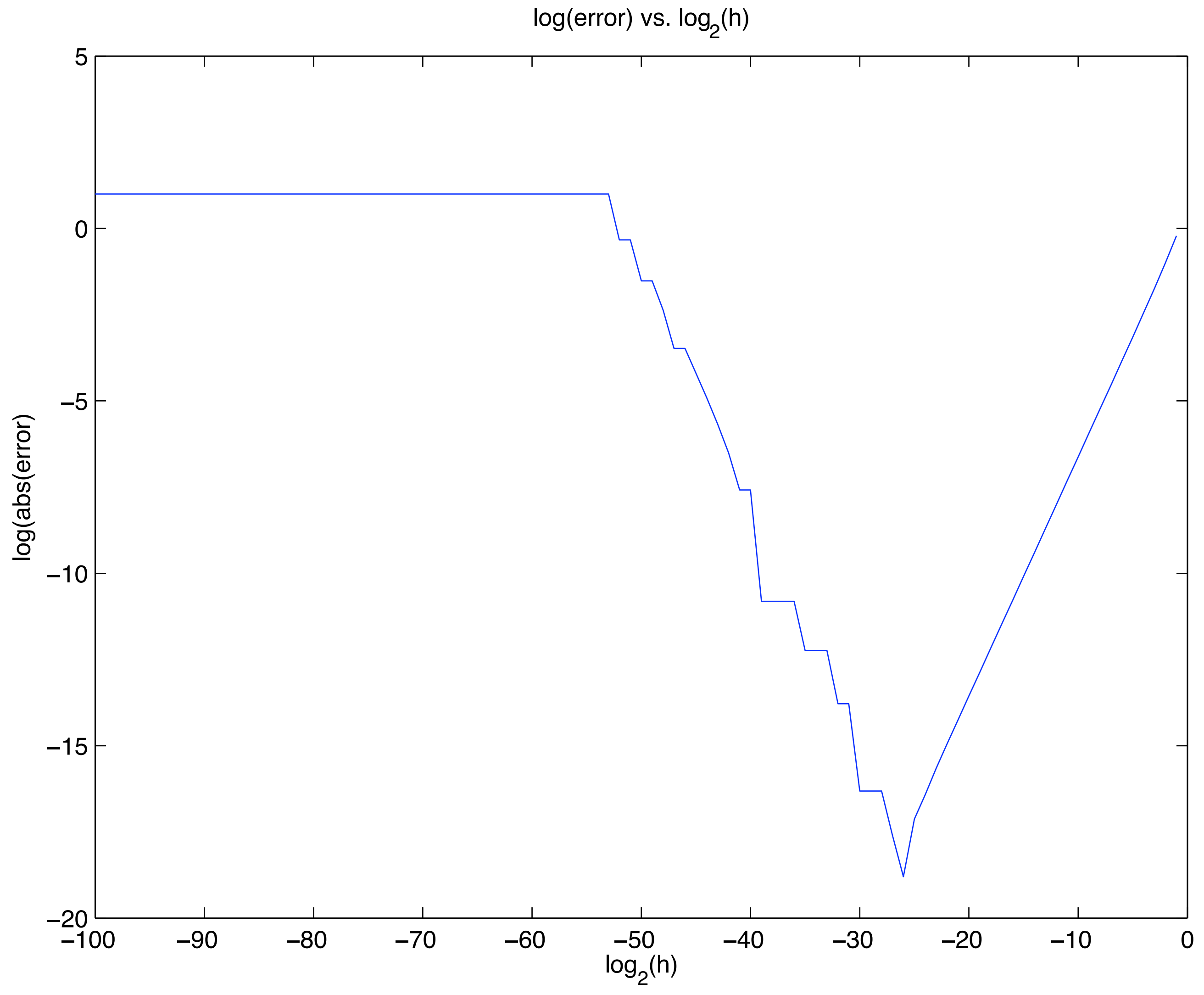
```
function m433roundoff
x=1.0;
n=100;
for j=1:n,
      h(j)=1/2^j;
      deriv=(exp(x+h(j))-exp(x))/h(j);
      error(j)=deriv-exp(x);
if floor(j/10)==j/10
      disp(['h=',num2str(h(j),'%1.15e'), ', error=',num2str(error(j),'%1.15e')])
end
end
plot(log2(h),(log(abs(error))))
title('log(error) vs. log2(h) ')
xlabel('log2(h)')
ylabel('log(abs(error)')
```

| $n$ | $h = 1/2^n$ | $D_+f - f'(1)$ |
|---|---|---|
| 10 | 9.765625000000000e-004 | 1.327718213427254e-003 |
| 20 | 9.536743164062500e-007 | 1.295809009427273e-006 |
| 30 | 9.313225746154785e-010 | -8.254840100363481e-008 |
| 40 | 9.094947017729282e-013 | -5.083909590455349e-004 |
| 50 | 8.881784197001252e-016 | -2.182818284590455e-001 |
| 60 | 8.673617379884036e-019 | -2.718281828459046e+000 |
| 70 | 8.470329472543003e-022 | -2.718281828459046e+000 |
| 80 | 8.271806125530277e-025 | -2.718281828459046e+000 |
| 90 | 8.077935669463161e-028 | -2.718281828459046e+000 |
| 100 | 7.888609052210118e-031 | -2.718281828459046e+000 |

1. For $h \geq 10^{-10}$, the error <u>decreases</u> as $h$ is reduced, due to the discrete approximation.

2. For $h \geq 10^{-10}$, the error is linearly proportional to $h$.

3. For $h < 10^{-10}$, the error <u>increases</u> as $h$ is reduced, due to finite precision arithmetic.



log(error) vs. log_2(h)
log(abs(error))
log_2(h)
5
0
−5
−10
−15
−20
−100
−90
−80
−70
−60
−50
−40
−30
−20
−10
0