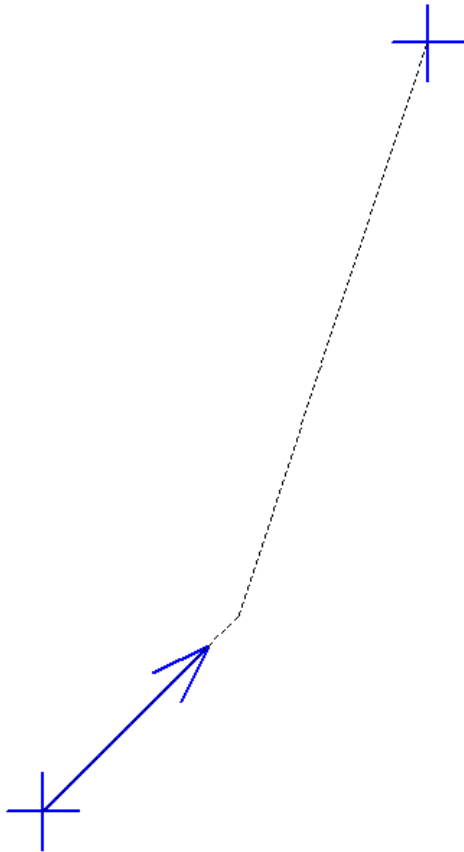**Task:**

A buoy lies 1000 m East and 2000 m North of a start line. A boat starts at start line and travels on a bearing of 45 deg at $6\,\frac{m}{s}$. After 6 mins the boat turned and increased speed to $9\frac{m}{s}$. How long does it take for the boat to reach buoy?

Solution:

$$s = v_0 t_1 + v_1 t_2$$

$$v_0 = 6\frac{m}{s}$$

$$t_1 = 120\ s$$

$$v_1 = 9\frac{m}{s}$$

$$s_{North} = v_0(\sin 45^0)t_1 + v_1(\sin \alpha)t_2$$

$$s_{East} = v_0(\cos 45^0)t_1 + v_1(\cos \alpha)t_2$$

$$s_{North} = 2000\ m$$

$$s_{East} = 1000\ m$$

$$2000 \ m = 720 \ m \ (\sin 45^0) + 9 \frac{m}{s} (\sin \alpha) t_2$$

$$1000 \ m = 720 \ m \ (\cos 45^0) + 9 \frac{m}{s} (\cos \alpha) t_2$$

$$t_2 = 174.402 \ s$$

Answer:

$$t = t_1 + t_2 = 120 \ s + 174.402 \ s = 294.402 \ s$$