Conjugate vectors

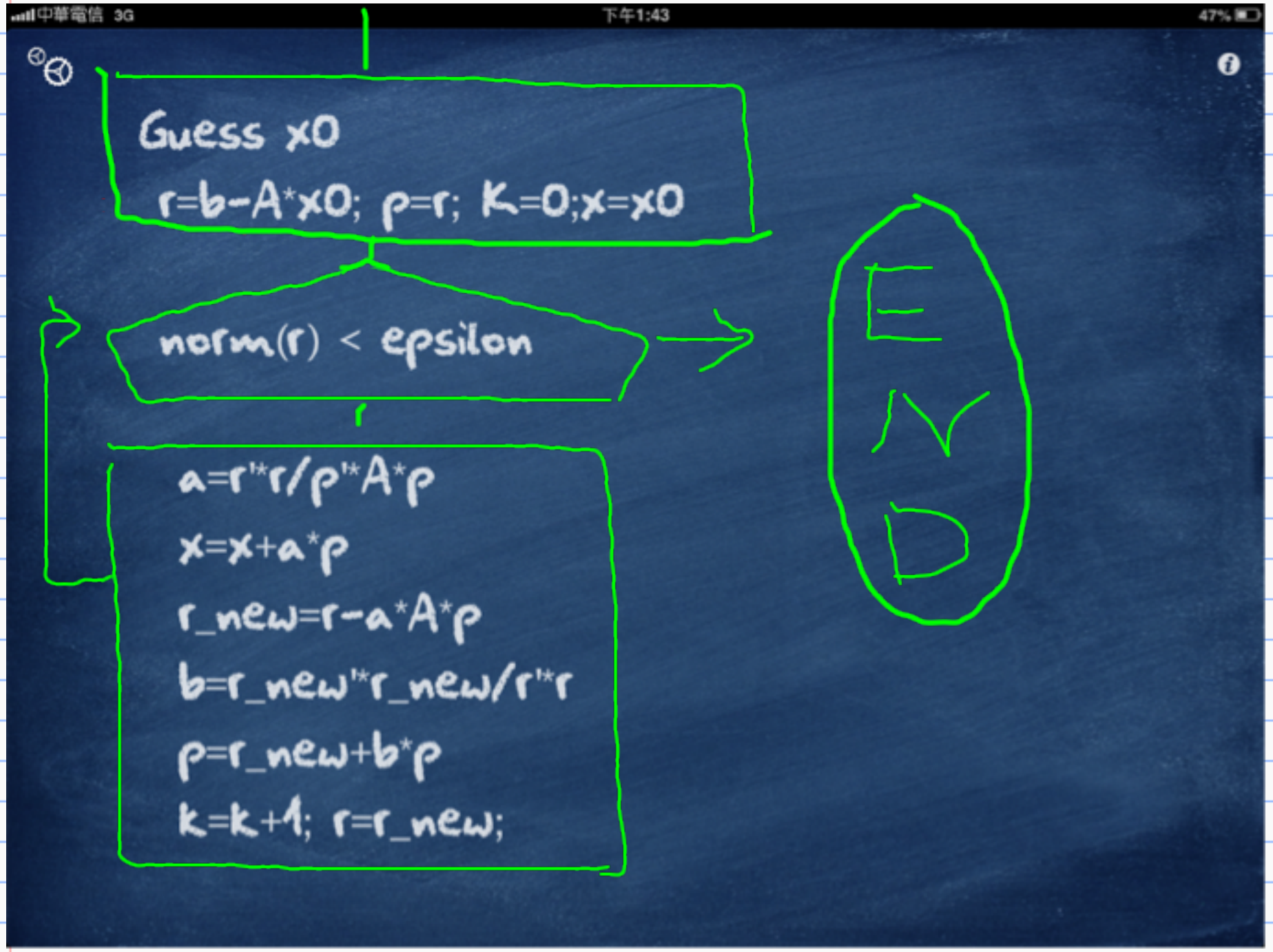
$$p_{k+1} = r_{k+1} - \sum_{i \le k} \frac{\langle p_i, r_{k+1} \rangle_A}{\langle p_i, p_i \rangle_A} p_i$$

$$p_j^T A p_{k+1} = p_j^T A r_{k+1} - p_j^T A \frac{\langle p_j, r_{k+1} \rangle_A}{\langle p_j, p_j \rangle_A} p_j = 0$$

$$\forall \; j \le k$$

Flow chart

Guess x0
r=b-A*x0; p=r
K=0; x=x0
Repeat
  a=r'*r/p'*A*p
  x=x+a*p
  r_new=r-a*A*p
  if r_new is sufficiently small exit
  b=r_new'*r_new/r'*r
  p=r_new+b*p
  K=k+1; r=r_new;
end repeat


中華電信 3G
下午1:43
47%
Guess x0
r=b-A*x0; p=r; K=0;x=x0
norm(r) < epsilon
a=r'*r/p'*A*p
x=x+a*p
r_new=r-a*A*p
b=r_new'*r_new/r'*r
p=r_new+b*p
k=k+1; r=r_new;
E
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D

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A=[1 2; 2 0];b=[1 1]';x0=rand(1,2)';
r=b-A*x0; p=r;
K=0;x=x0;ep=10^-6;
while ~(norm(r) < ep)

  a=r'*r/(p'*A*p);
  x=x+a*p;
  r_new=r-a*A*p;
  b=r_new'*r_new/(r'*r);
  p=r_new+b*p;
  K=k+1; r=r_new;
end
```

Prove conjugate