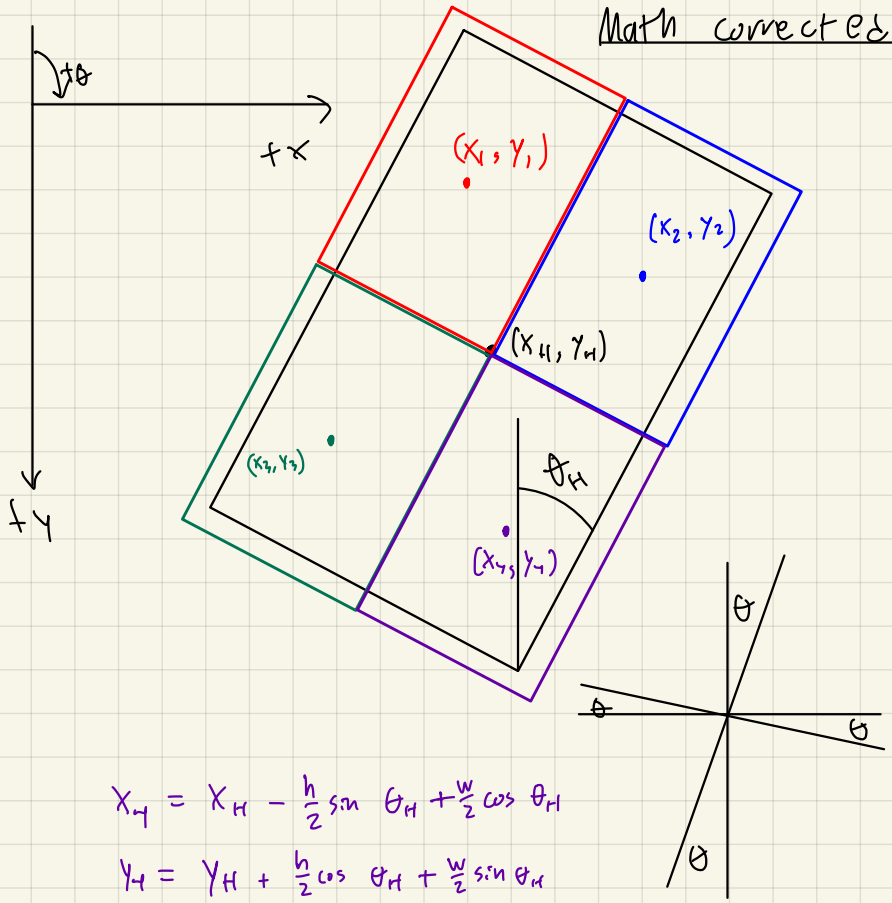
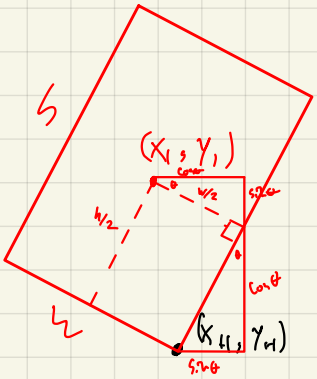
# Math corrected 10/14/2021




$$x_1 = x_H + \frac{h}{2}\sin\theta_H - \frac{w}{2}\cos\theta_H$$
$$y_1 = y_H - \frac{h}{2}\cos\theta_H - \frac{w}{2}\sin\theta_H$$

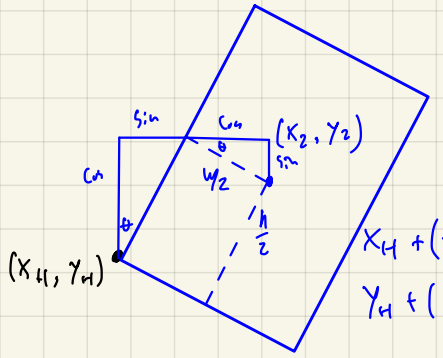



$$x_H + \left(\frac{h}{2}\sin\theta_H - \frac{w}{2}\cos\theta_H\right)$$
$$y_H - \left(\frac{h}{2}\cos\theta_H + \frac{w}{2}\sin\theta_H\right)$$

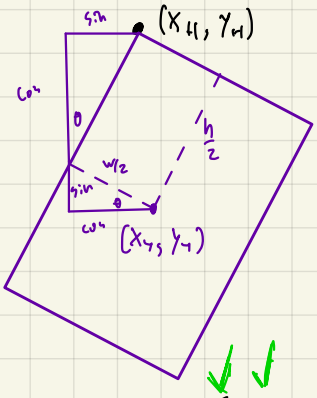
$$x_2 = x_H + \frac{h}{2}\sin\theta_H + \frac{w}{2}\cos\theta_H$$
$$y_2 = y_H - \frac{h}{2}\cos\theta_H + \frac{w}{2}\sin\theta_H$$




$$x_4 = x_H - \frac{h}{2}\sin\theta_H + \frac{w}{2}\cos\theta_H$$
$$y_4 = y_H + \frac{h}{2}\cos\theta_H + \frac{w}{2}\sin\theta_H$$

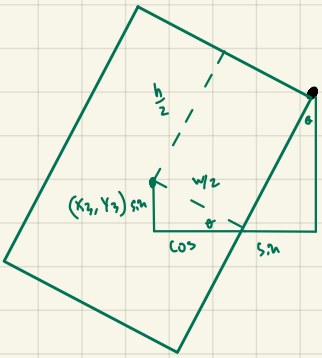



$$x_H + \left(\frac{h}{2}\sin\theta_H + \frac{w}{2}\cos\theta_H\right)$$
$$y_H + \left(\frac{w}{2}\sin\theta_H - \frac{h}{2}\cos\theta_H\right)$$

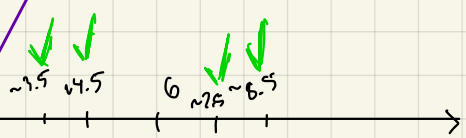



$$x_H + \left(\frac{w}{2}\cos\theta - \frac{h}{2}\sin\theta\right)$$
$$y_H + \left(\frac{h}{2}\cos\theta + \frac{w}{2}\sin\theta\right)$$

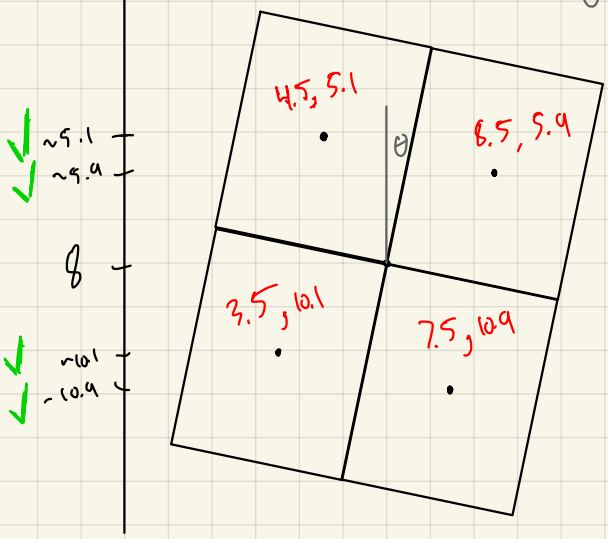
$$x_3 = x_H - \frac{h}{2}\sin\theta_H - \frac{w}{2}\cos\theta_H$$
$$y_3 = y_H + \frac{h}{2}\cos\theta_H - \frac{w}{2}\sin\theta_H$$




$$x_H - \left(\frac{h}{2}\sin\theta_H + \frac{w}{2}\cos\theta_H\right)$$
$$y_H + \left(\frac{h}{2}\cos\theta_H - \frac{w}{2}\sin\theta_H\right)$$

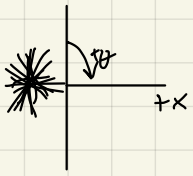



$$\theta \cong \tan^{-1}\left(\frac{1}{5}\right) \approx 11.5°$$




$$x_H = 6$$
$$y_H = 8$$
$$h = 5$$
$$w = 4$$

Conversions





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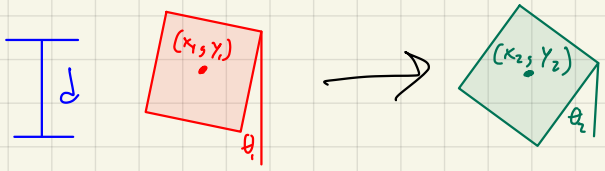
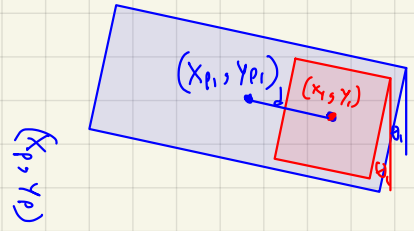



* Correct for
  - in the x
  + in the y

before pickup

rotate $90° + \theta_1$

$\sin(\theta_1 + 90)$




$$x_{p_1} = x_1 - d\cos\theta_1$$
$$y_{p_1} = y_1 - d\sin\theta_1$$

After pickup

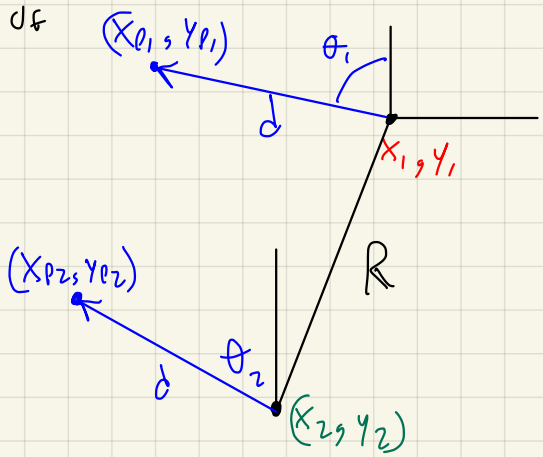
rotate $\theta_1 \rightarrow \theta_2$

move to

$$x_{p_2} = x_2 - d\cos\theta_2$$
$$y_{p_2} = y_2 - d\sin\theta_2$$

UNRELATED!!! Translation vector

translation of




$$R^2 = \Delta x^2 + \Delta y^2$$

$(\Delta x, \Delta y)$

10/19/2021

Surveying the sensors

TR - tr: 654.321, 194.020, 88.666
br: 654.103, 214.072, 88.604
bl: 642.239, 213.460, 88.591
tl 642.463, 193.888, 88.648

BR - tr: 654.040, 219.453, 88.591
br: 653.461, 239.488, 88.591
bl: 641.930, 239.314, 88.591
tl 642.148, 219.308, 88.591

BL - tr: 633.387, 219.094, 88.542
br: 633.174, 239.113, 88.533
bl: 621.340, 238.982, 88.549
tl 621.555, 218.965, 88.565

TL - tr: 633.667, 193.768, 88.598
633.387, 213.825, 88.598
621.512, 213.656, 88.548
621.788, 193.609, 88.675

10/21/21

Glass z: 93.467
HDI z: 93.332