



First Order Ordinary Differential Equations

Question 1: Identify the equation and solve.

- i. $\frac{dy}{dx} + \frac{y}{x-2} = 5(x-2)y^{\frac{1}{2}}$
- ii. $\frac{dy}{dx} = \frac{1}{y e^{y-x}}; y(0) = 1$
- iii. $\frac{dy}{d\theta} = \frac{x \sec(\frac{y}{x}) + y}{x}$
- iv. $\frac{dy}{dx} = \frac{\ln(\ln y - \ln x + 1)}{x}$
- v. $(x^2 \sin x + 4y)dx + xdy = 0$
- vi. $(2y^2x - y)dx + xdy = 0$
- vii. $\frac{dy}{dx} = \frac{y(y+\sin x)}{\left(\frac{1}{1+y^2} + \cos x - 2xy\right)}, y(0) = 1$

Question 2: Suppose it is known that the population of the community in Problem 1 is 10,000 after 3 years. What was the initial population P_0 ? What will be the population in 10 years? How fast is the population growing at $t = 5$ and $t = 10$?

Question 3: The radioactive isotope of lead, $Pb - 209$, decays at a rate proportional to the amount present at time t and has a half-life of 3.3 hours. If 1 gram of this isotope is present initially, how long will it take for 90% of the lead to decay?

Question 4: A small metal bar whose initial temperature was $20^\circ C$ is dropped into a large container of boiling water. How long will it take the bar to reach $90^\circ C$ if it is known that its temperature increases 2° in 1 second? How long will it take the bar to reach $98^\circ C$?

Good Luck