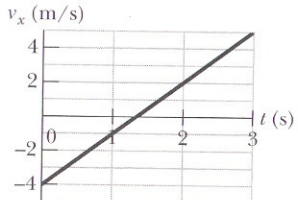
5-3

Two horizontal Forces act on a 2.0 kg chopping block that can slide over a frictionless kitchen counter, which lies in an xy plane. One force is $\vec{F}_1 = (3.0\text{ N})\,\hat{i} + (4.0\text{ N})\,\hat{j}$. Find the acceleration of the chopping block in unit-vector notation when the other force is (a) $\vec{F}_2 = (-3.0\text{ N})\,\hat{i} + (-4.0\text{ N})\,\hat{j}$, (b) $\vec{F}_2 = (-3.0\text{ N})\,\hat{i} + (4.0\text{ N})\,\hat{j}$, and (c) $\vec{F}_2 = (3.0\text{ N})\,\hat{i} + (-4.0\text{ N})\,\hat{j}$.

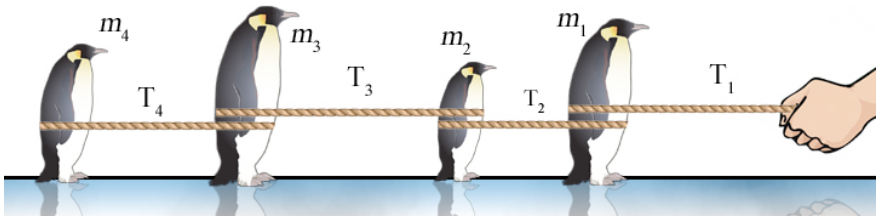
5-8

Two horizontal forces ($\vec{F}_1$) and ($\vec{F}_2$) act on a 4.0 kg disk that slides over frictionless ice, on which an xy coordinate system is laid out. Force ($\vec{F}_1$) is in the positive direction of the x-axis and has a magnitude of 7.0 N. Force ($\vec{F}_2$) has a magnitude of 9.0 N. The figure gives the x-component v_x of the velocity of the disk as a function of time t during the sliding. What is the angle between the constant directions of forces ($\vec{F}_1$) and ($\vec{F}_2$)?



5-42

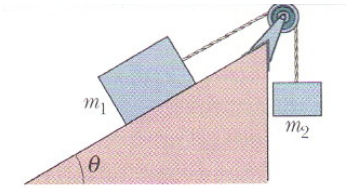
The figure shows four penguins that are being playfully pulled along very slippery (frictionless) ice by a curator. The masses of three penguins and the tension in two of the cords are $m_1 = 20$kg, $m_2 = 15$kg, $m_4 = 12$kg, $T_3 = 111$N, and $T_1 = 222$ N. Find the penguin



mass m_3 that is not given.

5-52

A block of mass $m_1 = 3.70$ kg on a frictionless plane inclined at angle $\theta = 30.0^\circ$ is connected by a cord over a massless, frictionless pulley to a second block of mass $m_2 = 2.30$ kg hanging vertically. What are (a) the magnitude of the acceleration of each block, (b) the direction of the acceleration of the hanging block, and (c) the tension in the cord?



5-72
Imagine a landing craft approaching the surface of Callisto, one of Jupiter's moons. If the engine provides an upward force (thrust) of 3260N, the craft descends at constant speed; if the engine provides only 2200N, the craft accelerates downward at 0.39 m/s². (a) What is the weight of the landing craft in the vicinity of Callisto's surface? (b) What is the mass of the craft? (c) What is the magnitude of the free-fall acceleration near the surface of Callisto?

5-82
An interstellar ship has a mass of 1.20×10^6 kg and is initially at rest relative to a star system. (a) What constant acceleration is needed to bring the ship up to a speed of $0.10c$ (where c is the speed of light, 3.0×10^8 m/s) relative to the star system in 3.0 days? (b) What is that acceleration in g units? (c) What force is required for the acceleration? (d) If the engines are shut down when $0.10c$ is reached, (the speed then remains constant), how long does the ship take (start to finish) to journey the 5.0 light-months, the distance that light travels in 5.0 months?

5-83
A motorcycle and 60.0 kg rider accelerate at 3.0 m/s² up a ramp inclined 10º above the horizontal. What are the magnitudes of (a) the net force on the rider and (b) the force on the rider from the motorcycle?