**SOUTH EASTERN UNIVERSITY OF SRI LANKA**

**SECOND EXAMINATION IN APPLIED SCIENCES – 2017 / 2018**

**SEMESTER II, MARCH / APRIL – 2020**

**MTM 22031 / MTM 22031 R(N) ELEMENTARY DIFFERENTIAL EQUATIONS**

Time Allowed: **One** hour

Answer **both** questions. All questions carry equal marks.

1. $(a)$ Find the values of the constants $a, b$ and $c$ such that the expression

$$y\left(x\right)=ax+bxe^{2x}+cx^{2}e^{2x}$$

 is a solution of the differential equation

$$\frac{d^{3}y}{dx^{3}}-3\frac{d^{2}y}{dx^{2}}+2\frac{dy}{dx}=10+4xe^{2x}.$$

$(b)$ A calf weighed 40 kg at birth gains weight at the rate

$$\frac{dw}{dt}=k \left(650-w\right),$$

 where $w$ is the weight (in kilograms) and $t$ is the time (in years).

1. If the animal weighs 320 kg in one year, solve the differential equation.
2. The animal is sold when its weight reaches 550 kg. Find the time of sale.
3. What will be the maximum weight of the animal?

2. $(a)$ Solve the homogeneous equation

$$2xy\frac{dy}{dx}+x^{2}+y^{2}=0.$$

 $(b)$ Solve the linear equation

$$\frac{dy}{dx}+\left(\frac{x+3}{x}\right) y=\frac{1}{x^{2}}.$$

 If the solution satisfies the conditions $y\left(1\right)=1$ and $y\left(2\right)=k$, then show that

$$k=\frac{e+1}{8e}.$$

 $(c)$ Use the test for exactness to show that the following differential equation is exact and then solve it:

$$\left(x^{2}+xy-y^{2}\right) dx+\left(\frac{1}{2}x^{2}-2xy\right) dy=0.$$

**END OF THE PAPER**