MECH 307 Numerical Methods for Mechanical Engineering
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Homework #5

Problem 1.
For what value of a, the following integral is $I = 200$?

$$I = \int_0^a 100\left[1 - e^{-0.1x}\cos(4x + \pi)\sin(x + 4)\right]dx$$

Problem 2. The following two alternative solutions were given in a MECH201 exam paper. Numerically evaluate either of the solution for I_x.
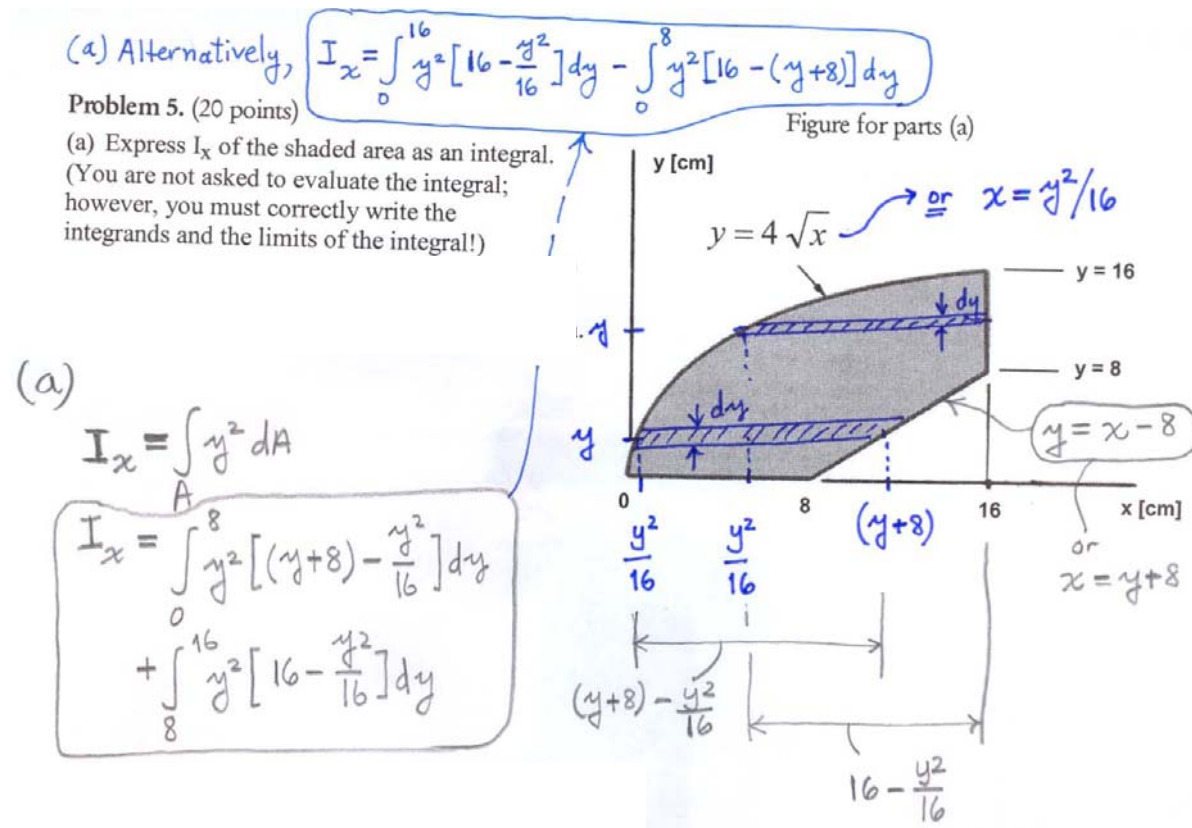
Problem 3. Given the function:

$$y(x) = 20 + \frac{10\sin(2x)e^{-0.1x}}{\sqrt{1+3x}}$$

(a) Plot y versus x, and dy/dx versus x on $0 \leq x \leq 10$ on two figures side by side (use subplots).

(b) Calculate $I = \int\limits_{0}^{10} y(x)\,dx$.

(c) For what value of b, $I = \int\limits_{0}^{b} y(x)\,dx = 80$?

Problem 4

An experimental data was collected as follows:

x [cm]	0	10	20	30	40	50	60	70	80	90	100
y [cm]	200	205	213	220	225	226	221	211	198	183	170

(a) Plot y versus x, and dy/dx versus x on $0 \leq x \leq 100$ on two figures side by side (use subplots).

(b) Calculate $I = \int\limits_{0}^{100} y(x)\,dx$.

Problem 5. Calculate the area of an ellipse with a = 10 cm and b = 5 cm. recall that the equation of an ellipse is given by

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

Problem 6.

Find the area of the intersection region where $(x-3)^2 + y^2 \leq 25$ and $y \geq 2 + 3(x-1)^2$.