

Each problem is worth 5 points. For full credit provide proper justification for your answer.

1. Find a solution to the differential equation $\frac{dQ}{dt} = -0.3Q$ subject to the initial condition $Q(0) = 20$.

$$\frac{dQ}{dt} = -0.3Q$$

$$\int \frac{1}{-0.3Q} dQ = \int dt$$

$$\frac{1}{-0.3} \ln|-0.3Q| = t + c$$

$$\frac{1}{-0.3} |-0.3Q| = e^{t+c}$$

$$|-0.3Q| = e^{-0.3t + (-0.3)c}$$

$$-0.3Q = Ae^{-0.3t}$$

$$Q = \frac{A}{-0.3} e^{-0.3t} \rightarrow \frac{A}{-0.3} = B$$

$$Q = Be^{-0.3t}$$

$$Q = Be^{-0.3t}$$

$$20 = Be^{-0.3(0)}$$

$$20 = B e^0$$

$$20 = B$$

$$\boxed{Q = 20e^{-0.3t}}$$

Great

2. A jar of jelly is placed in a 68° F room. Write a differential equation for H , the temperature of the object at time t .

$$\frac{dH}{dt} = k(\text{difference in temp})$$

$$\frac{dH}{dt} = k(H - 68)$$

Excellent