How fast is Ax=b?

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Let's explore how the speed of solving $Ax = b$ scales with the size n of the matrix A. We'll use a random $n \times n$ matrix with independent normally distributed entries, and a random right-hand-side b.

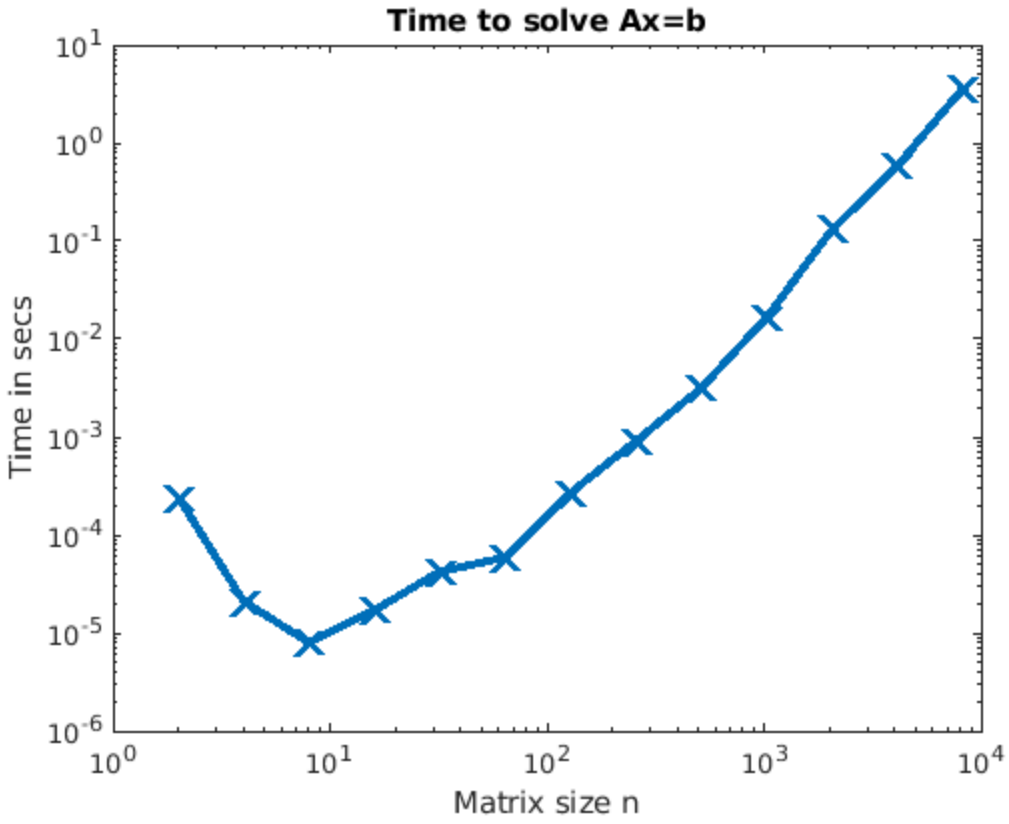
```
n = 1000;
A = randn(n,n);
b = randn(n,1);
tic, x = A\b; toc
```

```
Elapsed time is 0.026166 seconds.
```

Vary n

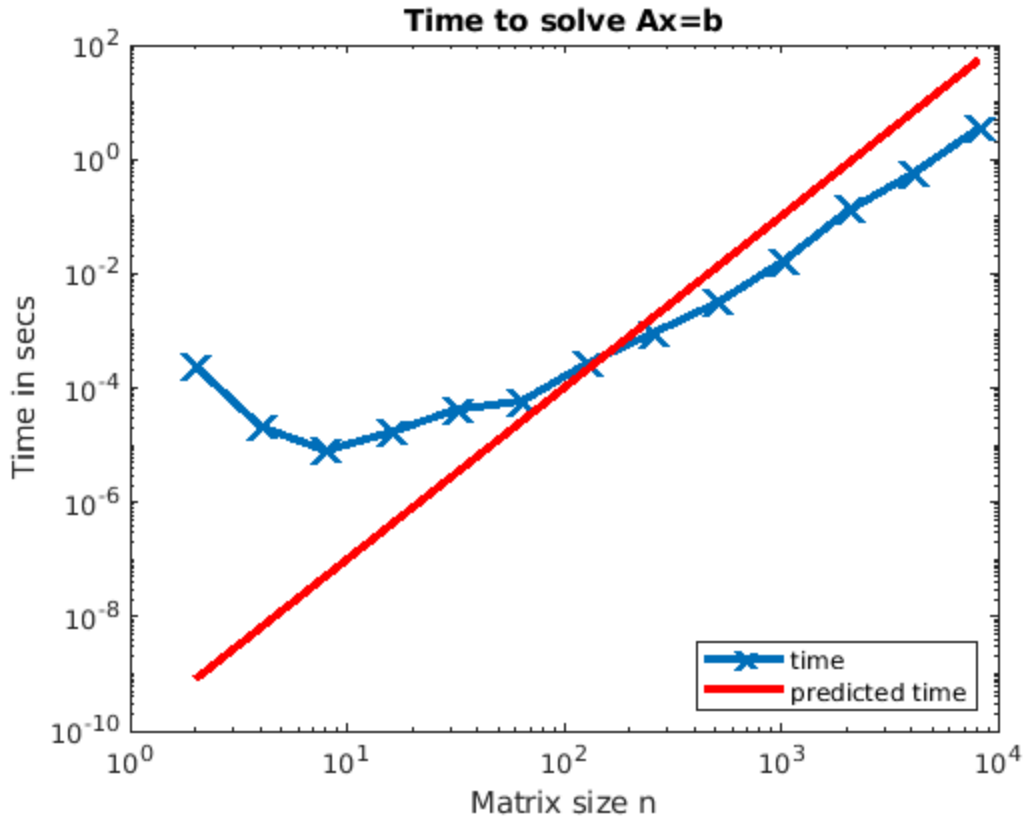
Now try for a range of matrix sizes

```
nn = 2.^(1:13);
% assign memory for tt vector
tt = zeros(size(nn)); % or tt = 0*nn;
for k = 1:length(nn)
    n = nn(k);
    A = randn(n,n);
    b = rand(n,1);
    tic, x = A\b; tt(k) = toc;
end
figure(1), clf
loglog(nn,tt,'x-','MarkerSize',12,'Linewidth',3)
xlabel('Matrix size n')
ylabel('Time in secs')
title('Time to solve Ax=b')
```



We know that it takes O(n^3) time to solve $Ax = b$ note that the second graph on the plot is in a separate section so the figure appears twice in the published version

```
hold on
loglog(nn, 1e-10*nn.^3,'r','Linewidth',3)
legend('time','predicted time','Location','SouthEast')
```



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