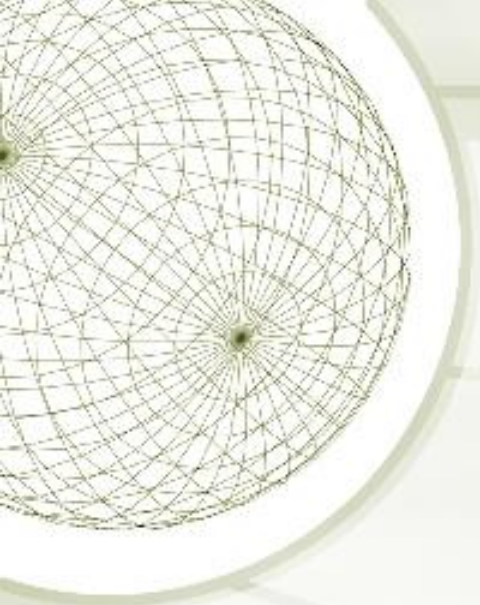
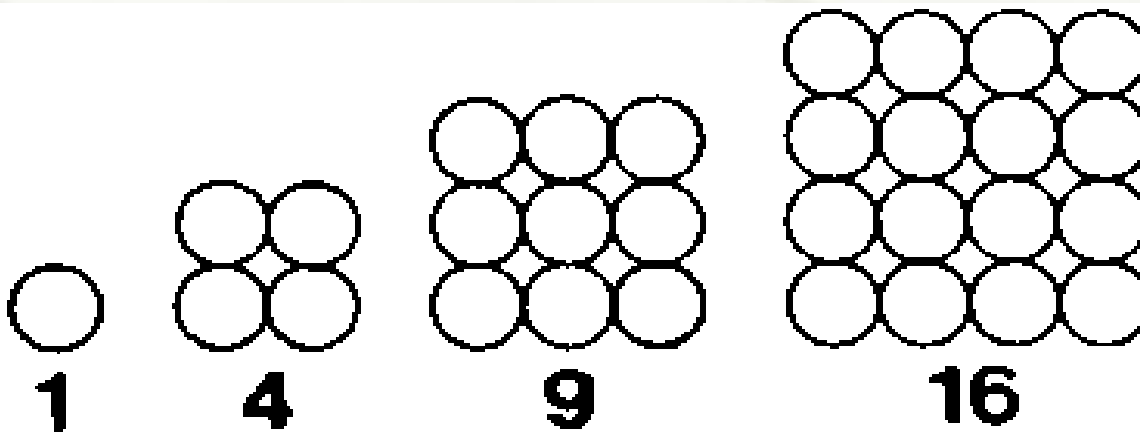




# *Squares & Square Roots*

# *Square Number*

- ✦ Also called a “*perfect square*”
- ✦ A number that is the square of a whole number
- ✦ Can be represented by arranging objects in a square.

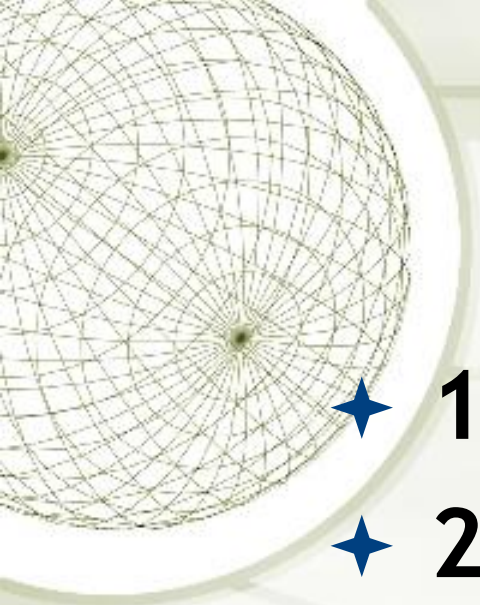




# *Square Numbers*

MULTIPLICATION TABLE

|   | 1 | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
|---|---|----|----|----|----|----|----|----|----|
| 1 | 1 | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 2 | 2 | 4  | 6  | 8  | 10 | 12 | 14 | 16 | 18 |
| 3 | 3 | 6  | 9  | 12 | 15 | 18 | 21 | 24 | 27 |
| 4 | 4 | 8  | 12 | 16 | 20 | 24 | 28 | 32 | 36 |
| 5 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 |
| 6 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 |
| 7 | 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 |
| 8 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 |
| 9 | 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 |



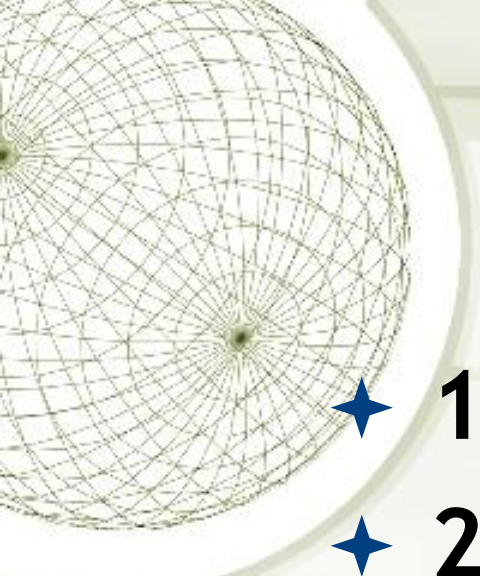
# *Square Numbers*

★  $1 \times 1 = 1$

★  $2 \times 2 = 4$

★  $3 \times 3 = 9$

★  $4 \times 4 = 16$



# *Square Numbers*

★  $1 \times 1 = 1$

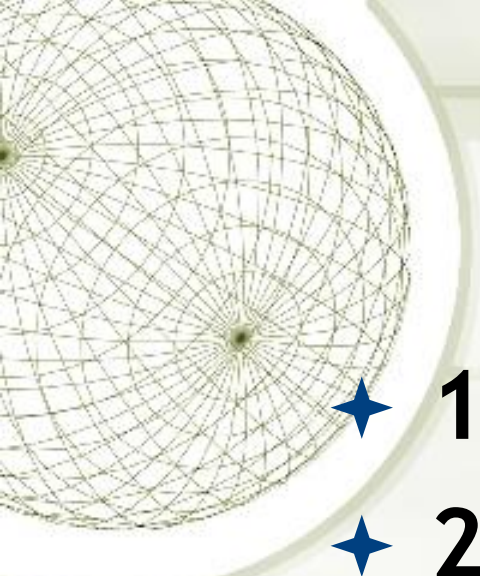
★  $2 \times 2 = 4$

★  $3 \times 3 = 9$

★  $4 \times 4 = 16$

***Activity:***

*Calculate the perfect squares up to  $15^2$ ...*



# *Square Numbers*

$$★ 1 \times 1 = 1$$

$$★ 2 \times 2 = 4$$

$$★ 3 \times 3 = 9$$

$$★ 4 \times 4 = 16$$

$$★ 5 \times 5 = 25$$

$$★ 6 \times 6 = 36$$

$$★ 7 \times 7 = 49$$

$$★ 8 \times 8 = 64$$

$$★ 9 \times 9 = 81$$

$$★ 10 \times 10 = 100$$

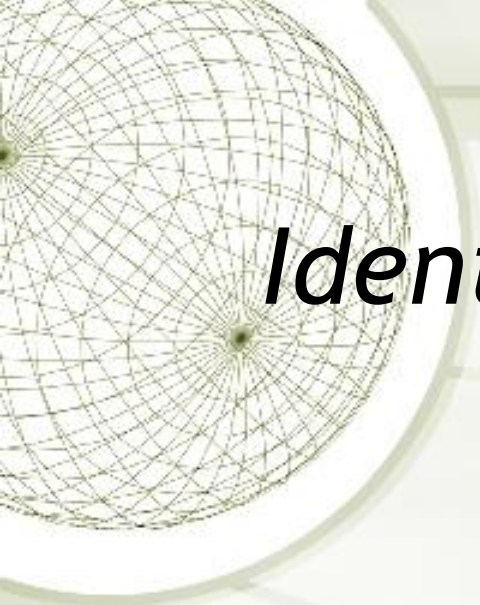
$$★ 11 \times 11 = 121$$

$$★ 12 \times 12 = 144$$

$$★ 13 \times 13 = 169$$

$$★ 14 \times 14 = 196$$

$$★ 15 \times 15 = 225$$



## *Activity:*

*Identify the following numbers as perfect squares or not.*

i. 16

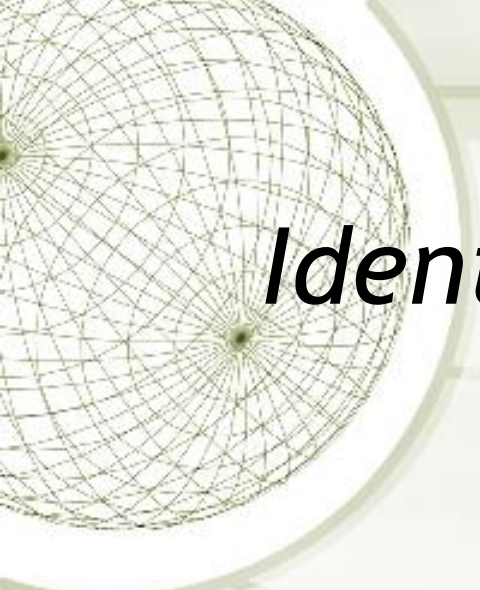
ii. 15

iii. 146

iv. 300

v. 324

vi. 729



## *Activity:*

*Identify the following numbers as perfect squares or not.*

i.  $16 = 4 \times 4$

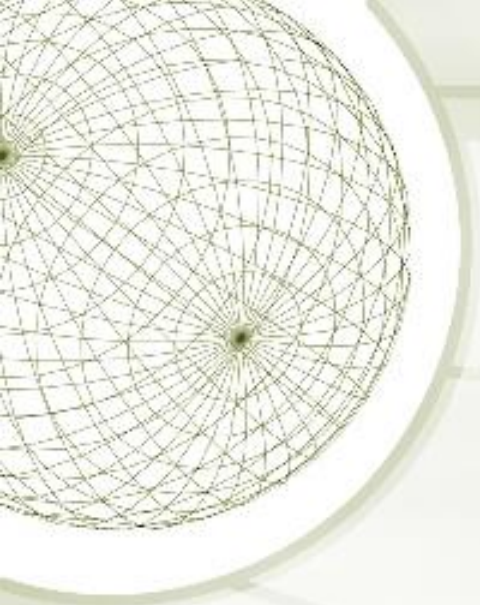
ii. 15

iii. 146

iv. 300

v.  $324 = 18 \times 18$

vi.  $729 = 27 \times 27$



# *Squares & Square Roots*

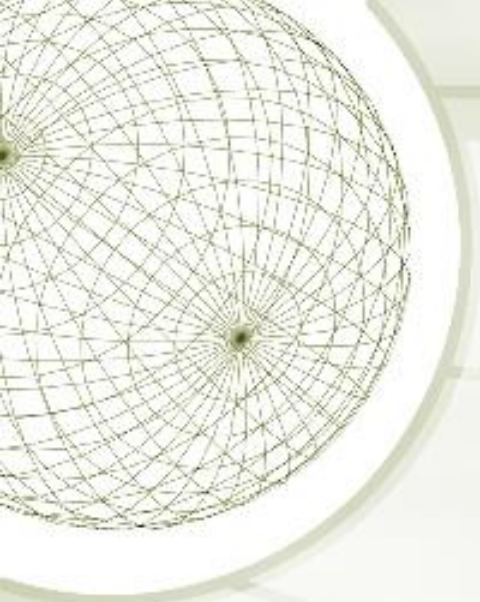
**Square Root**

# *Square Numbers*

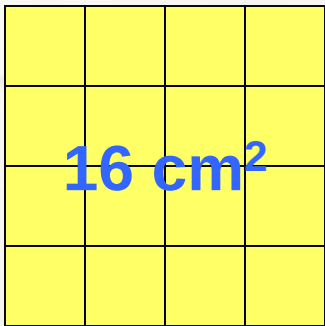
★ One property of a perfect square is that it can be represented by a square array.

★ Each small square in the array shown has a side length of 1cm.

★ The large square has a side length of 4 cm.



4cm



16 cm<sup>2</sup>

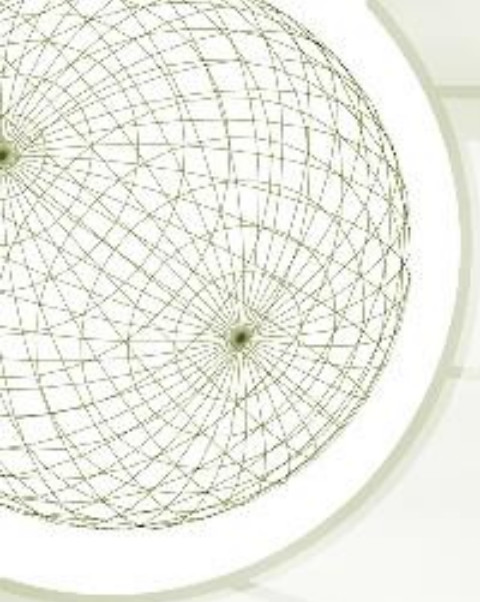
4cm

# *Square Numbers*

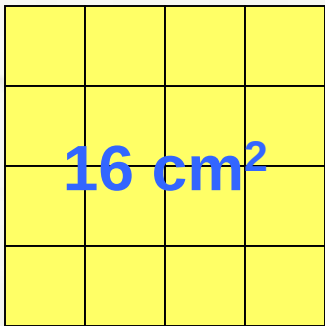
✦ The large square has an area of  $4\text{cm} \times 4\text{cm} = 16\text{ cm}^2$ .

✦ The number 4 is called the square root of 16.

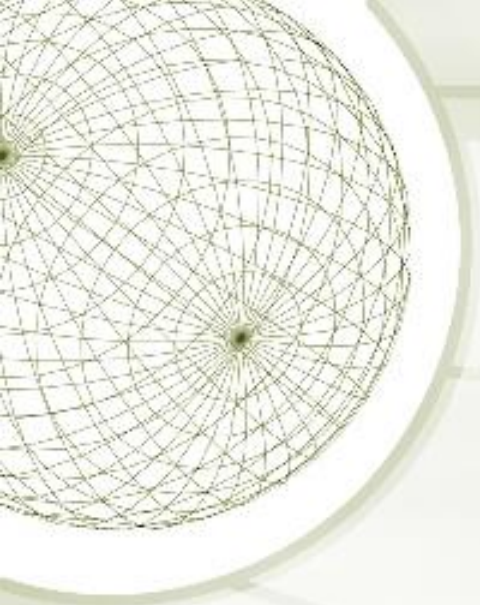
✦ We write:  $4 = \sqrt{16}$



4cm



4cm



# *Square Root*

✦ A number which, when multiplied by itself, results in another number.

✦ Ex: 5 is the square root of 25.

$$5 = \sqrt{25}$$



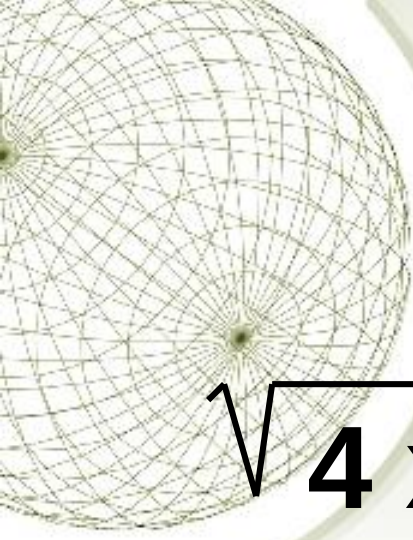
# ***Finding Square Roots***

✦ We can use the following strategy to find a square root of a large number.

$$\sqrt{4 \times 9} = \sqrt{4} \times \sqrt{9}$$

$$\sqrt{36} = 2 \times 3$$

$$6 = 6$$



# ***Finding Square Roots***

$$\sqrt{4 \times 9} = \sqrt{4} \sqrt{9}$$

$$\sqrt{36} = 2 \times 3$$

$$6 = 6$$

★ We can factor large perfect squares into smaller perfect squares to simplify.



# ***Finding Square Roots***

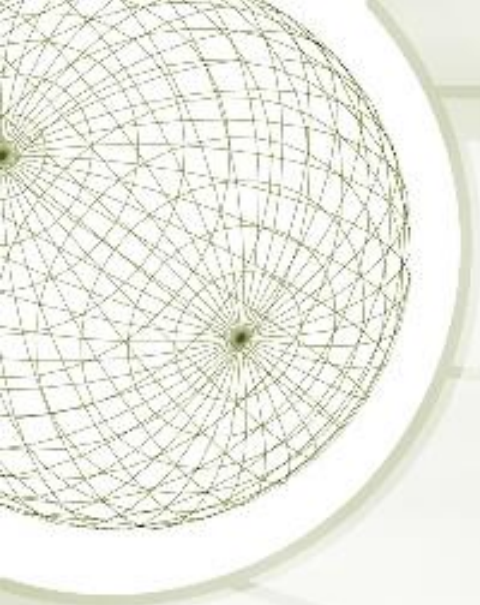
★ *Activity: Find the square root of 256*

$$\sqrt{256}$$

$$= \sqrt{4} \times \sqrt{64}$$

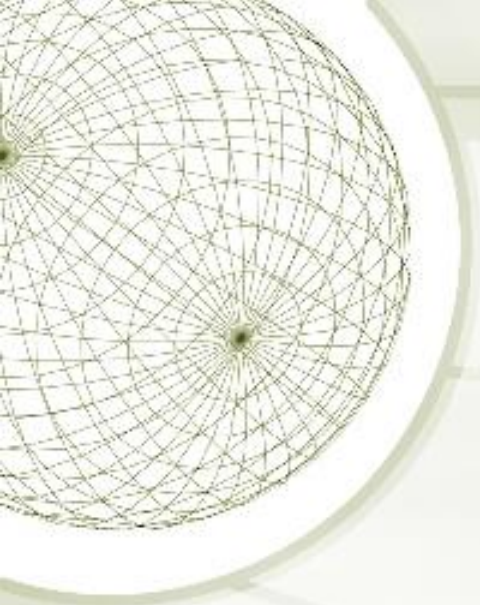
$$= 2 \times 8$$

$$= 16$$



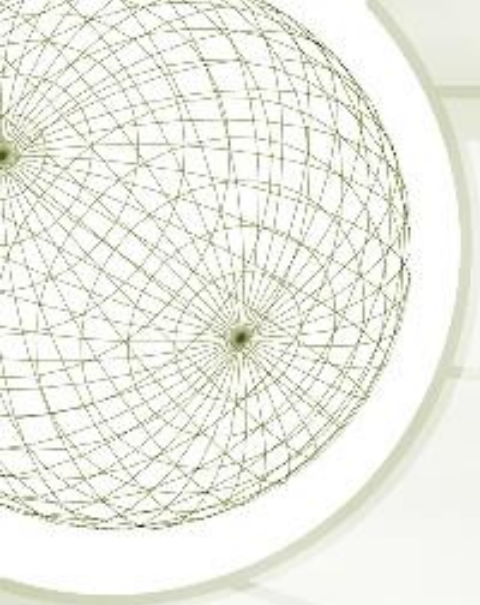
# *Squares & Square Roots*

## **Estimating Square Root**



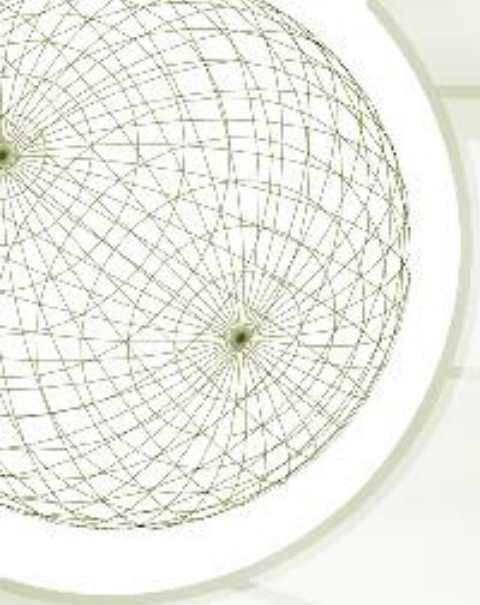
# ***Estimating Square Roots***

$$\sqrt{25} = ?$$



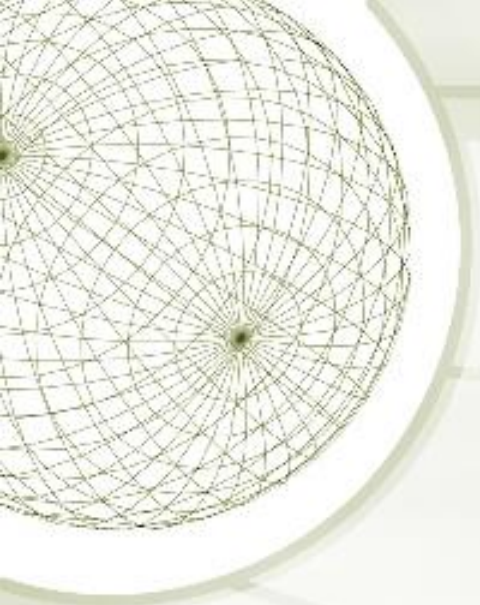
# ***Estimating Square Roots***

$$\sqrt{25} = 5$$



# ***Estimating Square Roots***

$$\sqrt{49} = ?$$

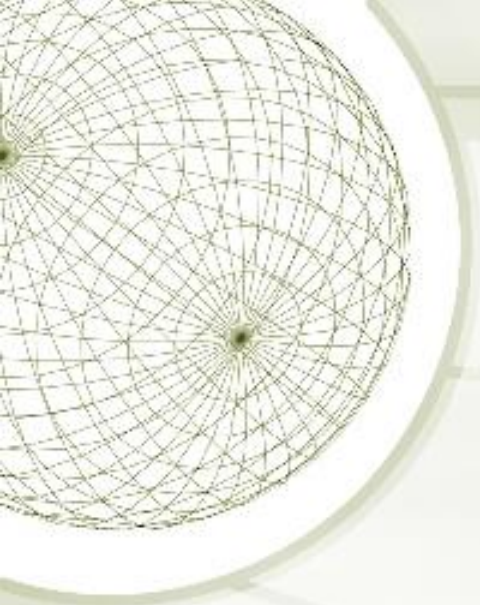


# ***Estimating Square Roots***

$$\sqrt{49} = 7$$

# ***Estimating Square Roots***

$$\sqrt{27} = ?$$



# *Estimating Square Roots*

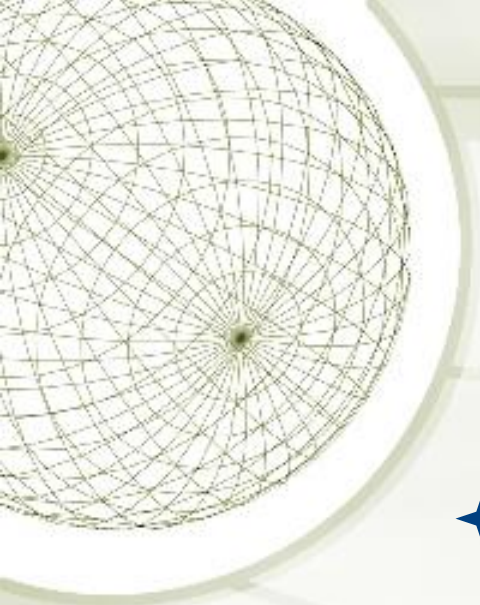
$$\sqrt{27} = ?$$

Since 27 is not a perfect square, we have to use another method to calculate it's square root.



# *Estimating Square Roots*

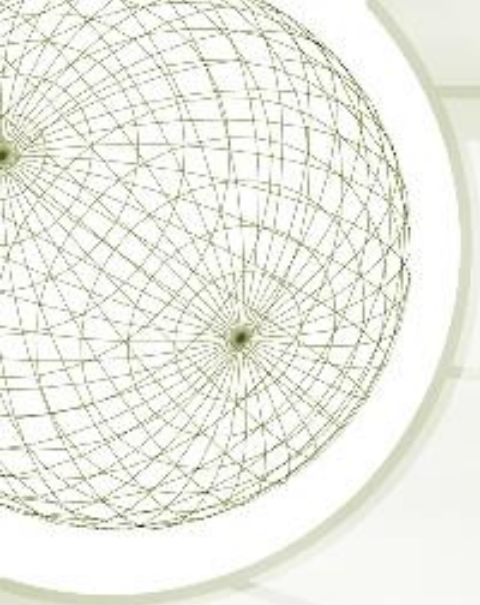
- ✦ Not all numbers are perfect squares.
- ✦ Not every number has an Integer for a square root.
- ✦ We have to estimate square roots for numbers between perfect squares.



# *Estimating Square Roots*

✦ To calculate the square root of a non-perfect square

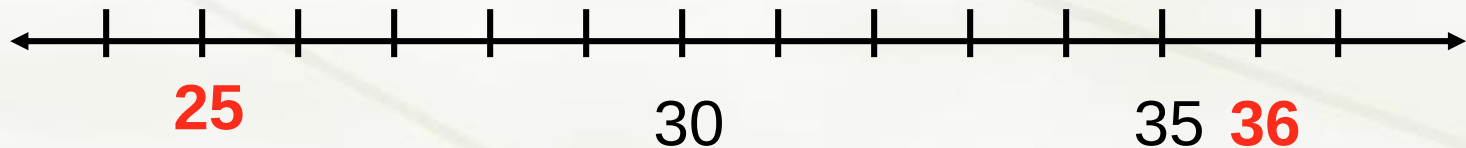
1. Place the values of the adjacent perfect squares on a number line.
2. Interpolate between the points to estimate to the nearest tenth.



# *Estimating Square Roots*

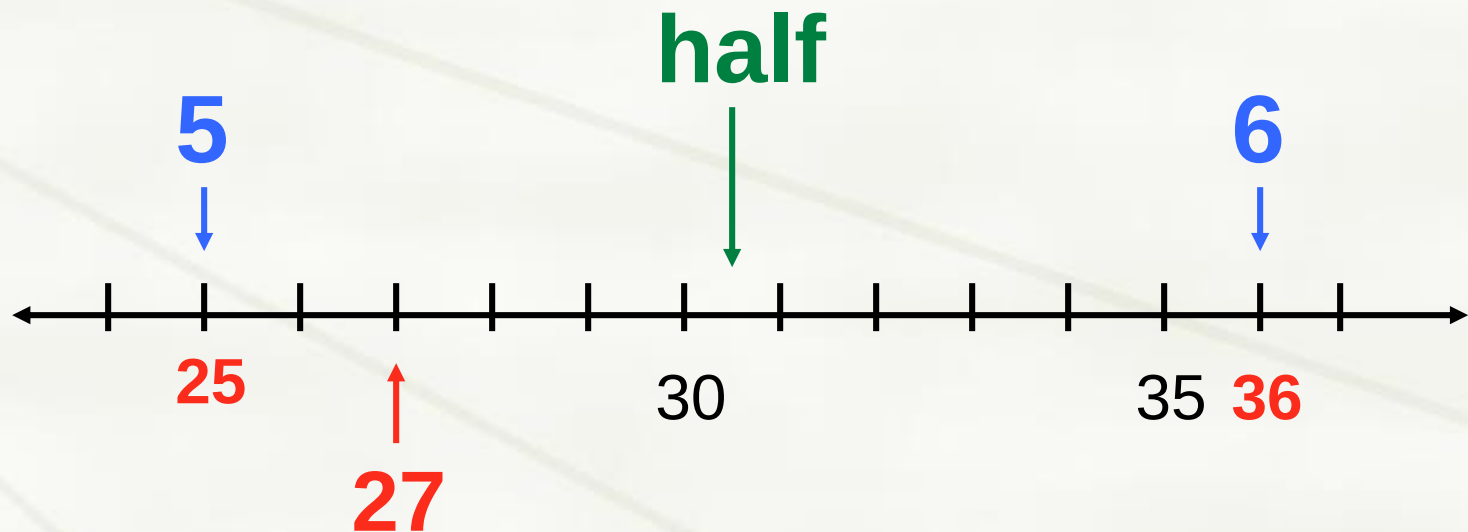
✦ Example:  $\sqrt{27}$

*What are the perfect squares on  
each side of 27?*

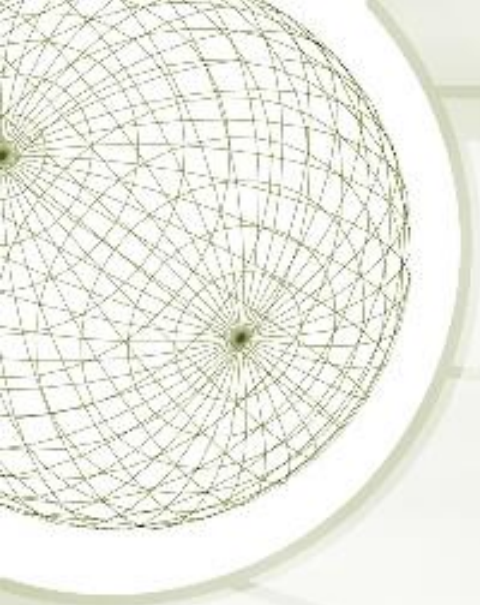


# *Estimating Square Roots*

✦ Example:  $\sqrt{27}$



Estimate  $\sqrt{27} = 5.2$



# *Estimating Square Roots*

✦ Example:  $\sqrt{27}$

✦ Estimate:  $\sqrt{27} = 5.2$

✦ Check:  $(5.2)(5.2) = 27.04$

# Concept Map

