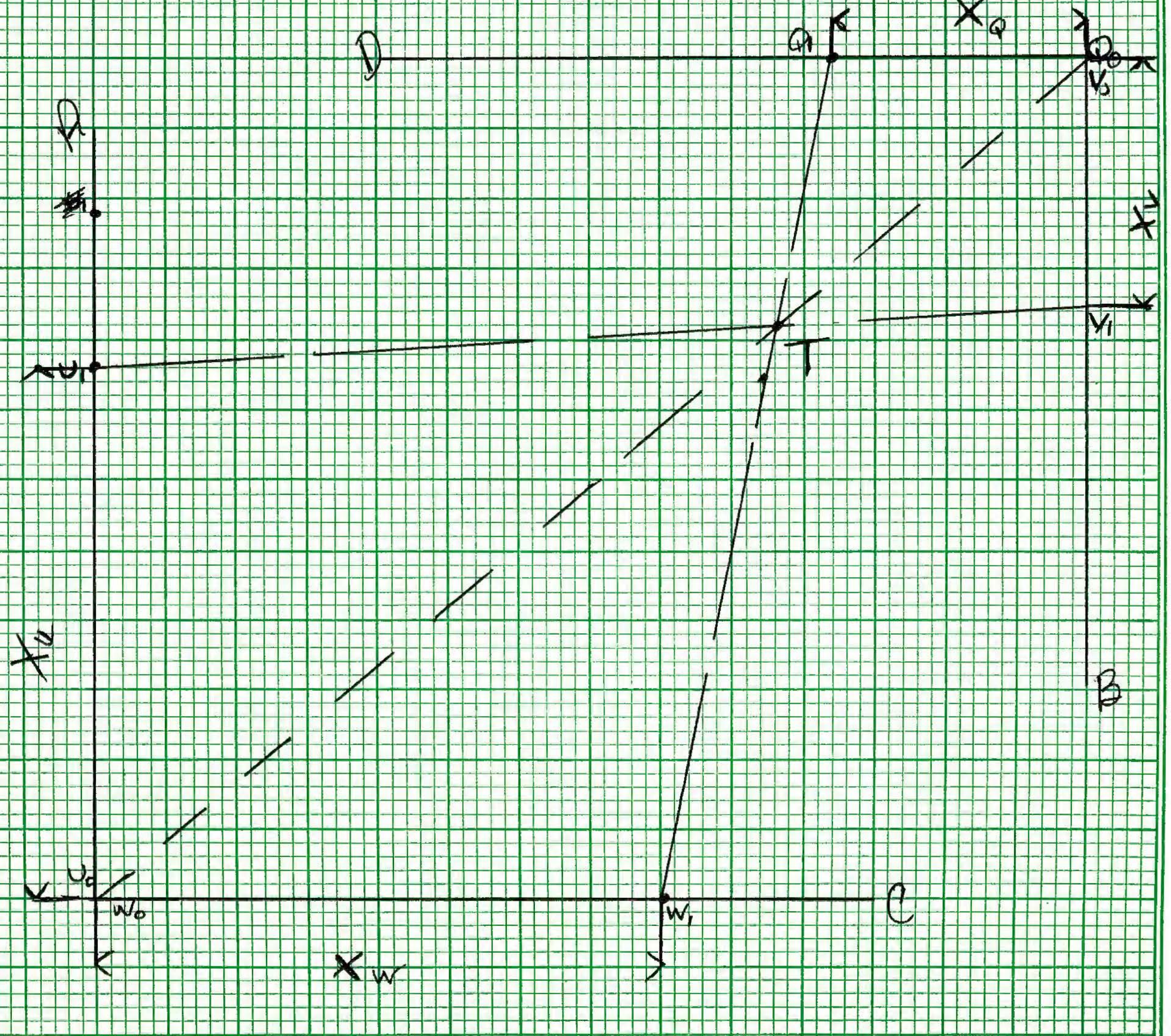
$$\boxed{\frac{f_1(u)}{f_2(v)} = \frac{f_3(w)}{f_4(q)}}$$

$X_u = m_u f_1(u)$

$X_V = m_u f_2(V)$

$X_W = m_w f_3(W)$

$X_Q = m_q f_4(Q)$



MISCELLANEOUS FORMS

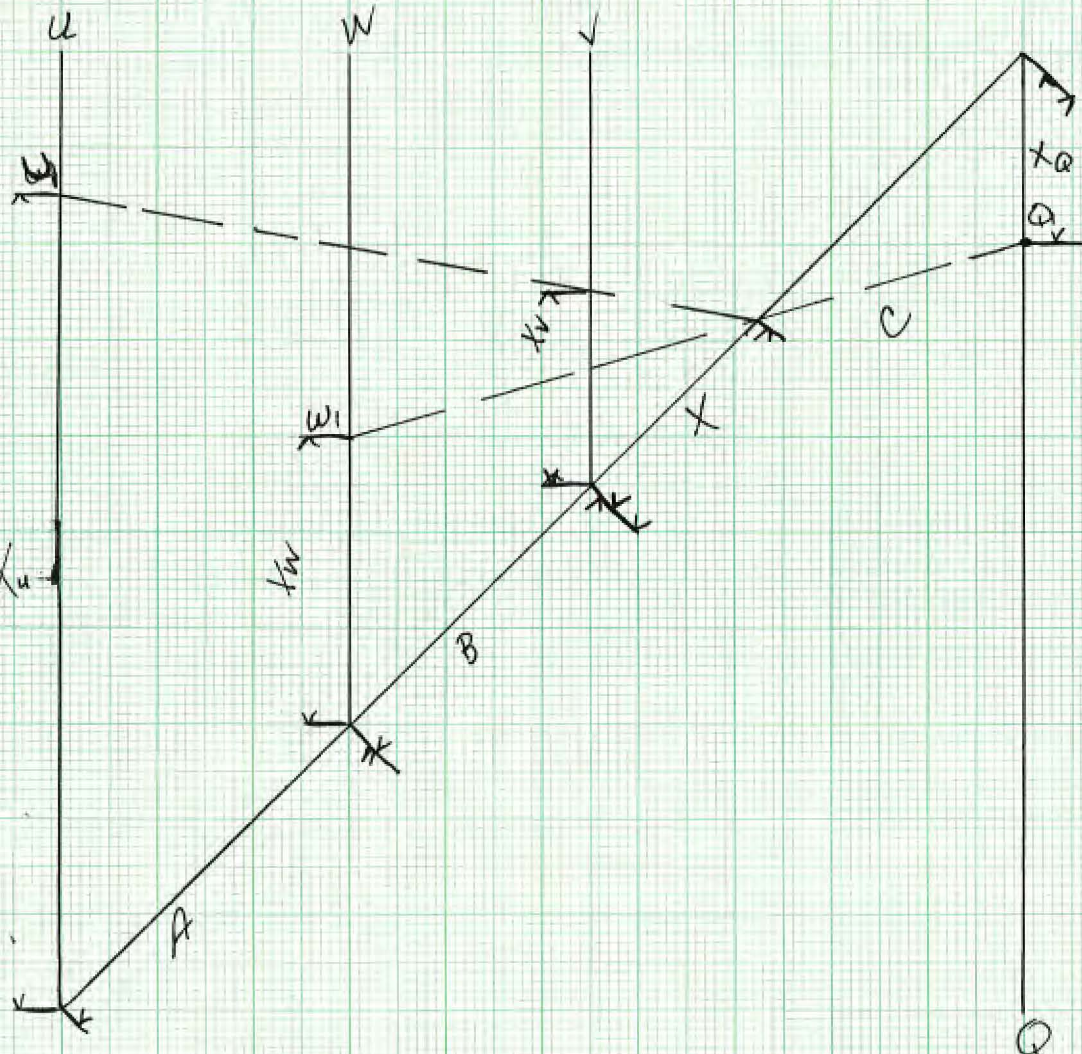
$$\boxed{\frac{f_1(u)+f_2(v)}{f_1(u)-f_2(v)} = \frac{f_3(\omega)}{f_4(Q)}}$$

$X_u = m_u f_1(u)$

$X_v = m_v f_2(v)$

$X_W = m_\omega f_3(\omega)$

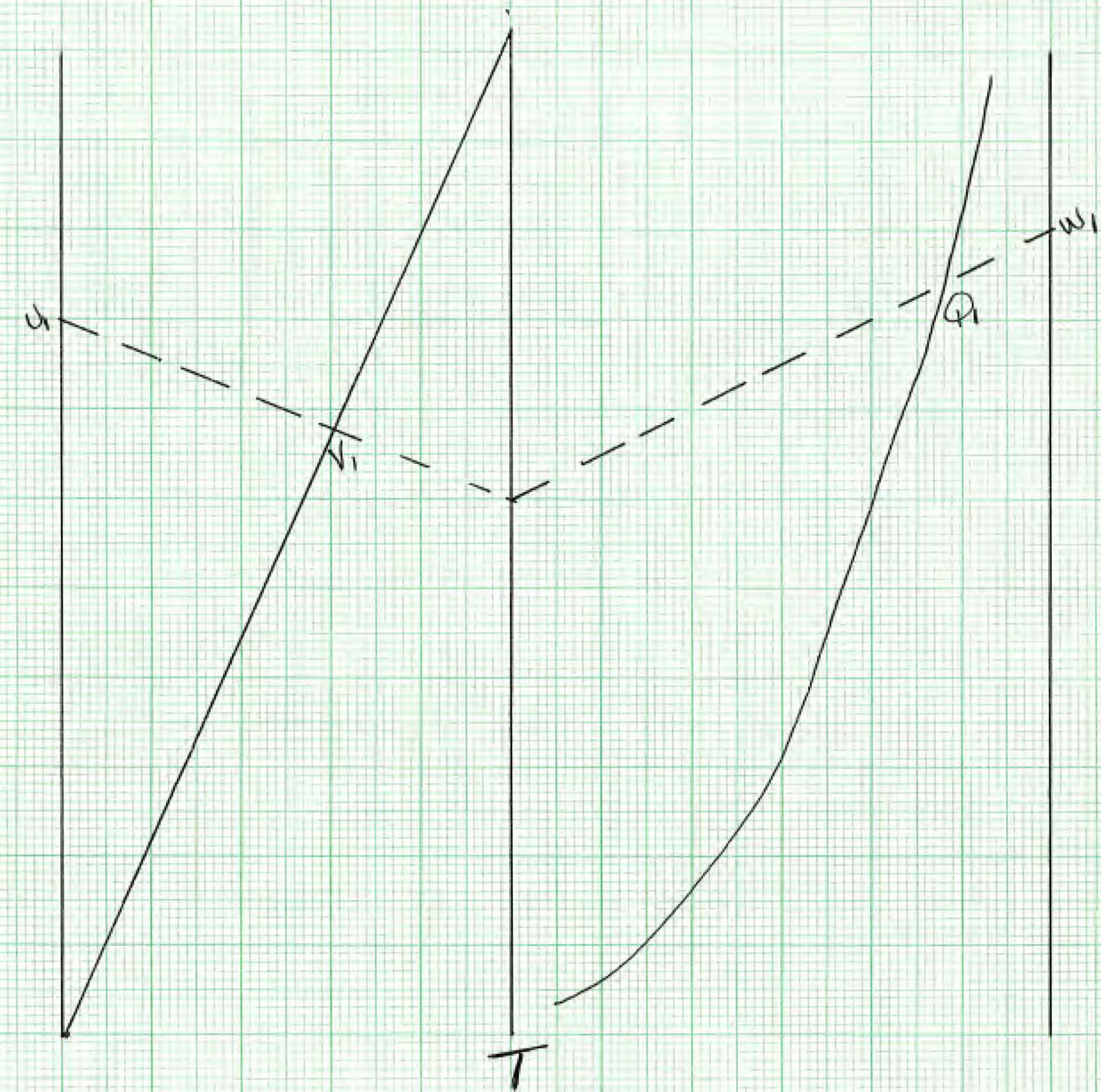
$X_Q = m_Q f_4(Q)$



M. F. (CONT)

$$\boxed{f_1(u)\cdot f_2(v) + f_3(w)\cdot f_4(q) = f_5(Q)}$$

$f_1(u)\cdot f_2(v) = T \qquad T + f_3(w)\cdot f_4(\varphi) = f_5(\varphi)$

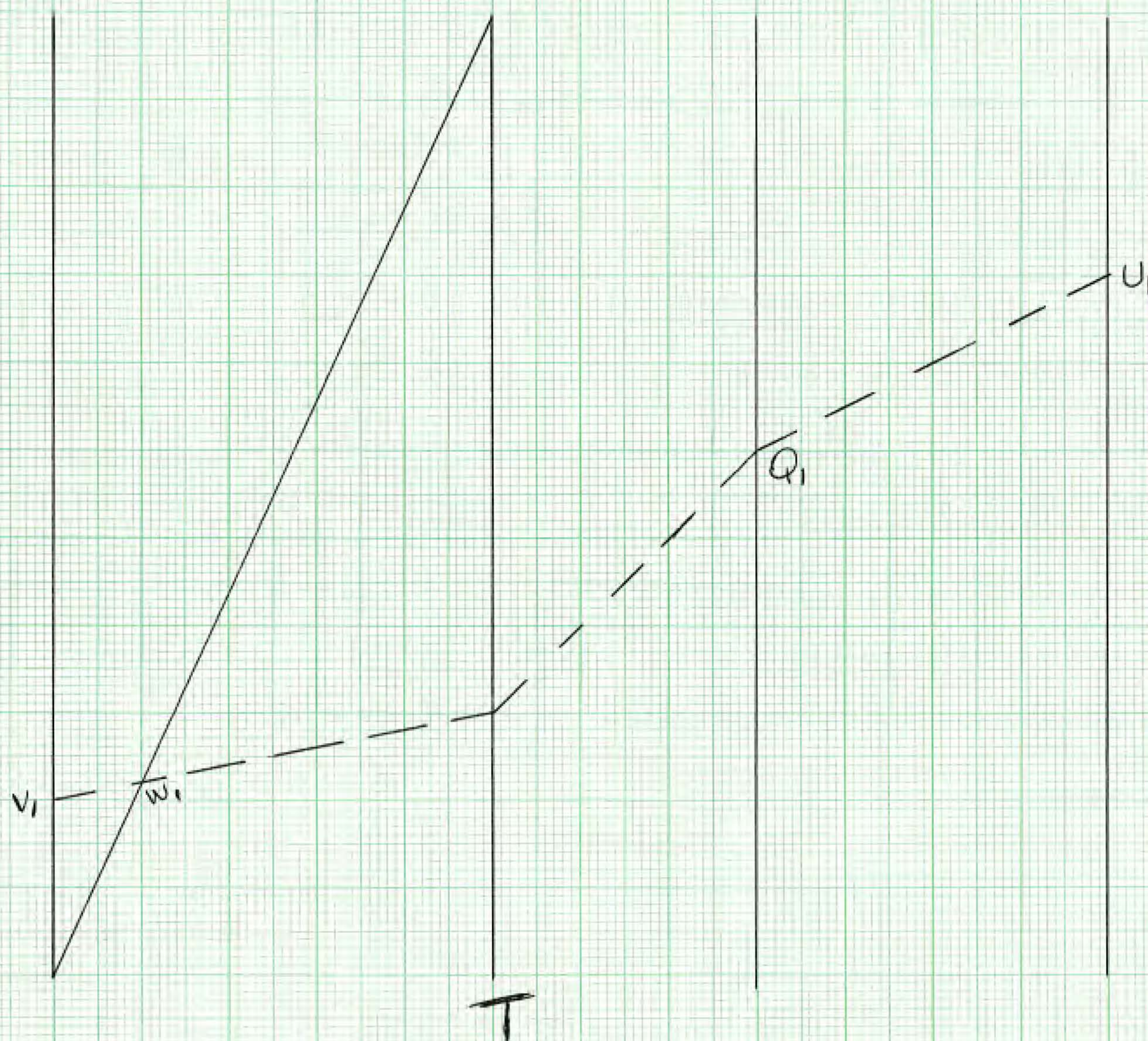


M.F. (CON'T)

$$\boxed{f_1(v) + f_2(v) \cdot f_3(\omega) = f_4(Q)}$$

$f_2(v) \cdot f_3(\omega) = T$

$f_1(v) + T = f_4(Q)$



M. F. (CONT)

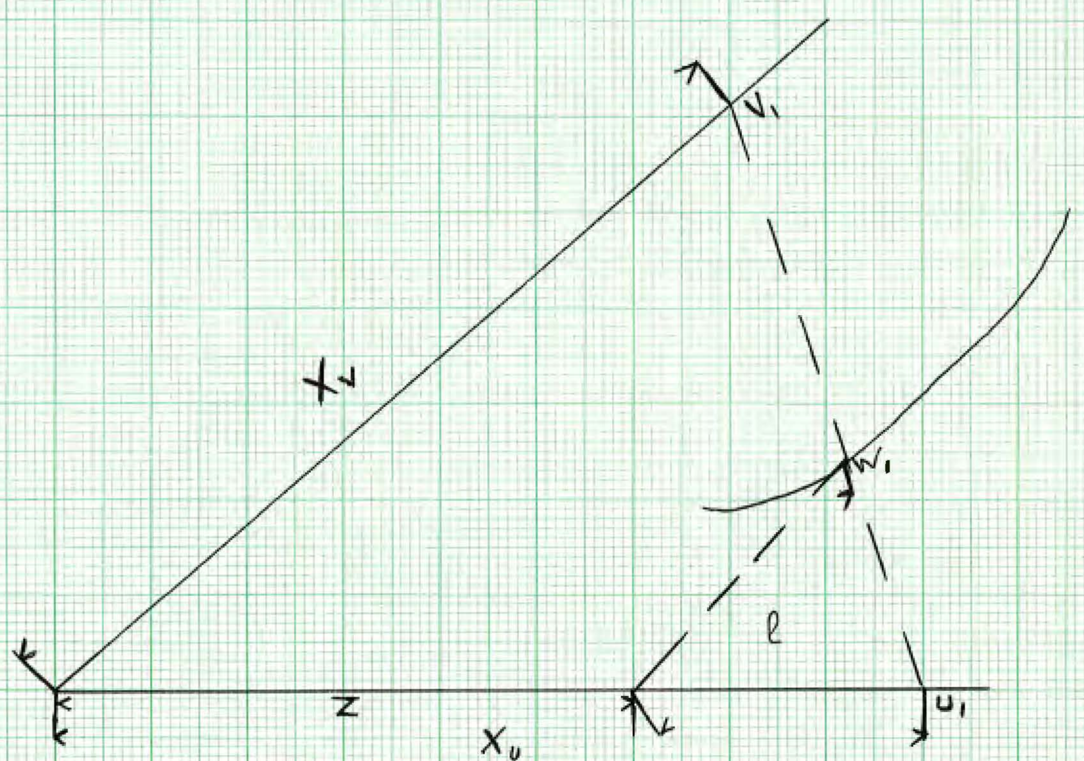
$$\boxed{\frac{1}{f_1(u)} + \frac{f_4(\omega)}{f_2(v)} = \frac{1}{f_3(\omega)}}$$

$x_u = m_\omega f_1(u)$

$X_v = m_v f_2(v)$

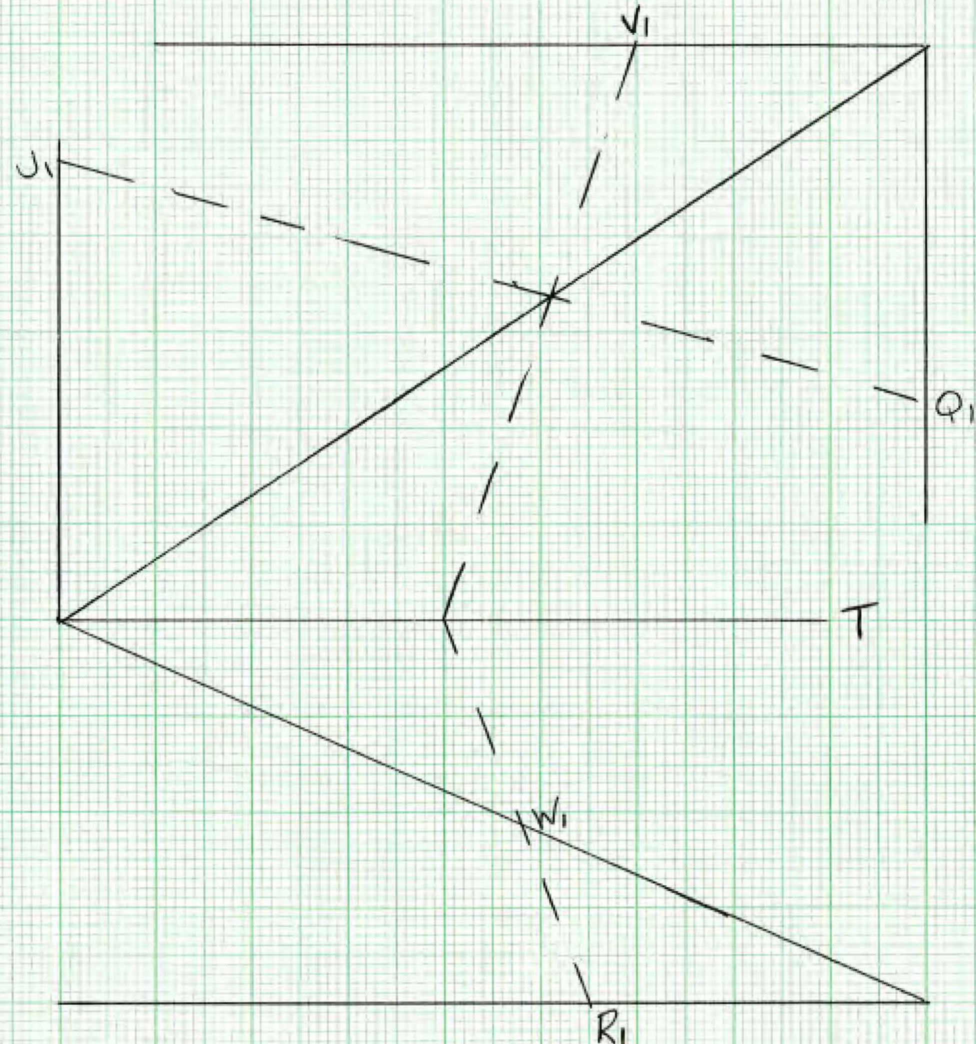
$Z = m_u f_3(\omega)$

$L = m_v f_3(\omega) f_4(\omega)$



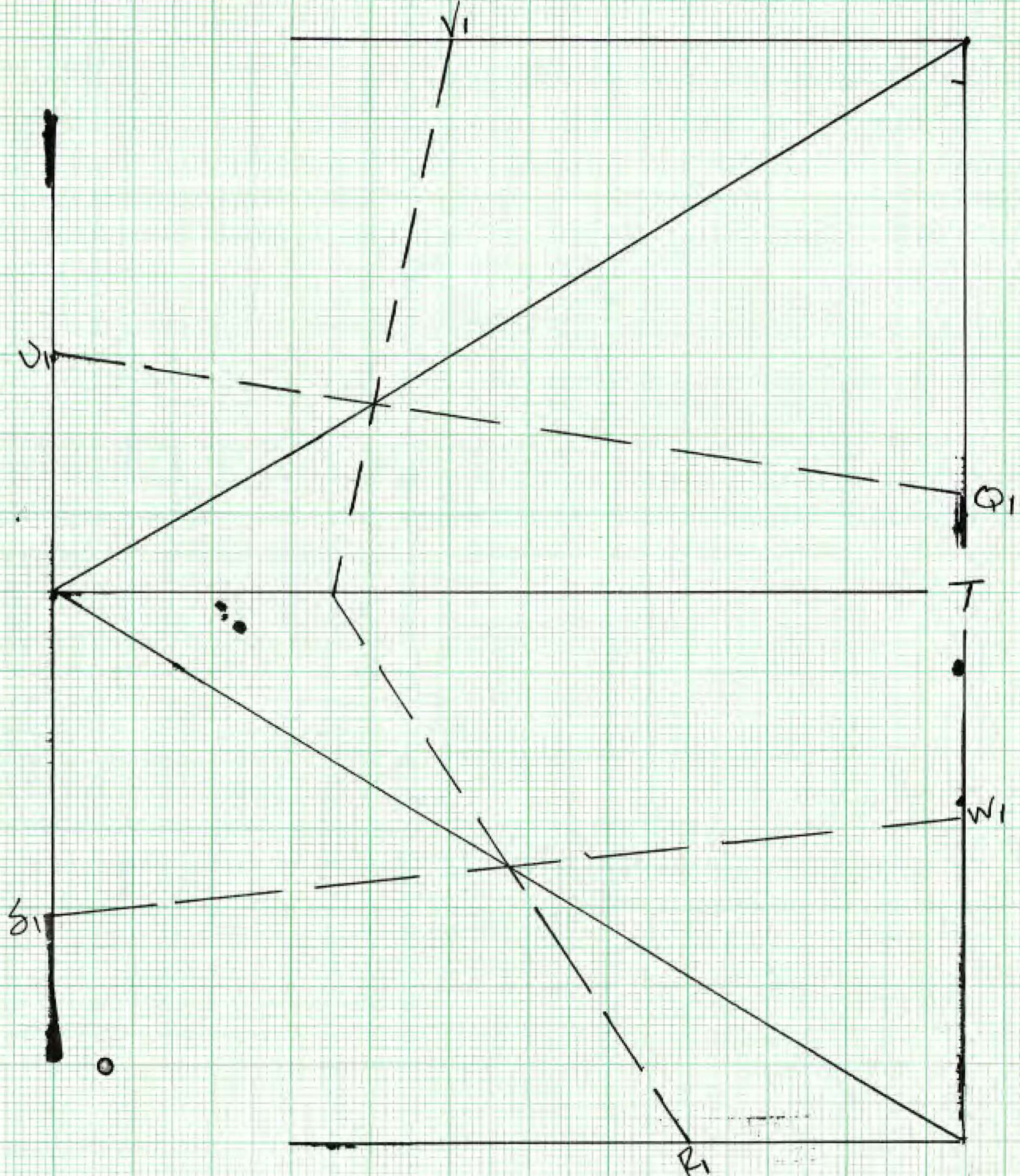
M. F. (CONT)

$$\boxed{f_1(u) \cdot f_2(v) \cdot f_3(w) = f_4(q) \cdot f_5(r)}$$



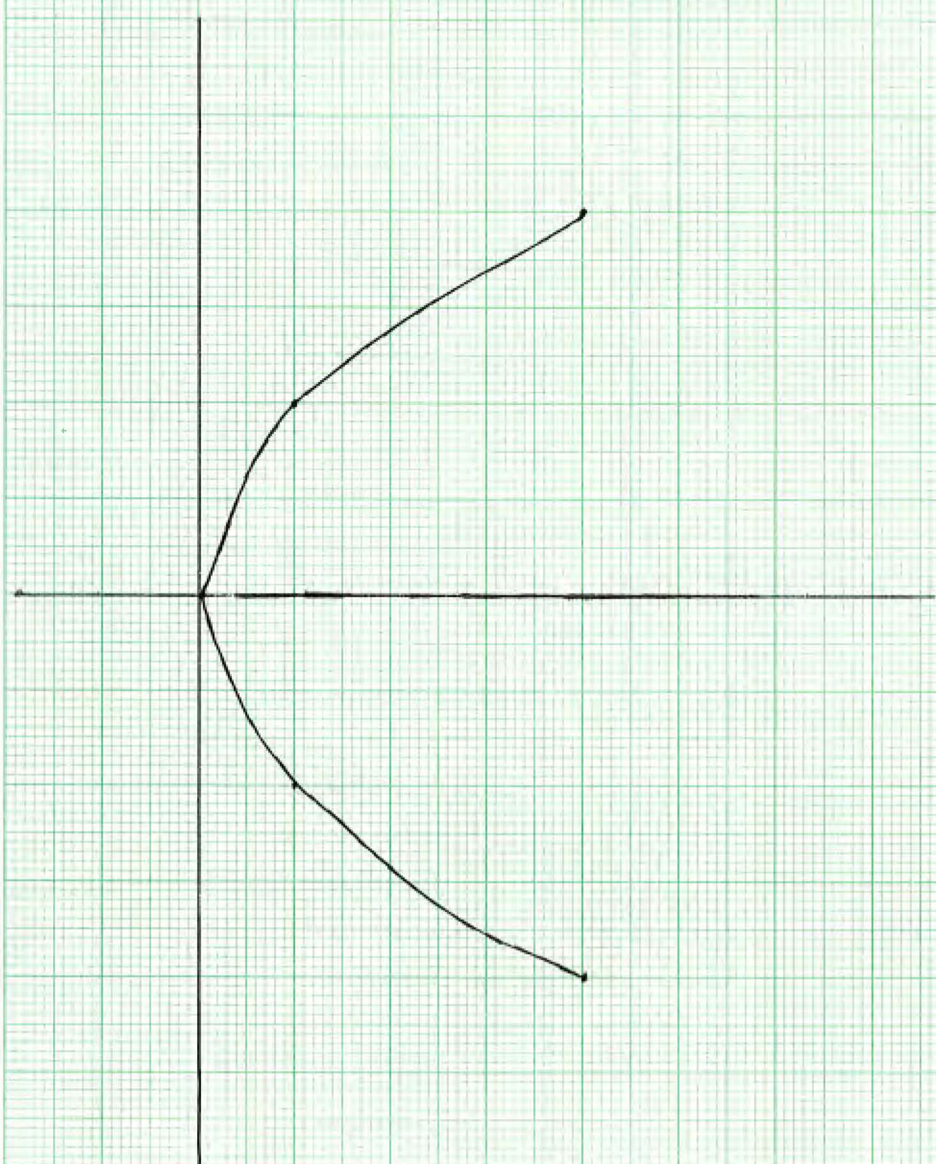
M. F. (CON'T)

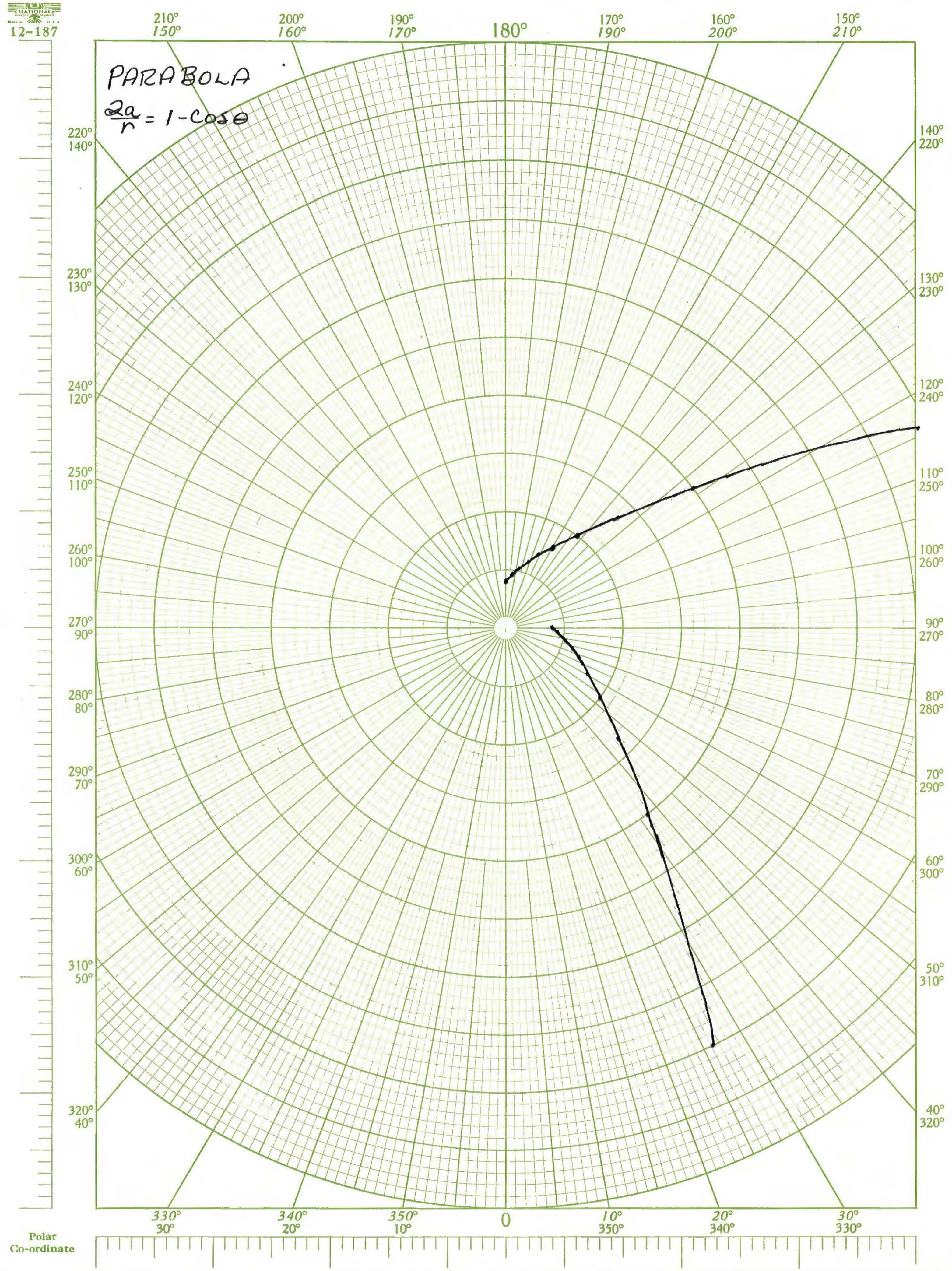
$$\boxed{f_1(u)\cdot f_2(v)\cdot f_3(w)=f_4(q)\cdot f_5(r)\cdot f_6(s)}$$



CARTESIAN EQUATION OF THE PARABOLA

$\boxed{y^2 = 4AX}$ where $A=1$

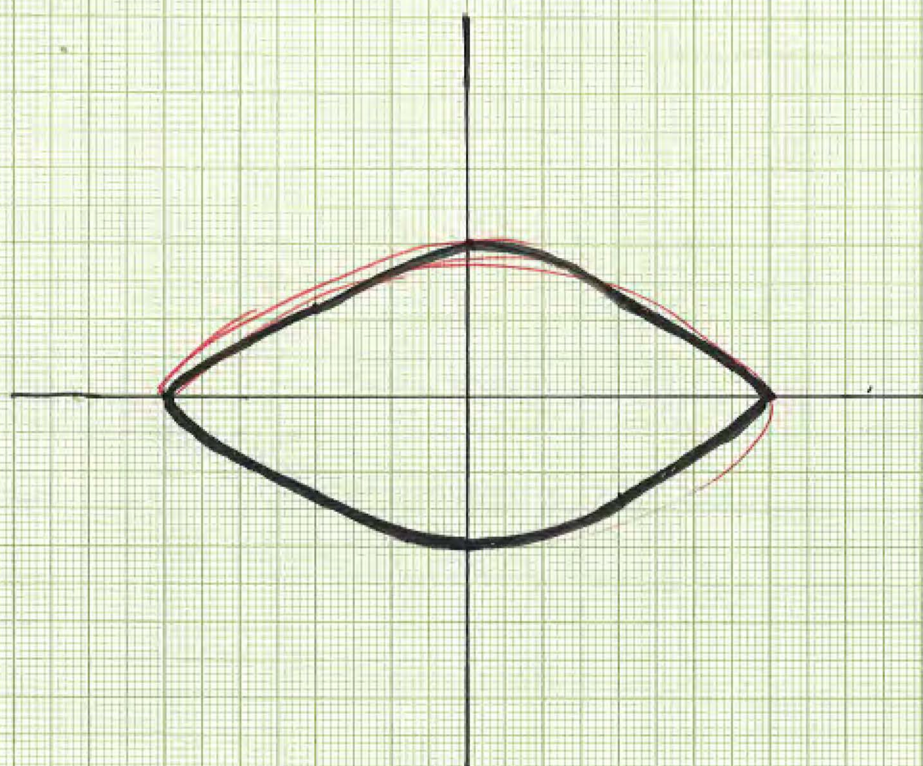



PARABOLA
$\frac{2a}{r} = 1 - \cos\theta$
NATIONAL
12-187
180°
0
Polar
Co-ordinate

ELLIPSE

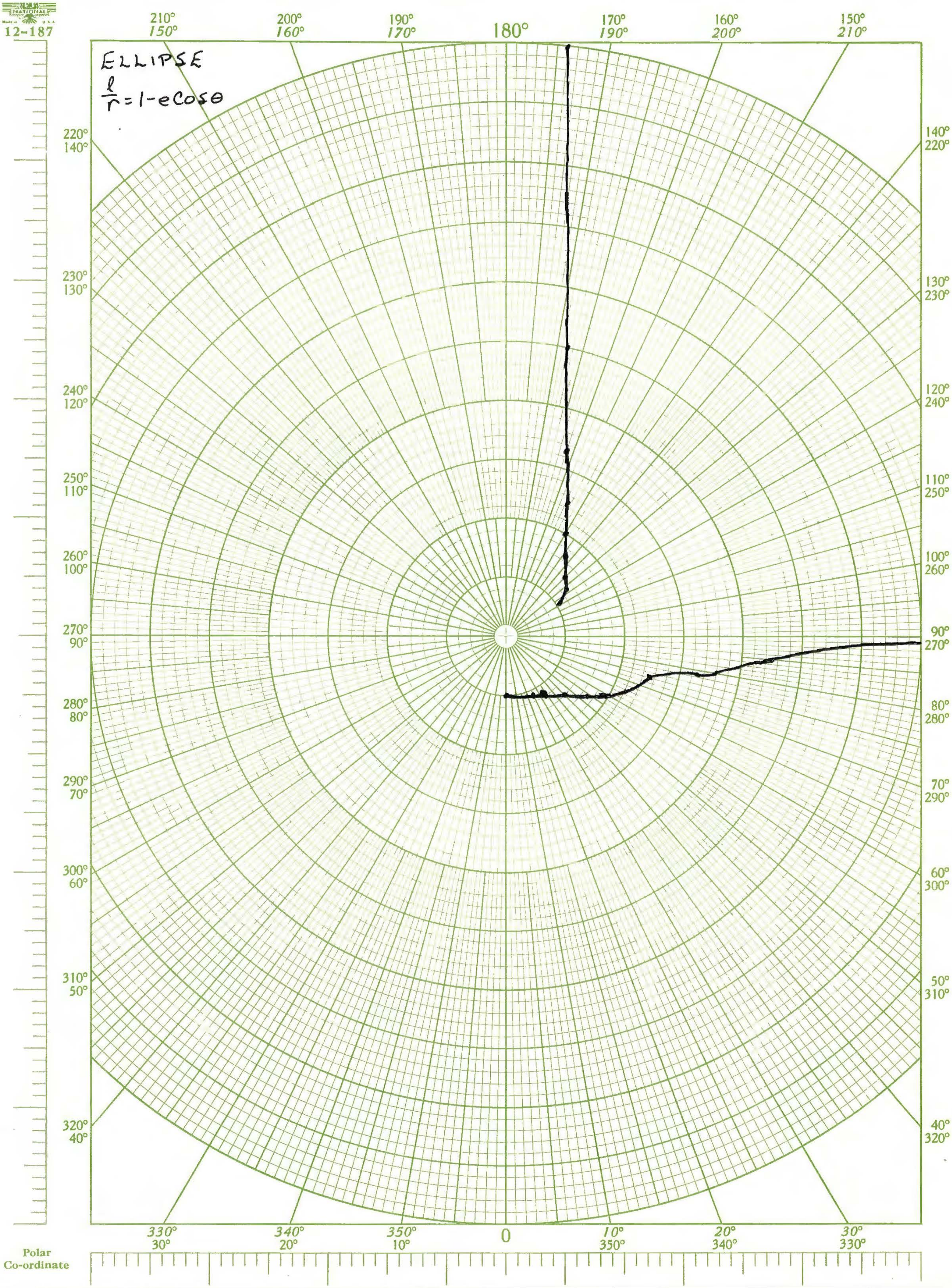
$$\boxed{\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1}$$

$a = 2$
$b = 1$



ELLIPSE

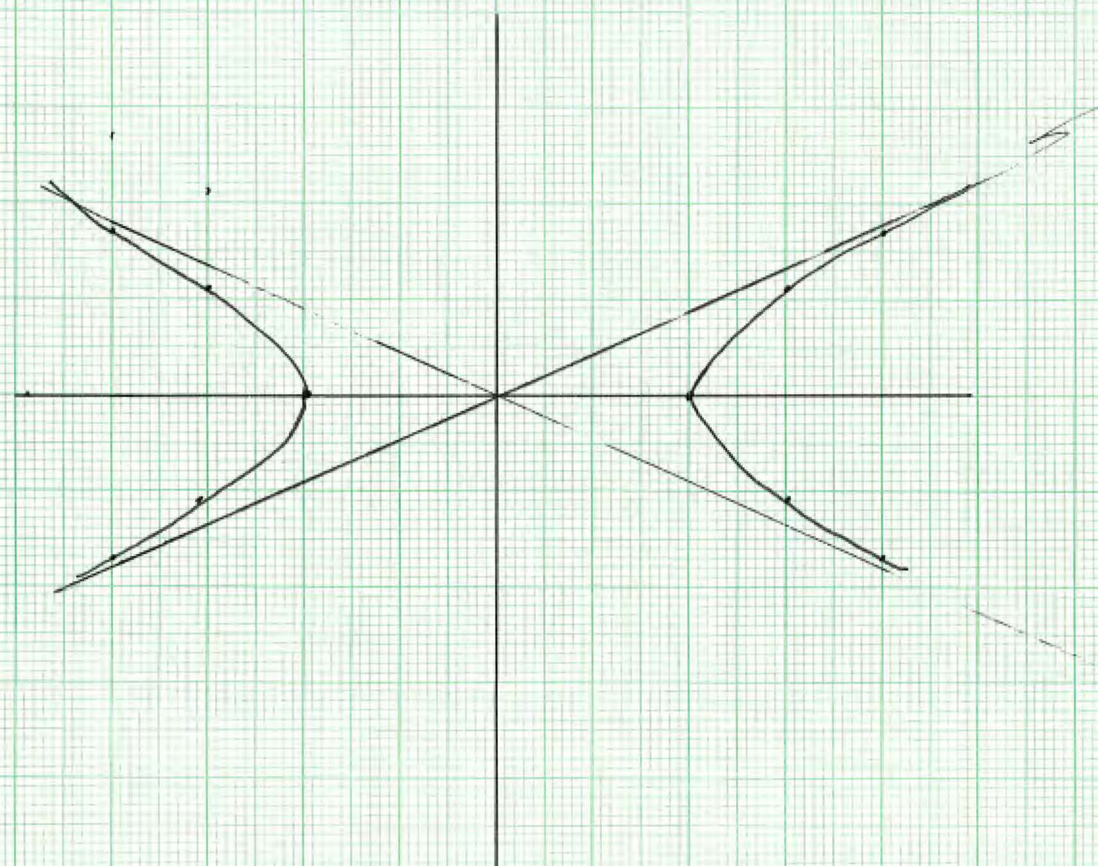
$\frac{l}{r} = 1 - e\cos\theta$

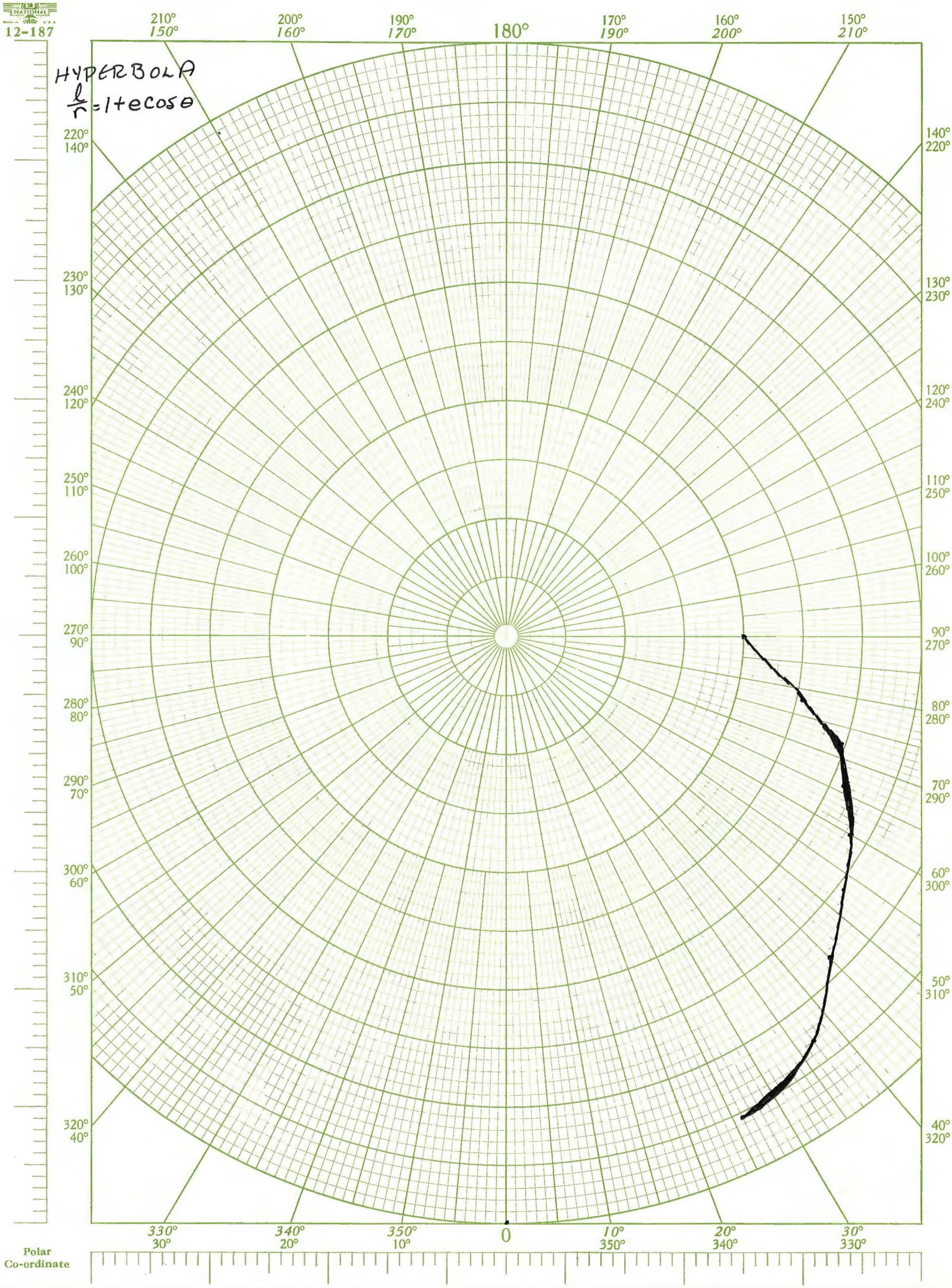


HYPERBOLA

$$\boxed{\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1}$$

$a=2$
$b=1$




HYPERBOLA
$\frac{l}{r} = 1 + e\cos\theta$
NATIONAL
12-187
Polar
Co-ordinate