

## Ideas about patterns from PITB Day 2

- If you divide  $n$  by 4 and look at the remainder

if remainder = 1

$$= 2$$

?

= 3 then  $n$  can't be written as  $x^2 + y^2$

$$= 4$$

These  
are conjectures

- If you divide  $n$  by 12 & get a remainder of 1, it seems to work
- Factoring the numbers that work...

$$y_1 = x^2 + 1$$
$$x^2 + 4$$
$$x^2 + 9$$
$$x^2 + 16$$

2<sup>nd</sup>

Table

$$\begin{array}{c} 1^2 + 1^2 \\ 1^2 + 2^2 \xrightarrow{3 \text{ more}} 2^2 + 2^2 \\ \vdots \\ 2^2 + 3^2 \xrightarrow{5 \text{ more}} 3^2 + 3^2 \end{array}$$



$$y_1 = \sqrt{\# - x^2}$$

Make a  
table and look  
for integers

# Bowen's Question:

How many different distances can you make on a n by n board?

Size of board	# diff lengths on sq board	# diff lengths on iso board
1x1	1	1 ?
2x2	3	3 ?
3x3	6	6 ?
4x4	10	10 ?
5x5	15	15 ?

• 0 counts as a distance for us

The diagram shows a 3x3 grid of points. The bottom-left point is the origin. Red lines connect it to other points, illustrating the calculation of distances. For example, the distance to the top-right point is  $\sqrt{9+9} = \sqrt{18}$ , which is simplified to  $3\sqrt{2}$ .

For the 5x5 case, a note in red says "but 6+6 is 20, not 21".