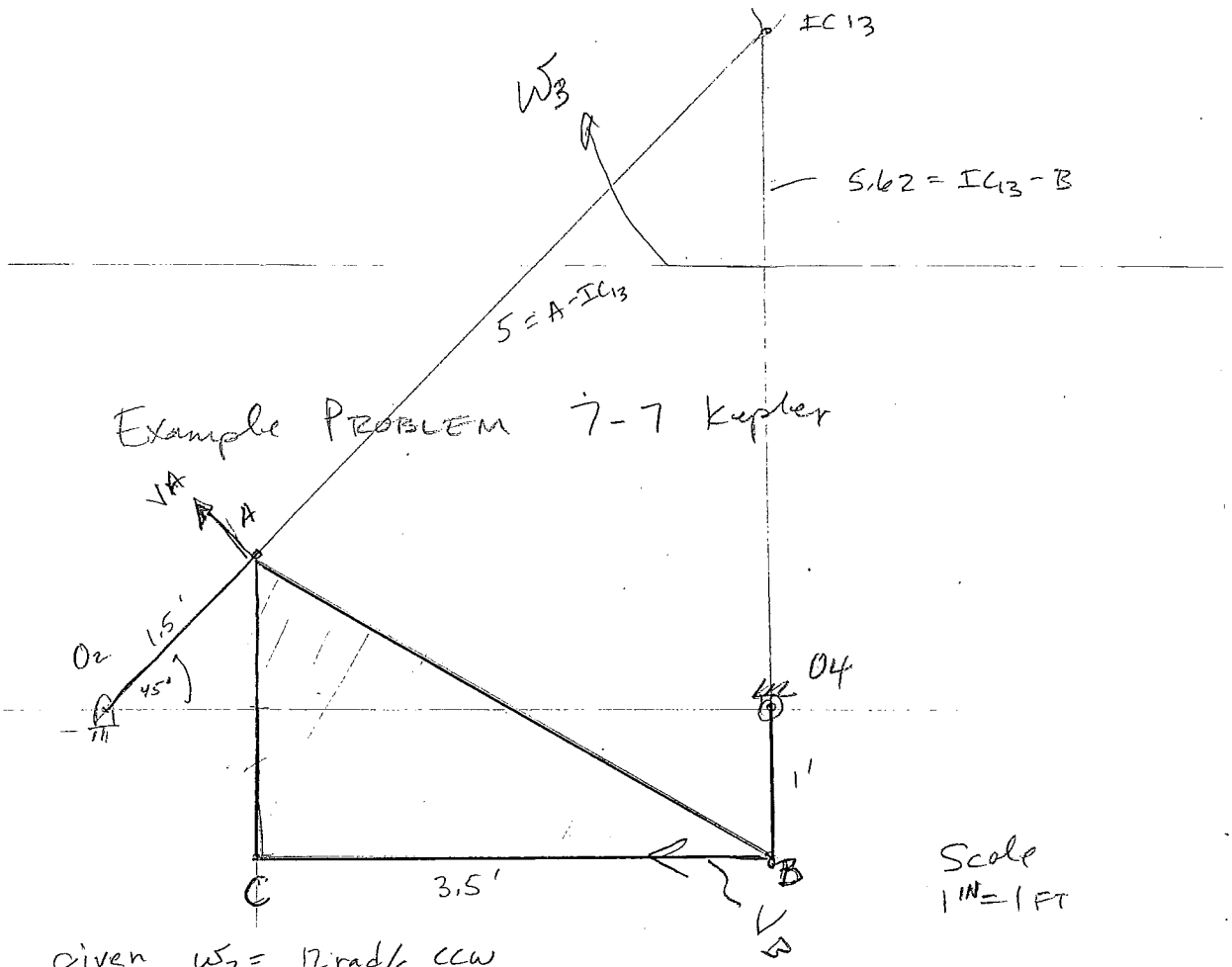
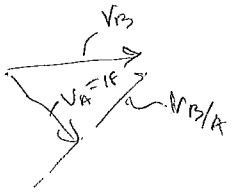


Scale
1 IN = 1 FT

given $\omega_2 = 12$ rad/s CCW

$\alpha_2 = 30$ rad/s² CCW



Step 1 Velocity Analysis to get ω_3 ω_4

$$V_{B3} = V_A + V_{B/A}$$

D	$\overrightarrow{IBO4}$	↑	⊥AB ↗
M	...	1.5(12) = 18	...

DIAGRAM NEXT PAGE

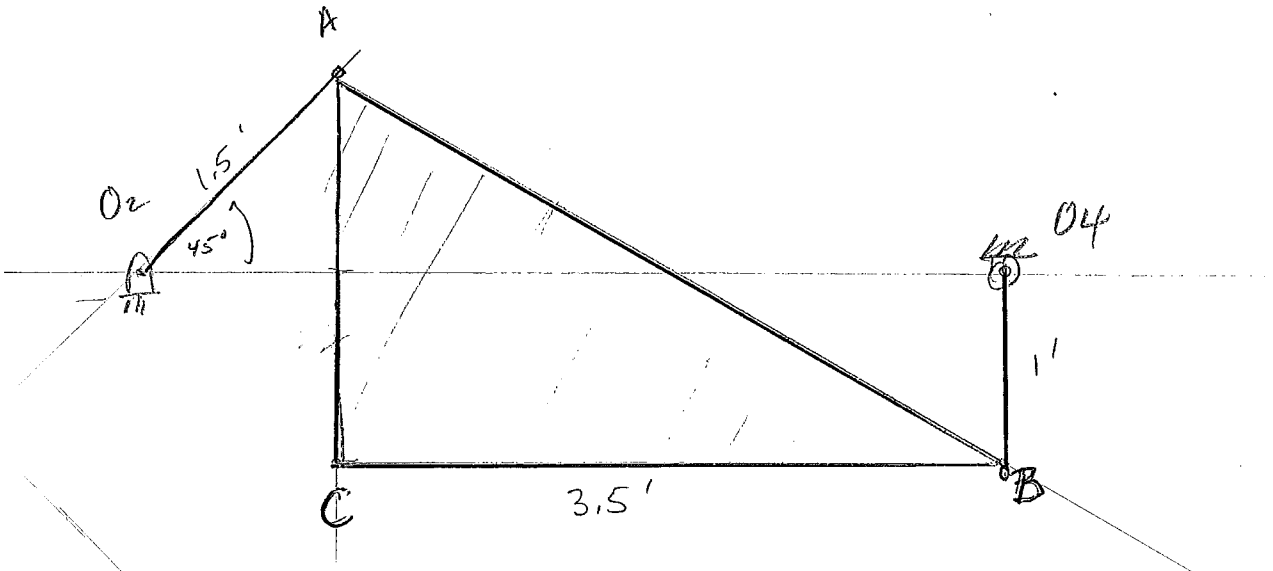
IC method $V_A = 18 = 1.5(12)$ ↘

$$\omega_3 = \frac{V_A}{r_{A/IC13}} = \frac{18}{5} = 3.6 \text{ rad/s} \ \text{)}$$

$$V_B = r_{B/IC13}\,\omega_3 = 5.62(3.6) = 20.23 \text{ FT/S} \rightarrow$$

$$\omega_4 = \frac{V_B}{r_{B/IC14}} = 20.23 \text{ rad/s} \ \text{)}$$

Example Problem 7-7 Kepler



$V_B = 6.62$ in
$= 19.86$ FT/S

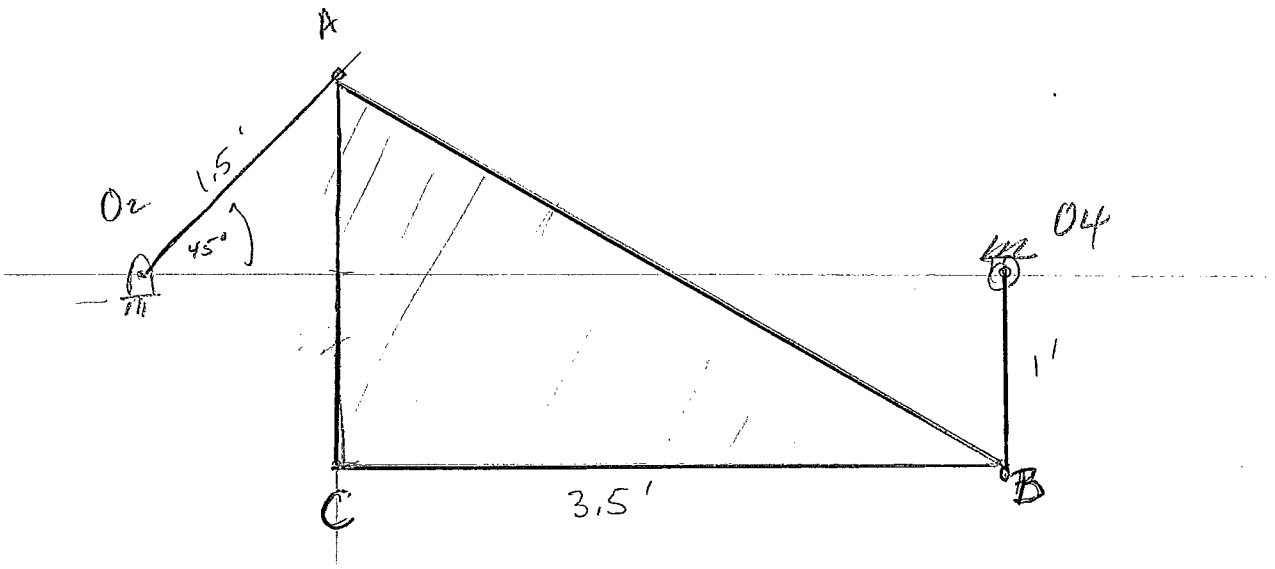
$V_A = 18$ FT/S $= 6.1$"

$V_{B/A} = 5$ in
$= 15$ FT/S

$$\omega_3 = \frac{V_{B/A}}{r_{B/A}} = \frac{15\ \text{FT/S}}{4\ \text{FT}} = 3.75\ \text{rad/s}\ \text{ccw}$$

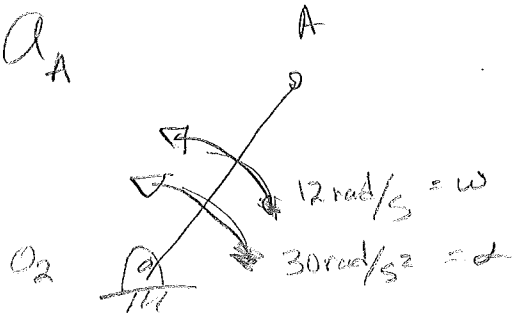
$$\omega_4 = \frac{V_B}{r_{B/O4}} = \frac{19.86}{1} = 19.86\ \text{rad/s}\ \text{ccw}$$

Example Problem 7-7 Kepler



Step 2

Evaluate a_A

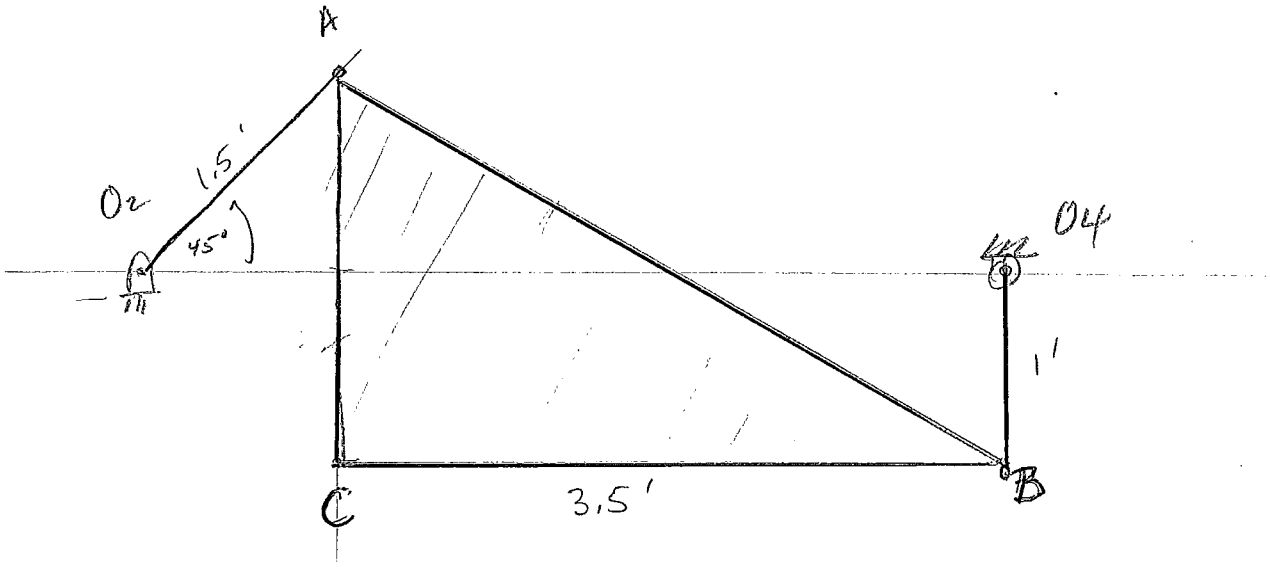


$$a_A^n = r_{A/O_2}\omega_{2}^{2} = 1.5\,\text{FT}\,(12\,\text{rad/s})^2$$

$$a_A^n = 216\,\text{FT/S}^2$$

$$a_A^t = r\alpha_{A/O_2} = 1.5\,\text{FT}\;\;30\,\text{rad/s}^2 = 45\,\text{FT/S}^2 \quad \perp AO_2$$

Example Problem 7-7 Kepler



Step 3 evaluate a_B

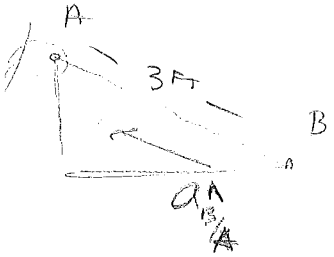
$$a_B^n = r_{B/O_4} \omega_4^2 \uparrow$$

a_B^n $1\text{ FT}\left(20\ \text{rad/s}\right)^2 = 400\ \text{FT/s}^2 \uparrow$ @ 90°

a_B^t is $\perp \overline{BO_4}$

Step 3 evaluate $a_{B/A}$

$$a_{B/A}^n = r\omega^2$$

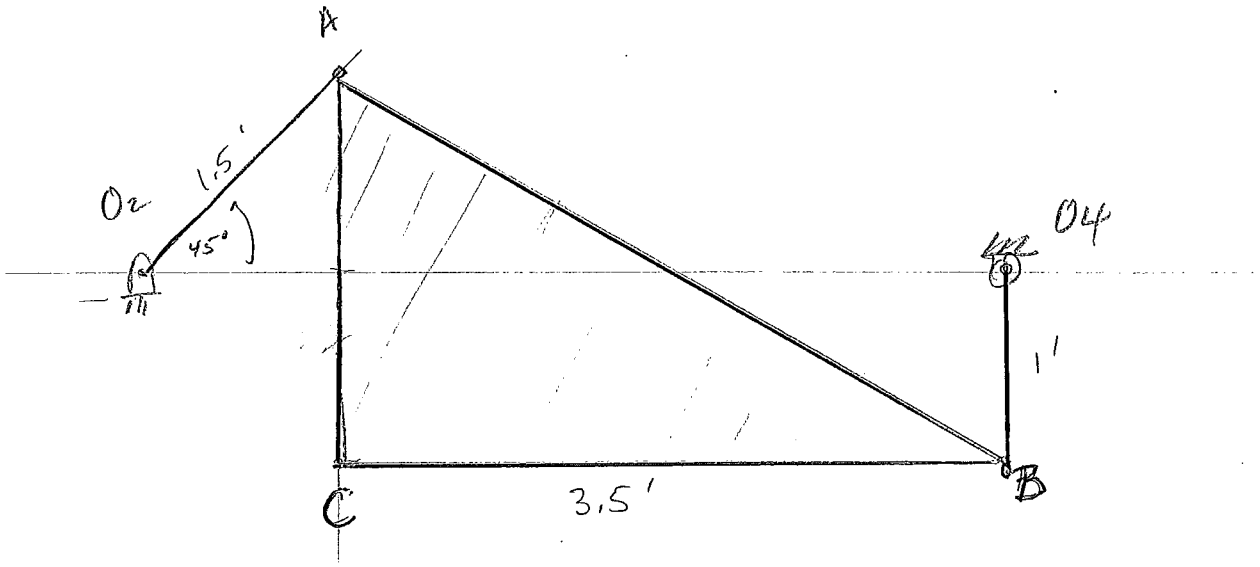


$$3\text{FT}\left(3.75\ \text{rad/s}\right)^2$$

$$a_{B/A}^n = 42.2\ \text{FT/s}^2$$

$a_{B/A}^t$ is $\perp \overline{BA}$

Example Problem 7-7 Kepler



Step 4

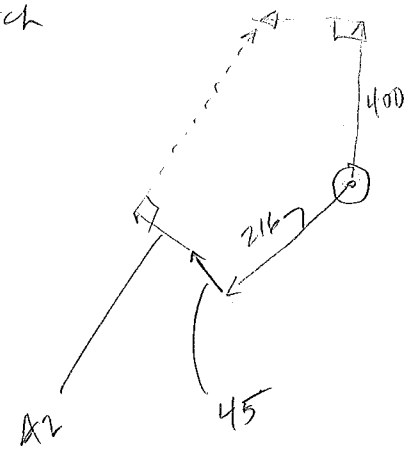
evaluate relative acceleration eqn

$$a_B = a_A + a_{B/A}$$

$$a_B^n + a_B^t = a_A^n + a_A^t + a_{B/A}^n + a_{B/A}^t$$

D	B TO O4	⊥ BO4	A TO O2 ↙	⊥ AO2 ↖	B TO A ↖	⊥ BA
FT/S² M	400		216	45	42.2	
Scaled	8 IN		4.32	.9	.844	

Sketch

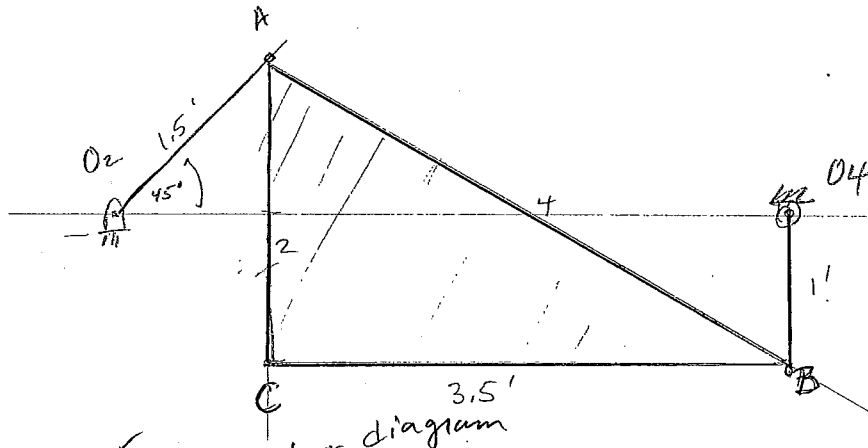


Scale

Let 1 in = 100 FT/S² ↑ 4"

(or 1 in = 50 FT/S² ↑ 8")

Example Problem 7-7 Kepler



Step 5 detailed vector diagram

step 6 compute α

$\alpha_3 = \frac{a^t_{B/A}}{r_{B/A}} = \frac{588\ FT/s^2}{4\ FT} = 147\ rad/s$ ↺ ccw

$a^t_{B/A} = 11.75'' = 587.5\ FT/s^2$

$\alpha_4 = \frac{a^t_B}{r_{B/O4}} = \frac{72\ FT/s^2}{1\ FT} = 72\ rad/s^2$ ↻ ccw

$a^t_B = 1.44'' = 72\ FT/s^2$

$a^t_B =$

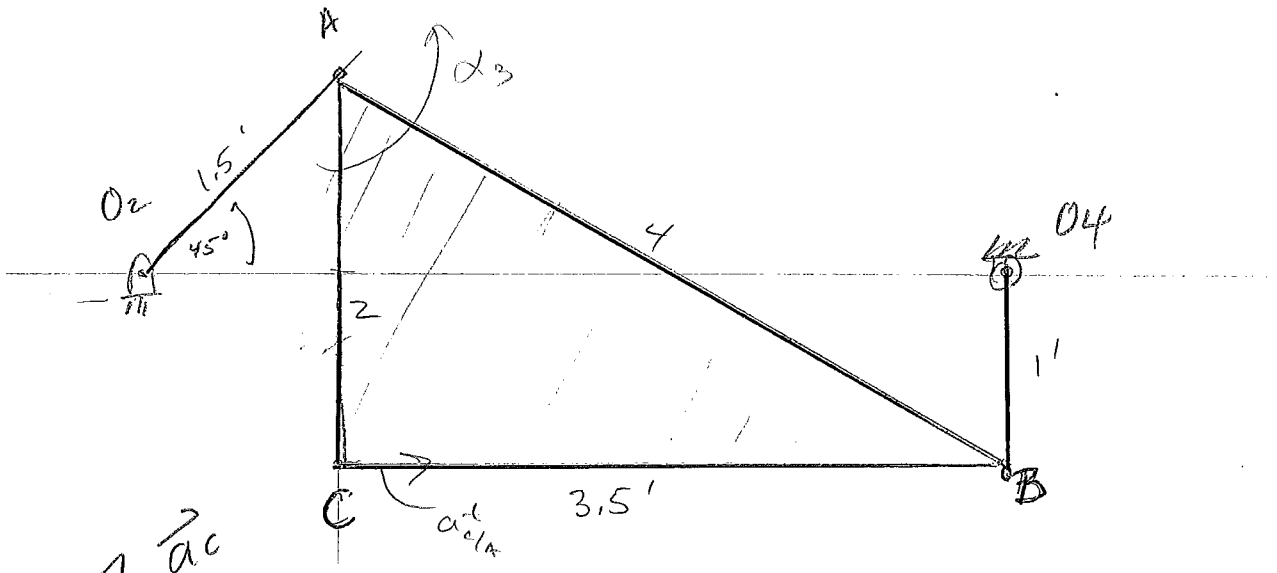
$a^n_B = 8\ in = 400\ in/s^2$

$a^n_{B/A} = .844\ in = 41.2\ in/s^2$

$a^t_K = 0.9\ in = 45\ in/s^2$

$\vec{a}^n_A = 4.32\ in = 216\ in/s^2$

Example Problem 7-7 Kepler



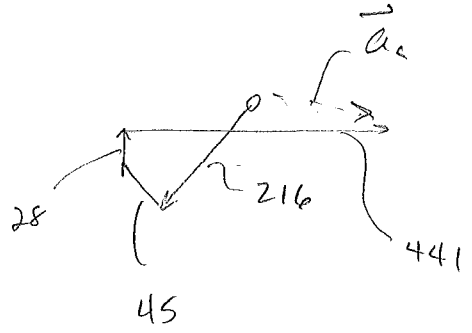
Step 1 $\vec{a}_C$

$$\vec{a}_C = \vec{a}_A + \vec{a}_{C/A}$$

$$\vec{a}_C = \vec{a}^{\,n}_A + \vec{a}^{\,t}_A + \vec{a}^{\,n}_{C/A} + \vec{a}^{\,t}_{C/A}$$

	$\vec{a}^{\,n}_A$	$\vec{a}^{\,t}_A$	$\vec{a}^{\,n}_{C/A}$	$\vec{a}^{\,t}_{C/A}$
D	$\overleftarrow{AO_2}$	$\perp AO_2$	$\uparrow AC$	$\perp AC$
M	$r_{A/O_2}\omega^2_2$	$r_{A/O_2}\alpha_2$	$r_{C/A}\omega^2_3$	$r_{C/A}\alpha_3$
M calc	$1.5(12)^2$	$1.5(30)$	$2(3.75)^2$	$2(147)$
M result (FT/S^2)	216	45	28	441
M scaled (IN)	2.16 in	.45	.028	4.41

Sketch of expected vector diagram



Scale
1 in = 100 FT/S2