

ASSIGNMENT 05
Fixed Closing Date: 29 July 2022
Total Marks: 100
UNIQUE ASSIGNMENT NUMBER: _____

1. Show whether or not the following differential equations are separable:

$$1.1 \quad \frac{dy}{dx} = \frac{x+1}{y-1} \quad (5)$$

$$1.2 \quad \frac{dy}{dx} = \frac{ye^{x+y}}{x^2+2} \quad (5)$$

$$1.3 \quad \frac{dS}{dt} = t(\ln(S^{2t})) + 8t^2 \quad (5)$$

2. Solve the following differential equation by using separation of variables method:

$$2.1 \quad x \frac{dy}{dx} = 4y \quad (5)$$

$$2.2 \quad \frac{dp}{dt} = \frac{(1+p^2)\cos t}{p \sin t} \quad (5)$$

3. Solve the following differential equations subject to the given initial conditions:

$$3.1 \quad \frac{dy}{d\theta} = y \sin \theta, \quad y(\pi) = 3. \quad (5)$$

$$3.2 \quad x^2 \frac{dy}{dx} = y - xy, \quad y(1) = 1. \quad (5)$$

4. The population of a certain community is known to increase at a rate proportional to the number of people present any time. If the population had doubled in 5 years, how long will it take to triple? (5)

$$5. \text{ Solve the initial value problem } \frac{dx}{dt} = \frac{3t^2 + \sec^2 t}{3x^2}, \quad x(0) = 5. \quad (5)$$

$$6. \text{ Solve the following initial value problem } \frac{dy}{dx} = \cos ec^2 x(e - 5y), \quad y\left(\frac{\pi}{2}\right) = 0. \quad (5)$$

7. A bacterial culture starts with 2200 bacteria and after 3 hours there are 3700 bacteria.

30 Assuming that the culture grows at a rate proportional to its size, find the population after 6 hours. (5)

8. Solve the following initial value problem: $\frac{dy}{dx} = \frac{\cos^2 y}{4x-3}$, $y(1) = \frac{\pi}{4}$. (5)
9. Solve the following Initial Value problem: $\frac{dy}{dx} = \frac{9x^2 - \sin x}{\cos y + 5e^y}$, $y(0) = \pi$. (5)
10. A bacterial culture starts with 1000 bacteria and after 2 hours there are 2500 bacteria. Assuming that the culture grows at a rate proportional to its size, find the population after 6 hours. (5)
11. Solve the following Initial value problem $\frac{dw}{dt} = \frac{2t + \sec^2 t}{2w}$, $w(0) = -5$. (5)
12. Determine the solution of $\frac{y'}{x} = \frac{1}{y^2 - y}$ that passes through the point (1, 2). (5)
13. Solve the Initial Value Problem $\frac{dw}{dt} = t^2 w^2$, $w(0) = a$. (5)
14. Use the method of separation of variables to find a general solution to the differential equation $\frac{dy}{dx} = 2xy + 3y - 4x - 6$. (5)
15. Find the solution to the initial-value problem $6\frac{dy}{dx} = (2x+1)(y^2 - 2y - 8)$ with $y(0) = -3$ using the method of separation of variables. (3)
16. Solve the equation $x dx + \sec x \sin y dy = 0$. (2)
17. A bacterial culture contains 100 cells at a certain point in time. Sixty minutes later, there are 450 cells. Assuming exponential growth, determine the number of cells present at time t . (3)
18. Solve the following Initial Value Problem $xy \frac{dy}{dx} = \ln x$, $y(1) = 2$. (2)

Total: [100]