1.(40 points) Follow the **guidelines** for sketching a curve to draw the graph of the function

$$y = 2x + 3x^{2/3}$$

2.(40 points) A poster of area 6000 cm^2 has blank margins of width 10 cm on the top and bottom and 6 cm on the sides. Find the dimensions of the poster that maximize the printed area.

3. (60 points) Find the following integrals:

a) $\int_{-2}^{0} |1+2x|\, dx$ b) $\int \frac{\sin(\ln x)dx}{x}$ c) $\int_{1}^{2} 2xe^{x^2}\, dx$

4. (40 points)

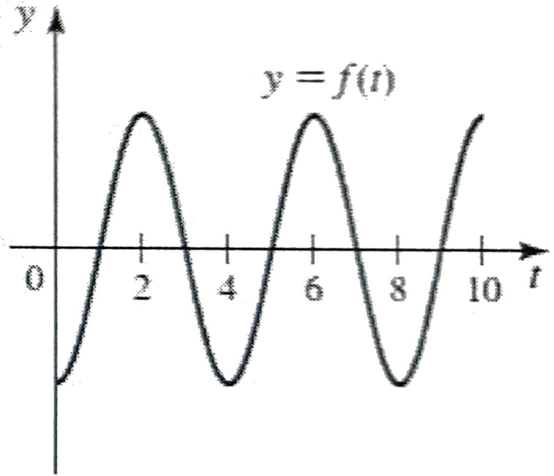
Consider the function f and its graph given in the picture.

a) Estimate the zeros of the area function

$$A(x) = \int_0^x f(t)\,dt, \quad 0 \le x \le 10.$$

b) Estimate the points (if any) at which $A(x)$ has a local maximum or minimum.

c) Sketch a graph of $A(x)$, $0 \le x \le 10$, without a scale on the y-axis.



5. (50 points)

a) Find the volume obtained by rotating the region enclosed by the graph of $y=x^2$, the y-axis and the lines $y=12-x$ around the line y= -2 by using the **method of disk and washer.**

b) Find the volume of the solid obtained by rotating the region underneath the graph of $y=x^{-4}$ over the interval [-3, -1] about the line x=4 by using the **method of cylindrical shells.**

6. (40 points) Find the area under the curve $y = x^2 + 2$ over the interval [-3, -1] by computing the limit of the Riemann sum using the right endpoint of each subinterval.

7.(40 points) Find the following limits:

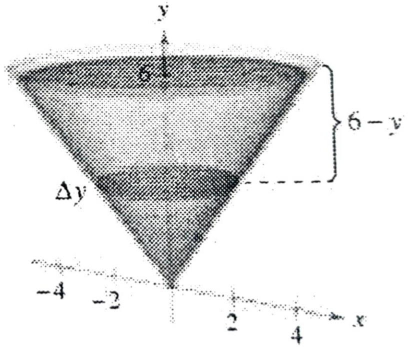
a) $\lim_{x\to 1^+}\left(\frac{3}{\ln x}-\frac{2}{x-1}\right)$

b) $\lim_{x\to 0^+}\left(\cos\left(\frac{\pi}{2}-x\right)\right)^x$

8.(50 points) Water is pumped from the bottle of an empty tank in the figure below. How much work is done to fill the tank in each of the following cases:

a) To the water level of 2 feets.

b) From the water level of 4 feets to the level of 6 feets.



9.(40 points) Given below is the graph of a function f(x) defined on the interval [0,6]. Find the following:

a) $\int_{2}^{5} f(x)dx$

b) $\int_{6}^{0} f(x)dx$