

HOMEWORK 11

Due date: April 9, 2020, 11:55PM.

Bibliography: Lesson 21, Trench, 3.1-3.3

1. Exercises 1-5, p. 106
2. Exercises 1-5, p. 124
3. Exercise 13, p. 108
4. Exercises 13, p. 126

Solutions

Here is a template for this numerical methods homework.

1. Euler's method. Ex.1. $y' = f(x, y) = 2x^2 + 3y^2 - 2$, $y(2) = 1$, $h = 0.05$.

```
(%i1) f(x,y):=2*x^2+3*y^2-2$
```

```
(%i2) h:0.05$ x0:2$ y0:1$
```

```
(%i5) for i:1 thru 3 do
      ( x1: x0+h, y1: y0+h*f(x0,y0), x0: x1, y0: y1,
        display([i,x1,y1]) )$
```

```
[i, x1, y1] = [1, 2.05, 1.45]
```

```
[i, x1, y1] = [2, 2.1, 2.085625]
```

```
[i, x1, y1] = [3, 2.149999999999999, 3.07909974609375]
```

```
(%i6)
```

2. Runge-Kutta method. Ex.1. $y' = f(x, y) = 2x^2 + 3y^2 - 2$, $y(2) = 1$, $h = 0.05$.

```
(%i6) f(x,y):=2*x^2+3*y^2-2$
```

```
(%i7) h:0.05$ x0:2$ y0:1$
```

```
(%i10) for i:1 thru 3 do
      ( x1: x0+h,
        k1: h*f(x0,y0),
        k2: h*f(x0+0.5*h, y0+0.5*k1),
        k3: h*f(x0+0.5*h, y0+0.5*k2),
        k4: h*f(x0+h, y0+k3),
        y1: y0+(1/6)*(k1+2*k2+2*k3+k4),
        x0: x1, y0: y1,
        display([i,x1,y1]) )$
```

```
[i, x1, y1] = [1, 2.05, 1.550598189929713]
```

```
[i, x1, y1] = [2, 2.1, 2.469649728729797]
```

```
[i, x1, y1] = [3, 2.149999999999999, 4.530350898626433]
```

```
(%i11)
```

