

Show all necessary work neatly, clearly, systematically, and understandably. Any incorrect statement and/or understatement may be penalized. There are 108 points available.

1. (8) Integrate: $\int \frac{x+1}{x^3-x^2} dx$

2. (10) Integrate: $\int \frac{2x^2 + x - 1}{x^3 - 3x^2 + x - 3} dx$. Note: YES, you need to know how to factor the denominator!

3. (9) Integrate: $\int \frac{2x+1}{x^2-2x+2} dx$. Note: Complete the square.

4. (9) Integrate: $\int_{-1}^8 \frac{dx}{\sqrt[3]{x}}$

5. (9) Integrate: $\int_0^{\infty} x \cdot e^{-x} dx$

6. (10:5,5) Let curve C: $y = \frac{2}{3}(x^2 + 1)^{3/2}$

a. Set up the integral that represents the length of curve C on $1 \leq x \leq 4$.

b. Integrate the result from part (a). NOTE: No point will be given in this part if your set-up in part (a) is incorrect.

7. (9:4,5) Let curve C: $y = x^3$.

a. Set up the integral that represents the surface area of x-axis revolution of curve C on $0 \leq x \leq 2$.

b. Integrate the result from part (a). NOTE: No point will be given in this part if your set-up in part (a) is incorrect.

8. (11:5,6) Let curve C: $y = x^3$.

a. Set up the integral that represents the surface area of y-axis revolution of curve C on $0 \leq x \leq 2$.

b. Integrate the result from part (a). NOTE: No point will be given in this part if your set-up in part (a) is incorrect.

9. (11:4,3,3,1) Let lamina D be a region bounded by $\begin{cases} y = x^3 \\ y = \sqrt{x} \end{cases}$ with constant density ρ .

a. Find the mass of D.

c. Find M_x , the moment about x -axis.

b. Find M_y , the moment about y -axis.

d. Find \bar{y} , the y -component of the centroid.

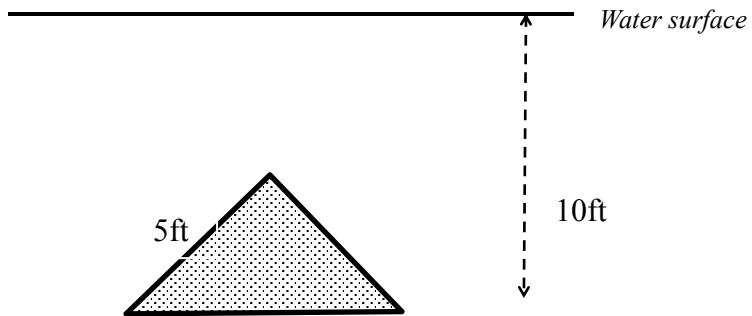
10. (12:4,4,4) Let lamina D be a triangle with vertices $(0,0)$, $(6,3)$ and $(0,9)$ with constant density ρ .

a. Find the mass of D .

c. Find \bar{x} , the x -component of center of mass.

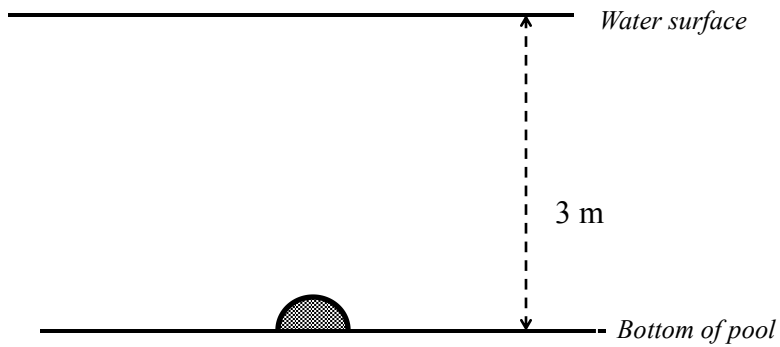
b. Find M_x , the moment about x -axis.

11. (10:5,5) A plate with the shape of isosceles right triangle of legs 5ft. each is submerged vertically into pool such that the hypotenuse is parallel to the water surface at 10 ft. depth.



- a. Set up the integral that represents the hydrostatic force against the plate.
- b. Integrate the result from part (a). NOTE: No point will be given in this part if your set-up in part (a) is incorrect.

12. (10:5,5) A drain with the shape of a semicircle with radius 0.2 m is located at the bottom wall of a pool with 3 m. depth.



- a. Set up the integral that represents the hydrostatic force against the cover of that drain.
- b. Integrate the result from part (a). NOTE: No point will be given in this part if your set-up in part (a) is incorrect.