

Worksheet 18

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Solve the differential equation

1. $\frac{dy}{dx} = \frac{\sqrt{x}}{e^y}$.

2. $y' = y^2 \sin x$.

Find the solution of the differential equation that satisfies the given condition.

3. $\frac{dy}{dx} = \frac{y \cos x}{y^2 + 1}$, $y(0) = 1$.

4. $x \cos x = (2y + e^{3y})y'$, $y(0) = 0$.

Find the orthogonal trajectories of the family of curves.

5. $y^2 = kx^3$.

6. $y = \frac{x}{1 + kx}$.

7. A vat with 500 gallons of beer contains 4% alcohol (by volume). Beer with 6% alcohol is pumped into the vat at a rate of 5 gal/min and the mixture is pumped out at the same rate. What is the percentage of alcohol after an hour?
8. The air in a room with volume 180 m^3 contains 0.15% carbon dioxide initially. Fresher air with only 0.05% carbon dioxide flows into the room at a rate of $2 \text{ m}^3/\text{min}$ and the mixed air flows out at the same rate. Find the percentage of carbon dioxide in the room as a function of time. What happens in the long run?