Quiz #3: Forces

Answer the following questions based on topics covered on last week’s homework assignment and lab. Draw a box around each of your final answers. Don’t forget units! If you do not have access to a calculator, you are encouraged to leave your answers in terms of square roots and transcendental functions. If you are uncomfortable doing this, write down the buttons you would press on a calculator in order to compute your final answer. If you cannot arrive at an answer for part of a question, you may denote the answer $A_{(a)}$, etc., for use in subsequent parts.

1. The spacecraft *Discovery One* cruises along the $x$-axis at a velocity of $+1000 \text{ m/s}$ relative to Earth. Outside, Frank flies his space pod along the $x$-axis at a velocity of $-200 \text{ m/s}$ relative to *Discovery One*.

   (a) Calculate Frank’s velocity relative to Earth.

   (b) One of Frank’s thrusters, pointed along the $-y$-axis, misfires, sending him away from *Discovery One* at an angle of 150° relative to the spacecraft. If the $x$-component of his velocity is unaltered and his motion is confined to the $x$-$y$ plane, what must his speed be in the $y$-direction (relative to *Discovery One*)?

   (c) Relative to Earth, what is Frank’s new velocity vector (in unit vector notation), and what angle does it make with respect to the $x$-axis?
2. Two blocks of weight $W$ are resting on top of a frictionless table when you decide to give block ‘A’ a push with a force $F$. Both blocks accelerate to the right.

![Free-body diagrams for both blocks](image)

(a) Below are free-body diagrams for both blocks. Label each of the forces in the following manner: $F_{X,Y}$ denotes a force from object $X$ acting on object $Y$. In your subscripts, denote block ‘A’ as $A$, block ‘B’ as $B$, the table as $T$, your hand as $H$, and the Earth as $E$. Cross out any force arrows that should not exist.

![Free-body diagrams for both blocks](image)

(b) Some of these forces may be missing their “interaction pair” partners. Using the same notation as above, list these forces, along with their missing partners, below.