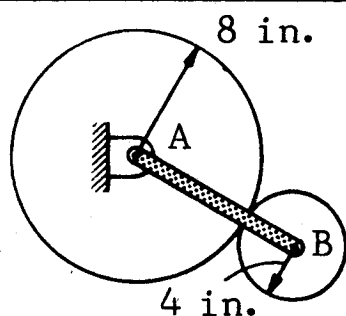


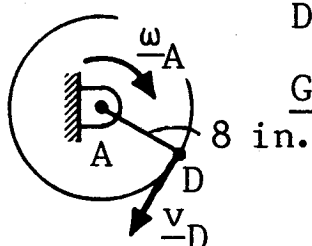
Rotating gears Kinematics Example



Gears A and B (gear teeth not shown) are connected by arm AB.

Given: $\omega_A = 60 \text{ rpm}$

Find: ω_B if (a) $\omega_{AB} = 40 \text{ rpm}$
(b) $\omega_{AB} = 40 \text{ rpm}$

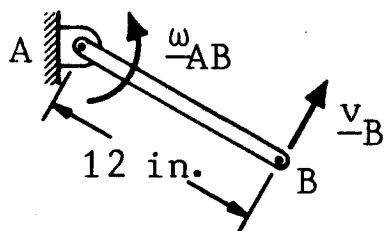


Denote by D the two teeth in contact

Gear A. $\omega_A = 60 \text{ rpm}$

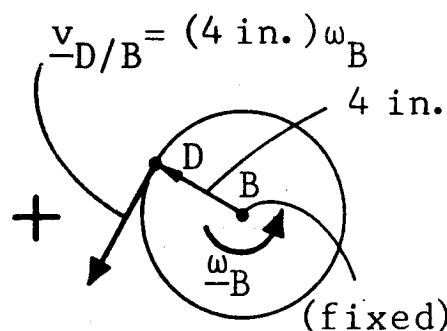
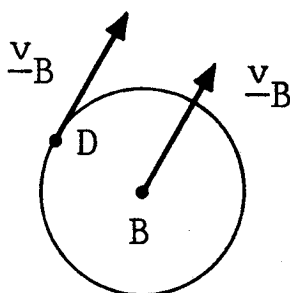
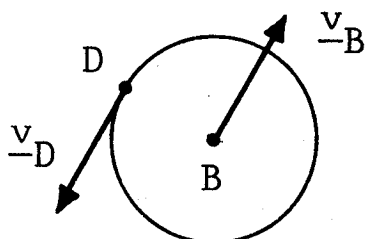
$$\underline{v}_D = (8 \text{ in.}) \omega_A$$

(a) Arm AB Rotates



$$\underline{v}_B = (12 \text{ in.}) \omega_{AB}$$

Gear B



Plane motion = Translation + Rotation

$$\underline{v}_D = \underline{v}_B + \underline{v}_{D/B}$$

$$\nearrow : 8\omega_A = -12\omega_{AB} + 4\omega_B$$

$$\omega_B = 2\omega_A + 3\omega_{AB} = 2(60 \text{ rpm}) + 3(40 \text{ rpm}) = 240 \text{ rpm}$$

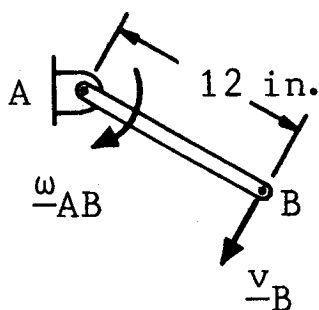
$$\omega_B = 240 \text{ rpm}$$

(continued)

Gear A. $\omega_A = 60 \text{ rpm}$ ↻

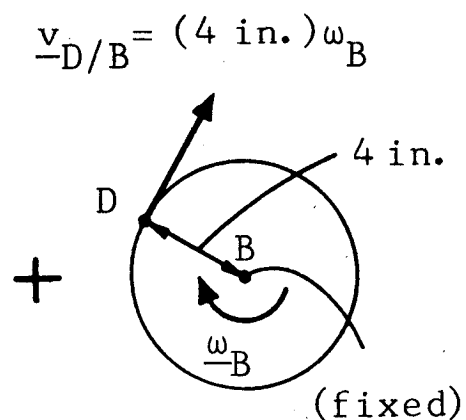
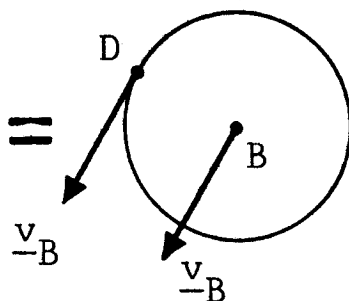
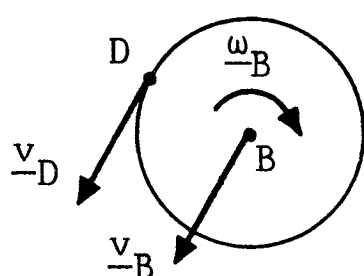
We have found: $\underline{v}_D = (8 \text{ in.})\omega_A$ ↗

(b) Arm AB Rotates ↻



$$\underline{v}_B = (12 \text{ in.})\omega_{AB} \swarrow$$

Gear B



Plane motion = Translation + Rotation

$$\underline{v}_D = \underline{v}_B + \underline{v}_{D/B}$$

$$+ \swarrow : 8\omega_A = 12\omega_{AB} - 4\omega_B$$

$$\omega_B = 3\omega_{AB} - 2\omega_A = 3(40 \text{ rpm}) - 2(60 \text{ rpm}) = 0$$

$$\omega_B = 0$$

Motion of Gear B is a curvilinear translation. ◀