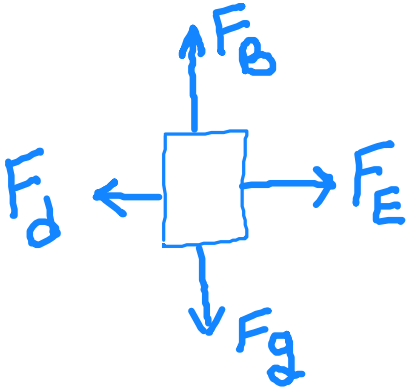## Forces Resisting Motion – oh what a drag, friction and air

1. A boat is accelerating horizontally through the water. If the thrust of the engine is 2500 N eastward at a time when resistance (drag from the water) acting on the 400 N westward, what will be the boat's acceleration if the mass of the boat is 1600 kg?
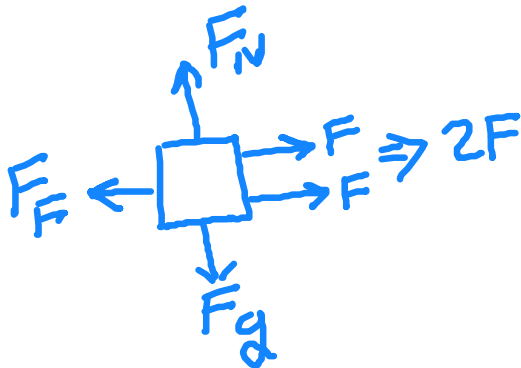
$$F_x Net = m \cdot a$$
$$F_E - F_d = m \cdot a$$
$$2500 - 400 = 1600 \cdot a$$
$$\frac{2100}{1600} = \frac{1600a}{1600}$$

$$a = 1.3 \text{ m/s}^2$$

(Free body diagram: F_B up, F_g down, F_d left, F_E right)

2. A box is being pushed forward by two physics students. They know the force of friction of the box is approximately 50 N. If the box has a mass of 100 kg, and it is accelerating forward at a rate of 2.4 m/s², what force are they each applying if they are applying equal forces?

(Free body diagram: F_N up, F_g down, F_F left, $F + F \Rightarrow 2F$ right)

$$F_x NET = m \cdot a$$
$$2F - F_F = m \cdot a$$
$$2F - 50 = 100(2.4) + 50$$
$$ + 50$$
$$2F = 240 + 50$$
$$2F = 290$$
$$F = \frac{290}{2} = \boxed{145 \text{ N}}$$

Drag Force Practice Problems

1. A jet plane accelerates horizontally with the thrust of the engines increasing to 50,000 N eastward at a time when air resistance (drag) acting on the 4000 kg plane amounts to 30,000 N westward, what will be the plane's acceleration?

2. A car is being pushed forward by three ingenious physics students. They know the force of friction of the car is approximately 320 N. If the car's sticker says it has a mass of 1040 kg, and it is accelerating forward at a rate of 1.2 m/s^2, what force are each applying if they are applying equal forces?

3. A 1200 kg car is traveling with a constant speed of 25 m/s. What is the net force acting on it?

4. My car accelerates from 0 to 18 m/s in 3.2 seconds. If the mass of my car is 2450 kg and the force of friction is 3,900 N, what is the force produced by my car's engine?

1) 5.0 m/s^2 (2)   523 N (3) too easy (4) 17,700 N