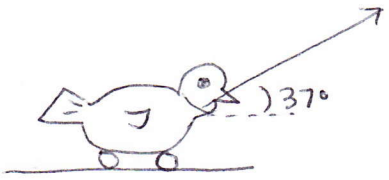
BFPM: Graphical Method: Find unknown force(s): A

Two-year old Matthew is pulling his 223 g ducky-on-wheels toy down the hallway by a string that is angled at 37° above the horizontal. The force of friction is 0.42 N. The ducky is moving with a constant velocity of 0.21 m/s toward the front door.

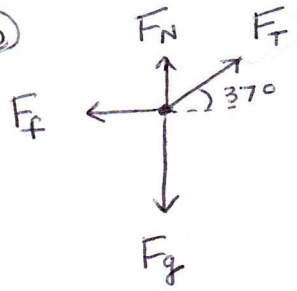
a) What force and motion models describe the situation?
b) Draw a labeled FBD for the ducky
c) Calculate the force of gravity on the ducky
d) Use graphical methods to find all unknown forces on the ducky. (State magnitude and direction for each)

Reminder:
In your work, be sure to write down your scale and list of all forces (include magnitude in Newtons, the direction, and the scaled length for each.)



(a) constant velocity
balanced forces

(b)



(c) $F_g = mg$
$= (0.223\ kg)(9.8\ N/kg)$
$= \boxed{2.19 N}$

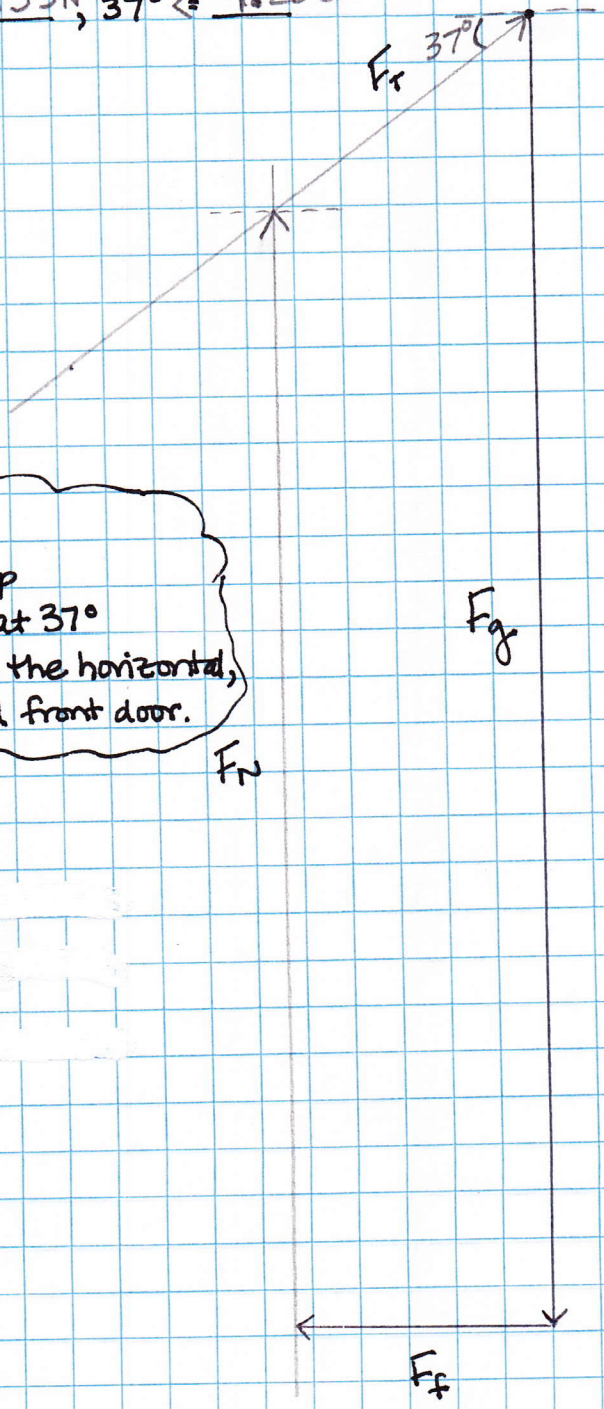
d) Scale: 1 cm = 1/8 N

F_g = 2.19N, down ⇒ 17.5 cm

F_f = .42N, left ⇒ 3.36 cm

F_N = 1.9N, up ⇐ 14.9 cm

F_T = 0.53N, 37° ⇐ 4.25 cm



My results:
F_N = 1.9N, up
F_T = .53N at 37° above the horizontal, toward front door.

- First I drew F_g because I knew its length and direction.
- Then I added F_f because this force is also known.
- For F_N and F_T, I only know the direction of each, so I drew a line for each, using the fact that the result has to be a closed figure because the $F_{net} = 0$.
- The intersection of these lines tells me how long these force vectors are, and I added arrowheads