

4) A population of drosophila (fruit flies) are present in a culture chamber. The chamber can hold no more than 5000 flies. If we assume that the relative growth rate is proportional to $1 - P/M$ and has a positive proportionality constant k , we have $\frac{dP}{dt} = \frac{k}{M}P(M - P)$. Given this, derive the logistic growth model,

$P(t)$. Fifteen points. For five more, given $k = 0.05$ and starting population of 100, determine how many days will pass until there are 1000 fruit flies present in the chamber.

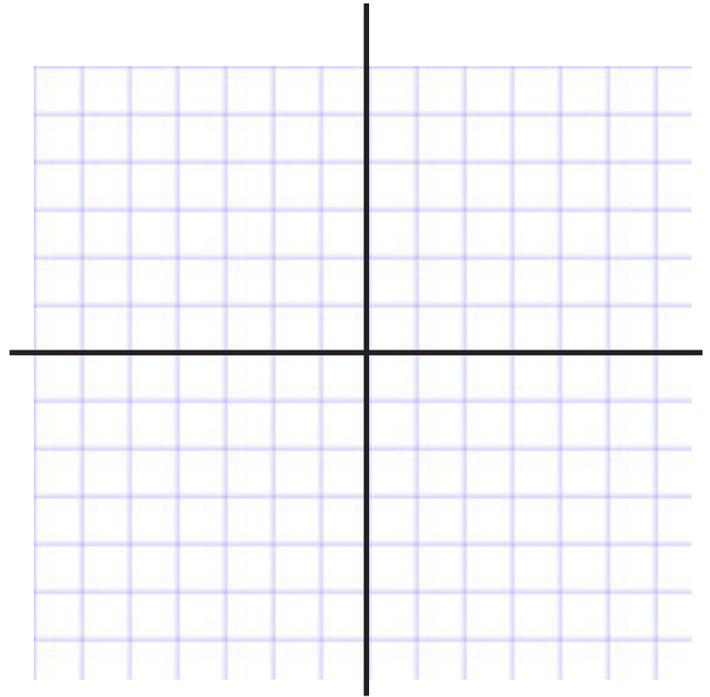
- 5) A hot ingot of silver is set in a room whose ambient temperature is $20\text{ }^{\circ}\text{C}$. The hot ingot is originally at a temperature of $1800\text{ }^{\circ}\text{C}$. After 20 minutes, it has cooled to $1000\text{ }^{\circ}\text{C}$. Using Newton's Law of Cooling, determine how long it will take to cool to $100\text{ }^{\circ}\text{C}$.

6) Evaluate this integral completely: $\int_0^1 \frac{16}{x^2 \sqrt{4-x^2}} dx$

- 7) Using the graph at the right and small lines about this size $|$, compose a slope field and sketch out three solution curves for

$$\frac{dy}{dx} = x - y^2$$

The slope field must contain at least twenty small lines.



- 8) EXTRA CREDIT. All or nothing. Guessing is okay. Five points.

A friend of mine visited a scientific outpost in Antarctica last year. He said the day he got there the temperature was -5°C . I said, "Sounds cold." He said, "Yeah it was, but the day before it was twice as cold." What was the temperature the day before?