Answer Key

Units are worth 25% of each problem. If an answer does not include units, please deduct appropriately.

Part I

1.) C
2.) 125 J
3.) 5 N· s
4.) 50 N
5.) 7.5 m/s

Part II

1.) $v = \sqrt{2gH}$
2.) t = $\sqrt{\frac{H-0.5L}{2|g|}} + \sqrt{\frac{H-0.5L}{2|g|} + \frac{L}{|g|}}$
3.) $\frac{\sqrt{3}}{2}\left(\sqrt{\frac{H-0.5L}{2|g|}} + \sqrt{\frac{H-0.5L}{2|g|} + \frac{L}{|g|}}\right) \cdot \left(\sqrt{2g(H-0.5L)}\right)$
4.) $\frac{\sqrt{3}}{2}\left(\sqrt{\frac{H-0.5L}{2|g|}}\right) \cdot \left(\sqrt{2g(H-0.5L)}\right) + \left(\frac{5\sqrt{3}}{8}\sqrt{2g(H-0.5L)} + \frac{v}{4}\right)\left(\sqrt{\frac{H-0.5L}{2|g|}} + \sqrt{\frac{H-0.5L}{2|g|} + \frac{L}{|g|}}\right)$
5.) C
6.) $F_B = V_o \delta_w g$
7.) $F_B = V \delta_w g$

Part III

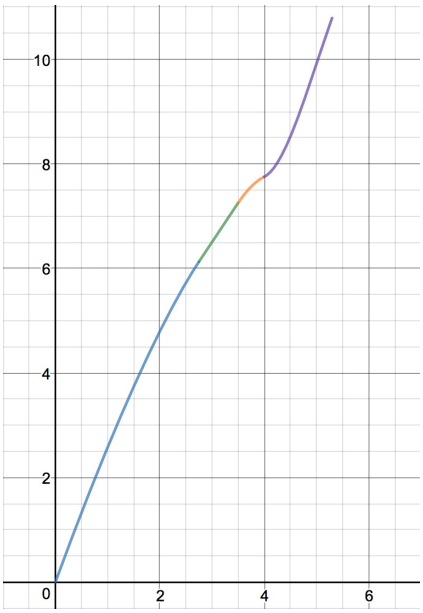
1.) B
2.) Functions; (Parts in bold must be in the answer in some form).
    a.) To **trap air underneath** while pressure increases enough to **lift up the hovercraft**
    b.) To provide **thrust to propel** the hovercraft forward
    c.) **To clear obstacles (A bigger skirt allows the hovercraft to go higher)**.
3.) **Smoother surface = more lift, faster speed OR Rough surface = less lift, slower speed**
4.) B
5.) A

Part IV

1.) δ_w (density of water) or 1000 kg/m^3
2.) 8000 kg
3.) 0.5 P· s
4.) B
5.) A pressure change occurring anywhere in a confined incompressible fluid is transmitted throughout the fluid such that the same change occurs everywhere. $\Delta P = \delta g \Delta h$

Part V

1.)



2.)

3.) Spots indicated should be:
    a.) An "a" at the point to the right of t'
    b.) A "b" at any point with a flat tangent line
    c.) Shade area under graph from t to t', labeled "c"
    d.) A tangent line to ane point on the graph, labeled "d"
4.) No. Cusps are bad. Make all sharp cusps on graph smooth.

Part VI

Due to the nature of this being a tie breaker, and the large number of individuals who have contributed to the hovercraft, answers will be checked in the event of a tie.