2. [9 points]   Note: *"Closed form" here means that the expression should* NOT *include sigma notation or ellipses (...) and should* NOT *be recursive.*

In the live-action series adaptation of *Derivative Girl*, Derivative Girl can lift $D_0 = 1000$ kg, and she can make as many copies of herself as she wants. The first copy can lift $1/3$ the amount Derivative Girl can lift, and the nth copy can lift $1/3$ the amount the $(n-1)$st copy can lift.

a. [3 points] Let D_n be the amount of mass, in kg, that the nth copy of Derivative Girl can lift. Calculate D_1 and D_2, and give a closed-form expression for D_n in terms of n:

$$D_1 = \underline{\quad 1000(\tfrac{1}{3}) \approx 333.33 \quad}$$

$$D_2 = \underline{\quad 1000(\tfrac{1}{3^2}) \approx 111.11 \quad}$$

$$D_n = \underline{\quad 1000(\tfrac{1}{3^n}) \quad}$$

b. [4 points] Let G_n be the amount of mass, in kg, that Derivative Girl and the first n copies can lift together. Calculate G_1 and G_2, and give a closed-form expression for G_n:

$$G_1 = \underline{\quad 1000 + 1000(\tfrac{1}{3}) \approx 1333.33 \quad}$$

$$G_2 = \underline{1000 + 1000(\tfrac{1}{3}) + 1000(\tfrac{1}{9}) \approx 1444.44}$$

$$G_n = \underline{\quad \dfrac{1000(1 - (\tfrac{1}{3})^{n+1})}{1 - 1/3} \quad}$$

c. [2 points] If Derivative Girl could make infinitely many copies, what is the largest amount, in kg, that Derivative Girl and her copies could lift together? Your answer should be a closed-form expression.

Answer: $\underline{\qquad\qquad 1500 \qquad\qquad}$