

40. The direction of motion (the direction of the barge's acceleration) is $+\hat{i}$, and $+\hat{j}$ is chosen so that the pull \vec{F}_h from the horse is in the first quadrant. The components of the unknown force of the water are denoted simply F_x and F_y .

(a) Newton's second law applied to the barge, in the x and y directions, leads to

$$(7900\text{N}) \cos 18^\circ + F_x = ma$$

$$(7900\text{N}) \sin 18^\circ + F_y = 0$$

respectively. Plugging in $a = 0.12 \text{ m/s}^2$ and $m = 9500 \text{ kg}$, we obtain $F_x = -6.4 \times 10^3 \text{ N}$ and $F_y = -2.4 \times 10^3 \text{ N}$. The magnitude of the force of the water is therefore

$$F_{\text{water}} = \sqrt{F_x^2 + F_y^2} = 6.8 \times 10^3 \text{ N}.$$

(b) Its angle measured from $+\hat{i}$ is either

$$\tan^{-1} \left(\frac{F_y}{F_x} \right) = +21^\circ \text{ or } 201^\circ.$$

The signs of the components indicate the latter is correct, so \vec{F}_{water} is at 201° measured counterclockwise from the line of motion ($+x$ axis).