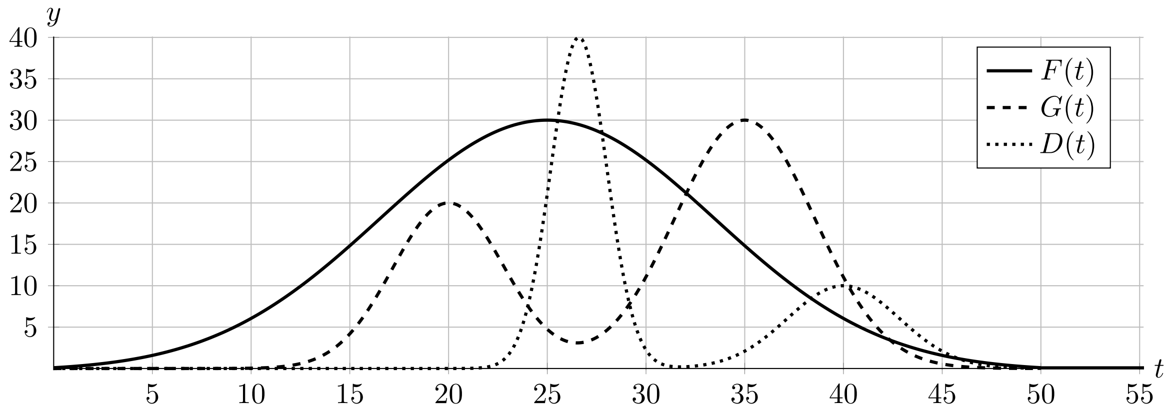
3. [10 points] A lone oak tree near the boundary between the Graham and Duckworth estates is shedding its leaves throughout the autumn season. Assume all the oak tree's leaves fall onto the Graham estate, at a rate of $F(t)$ thousand leaves per day, t days after 12am on Sept 30^{th}.

Graham, feuding with Duckworth, uses a leaf-blower to blow the oak tree leaves onto Duckworth's estate at a rate of $G(t)$ thousand leaves per day, t days after 12am on Sept 30^{th}. Not to be outdone, Duckworth blows the oak tree leaves back onto Graham's estate at a rate of $D(t)$ thousand leaves per day, t days after 12am on Sept 30^{th}. Throughout this problem, assume that all oak tree leaves on either estate have originally fallen from this tree.

Graphs of the continuous functions $F(t)$, $G(t)$, and $D(t)$ are shown below. Note that, for instance, $t = 15$ corresponds to 12am on Oct 15^{th}, and $t = 35$ corresponds to 12am on Nov 4^{th}.



a. [2 points] Approximately how many leaves fell from the tree onto Graham's estate between 12am Oct 20^{th} and 12am Oct 25^{th}? Give a numerical answer, rounded to the nearest 10,000.

Answer: 140,000 leaves.

b. [2 points] Write an expression involving one or more integrals for the total number of oak tree leaves that are on Graham's estate 55 days after 12am on Sept 30^{th}.

Answer: $1000 \int_0^{55} \big(F(t) - G(t) + D(t)\big)\, dt$

c. [2 points] Estimate the rate of change, in thousands of leaves per day, of oak tree leaves on Graham's estate at 12am on Nov 4^{th}.

Answer: -13 **(or** $-13{,}000$ **leaves per day)**

d. [2 points] On which single calendar day was the *increase* in the number of oak tree leaves on Graham's estate the greatest? Give your best estimate.

Answer: **October 26th**

e. [2 points] On which single calendar day was the total *number* of oak tree leaves on Graham's estate the greatest? Give your best estimate.

Answer: **November 1^{st}**