

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECTION 4.1

Math 1001 Worksheet

WINTER 2024

For practice only. Not to be submitted.

1. Determine which of the following is a solution of

$$t^2 \frac{d^2 y}{dt^2} - t \frac{dy}{dt} + y = 0$$

by substituting directly into the differential equation.

- (a) $y = t$
 - (b) $y = \ln(t)$
 - (c) $y = t \ln(t)$
2. Find the particular solution to each initial value problem.
- (a) $\frac{dy}{dt} + \sqrt{t} = 9, \quad y(0) = 4$
 - (b) $\cos^2(t) \frac{dy}{dt} + \cos(t) - 1 = 0, \quad y(0) = 0$
 - (c) $t^2 f'(t) = \ln(t), \quad f(1) = 2$
 - (d) $f''(t) - \frac{4}{t^2} = 0, \quad f(-1) = 3$ and $f'(1) = 0$
 - (e) $f''(t) = 3t - 3, \quad f(0) = -5$ and $f(2) = -7$
3. Find all functions $f(x)$ such that $f'(x) = 9x^2$ and the line $y = 36x$ is tangent to the graph of $f(x)$.
4. A toy rocket is launched vertically upward from the ground.
- (a) With what initial velocity must the rocket be launched in order to reach a maximum height of 4410 metres?
 - (b) How long does it take the rocket to achieve this height?
 - (c) What will the rocket's height be after 10 seconds?