

More problems for section 9.3 of *Calculus, Early Transcendentals* by James Stewart, 8e.

1. Find the orthogonal trajectories of the given family of curves.

a. $y = kx^4$

b. $y^2 = kx$

c. $y = e^{kx}$

d. $x^{2/3} - y^{2/3} = k$

e. $y = -2x + k$

f. $y = kx + 4$

g. $x^2 - ky^2 = 16$

h. $y = ke^{\sin x}$

i. $y = ke^x$

2. A tank initially contains 90 L of water and 10 L of alcohol. A 3% alcohol solution is added to the tank at the rate of 10 L/hr. The contents of the tank are kept thoroughly mixed and drain from the tank at the same rate. How much alcohol is in the tank after 1 hour?

3. A tank initially contains 5 L of brine with 1 kg of dissolved salt. Another brine containing .6 kg salt per L is added to the tank at the rate of 1/10 L/hr. The contents of the tank are kept thoroughly mixed and drain from the tank at the same rate. Express the amount y of salt in the tank as a function of time t , measured in hours.

4. A tank initially contains 25 L of brine with 2 kg of dissolved salt. Fresh water is added to the tank at the rate of 5 L/hr. The contents of the tank are kept thoroughly mixed and drain from the tank at the same rate. Express the amount y of salt in the tank as a function of time t , measured in hours.

5. A tank initially contains 50 L of sports drink made from water and 5 L of concentrate. Its contents are drained from the tank at the rate of 10 L/min while pure concentrate is added at the same rate. The contents of the tank are kept thoroughly mixed. Express the amount y of concentrate in the tank as a function of time t , measured in minutes.

Answers

1a. $2y^2 + \frac{1}{2}x^2 = C$ 1b. $y^2 + 2x^2 = C$ 1c. $2y^2 \ln y - y^2 + 2x^2 = C$ 1d. $y^{4/3} + x^{4/3} = C$ 1e. $y = \frac{1}{2}x + C$ 1f. $y^2 - 8y + x^2 = C$
1g. $y^2 = 32 \ln|x| - x^2 + C$ 1h. $y^2 = -2 \ln|\sec x + \tan x| + C$ 1i. $\frac{1}{2}y^2 = -x + C$ 2. $3 + 7e^{-1/10}$ L. 3. $y = 3 - 2e^{-t/50}$. 4. $y = 2e^{-t/5}$. 5. $y = 50 - 45e^{-t/5}$.