
HW #8

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4.6

4d)

```
fun = @(x) exp(x).*(6*cos(4*x)+4*sin(6*x))  
[Int,flg,fcnt,level] = AdaptSimpson(fun, [0, pi/2], 0.00001, 100)  
clear
```

```
fun =  
  
    @(x)exp(x).*(6*cos(4*x)+4*sin(6*x))
```

```
Int =  
  
    5.1138
```

```
flg =  
  
    0
```

```
fcnt =  
  
    121
```

```
level =
```

6

5b)

```
fun = @(x) x.*sin(x.^2);
q = integral(fun, 0, pi);
n = 5;
while(abs(q - CompSimpson(fun, n, [0 , pi])) > 0.000001)
    n = n + 2;
end
n
[Int,flg,fcnt,level] = AdaptSimpson(fun, [0 , pi], 0.000001, 10)
clear
```

n =

147

Int =

0.9513

flg =

0

fcnt =

205

level =

8

6b)

```
x = 0.1:pi/100:2;
y = cos(1./x);
% figure
% plot(x, y)
y = @(x) cos(1./x);
[Int,flg,fcnt,level] = AdaptSimpson(y, [0.1, 2], .001, 10)
clear
```

Int =

0.6738

flg =

0

fcnt =

29

level =

7

7)

```
m = 1;
k = 9;
F_0 = 1;
w = 2;
w_0 = sqrt(k/m);
% t = 0:pi/20:2*pi
% y = F_0/(m*(w_0^2-w^2)).*(cos(w*t)-cos(w_0*t))
% plot(t, y)
u = @(t) F_0/(m*(w_0^2-w^2)).*(cos(w*t)-cos(w_0*t));
[Int,flg,fcnt,level] = AdaptSimpson(u, [0, 2*pi], .0001, 10)
clear
```

Int =

-2.2204e-16

flg =

0

fcnt =

65

level =

5

8a)

```

m = 1;
k = 9;
F_0 = 1;
c = 10;
w = 2;
w_0 = sqrt(k/m);
r_1 = (-c+sqrt(c^2-4*w_0^2*m^2))/2*m;
r_2 = (-c-sqrt(c^2-4*w_0^2*m^2))/2*m;
syms c_1 c_2 t
u = c_1*exp(r_1*t) + c_2*exp(r_2*t) + (F_0/(c^2*w^2+m^2*(w_0^2-w^2)^2)).*(c*w*sin
diff_u = diff(u)
u_0 = vpa(subs(u, t, 0))
diff_u_0 = vpa(subs(diff_u, t, 0))
% c_1 = solve(u_0 == 0)
c_1 = -1/40;
c_2 = 9/680;
u = @(t) c_1*exp(r_1*t) + c_2*exp(r_2*t) + (F_0/(c^2*w^2+m^2*(w_0^2-w^2)^2)).*(c*w
[Int,flg,fcnt,level] = AdaptSimpson(u, [0, 2*pi], 0.0001, 10)
clear

```

u =

*cos(2*t)/85 + (4*sin(2*t))/85 + c_1*exp(-t) + c_2*exp(-9*t)*

diff_u =

*(8*cos(2*t))/85 - (2*sin(2*t))/85 - c_1*exp(-t) - 9*c_2*exp(-9*t)*

u_0 =

c_1 + c_2 + 0.011764705882352941176470588235294

diff_u_0 =

*0.094117647058823529411764705882353 - 9.0*c_2 - 1.0*c_1*

u =

*@(t)c_1*exp(r_1*t)+c_2*exp(r_2*t)+(F_0/(c^2*w^2+m^2*(w_0^2-w^2)^2)).*(*

Int =

-0.0235

```
flg =  
  
0  
  
fcnt =  
  
37  
  
level =  
  
5
```

4.7

1b)

```
a = 0;  
b = 1;  
syms t x  
f = @(x) (x.^2).*exp(-1*x);  
actual = int(f, x, a, b)  
x = (t+1)/2;  
% dx = 1/2 * dt;  
[c,x_val] = Legendre(2)  
ans = vpa((1/2) * (c(1) * subs(f(x), t, x_val(1)) + c(2) * subs(f(x), t, x_val(2)))  
diff = vpa(abs(actual - ans))  
clear
```

```
actual =  
  
2 - 5*exp(-1)
```

```
c =  
  
1.0000  
1.0000
```

```
x_val =  
  
-0.5774  
0.5774
```

```
ans =  
  
0.15941043096637894599613928452297
```

```
diff =  
  
0.0011923631764094460262418646697296
```

2b)

```
a = 0;  
b = 1;  
syms t x  
f = @(x) (x.^2).*exp(-1*x);  
actual = int(f, x, a, b)  
x = (t+1)/2;  
% dx = 1/2 * dt;  
[c,x_val] = Legendre(3)  
ans = vpa((1/2) * (c(1) * subs(f(x), t, x_val(1)) + c(2) * subs(f(x), t, x_val(2))  
diff = vpa(abs(actual - ans))  
clear
```

```
actual =  
  
2 - 5*exp(-1)
```

```
c =  
  
0.5556  
0.8889  
0.5556
```

```
x_val =  
  
-0.7746  
0  
0.7746
```

```
ans =  
  
0.16059538680891924572776499743668  
  
diff =  
  
0.0000074073338691462946161517560162053
```

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