1. [15 points]
A wagon of mass 7.21 kg has an initial velocity of \( + 2.87 \, \hat{i} \, \text{m/s} \). If the wagon comes to rest after moving \( 5.88 \, \hat{i} \, \text{m} \), what force acted on it? Assume the force is constant and ignore friction.

2. [10 points]
A constant force \( \vec{F} = ( -18.6 \, \hat{j} ) \, \text{N} \) acts through a straight-line displacement \( \Delta \vec{r} = ( +3.91 \, \hat{i} - 3.64 \, \hat{j} ) \, \text{m} \). Calculate the work done.

3. [20 points]
A block of mass 3.85 kg is on a horizontal surface whose coefficient of friction is 0.218. A force \( F = 51.4 \, \text{N} \) is applied at an angle of \( \theta = 18.6 \, \text{deg} \) as shown in the drawing.

(A) Draw a free-body diagram for the box showing all forces in terms of their x and y components:

(B) Calculate the speed of the box 3.5 s after it starts from rest.

4. [5 points]
**True or False:** The net force on an object is zero if the object is traveling at a constant speed. *Explain your answer in one sentence.*
5. [15 points]
A 7.11 kg mass, initially at rest, is struck by a 2.83 kg mass traveling at 11.4 \( \hat{i} \) m/s.

After the collision, the 2.83 kg mass is seen moving at 3.27 m/s at an angle of +107° from the +x axis. Calculate the velocity of the 7.11 kg mass after the collision. \textit{Give your answer as a vector using components.}

6. [10 points]
Calculate the gravitational force between an 85 kg astronaut and a small satellite with a mass of 473 kg if their centers of mass are separated by 3.7 m.

7. [15 points]
A projectile is launched at 33.7 m/s at an angle of 58.3° above horizontal from ground level (x=0, y=0).

(A) What is its velocity when it reaches the highest point above the ground?

(B) What is its position vector at 4.88 s after launch?

8. [15 points]
A spring-loaded gun is used to launch a 0.107 kg projectile straight up in the air. The spring (with a force constant of 7231 N/m) is initially compressed by 10.6 cm. How high will the projectile go if air drag and friction together do –21.6 J of work? Set \( y = 0 \) at the point where the spring is released.