Solve the differential equations using integrating factors.

1. \( y' + 5x^4y = x^4 \)

2. \( 4x^3y + x^4 \frac{dy}{dx} = \sin^3 x \)
3. $2xy' + y = 2\sqrt{x}$

4. $x^2y' + 3xy = \sin(1 + 2x^2)$
5. $x^3y' + 3x^2y = \ln x \quad y(1) = 4$

6. $xy' = x \ln x - y \quad y(1) = 0$
7. A tank contains 100 L of pure water. A salt solution with a concentration of .04 kg/L is added at a rate of 5 L/min. The well-mixed solution is drained from the tank at a rate of 3 L/min.

Write a function that describes the volume of water in the tank at time $t$:

$$ V(t) = $$

Let $y(t)$ be the amount of salt in the tank at time $t$. The concentration of the solution in the tank at time $t$ is then $\frac{y(t)}{V(t)}$. Use this to write a differential equation describing how the amount of salt is changing over time.

$$ \frac{dy}{dx} = $$

You should have a linear differential equation. Using that $y(0) = 0$, find the amount of salt in the tank at time $t$.

At what time does the tank contain 200 L of water? How much salt is in the tank at that time?