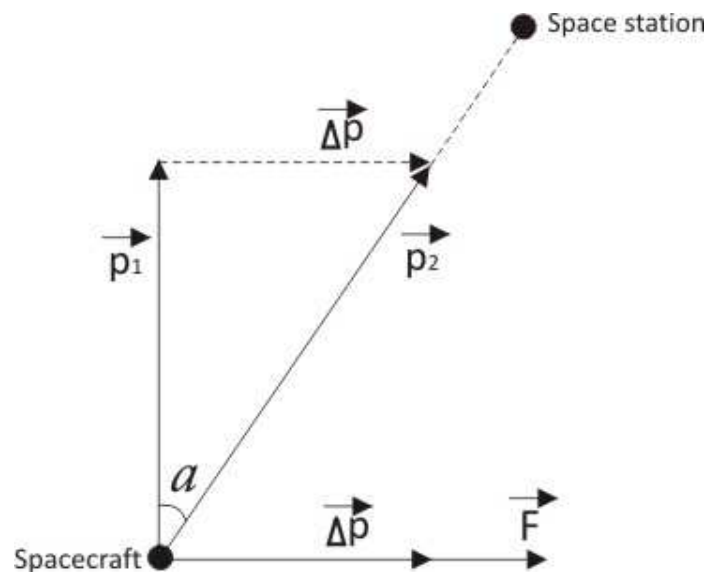Your spacecraft is travelling forward with a momentum of $4940\frac{kg\cdot m}{s}$,. The space station is $40°$ to the right. The thrusters on the spacecraft exert a force of $1112N$ perpendicular to the motion. How many seconds should you turn the thruster on to change your heading to reach the station?

Solution.

$$p_1 = 4940\frac{kg\cdot m}{s}, F = 1112N, \alpha = 40°;$$

$$t-?$$

$\overrightarrow{p_1}$ – an initially momentum of the spacecraft;

$\overrightarrow{p_2}$ – a final momentum of the spacecraft;

$\overrightarrow{\Delta p}$ – changing of the momentum of the spacecraft.

From diagram:

$$\frac{\Delta p}{p_1} = tan\alpha;$$

$$\Delta p = p_1 tan\alpha.$$

If a force F is applied to a spacecraft for a time interval t, the momentum of the spacecraft changes by an amount:

$$\Delta p = Ft;$$

$$t = \frac{F}{\Delta p};$$

$$t = \frac{F}{p_1 tan\alpha}.$$

$$t = \frac{1112}{4940 \cdot tan40°} = 0.27(s).$$

Answer: $t = 0.27s$.