No work = No credit! The mass density of water is 1000 kg/m^3 and for simplicity take gravity acceleration to be $10m/s^2$.

1. Find the **EXACT** arc length of curve $x = \sqrt{2}sin^2(t)$, $y = \sqrt{2}cos^2(t)$, $t \in (0, \pi/2)$.

2. $f(x) = x^2 - 2x + 2$, $x \in [0, 3]$. Find f_{ave} and c such that $f(c) = f_{ave}$.

3. The force to stretch a spring from it natural length 0.1m to 0.25m is 30N. How much work is done in stretching this spring from 0.2m to 0.3m?

4. A tank has the shape of a hemisphere (circular part at the top) with a radius of $\sqrt{2}$ meters. If the tank is full of water, find the **EXACT** work required to empty the tank by pumping the water to the top of the tank.

5. A trapezoid with bases 5 m and 11 m is partially submerged vertically in water so that the top is 1 m above the surface and the bottom is 1 m below the surface (The figure below is not drawn to scale.) Express the hydrostatic force against one side of the plate as an integral and evaluate it Exactly.

6. A plane lamina with a constant density $\rho = 10$ is enclosed by $x = 0$ from left, $x = \pi/2$ from right, $y = 0$ from below and $y = cos(x)$ from above. Find the **EXACT** values of moments M_x, M_y and center of mass $(\bar{x}, \bar{y})$. (Property of $cos(x)$: $cos^2(x) = \frac{1}{2}(cos(2x) + 1)$)
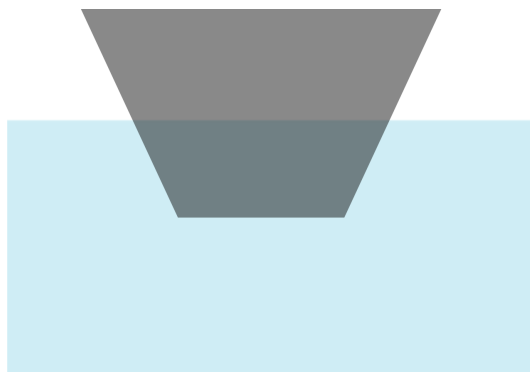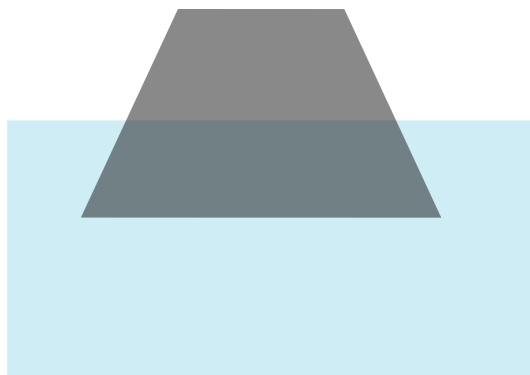
Test-1 Version B

No work = No credit! The mass density of water is 1000 kg/m^3 and for simplicity take gravity acceleration to be $10m/s^2$.

1. Find the **EXACT** arc length of curve $x = cos^2(t)$, $y = \sqrt{3}sin^2(t)$, $t \in (0, \pi/2)$.

2. $f(x) = x^2 - 4x + 5$, $x \in [0, 3]$. Find f_{ave} and c such that $f(c) = f_{ave}$.

3. The force to stretch a spring from it natural length 0.15m to 0.3m is 30N. How much work is done in stretching this spring from 0.25m to 0.35m?

4. A tank has the shape of a hemisphere (circular part at the top) with a radius of 2 meters. If the tank is full of water, find the **EXACT** work required to empty the tank by pumping the water to the top of the tank. (The mass density of water is 1000 kg/m^3 and use gravity acceleration $10m/s^2$).

5. A trapezoid with bases 11 m and 5 m is partially submerged vertically in water so that the top is 1 m above the surface and the bottom is 1 m below the surface (The figure below is not drawn to scale.) Express the hydrostatic force against one side of the plate as an integral and evaluate it Exactly.

6. A plane lamina with a constant density $\rho = 10$ is enclosed by $x = 0$ from left, $x = \pi/2$ from right, $y = 0$ from below and $y = sin(x)$ from above. Find the **EXACT** values of moments M_x, M_y and center of mass $(\bar{x}, \bar{y})$. (Property of $sin(x)$: $sin^2(x) = \frac{1}{2}(1 - cos(2x))$)