Answers

1. 1012101, and python code...

```
ctr=0
n=0
nmax=input("Enter index of palindromic number: ")
while ctr<nmax:
    mstr=str(n)
    if mstr==mstr[::-1]:
        ctr+=1
    n+=1
print(str(ctr) + "'th palindromic number is " + mstr)
```

2.

3. for positive integers p, q,

$$p^{\frac{p}{\bar{p}}} \quad p^{\frac{q}{\bar{q}}} = p^{\frac{p}{\bar{p}} + \frac{q}{\bar{q}}}$$

4. (a) $29 = 5^2 + 2^2$; $37 = 6^2 + 1^2$. For 30, note that none of the following are square numbers:

$$30 \quad 1 = 29; 30 \quad 4 = 26; 30 \quad 9 = 21; 30 \quad 16 = 14; 30 \quad 25 = 5$$

Similarly, 31 cannot be expressed as a sum of two squares.

(b) easy

(c) $1073 = (5^2 + 2^2)(6^2 + 1^2) = (30 \quad 2)^2 + (5 + 12)^2$. Swapping $5^2 + 2^2$ with $2^2 + 5^2$ yields $1073 = 7^2 + 32^2$.

5. Divide the grid into nine 1x1 squares. If ten darts are thrown, at least one square contains at least two darts. These darts are less than $p^{\bar{2}}$ from each other.