Lab Final Quiz

Integral Calculus & Differential Equations (MAT120)

Time: 40 minutes, Total Marks: 20

Name: _____

Student ID: _____ Section: _____

MCQ

Marks: 10 × 1

1. Which SymPy function is used to find the numerical value of SymPy expressions?
   ◯ symbols() ◯ evalf() ◯ subs() ◯ solve()

2. Which of the following solve the equation: $\sin(2x) - \cos(3x) = 0$ where, $x \in [0,\ 2\pi]$?
   ◯ `sympy.solver()` ◯ `sympy.solve()` ◯ `sympy.solveset()` ◯ `sympy.simplify()`

3. When Simpson's rule is used to approximate the definite integral, it is necessary that the number of points be —
   ◯ an odd number ◯ even number ◯ either an even or an odd number ◯ a multiple of 3

4. Suppose you need to create a NumPy Array for x in interval $[0, 1]$ with step-size, $h = 0.1$. Which of the following statements generate this?
   ◯ `numpy.linspace(0, 1, 0.1)` ◯ `numpy.linspace(0, 1, 0.2)`
   ◯ `numpy.linspace(0, 1, 10)` ◯ `numpy.linspace(0, 1, 100)`

5. Which Matplotlib function is used to show the labels of different plots in a graph?
   ◯ `pyplot.show()` ◯ `pyplot.label()` ◯ `pyplot.grid()` ◯ `pyplot.legend()`

6. In trapezoidal method, if the step-size is 0.1 ($h = 0.1$), order of error of the integral $\int_0^1 x^x dx$ should be
   ◯ 10^{-1} ◯ 10^{-2} ◯ 10^{-3} ◯ 10^{-4}

7. Which one is the correct way to define the dependent variable using sympy for this ODE?

$$y\frac{dm}{dn} + n^2 x = 0$$

   ◯ `y = sympy.Function('y')(x)` ◯ `m = sympy.Function('m')(x)`
   ◯ `y = sympy.Function('y')(n)` ◯ `m = sympy.Function('m')(n)`

8. How many initial conditions are needed in a second-order ordinary differential equation?
   ◯ 1 ◯ 2 ◯ 3 ◯ 4

9. Which one is the correct way to use `integrate()` to solve the integral $\int_0^\infty x^3 e^{-x} dx$?
   ◯ `integrate(x*3*exp(-x), (x, oo, 0))` ◯ `integrate(x**3*exp(-x), (x, 0, oo))`
   ◯ `integrate(x*3*exp(-x), (x, 0, oo))` ◯ `integrate(x**3*exp(-x), (x, oo, 0))`

10. Simpson's rule uses —in each sub-interval to approximate the curve.
    ◯ straight line ◯ parabola ◯ hyperbola ◯ exponential

Fill in the blanks

11. The following code part tries to solve the linear drag problem: $m\frac{dv}{dt} = mg - qv$. Fill in the gaps with appropriate code parts. (2)

```
import sympy as sp
m, g, q, t = _______
v = _______
dsolve(Eq(m*diff(v), m*g - q*v(t)))
```

12. The following code part tries to solve the ODE $\frac{dv}{dt} = 9.8 - 0.5v^2$ with the initial condition $v(0) = 10$. Fill in the gaps with appropriate code parts. (2)

```
import numpy as np
def f(t,v): return ________
h       = 0.1
t       = np.arange(0, 3+h, h)
v       = np.zeros(len(t))
v[0]    = _____
for i in range(0, len(t)-1):
    v[i + 1] = v[i] + h*f(t[i], v[i])
```

Written Part

13. Write down the differential equation and the initial conditions which the following code tries to solve. (3)

```
from sympy import *
x = symbols('x')
y = Function('y')(x)
LHS = diff(y,x,2)- 5*diff(y)+ 4*y
ode = Eq(LHS, 0)
dsolve(ode, ics = {diff(y).subs(x,0): 10, y.subs(x,1): 0})
```

14. See the table, the function $f(x)$ is continuous on the closed interval [2, 14] and has values as shown the table below. Using three subintervals, what is the approximation of $\int_2^{14} f(x)dx$ found by using the Trapezoid rule? (3)

x	2	6	10	14
$f(x)$	12	28	34	30