Ryan Fahrenkrug

MECH 105

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Homework 17

```
clear
clc
close all
```

Part 1

Analytically

```
format long
syms x
f=8+4*cos(x);
a=0;
b=pi/2;
an=int(f,a,b);
an=double(an);
fprintf('The analytical solution is %3.12f\n',an)
```

```
The analytical solution is 16.566370614359
```

$$\int_0^{\frac{\pi}{2}} 8 + 4\cos(x)\mathrm{dx} = 16.566370614359$$

Part 2

Trapezoidal Rule

$$I = \left(\frac{\pi}{2}\right)\frac{f(0) + f\left(\frac{\pi}{2}\right)}{2} = 15.707963267949$$

$$\varepsilon_t = \left|\frac{16.566370614359 - 15.707963267949}{16.566370614359}\right| * 100 = 5.1816\%$$

Part 3

Composite Trapezoidal Rule, n=4

$$I = \left(\frac{\pi}{2}\right)\frac{f(0) + 2\left[f\left(\frac{\pi}{8}\right) + f\left(\frac{\pi}{4}\right) + f\left(\frac{3\pi}{8}\right)\right] + f\left(\frac{\pi}{2}\right)}{8} = 16.51483381825$$

$$\varepsilon_t = \left|\frac{16.566370614359 - 16.51483381825}{16.566370614359}\right| * 100 = 0.311093\%$$

Part 4

Simpson's 1/3 Rule

$$I = \left(\frac{\pi}{2}\right) \frac{f(0) + 4f\left(\frac{\pi}{4}\right) + f\left(\frac{\pi}{2}\right)}{6} = 16.575490124328$$

$$\varepsilon_t = \left| \frac{16.566370614359 - 16.575490124328}{16.566370614359} \right| * 100 = 0.055048\%$$

Part 5

Simpson's 3/8 Rule

$$I = \left(\frac{\pi}{2}\right) \frac{f(0) + 3f\left(\frac{\pi}{6}\right) + 3f\left(\frac{\pi}{3}\right) + f\left(\frac{\pi}{2}\right)}{8} = 16.570390307617$$

$$\varepsilon_t = \left| \frac{16.566370614359 - 16.570390307617}{16.566370614359} \right| * 100 = 0.02426\%$$