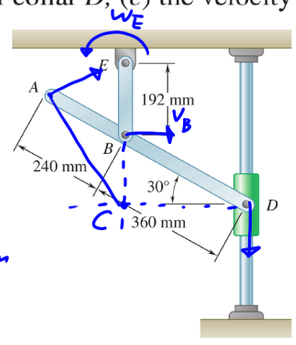
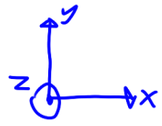
Knowing that at the instant shown the angular velocity of rod BE is 4 rad/s counterclockwise, determine (a) the angular velocity of rod AD, (b) the velocity of collar D, (c) the velocity of point A.





$V_B = \omega r$

$= 4 \text{ rad/s} \; 192 \text{ mm}$

$= 768 \text{ mm/s}$

$\omega = \dfrac{V_B}{BC} = \dfrac{768 \text{ mm/s}}{360 \sin 30 \text{ mm}}$

$= 4.27 \text{ rad/s}$

$V_D = (CD)\omega = 360 \text{ mm} \cos 30 \cdot 4.27 \text{ rad/s} = 1331 \text{ mm/s}$

$\vec{V}_B = 768\,i \text{ mm/s} \qquad \vec{\omega} = -4.27\,k \text{ rad/s}$

$\vec{r}_{A/B} = -240 \text{ mm} \cos 30\, i + 240 \text{ mm} \sin 30\, j$

$= -208\,i + 120\,j \text{ mm}$

$\vec{V}_A = \vec{V}_B + \vec{\omega} \times \vec{r}_{A/B}$

$$= 768\,i + \begin{vmatrix} i & j & k \\ 0 & 0 & -4.27 \\ -208 & 120 & 0 \end{vmatrix} \quad \begin{matrix} i & j \\ 0 & 0 \\ -208 & 120 \end{matrix}$$

$= 4.27 \cdot 208\,j + 4.27 \cdot 120\,i \text{ mm/s}$

$= 1280\,i + 888\,j \text{ mm/s}$

$V_A = (CA)\omega$

$= 365 \text{ mm} \; 4.27 \text{ rad/s}$

$= 1559 \text{ mm/s}$

$CA = 240 \cos 30\, i + (240 + 360) \sin 30\, j$

$= 208\,i + 300\,j$

$|CA| = \sqrt{208^2 + 300^2} = 365 \text{ mm}$

$|\vec{V}_A| = \sqrt{1280^2 + 888^2} = 1558 \text{ mm/s}$