## Quiz 12: Chapter 10

Examine the solved problem below. There are four errors in the solution below. One error occurs twice! Your task is to locate and identify those errors then correct them and calculate the proper result. Each correctly identified error is worth 6 points, and the re-calculated result is worth 6 points. You must save your work in pdf format and submit via the Quiz 12 Assignment in the Quizzes folder of the Online Classroom in Blackboard. Please do not use any other file format than pdf (unless you submit an edited MS Word .docx file).

Determine the moments of inertia  $I_x$  and  $I_y$  for the shaded area bounded by curves  $y_1 = A\sqrt{x}$  and  $y_2 = Bx^3$ .

A) Calculate the coefficients A and B:

 $y_1 = A\sqrt{x}$  $y_2 = Bx^3$  $100mm = A\sqrt{100mm}$  $100mm = B(100mm)^3$  $A = 10mm^{1/2}$  $B = 0.01mm^{-2}$ 

B) Calculate the moment of inertia  $I_x$  using the horizontal area increment shown:

$$I_{x} = \int y^{2} dA = \int y^{2} (x_{2} - x_{1}) dy$$

$$I_{x} = \int y^{2} \left[ \sqrt[3]{\left(\frac{y}{B}\right)} - \left(\frac{y}{A}\right)^{2} \right] dy = \int_{0}^{100} y^{2} \left[ \sqrt[3]{\left(\frac{y}{0.01}\right)} - \left(\frac{y}{10}\right)^{2} \right] dy$$

$$I_{x} = \int_{0}^{100} \left[ 4.64y^{\frac{2}{3}} - \frac{y^{4}}{100} \right] dy$$

$$I_{x} = (4.64) \left(\frac{3}{5}\right) y^{\frac{5}{3}} \Big|_{0}^{100} - \left(\frac{1}{100}\right) \left(\frac{1}{5}\right) y^{5} \Big|_{0}^{100} = 2.0 \times 10^{7} \text{mm}^{4}$$

C) Calculate the moment of inertia  $I_y$  using the vertical area increment shown:

$$I_{y} = \int x^{2} dA = \int x^{2} (y_{1} - y_{2}) dx$$
  

$$I_{y} = \int x^{2} (A\sqrt{x} - Bx^{3}) dx = \int_{0}^{100} x^{2} (10\sqrt{x} - 0.01x^{3}) dx$$
  

$$I_{y} = \int_{0}^{100} \left[ 10x^{\frac{5}{2}} - 0.01x^{6} \right] dx$$
  

$$I_{y} = (10) \left(\frac{2}{7}\right) x^{\frac{7}{2}} \Big|_{0}^{100} - (0.01) \left(\frac{1}{7}\right) x^{7} \Big|_{0}^{100} = 2.8 \times 10^{18} \text{ mm}^{4}$$

