

## Integrating the Basic Derivatives

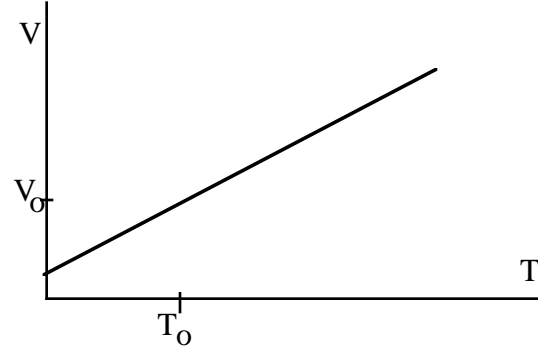
cst. P       $dV = V \alpha dT$

Good:  $V \cong V_0$

$$\int_{V_0}^V dV = \int_{T_0}^T V \alpha dT$$

$$V - V_0 = V_0 \alpha (T - T_0)$$

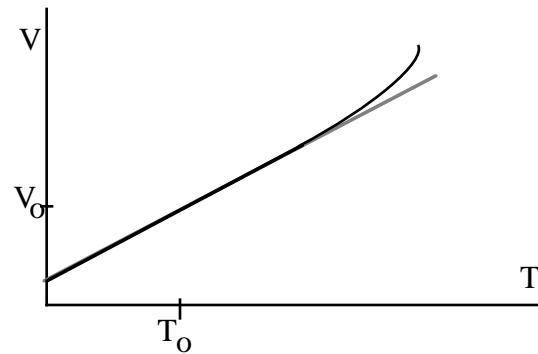
$$\Delta V = V_0 \alpha \Delta T$$



Better:  $V \approx V_0 + V_0 \alpha (T - T_0)$

$$\int_{V_0}^V dV = \int_{T_0}^T (V_0 + V_0 \alpha (T - T_0)) \alpha dT$$

$$V - V_0 = V_0 \alpha (T - T_0) + V_0 \alpha^2 \frac{(T - T_0)^2}{2}$$



Best:  $\frac{dV}{V} = \alpha dT$

$$\int_{V_0}^V \frac{dV}{V} = \int_{T_0}^T \alpha dT$$

$$\ln \frac{V}{V_0} = \alpha (T - T_0)$$

$$\frac{V}{V_0} = e^{\alpha (T - T_0)}$$

$$V = V_0 e^{\alpha (T - T_0)}$$

