Graded Problem 2

Math 4B, Spring 2017, Dr. Paul

1. In physics, one can show that the air pressure P at altitude h is proportional to the integral of $P(y)$ for $y > h$. That is

$$P(h) = k \int_h^\infty P(y)\, dy$$

   (a) Take the derivative of both sides of the equation above to get a differential equation (rather than an integral equation). You will need to use the Fundamental Theorem of Calculus, Part 1.

   (b) If the air pressure at sea level is 100 kPa, and the top of Mt. Whitney, which is at elevation 4000m, is 60 kPa, what is the air pressure at the top of Annapurna, which is at elevation 8000m?

2. We will use our model from class in which a person's liver can remove caffeine from the blood at a rate of 20% per hour. Caixing started with no caffeine in his blood. For four hours, he drank coffee at continuous rate of 1 cup per hour (there are 100 mg of caffeine in one cup), and then he stopped drinking caffeine.

   (a) How much caffeine do you predict would be in Caixing's blood three hours after he stopped drinking coffee (so, seven hours after he started)?

   (b) Sketch a graph of the amount of caffeine in Caixing's blood as a function of time.