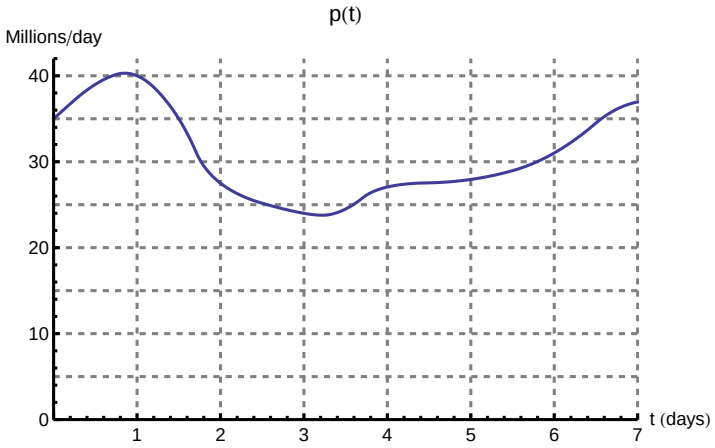
2. [12 points] Photo sharing through social networking sites has become increasingly popular over the years. Suppose $p(t)$ gives the rate at which photos are uploaded to Facebook's servers, over a certain one-week period, in millions of photos per day. ($t = 0$ corresponds to the beginning of Sunday.) A graph of $p(t)$ is given below.



a. [2 points] Write a definite integral that gives the total number of photos uploaded to Facebook from the beginning of Sunday through the end of Monday. Include units in your answer.

Solution: $\displaystyle\int_0^2 p(t)dt$ millions of photos *or* $10^6 \displaystyle\int_0^2 p(t)dt$ photos

b. [8 points] Estimate the value of the definite integral in part (a) using LEFT(2), RIGHT(2), MID(2) and TRAP(2). Write each sum in terms of p.

Solution: $\Delta t = \frac{2-0}{2} = 1$, so the width of each rectangle in the Riemann sums is 1. Then

$$\text{LEFT}(2) = p(0)\Delta t + p(1)\Delta t \approx 35 \cdot 1 + 40 \cdot 1 = 75 \text{ million photos}$$

$$\text{RIGHT}(2) = p(1)\Delta t + p(2)\Delta t = 40 \cdot 1 + 27.5 \cdot 1 \approx 67.5 \text{ million photos}$$

$$\text{MID}(2) = p(0.5)\Delta t + p(1.5)\Delta t = 38 \cdot 1 + 35 \cdot 1 \approx 73 \text{ million photos}$$

$$\text{TRAP}(2) = \frac{\text{LEFT}(2) + \text{RIGHT}(2)}{2} \approx \frac{75 + 67.5}{2} = 71.25 \text{ million photos}$$

In terms of the function p, one can also calculate

$$\text{TRAP}(2) = \frac{1}{2}p(0) + p(1) + \frac{1}{2}p(2) \approx \frac{1}{2} \cdot 35 + 40 + \frac{1}{2} \cdot 27.5 = 71.25 \text{ million photos.}$$

Note that answers may vary slightly because exact values of the $p(t)$ were not given in the statement of the problem.

c. [2 points] Give a real world interpretation of the quantity $\frac{1}{5}\int_1^6 p(t)dt$. Include units.

Solution: Since $\frac{1}{5}\int_1^6 p(t)dt = \frac{1}{6-1}\int_1^6 p(t)$, the given integral represents the average rate at which photos are uploaded to Facebook's servers during the work week (Monday through Friday).