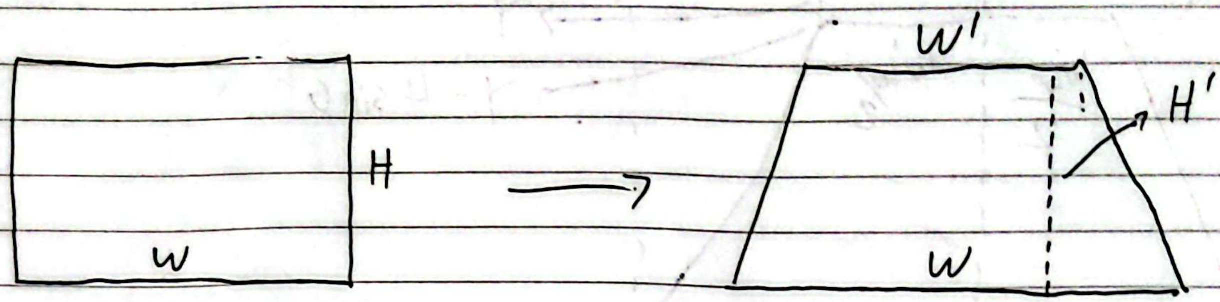
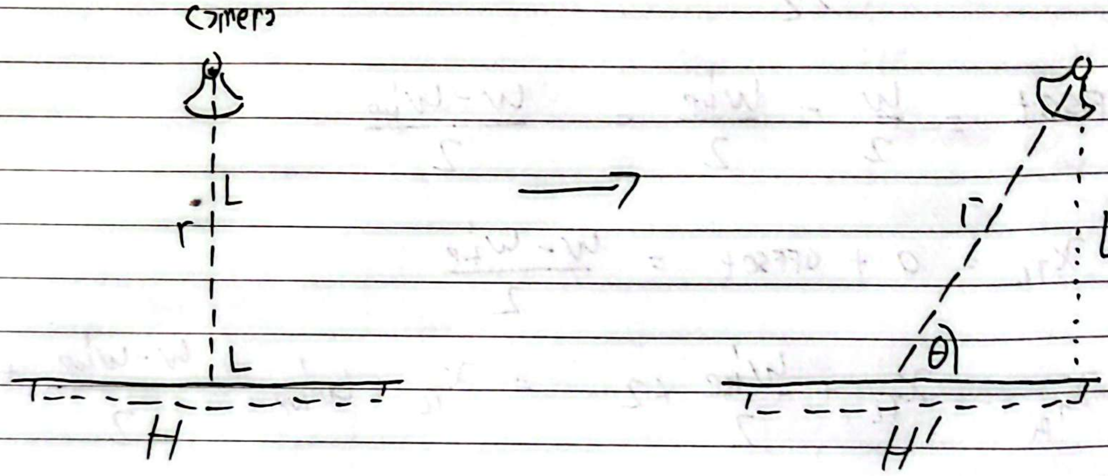
M. Athallah Y.

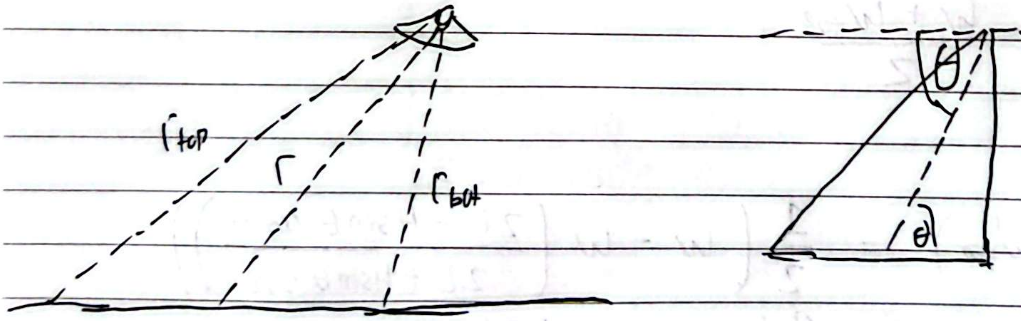
24/532752/PA/22532   Day 3   Date:

Trapezoid From Perspective transform



Original (90°)   Transformed



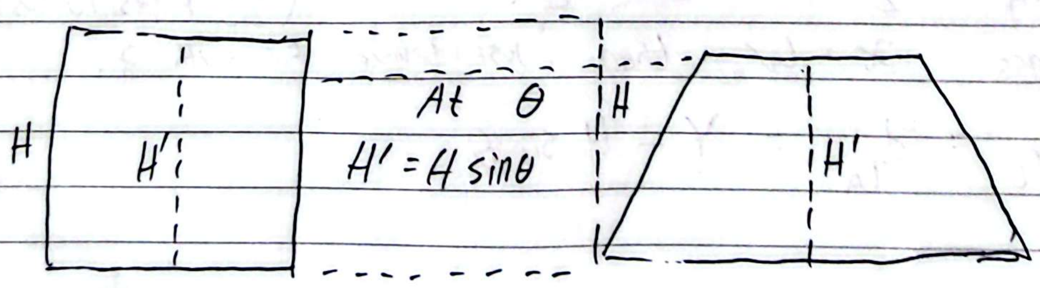


$H' = H \sin\theta$

At 90°

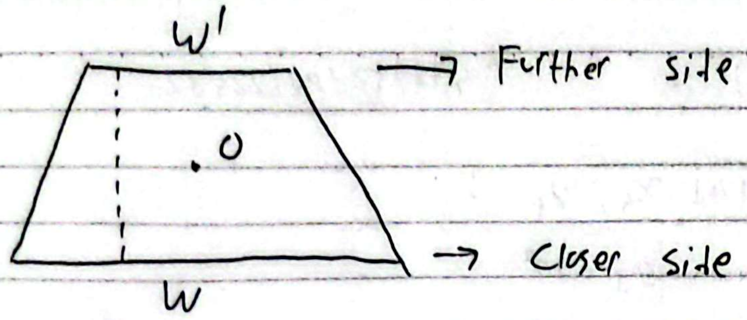
$H' = H \sin 90°$

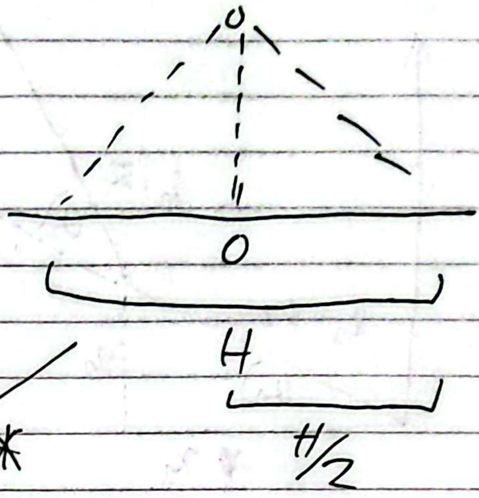
$H' = H$



Surely at $\theta = 0$, $H' = 0$

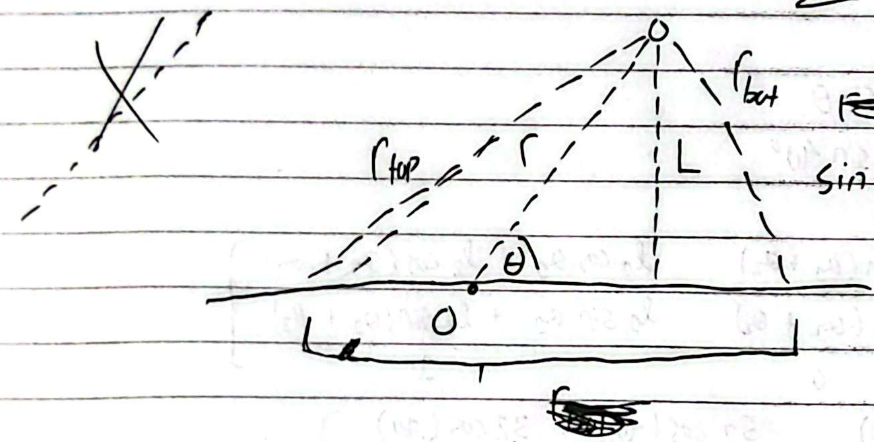
~~[illegible]~~ with paper can see if is a bit accurate





$$\frac{\text{Apparent } W}{\text{Apparent } W} = \frac{\text{Persp dist}}{\text{Persp dist.}}$$

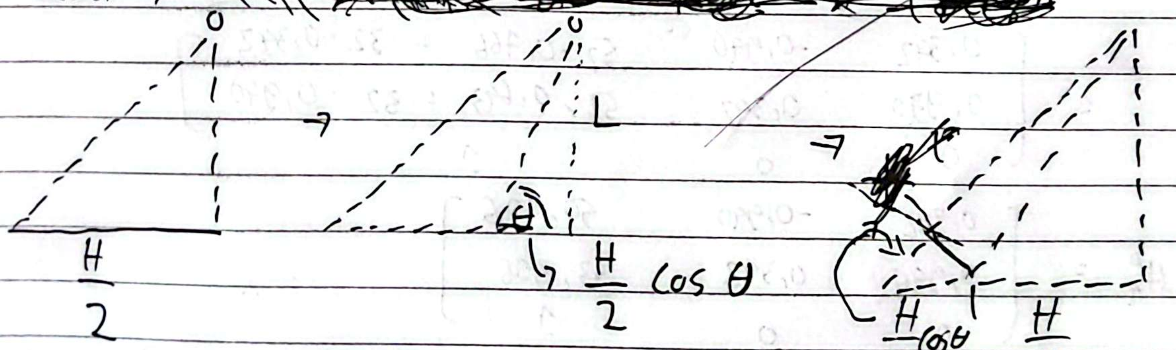
*



$$\sin\theta = \frac{L}{r} \rightarrow r = \frac{L}{\sin\theta}$$

$\frac{H}{2}\cos\theta$ is a projection of $H/2$

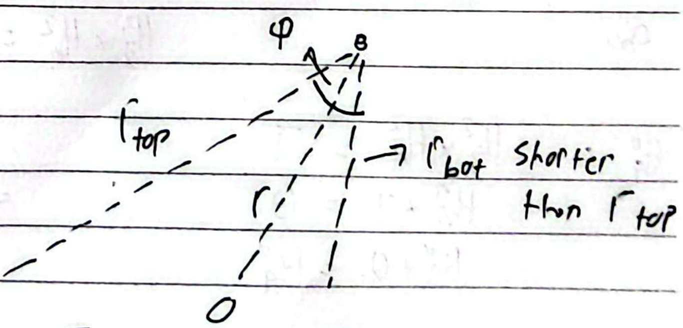
* this is closer,



$$r_{top} = r + \frac{H}{2}\cos\theta$$

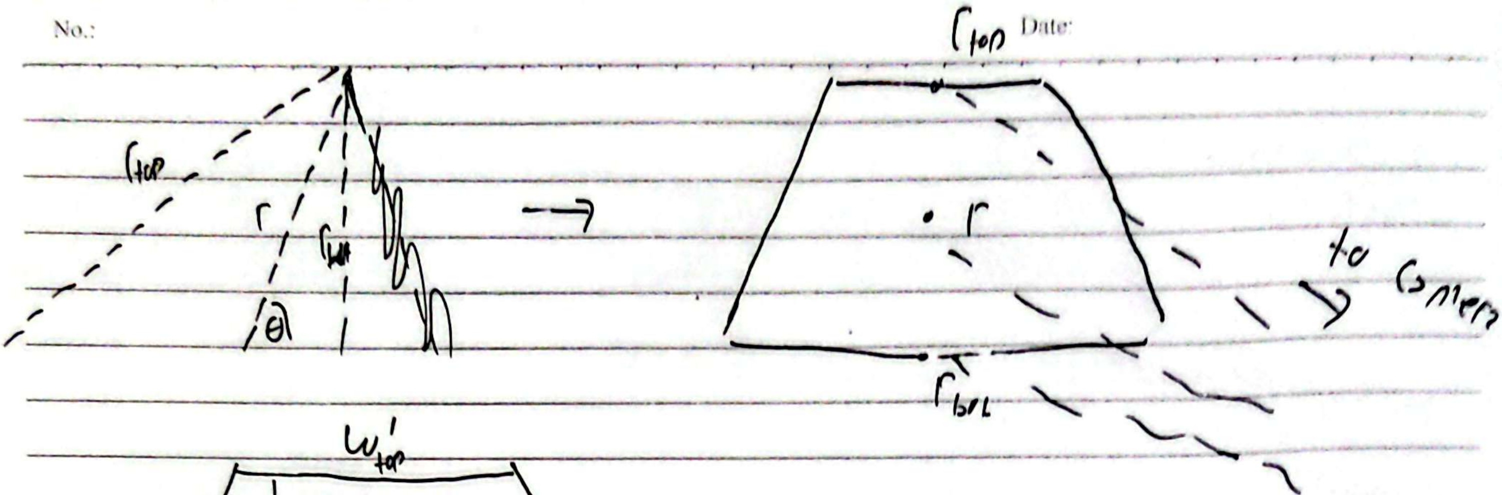
look :

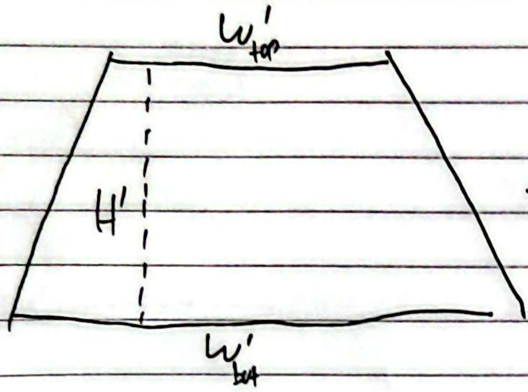
$$r_{bot} = r - \frac{H}{2}\cos\theta$$



At $\theta = 90^\circ \rightarrow \cos\theta = 0 \rightarrow r_{bot} = L - 0 = L$ because at 90 they all overlap.

$r_{top} = L + 0 = L$





$$\rightarrow \frac{W'_{top}}{W'_{bot}} = \frac{r_{bot}}{r_{top}} \rightarrow \frac{W'_{top}}{W} = \frac{r_{bot}}{r_{top}}$$

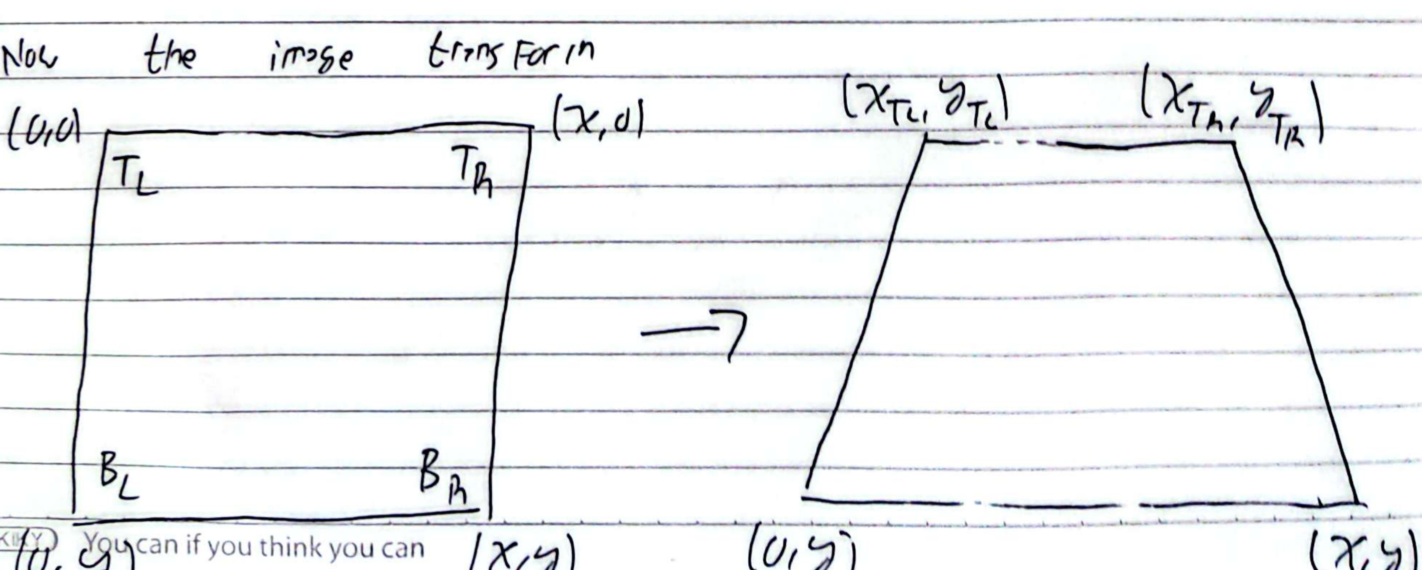
because $W'_{bot} = W$
look at first page.

$$\rightarrow W'_{top} = W\left(\frac{r_{bot}}{r_{top}}\right)$$

$$= W\left(\frac{r - \frac{H}{2}\cos\theta}{r + \frac{H}{2}\cos\theta}\right) = W\left(\frac{\frac{L}{\sin\theta} - \frac{H}{2}\cos\theta}{\frac{L}{\sin\theta} + \frac{H}{2}\cos\theta}\right)$$

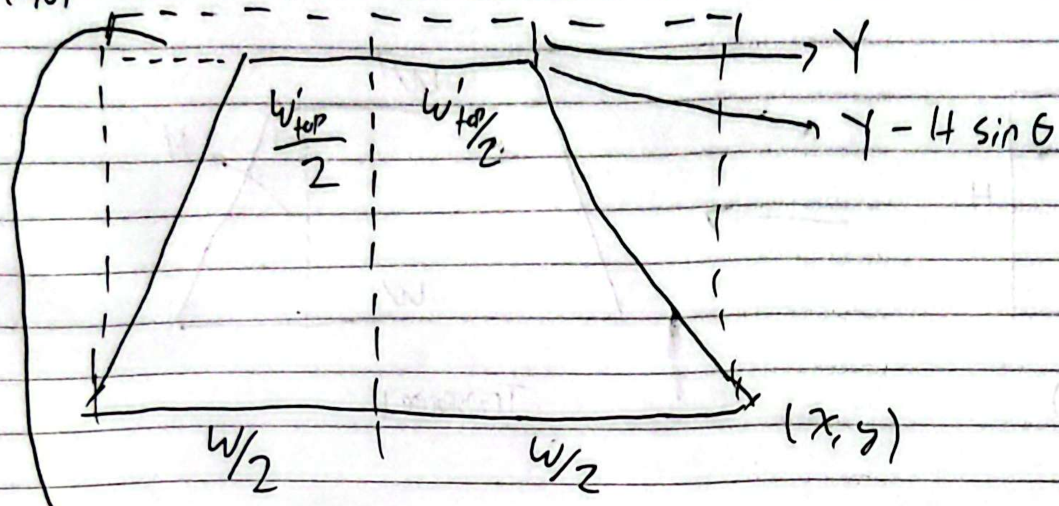
$$W'_{top} = W\left(\frac{2L - H\sin\theta\cos\theta}{2L + H\sin\theta\cos\theta}\right)$$

Now the image transform



No.: Date:

$(0,0)$ $Y_T = Y - H' = Y - H\sin\theta$



$\rightarrow$ OFFset $= \frac{w}{2} - \frac{w'_{top}}{2} = \frac{w - w'_{top}}{2}$

so that $x_{TL} = 0 + \text{OFFset} = \frac{w - w'_{top}}{2}$

$$x_{TR} = x_{TL} + \frac{w'_{top}}{2} \times 2 = x_{TL} + w'_{top} = \frac{w - w'_{top}}{2} + w'_{top}$$

$$= \frac{w + w'_{top}}{2}$$

Therefore

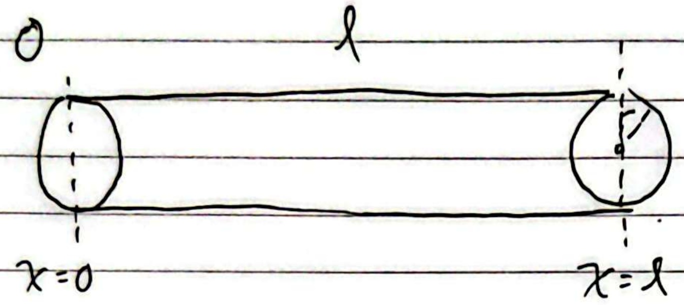
$$x_{TL} = \frac{1}{2}(w - w'_{top}) = \frac{1}{2}\left(w - w\left(\frac{2L - H\sin\theta\cos\theta}{2L + H\sin\theta\cos\theta}\right)\right)$$

$$x_{TR} = \frac{1}{2}(w + w'_{top}) = \frac{1}{2}\left(w + w\left(\frac{2L - H\sin\theta\cos\theta}{2L + H\sin\theta\cos\theta}\right)\right)$$

since $x = w$ then just replace w with x.

$$y_{TL} = y_{TR} = Y - H\sin\theta$$

No.: Date:

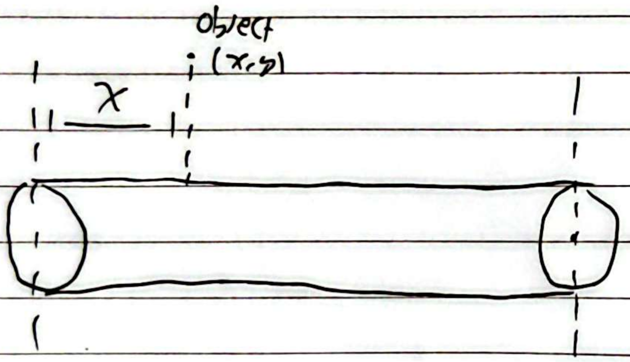


$C = 2\pi r$ // circumference of wheel

$kC = 2\pi r k$

$l = 2\pi r k$

↳ total dist travelled.



→ $x = 2\pi r k$

$k = \frac{x}{2\pi r}$ // how many revolutions to get to x.

Translate pixel to cm

0 px ... 640 px

0 cm ... 120 cm

→ $\frac{640\ px}{120\ cm} = \frac{16}{3}\ px/cm$

* need actual measurement with ruler ~~[illegible]~~
* only applies to 90° view, that's why the need for perspective transform.