

**Answer on Question #43289-Math-Multivariable Calculus**

Differentiate this expression with respect to Z ?

$$J = X \left\{ L + \left( \frac{LW}{Z} \right)^{\frac{p}{p-1}} \right\}^{-\left(\frac{1}{p}\right)}$$

**Solution**

$$\frac{\partial J}{\partial Z} = X \frac{\partial}{\partial Z} \left\{ L + \left( \frac{LW}{Z} \right)^{\frac{p}{p-1}} \right\}^{-\left(\frac{1}{p}\right)} = X \left[ -\left(\frac{1}{p}\right) \right] \left\{ L + \left( \frac{LW}{Z} \right)^{\frac{p}{p-1}} \right\}^{-\left(\frac{1}{p}\right)-1} \frac{\partial}{\partial Z} \left\{ L + \left( \frac{LW}{Z} \right)^{\frac{p}{p-1}} \right\}.$$

$$\frac{\partial J}{\partial Z} = - \frac{\left(\frac{X}{p}\right)}{\left\{ L + \left( \frac{LW}{Z} \right)^{\frac{p}{p-1}} \right\}^{\frac{1+p}{p}}} \left( \frac{p}{p-1} \right) \left( \frac{LW}{Z} \right)^{\frac{p}{p-1}-1} \frac{\partial}{\partial Z} \left( \frac{LW}{Z} \right) = - \frac{\left(\frac{X}{p-1}\right) \left( \frac{LW}{Z} \right)^{\frac{1}{p-1}}}{\left\{ L + \left( \frac{LW}{Z} \right)^{\frac{p}{p-1}} \right\}^{\frac{1+p}{p}}} \left( -\frac{LW}{Z^2} \right).$$

$$\frac{\partial J}{\partial Z} = \frac{\left(\frac{X}{(p-1)Z}\right) \left( \frac{LW}{Z} \right)^{\frac{1}{p-1}+1}}{\left\{ L + \left( \frac{LW}{Z} \right)^{\frac{p}{p-1}} \right\}^{\frac{1+p}{p}}} = \frac{\left(\frac{X}{(p-1)Z}\right) \left( \frac{LW}{Z} \right)^{\frac{p}{p-1}}}{\left\{ L + \left( \frac{LW}{Z} \right)^{\frac{p}{p-1}} \right\}^{\frac{1+p}{p}}}.$$

**Answer:**  $\frac{\left(\frac{X}{(p-1)Z}\right) \left( \frac{LW}{Z} \right)^{\frac{p}{p-1}}}{\left\{ L + \left( \frac{LW}{Z} \right)^{\frac{p}{p-1}} \right\}^{\frac{1+p}{p}}}.$