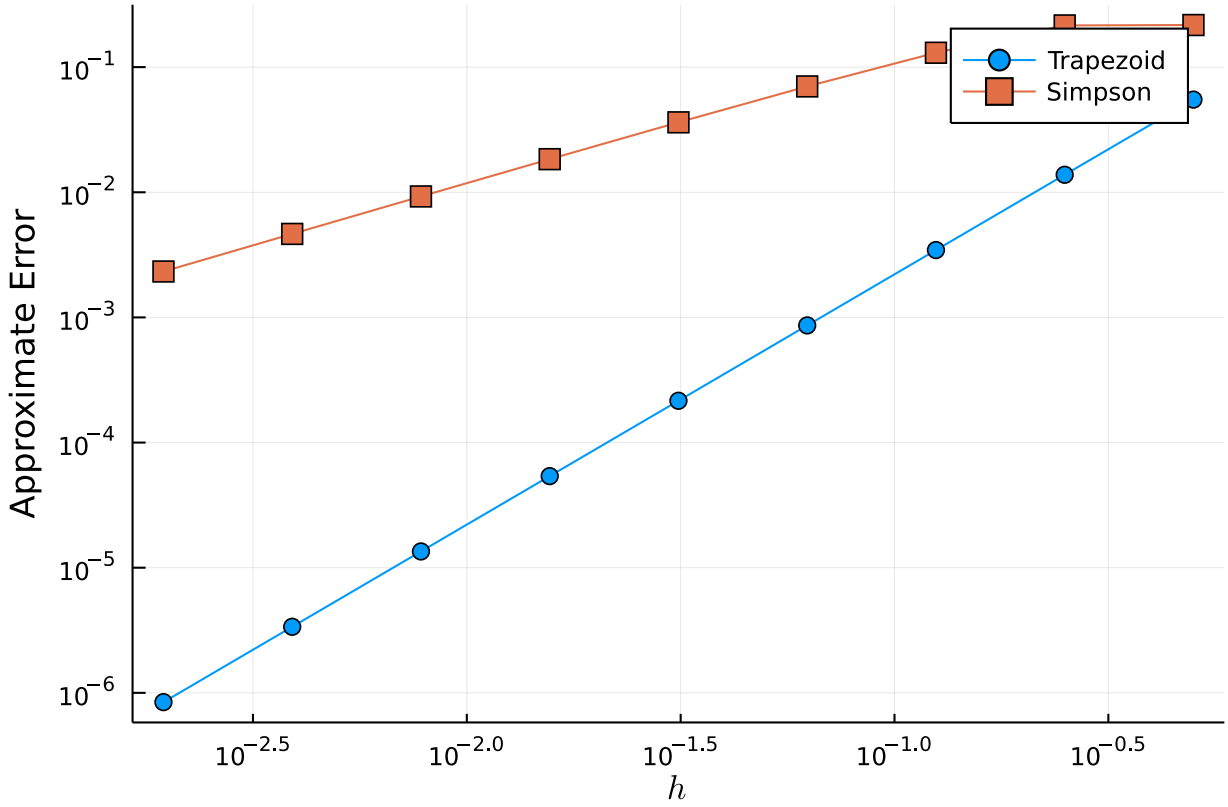
# 1 Problem 1

# 2 Problem 2

$\int_1^3 \sqrt{(2+\cos(x)^3)}\exp(\sin(x))dx$

```
using LinearAlgebra
using Plots
using LaTeXStrings

f(t) = sqrt(2 + cos(t)^3)*exp(sin(t))

function CompTrapezoid(N, a, b, f)

    #=
        Integrates f(t) from a to b using composite trapezoid rule

        Input variables
        N: number of points
        a: initial point
        b: final point
        f: function to be integrated

        local variables
        h: step size
        s: solution
    =#

    h = (b-a)/N
    s = 0
    for i = 1:N
        s += h/2 * (f(a + h*(i-1)) + f(a + h*i))
    end
    return s
end

function CompSimpson(N, a, b, f)

    #=
        Integrates f(t) from a to b using composite simpsons rule

        Input variables
        N: number of points
        a: initial point
        b: final point
        f: function to be integrated

        local variables
        h: step size
        s: solution
        ts: partition points
    =#

    h = (b-a)/N
    s = f(a) + f(b)

    ts = a:h:b
    for i = 1:(Int(N/2) - 1)
```

```
        s += 2*f(ts[2*i])
    end
    for i = 1:Int(N/2)
        s += 4*f(ts[2*i-1])
    end

    s = h/3 * s
    return s
end

a = 1; b = 3; T = b-a;

# CompTrapezoid(N,a,b,f)
# CompSimpson(N,a,b,f)

# Plotting error routine
NList = 2 .^(2:10)
errTrapeList = zeros(size(NList))
errSimpList = zeros(size(NList))
for i = 1 : length(NList)
    N = NList[i]

    utrape = CompTrapezoid(N,a,b,f)
    utexact = CompTrapezoid(2*N,a,b,f)

    usimps = CompSimpson(N,a,b,f)
    usexact = CompSimpson(2*N,a,b,f)

    # errTrapeList[i] = norm(utrape-uexact)
    errTrapeList[i] = abs(utrape-utexact)./(1-(1/2^2))
    errSimpList[i] = abs(usimps-usexact)./(1-(1/2^4))
end

plot(T./NList, errTrapeList,label="Trapezoid",xaxis=:log,yaxis=:log, marker = (:dot,5),
add_marker = true)
plot!(T./NList, errSimpList,label="Simpson",xaxis=:log,yaxis=:log, marker = (:square,5),
add_marker = true)
xlabel!(L"h")
ylabel!("Approximate Error")
```


Approximate Error
$10^{-1}$
$10^{-2}$
$10^{-3}$
$10^{-4}$
$10^{-5}$
$10^{-6}$
$10^{-2.5}$
$10^{-2.0}$
$10^{-1.5}$
$10^{-1.0}$
$10^{-0.5}$
$h$
Trapezoid
Simpson