Count maximum points on same line

Given N point on a 2D plane as pair of (x, y) co-ordinates, we need to find maximum number of point which lie on the same line.

Examples:

Recommended: Please solve it on "<u>PRACTICE</u>" first, before moving on to the solution.

We can solve above problem by following approach – For each point p, calculate its slope with other points and use a map to record how many points have same slope, by which we can find out how many points are on same line with p as their one point. For each point keep doing the same thing and update the maximum number of point count found so far.

Some things to note in implementation are:

1) if two point are (x1, y1) and (x2, y2) then their slope will be (y2 - y1) / (x2 - x1) which can be a double value and can cause precision problems. To get rid of the precision problems, we treat slope as pair ((y2 - y1), (x2 - x1)) instead of ratio and reduce pair by their gcd before inserting into map. In below code points which are vertical or repeated are treated separately.

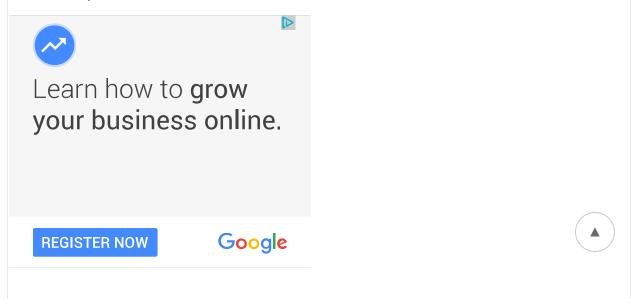
2) If we use unordered_map in c++ or HashMap in Java for storing the slope pair, then total time complexity of solution will be O(n^.)

```
/* C/C++ program to find maximum numbelearኬMብte
   which lie on same line */
#include < Reals himes saging, file sharing and powerful search. Slack: where work happens.
using namespace std;
// method to find maximum colinear point
int maxPointOnSameLine(vector< pair<int, int> > points)
    int N = points.size();
    if (N < 2)
        return N;
    int maxPoint = 0;
    int curMax, overlapPoints, verticalPoints;
    // map to store slope pair
    unordered map<pair<int, int>, int> slopeMap;
    // looping for each point
    for (int i = 0; i < N; i++)
    {
        curMax = overlapPoints = verticalPoints = 0;
        // looping from i + 1 to ignore same pair again
        for (int j = i + 1; j < N; j++)
            // If both point are equal then just
            // increase overlapPoint count
            if (points[i] == points[j])
                overlapPoints++;
            // If x co-ordinate is same, then both
            // point are vertical to each other
            else if (points[i].first == points[j].first)
                verticalPoints++;
            else
                int yDif = points[j].second - points[i].second;
                int xDif = points[j].first - points[i].first;
                int g = __gcd(xDif, yDif);
                // reducing the difference by their gcd
                yDif /= g;
                xDif /= g;
                // increasing the frequency of current slope
                // in map
                slopeMap[make pair(yDif, xDif)]++;
                curMax = max(curMax, slopeMap[make pair(yDif, xDif)]);
            }
            curMax = max(curMax, verticalPoints);
        }
        // updating global maximum by current point's maximum
        maxPoint = max(maxPoint, curMax + overlapPoints + 1);
        // printf("maximum colinear point which contains current
```

```
// point are : %d\n", curMax + overlapPoints + 1);
       slopeMap.clear();
   }
   return maxPoint;
                                   Learn More
}
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int main()
   const int N = 6;
   vector< pair<int, int> > points;
   for (int i = 0; i < N; i++)
       points.push_back(make_pair(arr[i][0], arr[i][1]));
   cout << maxPointOnSameLine(points) << endl;</pre>
   return 0;
                                                                      Run on IDE
Output:
 4
```

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