

g)  $\frac{dy}{dx} = (4 - y)x$ , (1,5)

h)  $\frac{dy}{dx} = \frac{x}{\sin y}$ , (4, - $\pi$ )

6. Bacteria in a culture increased from 400 to 1600 in three hours. Assuming the rate of increase is proportional to the population:

- a) Find the exponential equation to model the population.
- b) Find the number of bacteria at the end of six hours using your equation from part a).

7. Radium-226 loses its mass at a rate that is directly proportional to its mass. Its half-life is 1590 years, and if we start with a sample of radium-226 with a mass of 100 mg: (Note:  $h = \frac{\ln 2}{k}$ )

- a) Find the formula for the mass that remains after  $t$  years.
- b) Find the mass after 1000 years
- c) When will the mass be reduced to 30 mg?

8. The rate at which a bacterial culture grows is directly proportional to the amount present. At  $t = 3$  hours there are 8000 bacteria. At  $t = 7$  hours there are 17000 bacteria.

- a) How many bacteria will be present at  $t = 9$  hours?
- b) How many bacteria were there initially?

*\* easier to do part b) first.*

9. Suppose the amount of oil pumped from a well decreases at a rate of 10 % per year. When will the well's output fall to one fifth of its present level.

10. An apple pie, whose internal temperature was 220°F when removed from an oven, was set outside to cool on a 40°F day. Fifteen minutes later, the pie was 180°F. How long did it take the pie to cool from there to 70°F?

11. A pan of warm water at 46°C was put in a refrigerator. Ten minutes later, the water's temperature was 39°C. 10 minutes after that it was 33°C. Using Newton's law of Cooling, how cold was the fridge?