Instructions:

- Put your name and section on the exam.
- Do not open the test until you are told to do so.
- Write your final answer in the box provided.
- If you finish with less than 5 minutes remaining, please stay seated until the exam is over.
- Stop work immediately when time is over; pass exams to the aisle; stay seated until all exams are collected.
- Turn in your equation sheet with your examination.

Guidelines:

- Assume 3 significant figures for all given numbers unless otherwise stated.
- Show all of your work – no work, no credit.
- Include units for all answers and directions for all vectors.

<table>
<thead>
<tr>
<th>Time</th>
<th>111 Front</th>
<th>111 Back</th>
<th>Est 209</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:10</td>
<td>S1a Tyler</td>
<td>S1b Tayler</td>
<td>S1c Rachel</td>
</tr>
<tr>
<td>12:40</td>
<td>S2a Tyler</td>
<td>S2b Tayler</td>
<td>S2c Rachel</td>
</tr>
<tr>
<td>2:10</td>
<td>S3a Tyler</td>
<td>S3b Tayler</td>
<td>S3c Rachel</td>
</tr>
</tbody>
</table>
1. (4 points) Rachel is walking 2 ft/s to the left on a moving sidewalk that is moving 6 ft/s to the right. Tyler is walking alongside the moving sidewalk at 4 ft/s to the right. How fast does Rachel appear to be moving relative to Tyler?
   a. 2 ft/s Left
   b. 0
   c. 2 ft/s Right
   d. 4 ft/s Right

2. (4 points) Lazydog weighs 15 lb on the moon, which has a gravitational constant of \( g_{\text{moon}} = 5.31 \text{ ft/s}^2 \). What is Lazydog’s mass on Earth?
   a. 0.468 slugs
   b. 1.53 slugs
   c. 2.82 slugs
   d. 15 slugs
   e. 15 lb
   f. 90.8 lb

3. (4 points) A box is sitting on the floor. The box is being pushed horizontally with a force \( P \), but is not moving. What happens to the friction force if the weight of the box increases?
   a. The friction force is zero and remains zero, even if the weight is increased.
   b. The friction force is not zero and remains constant, even if the weight is increased.
   c. The friction force will increase if the weight is increased.

4. (4 points) If the area of an object is increased by two, what will happen to the terminal speed of the object?
   a. The speed will increase by \( \sqrt{2} \)
   b. The speed will increase by 2
   c. The speed will decrease by 2
   d. The speed will decrease by \( \sqrt{2} \)
   e. The speed will not change
5. (14 pts) A 10 gram piece of ice falls from the sky during the ice storm and is subjected to air resistance. What is the terminal speed of the piece of ice?
\( \rho_{\text{air}} = 1.2 \text{ kg/m}^3, \ C_D = 0.48, \ A = 12.57 \text{ cm}^2 \)

6. (14 pts) During the big ice storm, Rachel sleds off a hill at an angle of \( \theta \). She lands as shown. If Rachel's launch speed is 12 ft/s, what was her angle of launch (\( \theta \))? (Neglect air resistance.)
7. (14 pts) A sled slides across Watts Bar Lake during the ice storm. If the friction force is 14 lb and the sled slows down at a rate of 2.85 ft/s², what is the coefficient of kinetic friction between the sled and the ground? (FBD=KD required)

8. (14 pts) Tyler pulls Tayler and Rachel on their sleds, as shown. Tyler weighs 170lb and pulls with a tractive force of 30lb to the right. Tayler and Rachel each weigh 125 lb. Tayler picks her feet up and so her sled moves freely. Rachel drags her feet on the ground and creates a friction force of 6 lb. Find the magnitude of the coupling force between Rachel and Tayler’s sled.
(2 FBD = KD’s required; HINT: try starting with an FBD=KD of the whole system)
9. (14 pts) To escape the cold weather, Professor Schleter charters an airplane to fly 600 miles from Knoxville, TN to Orlando, FL. If the wind is blowing 24 mph S, the trip takes 1.5 hours. How fast can the plane fly in still air?

10. (14 pts) Tayler, Tyler, and Rachel need to get their sled up the hill to go for another sledding run. Tyler is on the sled and weighs 170 lb. Rachel is pushing from behind at with a force of 40 lb horizontal to the hill’s surface. Tayler is pulling a rope with a force, P, horizontal to the hill’s surface. The sled is on a 24° incline. How hard does Tayler need to pull to get the sled to start moving? (FBD required)