

Name:

1. A quantity of gas is housed in an adjustable container. Its pressure P in kPa, temperature T in Kelvin, and volume V in liters satisfy

$$PV = 8T.$$

Suppose at time $t = 0$ (measured in seconds) that the system that the volume and the temperature of the gas are changing and:

$$V = 20\ell \tag{1}$$

$$T = 300K \tag{2}$$

$$\frac{dV}{dt} = 0.1 \frac{\ell}{s} \tag{3}$$

$$\frac{dT}{dt} = 0.2 \frac{K}{s}. \tag{4}$$

1. What is the pressure of the gas at time $t = 0$?

2. Use the chain rule to compute dP/dt at time $t = 0$.

2. Suppose a temperature field $T(x, y)$ satisfies $\nabla T = \langle y - 4, x + 2y \rangle$. A bug follows a path $\mathbf{r}(t) = \langle -t, t^2 \rangle$. At what times t does the bug report that $d/dt T(\mathbf{r}(t)) = 0$?