Name: ____________________________  Section: ____________

Instructions:
- Put name and section on your exam.
- Put seating label on your equation sheet.
- Do not open the test until you are told to do so.
- Write your final answers in the boxes 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.
- Turn in your equation sheet with your examination.
- Pass exams to the aisle; stay seated until all exams are collected.

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.
- Include 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</td>
<td>S1b</td>
<td>S1c</td>
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<tr>
<td></td>
<td>Katherine</td>
<td>Gabrielle</td>
<td>Josh</td>
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<tr>
<td>12:40</td>
<td>S2a</td>
<td>S2b</td>
<td>S2c</td>
</tr>
<tr>
<td></td>
<td>Katherine</td>
<td>Gabrielle</td>
<td>Josh</td>
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<tr>
<td>2:10</td>
<td>S3a</td>
<td>S3b</td>
<td>S3c</td>
</tr>
<tr>
<td></td>
<td>Katherine</td>
<td>Gabrielle</td>
<td>Josh</td>
</tr>
</tbody>
</table>
1. (3 pts)
A bug is moving in 2 dimensions with a constant acceleration of \( A = (2i - 3j) \) mm/s\(^2\).
Circle the THREE statements that MUST BE TRUE about the point in time when the bug is at its maximum y position. (\( Ax, Ay, Vx, \) and \( Vy \) are the acceleration and velocity components)

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<tbody>
<tr>
<td>( Ax &lt; 0 )</td>
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<td>( Ay &lt; 0 )</td>
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<td>( Vx &lt; 0 )</td>
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<td>( Vy &lt; 0 )</td>
<td>( Vy = 0 )</td>
<td>( Vy &gt; 0 )</td>
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2. (3 pts)
An object has a negative velocity and positive acceleration. Circle the correct statement.

The object is slowing down.
The object's speed is not changing
The object is speeding up
Can't determine from the given information

3. (3 pts)
How many gallons are in 0.5 cubic meter?
1 m = 3.281 ft
7.48 gallons = 1 ft\(^3\)

4. (3 pts)
Circle the correct equation for the x-component of this vector.

\[ +13 \sin(65) \text{ Ians} \quad +13 \cos(65) \text{ Ians} \quad +13 \tan(65) \text{ Ians} \]
\[ -13 \sin(65) \text{ Ians} \quad -13 \cos(65) \text{ Ians} \quad -13 \tan(65) \text{ Ians} \]
5. (12 pts)
Your road trip starts in Knoxville. You travel to Chattanooga (111 miles 36° W of S) in 1.5 hours, then to Nashville (142 mi 36° N of W) in 2 hours, and finally back to Knoxville (180 miles 2° N of E) in 2.5 hours. Determine your average speed and velocity for the entire trip.

\[ \text{Avg Speed } = \]
\[ \text{Avg Velocity } = \]

6. (12 pts)
Determine the average acceleration when going from \( V_1 \) to \( V_2 \) in 4.0 seconds. Leave your answer in \( i, j \) notation.

\[ V_1 = (7.9i + 1.1j) \text{ ft/s} \]
\[ V_2 = (-1.1i + 5.0j) \text{ ft/s} \]
7. (12 pts)
Josh starts at the front door of Estabrook and walks 468 meters east, runs 239 meters north, and then skips 170 meters west. Katherine also starts at Estabrook. What direction should she walk to go directly to where Josh ended up?

8. (12 pts)
Gabrielle flies a plane 750km at 30° west of south and then 600km at 10° north of east. The entire trip takes 4 hours. What was the magnitude of the plane’s average velocity?
9. (12 pts)
A T-38 training jet starts from rest and has an acceleration of 3.6 m/s\(^2\) that lasts 4.8 seconds. The afterburners are then turned up to full power for an acceleration of 5.7 m/s\(^2\). It takes off when it reaches a speed of 85 m/s. How far does the jet travel before taking off?

10. (12 pts)
A student standing on the ground throws a bowling ball upwards. The ball is caught on its way down by another student standing on a bridge 27 feet above the first student. If the ball reached a maximum height of 50 ft, how long was the ball in the air?
11. (16 pts)
This system of four forces is in equilibrium. What is the magnitude of \( G \)?