Calculus Quiz 5 IE-G

Class:

Student Number:

Name:

1. (5 points) A rectangular storage container with an open top is to have a volume of 10 m³. The length of its base is twice the width. Material for the base costs $10 per square meter. Material for the sides costs $6 per square meter. Find the cost of materials for the cheapest such container.

\[ V = 10 \text{ m}^3 \]

\[ xy^2 \cdot x = 10 \implies x = \frac{10}{y^2} \]

\[ f(x) = 2y^2 \cdot 10 + (2xy \cdot 2 + xy \cdot 2) \cdot 6 \]

\[ = 20y^2 + 36xy \quad (x = \frac{10}{2y^2}) \]

\[ = 20y^2 + 36 \cdot \frac{10}{2y^2} \cdot y \]

\[ = 20y^2 + \frac{180}{y} \]

\[ f'(x) = 40y - \frac{180}{y^2} = 0 \]

\[ 40y^2 = 180 \]

\[ y^2 = \frac{9}{2} \]

\[ y = \sqrt[2]{\frac{9}{2}} \]

\[ \sqrt[6]{\frac{10}{y^2}} = \frac{10 \sqrt[6]{\frac{9}{2}}}{2 + \frac{180}{2}} = \frac{10 \sqrt[6]{\frac{9}{2}}}{20 \cdot \frac{9}{2} + 180} \]

\[ = 2 \sqrt[6]{\frac{9}{2}} \]

Ans: $2 \sqrt[6]{\frac{9}{2}}$

2. (5 points) What constant acceleration is required to increase the speed of a car from 50 km/h to 90 km/h in 5 s?

\[ 50 \text{ km/h} = \frac{50 \times 1000 \frac{m}{h}}{3600 \frac{h}{s}} = \frac{125}{9} \]

\[ 90 \text{ km/h} = \frac{90 \times 1000 \frac{m}{h}}{3600 \frac{h}{s}} = 25 \]

\[ \left( 25 - \frac{125}{9} \right) / 5 = \frac{150}{45} = \frac{20}{9} \]

Ans: $\frac{20}{9} \text{ m/s}^2$