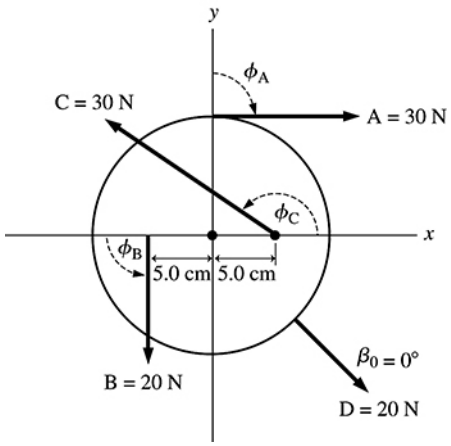
12.22. Model: The disk is a rotating rigid body.

Visualize:



The radius of the disk is 10 cm and the disk rotates on an axle through its center.

Solve: The net torque on the axle is

$$\tau = F_A r_A \sin\phi_A + F_B r_B \sin\phi_B + F_C r_C \sin\phi_C + F_D r_D \sin\phi_D$$
$$= (30\text{ N})(0.10\text{ m})\sin(-90°) + (20\text{ N})(0.050\text{ m})\sin 90° + (30\text{ N})(0.050\text{ m})\sin 135° + (20\text{ N})(0.10\text{ m})\sin 0°$$
$$= -3\text{ N m} + 1\text{ N m} + 1.0607\text{ N m} = -0.94\text{ N m}$$

Assess: A negative torque means a clockwise rotation of the disk.