

**Problem 1 (Separation of Variables)**

Solve the following differential equations by separation of variables:

a.  $y' = \frac{t^2}{y}$

$$\frac{dy}{dt} = \frac{t^2}{y} \quad ydy = t^2 dt \quad \int ydy = \int t^2 dt \quad \frac{y^2}{2} = \frac{t^3}{3} + C$$

$$y^2 = \frac{2}{3}t^3 + C$$

b.  $y' = \frac{2t}{1+2y} \quad y(2) = 0$

$$\frac{dy}{dt} = \frac{2t}{1+2y} \quad (1+2y)dy = 2tdt \quad \int (1+2y)dy = \int 2tdt \quad y + y^2 = t^2 + C$$

$$0 + 0^2 = 2^2 + C$$

$$C = -4$$

$$y^2 + y = t^2 - 4$$

**Problem 2**

Solve the IVP numerically

$$\frac{dy}{dt} = f(t, y) = 4 - 2t + 2.5y$$

Let  $t_0 = 0, y(0) = 1$

Additionally, choose  $t$  to be in increment of 0.1 until you reach  $t = 0.4$ . Show your result in tabular form using the format below:

	t	Euler ( $y_n$ )	$\frac{dy}{dt}$
0	0	1	6.50
1	0.1	1.650	7.925
2	0.2	2.443	9.707
3	0.3	3.414	11.935
4	0.4	4.608	14.720