

# MEMORIAL UNIVERSITY OF NEWFOUNDLAND

## DEPARTMENT OF MATHEMATICS AND STATISTICS

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SECTION 4.1

Math 1001 Worksheet

WINTER 2025

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**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)  $f''(t) - \frac{4}{t^2} = 0, \quad f(-1) = 3 \text{ and } f'(1) = 0$

(e)  $f''(t) = 3t - 3, \quad f(0) = -5 \text{ and } f(2) = -7$

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?