2000

2. At a certain instant ship Q is at a distance of $4a$ due east of ship P.
Q is moving northwards with constant speed u and P is travelling with constant speed $2u$.

Find the direction of P if it is to intercept Q.
Find the time T, in terms of a and u, it would take P to intercept Q.

If, instead, after time $\frac{T}{2}$ has elapsed, the speed of P drops to constant speed u without changing direction, find, in terms of a,

(i) the shortest distance between P and Q

(ii) the distance each ship has moved from its original position to its position when they are closest together.

Direction : $2\,u\sin\alpha = u$

$\Rightarrow \quad \sin\alpha = \frac{1}{2} \quad$ or $\quad \alpha = 30°$ — 10

Time : $2\,u\cos\alpha\,(T) = 4a \Rightarrow T = \dfrac{4a}{u\sqrt{3}}$ — 10

After $\frac{T}{2}$ seconds P has moved $2\,u\cos\alpha\left(\frac{T}{2}\right) = 2a$ East — 5

New position of P and Q