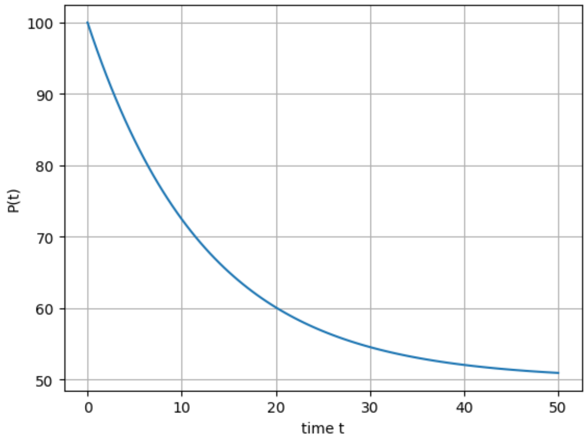
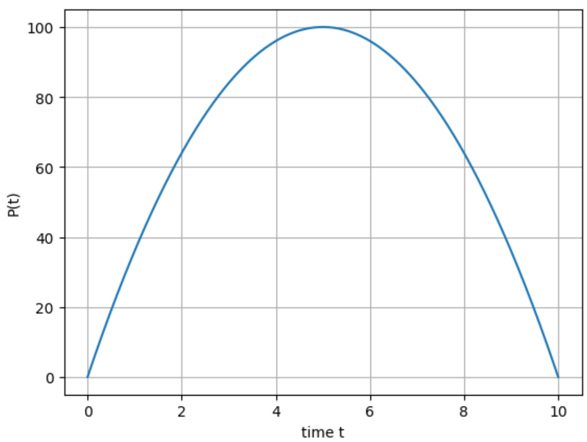
Solutions to Autonomous ODEs

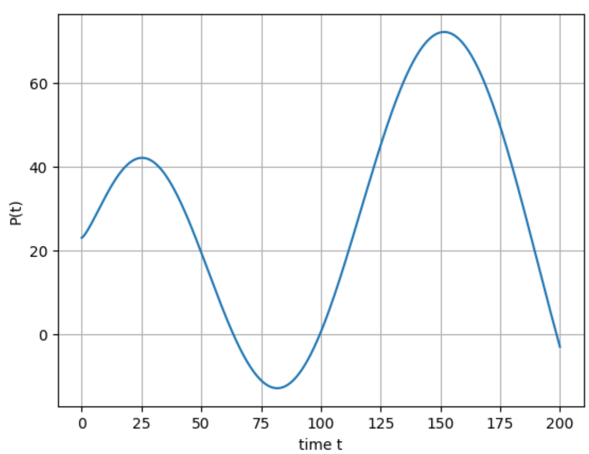
Differential Equations

College of the Atlantic. January 19, 2026

Which of the following could be solutions to a differential equation of the form $\frac{dP}{dt} = f(P)$.







Euler's Method Practice

Differential Equations

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1. In this problem we'll work with the logistic equation:

$$\frac{dP}{dt} = rP\left(1 - \frac{P}{K}\right) . \tag{1}$$

   Let's say that the growth constant r is 0.2 and the carrying capacity is 1000. Let the population P at time $t = 0$ be 600.

   (a) Using $\Delta t = 0.5$, use Euler's method to come up with approximate values for $P(0.5)$, $P(1.0)$, and $P(1.5)$.

   (b) Using $\Delta t = 0.25$, use Euler's method to come up with approximate values for $P(0.25)$, $P(0.5)$, $P(0.75)$, and $P(1.0)$.

   (c) Make a qualitatively accurate sketch of the exact solution $P(t)$. Think about the concavity of the graph.

   (d) Are your Euler-method approximate solutions above or below the exact solution? Briefly explain why.

2. Write some python that will use Euler's method to produce a numerical solution to this differential equation. It should be adjustable so that you can change Δt and also how far (i.e., to what t value) you want your solution to go to.

3. Write a general-purpose program to produce approximate solutions to a general differential equation via Euler's method. Your Euler solver should take a function (the right-hand side of the differential equation) as an argument.