

**Assignment 6: Due Mon Sept 25th**

Stardate 242-06: Spaceship A is 10 lightyears due west of Spaceship B (in the same 2-dimensional plane, which we will describe with cardinal directions). Ship A is traveling due north at 1 lightyear / hour, and Ship B is traveling due west at 2 lightyears / hour. In order to establish a link, the ships must be close, and the speed of one ship relative to the other must be low. So we wish to find how fast the distance between the two ships is changing.

-Let  $h$  be the distance between the two ships. Find a general formula for  $dh/dt$  in terms of  $a$ ,  $b$ , and  $h$ .

-Find  $dh/dt$  3 hours after Stardate 242-06.



$$\frac{d}{dt}(a^2 + b^2) = \frac{d}{dt}(h^2) \rightarrow 2a \frac{da}{dt} + 2b \frac{db}{dt}$$

$$\rightarrow a \frac{da}{dt} + b \frac{db}{dt} = h \frac{dh}{dt} = \frac{a \frac{da}{dt} + b \frac{db}{dt}}{h} = \frac{dh}{dt}$$

$$a = 3 \text{ ly}$$

$$b = \text{Orig. distance (A,B)} - \frac{db}{dt}(t) \rightarrow b = 10 \text{ ly} - 2 \frac{\text{ly}}{\text{hr}}(3 \text{ hr})$$

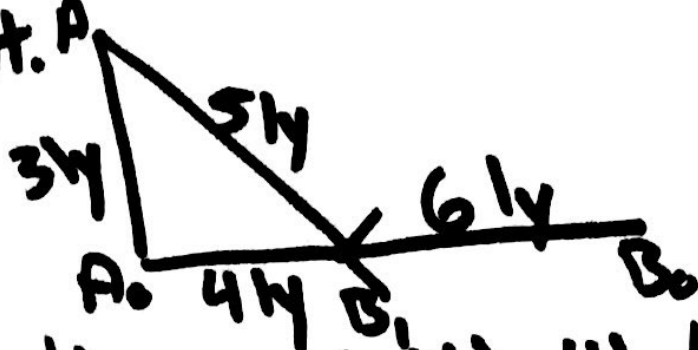
$$\therefore b = 4 \text{ ly}$$

$$h = \sqrt{a^2 + b^2} = \sqrt{(3 \text{ ly})^2 + (4 \text{ ly})^2} = \sqrt{9 + 16} = \sqrt{25} = 5 \text{ ly}$$

$$\therefore h = 5 \text{ ly}$$

Cont.

Cont. A



$$\frac{dh}{dt} = \frac{314(1\frac{1}{2}) + 414(-2\frac{1}{2})}{514}$$

$$\therefore \frac{dh}{dt} = -1\frac{1}{4} \text{ @ 3 hours}$$

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$$\frac{dh}{dt} \cdot 5 + \frac{dh}{dt} \cdot 4 = (5\frac{1}{2}) \cdot \frac{6}{5} = (5\frac{1}{2}) \cdot \frac{6}{5}$$



$$\frac{dh}{dt} \cdot 5 + \frac{dh}{dt} \cdot 4 = \frac{dh}{dt} \cdot 5 = \frac{dh}{dt} \cdot 5 + \frac{dh}{dt} \cdot 4$$

$$\frac{dh}{dt} \cdot 5 - \frac{dh}{dt} \cdot 4 = \frac{dh}{dt} \cdot 5 - \frac{dh}{dt} \cdot 4$$

$$\frac{dh}{dt} \cdot 5 - \frac{dh}{dt} \cdot 4 = \frac{dh}{dt} \cdot 5 - \frac{dh}{dt} \cdot 4$$

Ans.