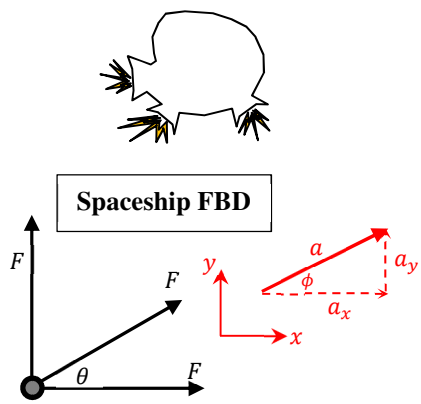
5.13½ Two forces act on a 2.50 kg object in deep space. Being in deep space, we needn't worry about any gravitational forces acting on the object. The object accelerates at a rate of $3.00\,\frac{\text{m}}{\text{s}^2}$ to the left. The first force has magnitude 12.50 N directed upwards. Determine the 2nd force (magnitude and direction) acting on the object. Include a sketch.

5.13 ¾ A spacecraft of mass m in deep space fires several thrusters at once. Each thruster exerts the same magnitude of force F. An FBD of the forces acting on the ship is shown below. The space ship starts from rest and accelerates at some *unknown angle* ϕ in the first quadrant. To be clear, because the spaceship is in deep space, we need not worry about the gravitational force mg.

a) Use the FBD shown at right to write down correct force equations in terms of the symbols F, θ, m, a_x & a_y.

b) Determine the angle of acceleration ϕ. You should find the symbols F, a & m drop out. Furthermore, we know $\theta = 30.0°$. You should be able to get a number (with three sig figs) for the angle!!!



5.13 $\frac{7}{8}$ Three forces act on an object. The first force, caused by gravity, is $\vec{F}_1 = -19.6\text{ N}\,\hat{\jmath}$. The second force has magnitude $F_2 = 20.0$ N pointing 30.0° *above the negative x-axis*. The third force is unknown. The object has acceleration $\vec{a} = (2.59\hat{\imath} - 8.75\hat{\jmath})\,\frac{\text{m}}{\text{s}^2}$. The object has mass $m = 2.00$ kg.

a) Determine the magnitude and direction of the third force.

b) Sketch and label all three forces acting on the object. Your sketch should be *roughly* to scale. For example, try to draw $\vec{F}_2$ *about* twice as long as $\vec{F}_1$ and ensure the 30.0° angle looks more like 30° than 45°. If it helps, use the grid below and assume each division represents 5 N.