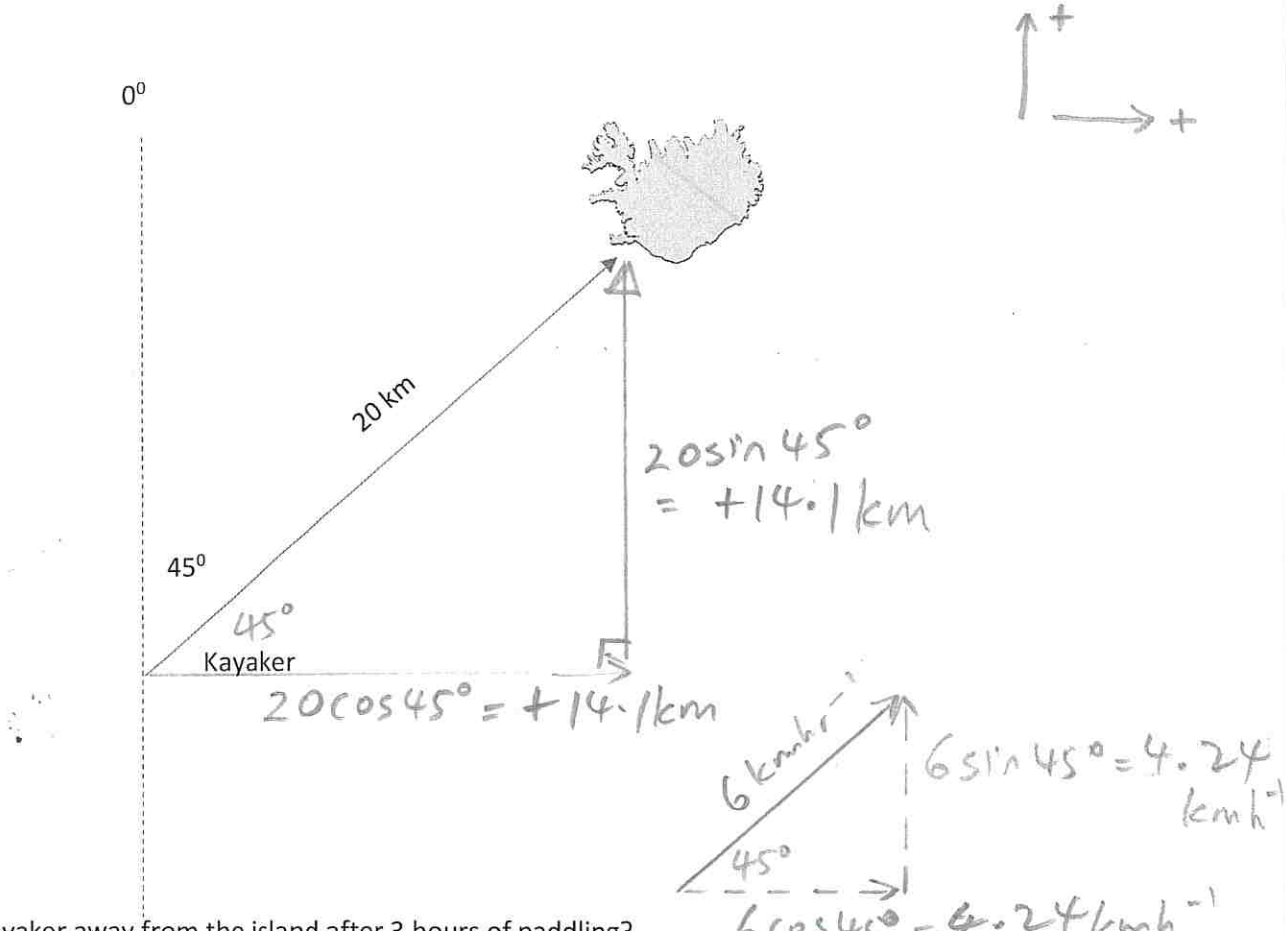
Vectors Review

1/ A kayaker can travel in flatwater with a speed of 6kmh^{-1}. She aims directly towards an island that is 20 km away and starts paddling. A tidal current is flowing at 2 kmh^{-1} in a direction of 0^0.



(a) How far is the kayaker away from the island after 3 hours of paddling?

X Direction: 4.24 x 3 = + 12.7 km $\Delta X = 12.7 - 14.1 = -1.4$ km

Y Direction: (4.24+2) x 3 = + 18.7 km $\Delta Y = 18.7 - 14.1 = +4.6$ km

(b) Her friend is able to paddle with the same flat water speed but choses to compensate for the current by offsetting his direction. How long does it take his friend to reach the island?

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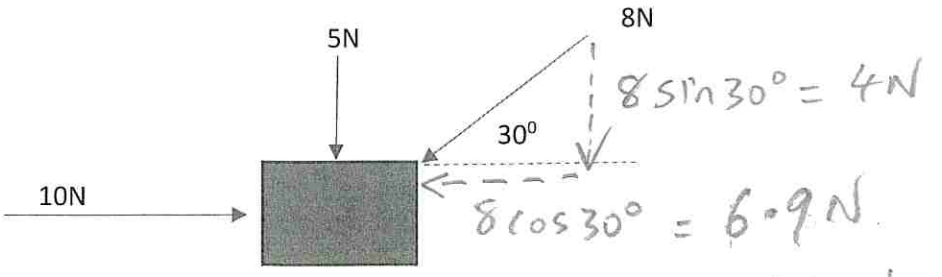
2. An object has 3 forces acting on it as shown below



(a) Find the sum of all three vectors, include both size and direction

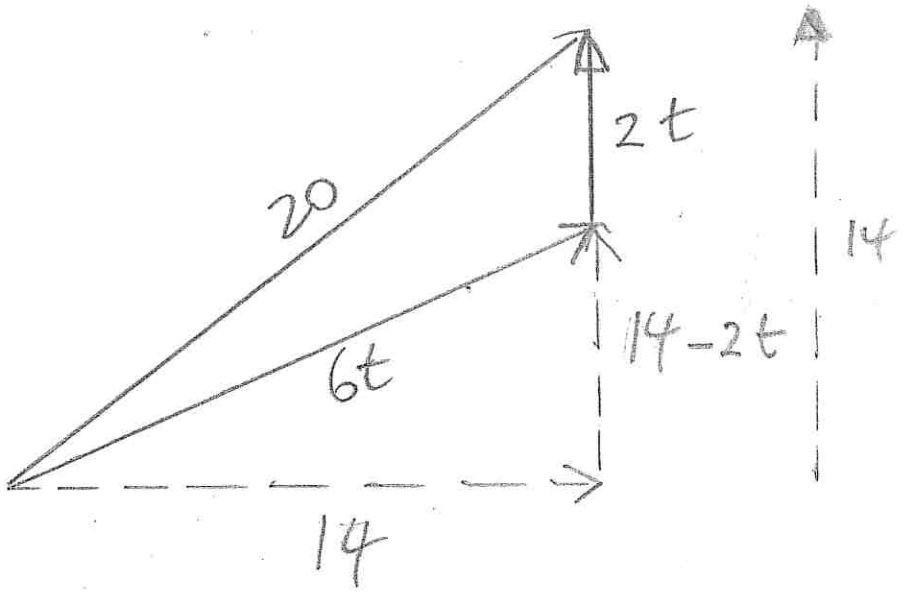
X Direction 10 − 6.9 = 3.1N →

Y Direction 5 + 4 = 9N ↓

(c) If a 4th force was added so that it was to stop the mass from accelerating what would be it size and direction?

X = 3.1N ←

Y = 9N ↑



Pythagoreas

$$(6t)^2 = 14^2 + (14-2t)^2$$

$$36t^2 = 200 + 200 - 56t + 4t^2$$

$$32t^2 + 56t - 400 = 0$$

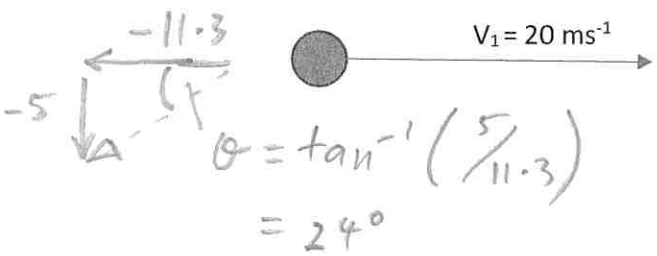
$$4t^2 + 7t - 50 = 0$$

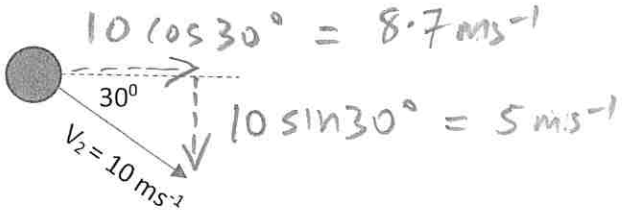
$$t = \frac{-4 \pm \sqrt{7^2 - 4(4)(-50)}}{2(4)}$$

$$= \frac{-4 \pm 29}{8}$$

$$= 3.14 \text{ hours}$$

3. An object changes its motion from V_1 to V_2 as shown below





(a) Determine the direction of the average acceleration based on the change in motion

$\vec{a} = \vec{V}_2 - \vec{V}_1$

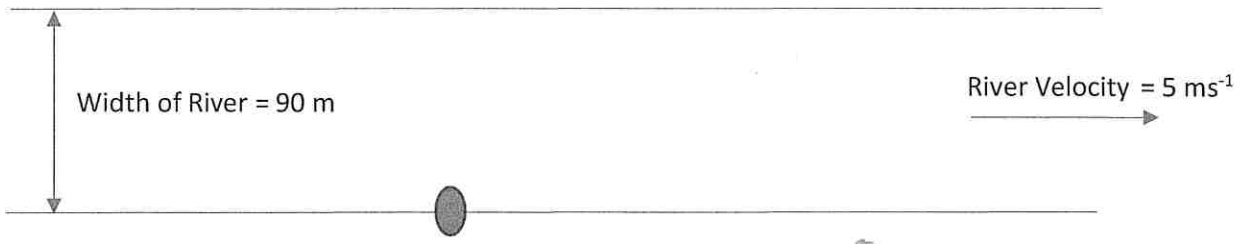
$a = \vec{V}_2 + (-\vec{V}_1)$

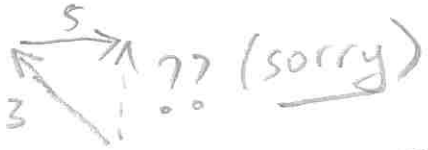
$\vec{a}_x = 8.7 - 20 = -11.3\ ms^{-1}$

$\vec{a}_y = -5\ ms^{-1}$

4. A cyclist is traveling at 10 ms^{-1} in the horizontal direction and rain drops fall vertically at 5 ms^{-1}. What is the velocity of the rain relative to the cyclist?

5. A swimmer can swim with a maximum flatwater speed of 3ms^{-1} . He is attempting to cross a river as shown below.





(a) Assume the swimmer wants to reach a point directly opposite. How long will it take? NOT POSSIBLE

(b) Suppose the swimmer wants to take the shortest amount of time to cross the river. How long will it take?

$V_{swimmer} = 3ms^{-1}$

90m

$t = \frac{90}{3}$

$= 30 seconds$