

Solve the differential equation.

1) $\frac{dy}{dx} = \frac{y}{x}$

$$y = Kx$$

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

$$y = \frac{1}{\cos x + K}$$

3) $(1 + \tan y)y' = x^2 + 1$

$$y + \ln|\sec y| = \frac{1}{3}x^3 + x + C$$

$$4) \frac{du}{dt} = 2 + 2u + t + tu \quad \boxed{u = -1 + Ae^{t^2/2 + 2t}}$$

$$5) \frac{dz}{dt} + e^{t+z} = 0 \quad \boxed{z = -\ln(e^t - C)}$$

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

$$6) \frac{dy}{dx} = y^2 + 1, \quad y(1) = 0 \quad \boxed{y = \tan(x-1)}$$

$$7) \frac{dy}{dx} = \frac{y \cos x}{1+y^2}, \quad y(0) = 1$$

$$\ln|y| + \frac{1}{2}y^2 = \sin x + \frac{1}{2}$$

$$8) \frac{dP}{dt} = \sqrt{Pt}, \quad P(1) = 2$$

$$P = \left(\frac{1}{3}t^{3/2} + \sqrt{2} - \frac{1}{3} \right)^2$$

9) Find an equation of the curve that satisfies $\frac{dy}{dx} = 4x^3y$ and whose y -intercept is 7.

$$y = 7e^{x^4}$$

10) Find an equation of the curve that passes through the point (1, 1) and whose slope at (x, y) is $\frac{y^2}{x^3}$.

$$y = \frac{2x^2}{x^2 + 1}$$

11) A tank contains 1000 L of brine with 15 kg of dissolved salt. Pure water enters the tank at a rate of 10 L/min. The solution is kept thoroughly mixed and drains from the tank at the same rate. How much salt is in the tank after t minutes and after 20 minutes?

$$y = 15e^{-t/100} \text{ kg}, \approx 12.3 \text{ kg}$$