



# Helping With Math

## Understanding Irrational Numbers



GRADE 8



**Irrational numbers (Q')** are numbers that cannot be expressed as the quotient of two integers.



Hello! I am **Pi**, the astronaut guy. Welcome to the **e-space**!



Numbers with decimal expansion that is non-repeating and non-terminating are considered **irrational numbers**.



## DID YOU KNOW?



All irrational numbers are real numbers.

Most of the square roots fall into irrational category.

$$\sqrt{4} = 2$$

2 can be written as a fraction

$$\frac{4}{2} = 2$$

Therefore,  $\sqrt{4}$  is a **rational number**.

$$\frac{6}{3} = 2$$

$$\sqrt{3} = 1.732050808 \dots$$

1.732050808... cannot be written as fraction

- Non-terminating decimals
- Non-repeating decimals

$$1.732050808 \dots = \frac{?}{?}$$

Therefore,  $\sqrt{3}$  is an **irrational number**.



### The number Pi ( $\pi$ )



$\pi$  is defined as the ratio of the circumference of the circle to its diameter. It is an irrational number because its decimal form neither ends or becomes repetitive.

3.1415926535897  
932384626433832  
795028841971693  
993751058209749  
445923078164062  
862089986280348  
253421170679821  
480865132823066  
4709384460955...



## LET'S PRACTICE!



Put a check mark whether the given term is an irrational number or rational number.



Term	Irrational Number	Rational Number
 1. $\sqrt{5}$		
 2. 3.918		
 3. $\sqrt{9}$		
 4. $\frac{9}{5}$		
 5. 0.1818		

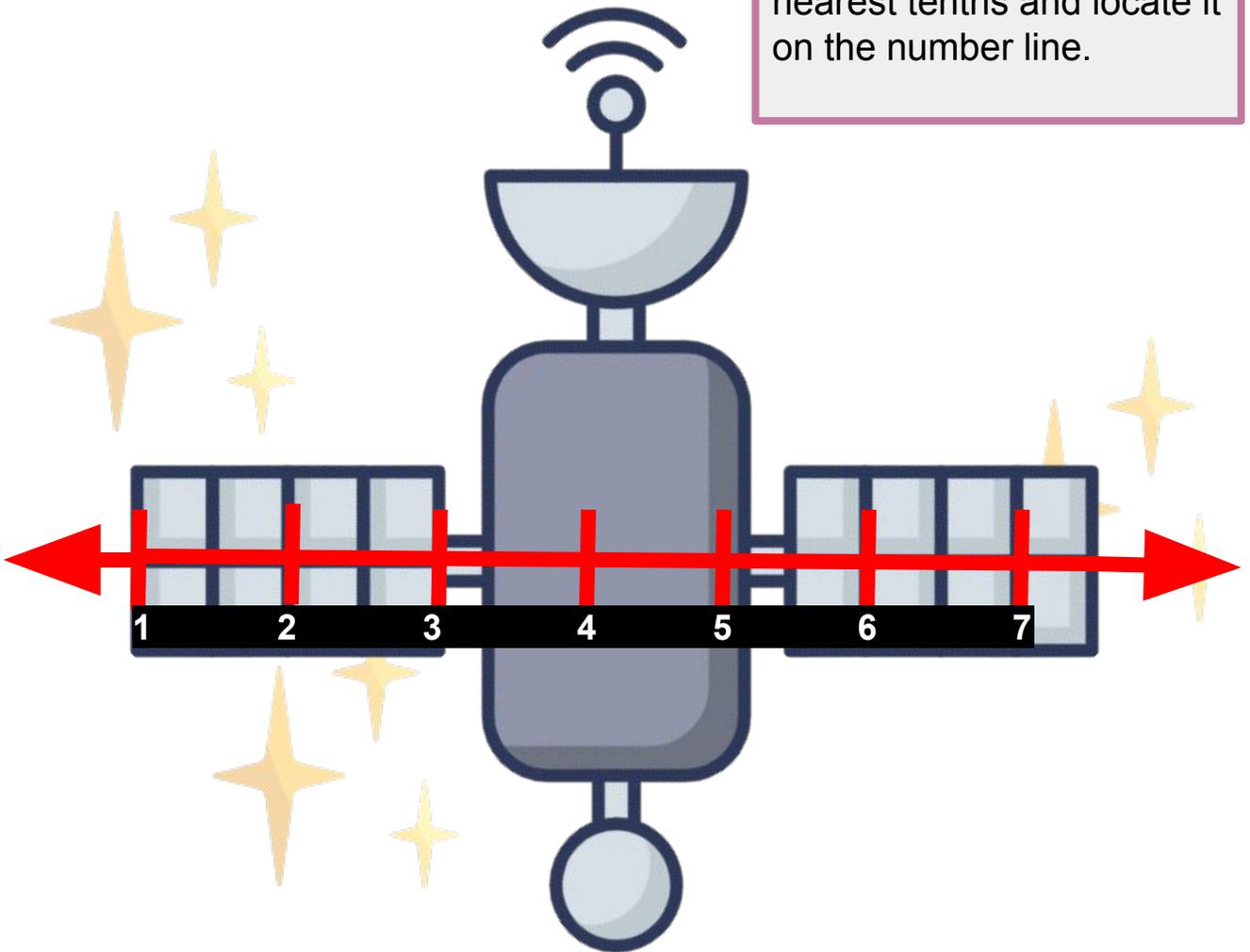


## LET'S HELP PI!

Pi was lost! Let's help him find his location.



Approximate  $\sqrt{3}$  to the nearest tenths and locate it on the number line.

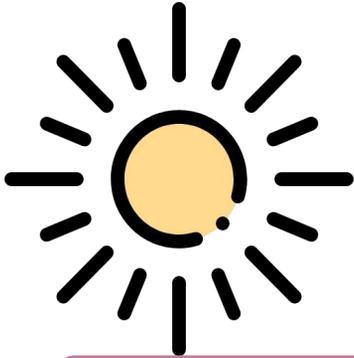


# TABLE OF ACTIVITIES

1. Sun or Moon? Planet or asteroid?
2. Planet or asteroid? Classifying planets
3. Rockets to the space Sun or Moon?
4. Comparing planets' sizes
5. Distance of the stars
6. Space travel
7. Is it a star?
8. Location of the moon
9. Transforming Spacecraft
10. Irrationality in the Outer Space



# SUN OR MOON?



The sun and moon can be found in the outer space. The sun is the center of the universe. It warms the planets and the moon creates the tides. Let's study them!



Write "sun" if the statement is true and "moon" if the statement is false.

Statement	Sun or Moon?
1. All fractions are irrational numbers.	
2. The square root of all perfect square is always rational.	
3. Irrational numbers can be written as terminating decimals.	
4. A repeating non-terminating decimal is a rational number.	
5. The quotient of an irrational number and a non-zero integer is irrational.	



# PLANET OR ASTEROID

Write "planet" if the given term is an irrational number and "asteroid" if it is not. State the reason why it is irrational or not.



1



2



3



4



5

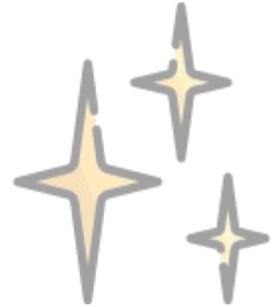


# ROCKETS TO THE SPACE

Let's help Pi launch the rockets! Approximate the square root of the given value to the nearest thousandths.



Help! Use your calculator and let's approximate the square root!



1

$\sqrt{7}$

2

$\sqrt{18}$

3

$\sqrt{51}$

4

$\sqrt{67}$

5

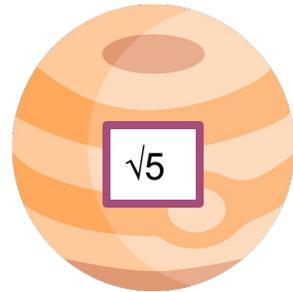
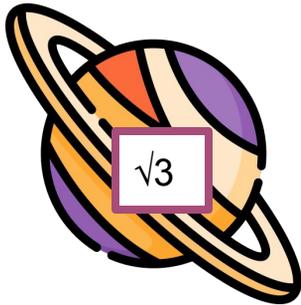
$\sqrt{84}$



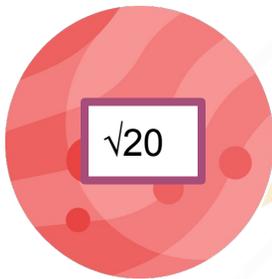
# COMPARING PLANETS' SIZES

Let's compare the planets' sizes. Compare the given values and write the symbol that makes the problem true. Use the symbols  $<$ ,  $>$  and  $=$ . Write your answers in the box.

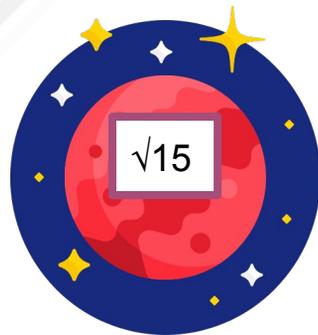
1



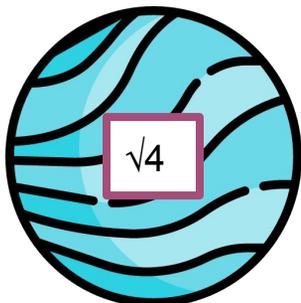
2



3



4



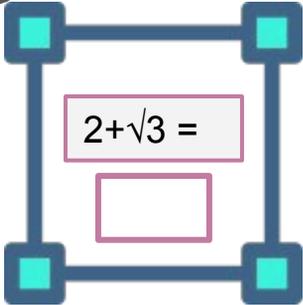
# DISTANCE OF THE STARS

Calculate the distance of the stars by solving the following and write whether the answer is irrational or rational.

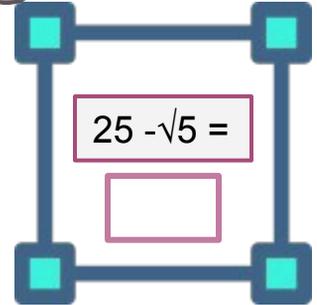


Note: Round off the decimals to the nearest thousandths

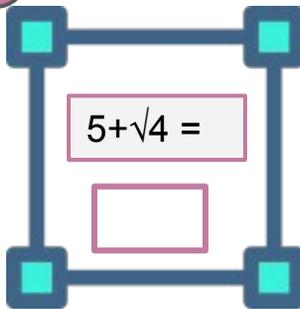
1



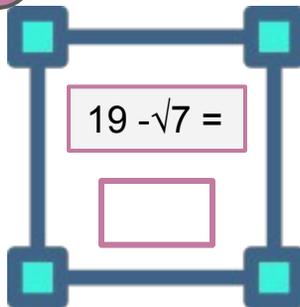
2



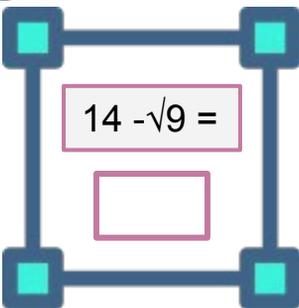
3



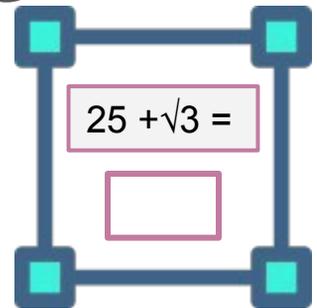
4



5



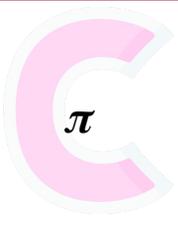
6

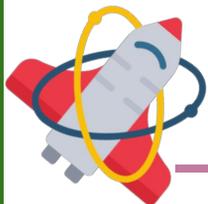


# SPACE TRAVEL

Each box has a corresponding letter. Classify the term inside the box whether it is irrational or not. If it is irrational, take note of its corresponding letter. Do this for all the boxes and form a word from the letters.

Hint: Pi will be using it to explore the space.

 $\sqrt{3}$	 $\sqrt{9}$	 2.67	 $\sqrt{144}$
 1.19	 $\frac{2}{3}$	 $\sqrt{18}$	 $\sqrt{5}$
 $\sqrt{7}$	 e	 $\sqrt{10}$	 $\sqrt{4}$
 $\sqrt{50}$	 $\sqrt{36}$	 $\sqrt{15}$	 $\pi$



# IS IT A STAR?

Write “star” if you agree with the given statement and “comet” if you disagree. Justify your answer.



There are billions of stars and comets all over the space. Let's explore them!

	STATEMENT	STAR OR COMET?	REASONS
1	The product of rational and irrational number is rational.		
2	A non-zero integer added to the number $\pi$ will result to an irrational number.		
3	All fractions are irrational numbers.		
4	The square root of perfect square is always irrational.		
5	$\sqrt{3/5}$ will result to an irrational number.		



# LOCATION OF THE MOON

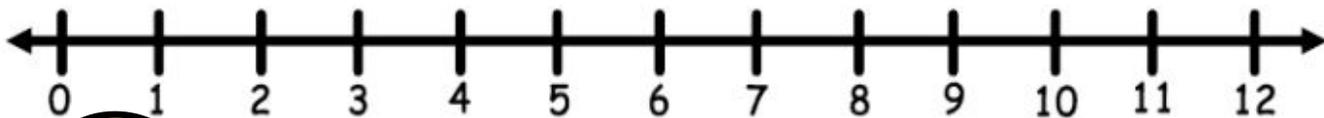
Find the location of the moon by approximating the given value to the nearest tenths. Graph it on the number line.



1.  $\sqrt{10}$



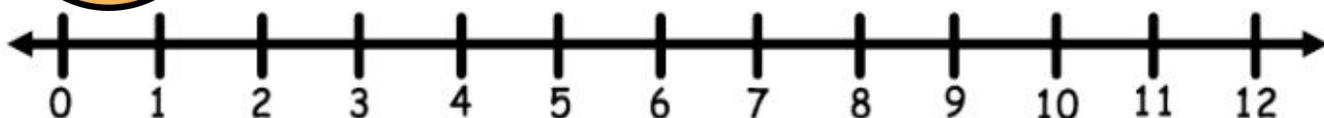
2.  $\sqrt{50}$



3.  $\sqrt{28}$



4.  $\sqrt{19}$



# TRANSFORMING SPACECRAFT

Let's help Pi transform his spacecraft. Transform the following irrational numbers to its simplest radical form. Write your solutions on the space provided.

1

$$\sqrt{75}$$

2

$$\sqrt{12}$$

3

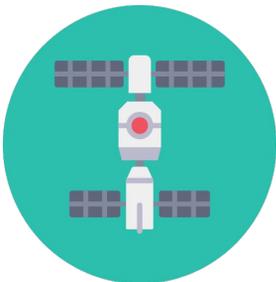
$$\sqrt{32}$$

4

$$\sqrt{45}$$

5

$$\sqrt{108}$$



# IRRATIONALITY IN THE OUTER SPACE

Let's work with irrational numbers! Read and answer each word problem carefully. Write the detailed solution of your answers on the space provided.

1. Pi is measuring his distance in the outer space. He found out that he is 10 km. away from his spacecraft. What irrational number is closest to 10? Encircle your answer.

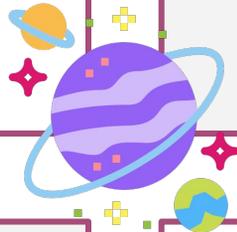
- a.  $\sqrt{85}$                       c.  $\sqrt{101}$   
b.  $\sqrt{10}$                         d.  $\sqrt{150}$

Explain your answer.

2. Approximately, how many meters does an astronaut need to cover if he travelled a circular path with a radius of 5 meters. Hint: Distance travelled is the circumference of a circle, C.

$$C=2\pi r$$

Is your answer an irrational number? Why or why not?



3. A square-shaped spacecraft has an area of 30 square meters. What is the approximate length of one of its sides.

4. Astronauts are making a rectangular-shaped satellite with a length of 55 meters and a width of  $\sqrt{905}$  meters. What is the area of the rectangular-shaped satellite? Is your answer an irrational number? Why or why not?



# ANSWER GUIDE

## Activity 1

1. Moon
2. Sun
3. Moon
4. Sun
5. Sun

## Activity 2

1. Asteroid- The answer is 12. 12 can be written as fraction therefore, it is not an irrational number.
2. Planet- it is irrational because the answer for this term is 7.416198487... which consists of non-terminating and non-repeating decimals
3. Planet- it is irrational because the answer for this term is 4.358898944... which consists of non-terminating and non-repeating decimals
4. Asteroid- The answer is 4. 4 can be written as fraction therefore, it is not an irrational number
5. Planet- it is irrational because the answer for this term is 2.645751311... which consists of non-terminating and non-repeating decimals

## Activity 3

1. 2.646
2. 4.243
3. 7.141
4. 8.155
5. 9.165

## Activity 4

1.  $<$
2.  $>$
3.  $>$
4.  $>$



# ANSWER GUIDE

## Activity 5

- |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|
| 1. 3.732- irrational  | 3. 7- rational        | 5. 11- rational       |
| 2. 22.764- irrational | 4. 16.354- irrational | 6. 26.732- irrational |

## Activity 6

SPACESHIP

## Activity 7

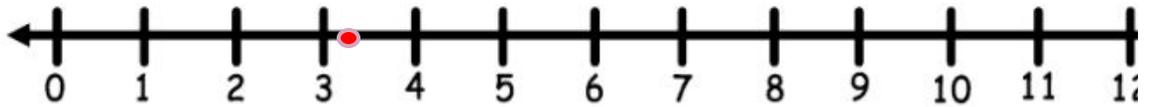
1. Comet- It is a false statement because any irrational number multiplied to any integer will always result to irrational number. For example:  $\sqrt{3} \times 2 = 3.464101615\dots$
2. Star - It is a true statement because  $\pi$  itself is an irrational number. Irrational numbers added to any integer would result to an irrational number.
3. Comet - It is a false statement because irrational numbers cannot be written as fraction.
4. Comet - It is a false statement because the square root of all perfect square numbers will always result to whole numbers. Whole numbers can be written as fraction. Therefore, it will always be rational.
5. Star- It is a true statement because  $\sqrt{3}$  is an irrational number. Irrational numbers divided by any non-zero integers will result to another irrational number.



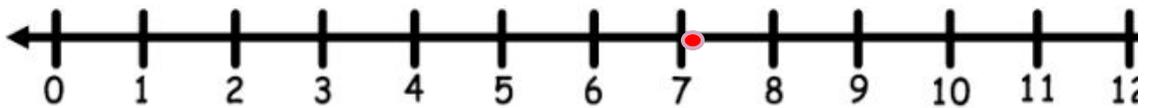
# ANSWER GUIDE

## Activity 8

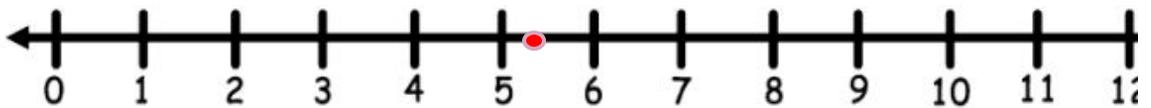
1. 3.2



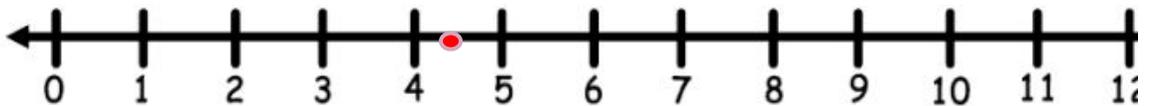
2. 7.1



3. 5.3



4. 4.4



## Activity 9

1.  $\sqrt{75} = \sqrt{25 \times 3} = 5\sqrt{3}$

2.  $\sqrt{12} = \sqrt{4 \times 3} = 2\sqrt{3}$

3.  $\sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}$

4.  $\sqrt{45} = \sqrt{9 \times 5} = 3\sqrt{5}$

5.  $\sqrt{108} = \sqrt{36 \times 3} = 6\sqrt{3}$



# ANSWER GUIDE

## Activity 10

1. Answer is letter c.

$$\sqrt{101} = 10.04987562\dots$$

It is the closest among other choices.

2. Answer is  $10\pi$  meters.

$$C = 2\pi r$$

$$r = 5 \text{ metres}$$

$$C = 2\pi(5)$$

$$C = 10\pi \text{ meters}$$

It is an irrational number because  $\pi$  is an irrational number and irrational numbers multiplied to any non-zero integer will result to irrational number.

3. Answer is 5.477225575 meters or  $\sqrt{30}$  meters.

The area of a square is defined as the square of the length of one of its side sides thus:

$$A = x^2$$

Where  $x$  is the length of one side of the square.

Therefore,  $x = \sqrt{A}$

$$x = \sqrt{30} \text{ meters}$$

or

$$x = 5.477225575 \text{ meters}$$



# ANSWER GUIDE

## Activity 10

4. Answer is  $55\sqrt{905} \text{ m}^2$  or  $1654.576985 \text{ m}^2$ .

Area of a rectangle is length times its width thus:

$$A = l \times w$$

Where,

$l$  = length

$w$  = width

Therefore,

$$A = 55 \times \sqrt{905}$$

$$A = 55\sqrt{905} \text{ m}^2 \text{ or } 1654.576985 \text{ m}^2$$

It is an irrational number because  $\sqrt{905}$  is an irrational number. Irrational numbers multiplied to any non-zero integer will result to irrational number.



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