

# Mathematics

## Quarter 1 - Module 5: Principal Roots and Irrational Numbers



**AIRs - LM**

## MATHEMATICS 7

Quarter 1 - Module 5: Principal Roots and Irrational Numbers

First Edition, 2021

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Region I

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### Development Team of the Module

**Author:** Monina I. Dumalagan

**Editor:** SDO La Union, Learning Resource Quality Assurance Team

**Content Reviewer:** Gema D. Jarata, Maryjane A. Gacusan and Richard O. Dizo

**Language Reviewer:** Erliza D. Areola and Marc Vincent Pacio

**Illustrator:** Ernesto F. Ramos Jr.

**Design and Layout:** Christian R. Bumatay

### Management Team:

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Belen C. Aquino, Ph D, *EPS in Charge of English*

Michael Jason D. Morales, *PDO II*

Claire P. Toluyen, *Librarian II*

Printed in the Philippines by: \_\_\_\_\_

### Department of Education – SDO La Union

Office Address: Flores St. Catbangan, San Fernando City, La Union

Telefax: 072 – 205 – 0046

Email Address: launion@deped.gov.ph

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# MATHEMATICS

## Quarter 1 - Module 5: Principal Roots and Irrational Numbers



## Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.



## Target

This module was designed to help you master the meaning and behavior of Principal Roots, Rational and Irrational Numbers. This will introduce the other faces of rational numbers aside from whole numbers, decimals and fractions. This will help you find the principal roots of rational numbers, gives you an idea what are irrational numbers and lastly, helps determine between what two integers the square root of a number is.

### Learning Competencies:

After going through this module, you are expected to:

- describe principal roots and tells whether they are rational or irrational **(M7NS-Ig-1)**;
- determine between what two integers the square root of a number is **(M7NS-Ig-2)**

### Learning Objectives:

1. Describe perfect square number.
2. Determine principal roots and tell whether they are rational or irrational.
3. Describe and define irrational numbers.
4. Determine between what two integers the square root of a number is.

**Before we start the lesson, find out how much you already know about these topics.**

## PRE – ASSESSMENT

**Directions:** Read each statement below carefully. Select the letter of the correct answer. Write your answer on a separate sheet of paper.

1. What do you call the positive  $n^{\text{th}}$  root of a number?  
A. Perfect Square      B. Principal Root      C. Radical      D. Radicand
2. What do you call a number that can be expressed in the form  $\frac{a}{b}$ , where  $a$  and  $b$  are both integers but  $b$  is not equal to zero?  
A. Integers      B. Irrational      C. Natural      D. Rational
3. Which of the following refers to a number that cannot be expressed as a quotient of integers and whose decimal representation is neither terminating nor repeating?  
A. Integers      B. Irrational      C. Natural      D. Rational
4. Which of the numbers is classified as perfect square integer?  
A. 6      B. 9      C. 12      D. 20
5. What is the principal root of  $\sqrt{25}$  ?  
A. 2      B. 5      C. 25      D. 50
6. What is the principal root of  $\sqrt{100}$  ?  
A. 1      B. 5      C. 10      D. 100
7. Which of the following describes the principal root of  $\sqrt{3}$  ?  
A. Integers      B. Irrational      C. Natural      D. Rational
8. Which of the following is a rational number ?  
A.  $\sqrt{10}$       B.  $\sqrt{24}$       C.  $\sqrt{36}$       D.  $\sqrt{50}$
9. Which of the following is **NOT** a rational number?  
A.  $\sqrt{\frac{16}{100}}$       B. 0.16      C.  $\sqrt{2}$       D. 1.21
10. Between what two consecutive integers does  $\sqrt{12}$  lie?  
A. 3 and 4      B. 4 and 5      C. 5 and 6      D. 16 and 25
11. Which of the following numbers lies between 5 and 6 ?  
A.  $\sqrt{12}$       B.  $\sqrt{25}$       C.  $\sqrt{35}$       D.  $\sqrt{56}$
12. Between what two consecutive integers does  $\sqrt{99}$  lie?  
A. 5 and 6      B. 7 and 8      C. 8 and 9      D. 9 and 10
13. Which of the following square roots lies between 2 and 3?  
A.  $\sqrt{5}$       B.  $\sqrt{10}$       C.  $\sqrt{15}$       D.  $\sqrt{20}$

14. Which of the following statements is true about the value of  $\sqrt{2}$  ?
- A. It is a rational number.
  - B. The principal root is 2.
  - C. It lies between 2 and 3.
  - D. It is an irrational number.
15. Which of the following statements is true about the value of  $\sqrt{81}$  ?
- A. It is a rational number and the principal root is 9.
  - B. It is a rational number and the principal root is 18.
  - C. It is an irrational number and it lies between 8 and 9.
  - D. It is an irrational number and it lies between 9 and 10.

## Lesson 1: Square Root and Principal Root



### ***Jumpstart***

#### **Activity 1: Make it Perfect!**

Find the product of the following:

Given	Product	Given	Product
1) $1 \cdot 1$		6) $10 \cdot 10$	
2) $3 \cdot 3$		7) $13 \cdot 13$	
3) $5 \cdot 5$		8) $15 \cdot 15$	
4) $8 \cdot 8$		9) $18 \cdot 18$	
5) $9 \cdot 9$		10) $20 \cdot 20$	





## Discover

### Important Parts to Remember in a Radical Expression

$${}^n\sqrt{a} = b$$

Diagram labels for the radical expression  ${}^n\sqrt{a} = b$ :

- Radical Sign**: Points to the radical symbol ( $\sqrt{\phantom{x}}$ ).
- Root**: Points to the index  $n$ .
- Radica**: Points to the radicand  $a$ .

- **Radical Expression**

- An expression containing an  $n$ th root of a number, where  $n$  is the index of the root. A root having an index of 2 is called a **square root** ( $\sqrt{\phantom{x}}$  or  $\sqrt[2]{\phantom{x}}$ ) and a root having index of 3 is a *cube root* ( $\sqrt[3]{\phantom{x}}$ ).

**Note:** Roots of higher index are referred by using ordinal numbers like *fourth* ( $4^{\text{th}}$ ) root, *fifth* ( $5^{\text{th}}$ ) root and more.

- **Index**

- The basis to determine how many times the number will be multiplied by itself which will result into the number within the radical sign.

- **Radical Sign ( $\sqrt{\phantom{x}}$ )**

- A symbol that represents a radical expression.

- **Radicand**

- A number inside the radical sign.

- **Root**

- the result of extracting a radical expression

In activity 1, you can observe that you have multiplied a number by itself. The product is what we call the **perfect square** number.

Examples:

Perfect Square numbers	Factors that make it perfect square	Perfect Square numbers	Factors that make it perfect square
0.01	$0.1 \cdot 0.1$	9	$3 \cdot 3$
0.25	$0.5 \cdot 0.5$	16	$4 \cdot 4$
$\frac{25}{64}$	$\frac{5}{8} \cdot \frac{5}{8}$	25	$5 \cdot 5$
$\frac{16}{49}$	$\frac{4}{7} \cdot \frac{4}{7}$	36	$6 \cdot 6$
1.44	$1.2 \cdot 1.2$	49	$7 \cdot 7$
2.25	$1.5 \cdot 1.5$	169	$13 \cdot 13$

Taking the **square root** of a number is like doing the **reverse operation of squaring a number**. The square root of a positive integer can be negative or positive because in multiplying two negative numbers the product is positive.

The **positive root** is what we call the **principal root**.

A **Perfect Square** is the square of a rational number.

**Principal Root** is a number which produces a specific quantity when multiplied by itself. It is the positive  $n^{\text{th}}$  root of a number.

Examples:

Given	Factors	Answer	Principal root
$\sqrt{9}$	$3 \cdot 3$ $-3 \cdot -3$	3 or - 3	3
$\sqrt{16}$	$4 \cdot 4$ $-4 \cdot -4$	4 or - 4	4
$\sqrt{25}$	$5 \cdot 5$ $-5 \cdot -5$	5 or - 5	5
$\sqrt{49}$	$7 \cdot 7$ $-7 \cdot -7$	7 or - 7	7
$\sqrt{169}$	$13 \cdot 13$ $-13 \cdot -13$	13 or - 13	13
$\sqrt{\frac{1}{4}}$	$\frac{1}{2} \cdot \frac{1}{2}$ $-\frac{1}{2} \cdot -\frac{1}{2}$	$\frac{1}{2}$ or $-\frac{1}{2}$	$\frac{1}{2}$
$\sqrt{\frac{9}{16}}$	$\frac{3}{4} \cdot \frac{3}{4}$ $-\frac{3}{4} \cdot -\frac{3}{4}$	$\frac{3}{4}$ or $-\frac{3}{4}$	$\frac{3}{4}$
0.81	$0.9 \cdot 0.9$ $-0.9 \cdot -0.9$	0.9 or - 0 . 9	0.9
1.21	$1.1 \cdot 1.1$ $-1.1 \cdot -1.1$	1.1 or - 1.1	1.1



## Explore

### Activity 2. Perfect or Not

Determine if the given number is a perfect square number. Write **PS** if it is a perfect square number otherwise write **NOT**.

1. 0.36

2.  $\frac{7}{12}$

3.  $\frac{16}{100}$

4. 1

5. 2.89

### Activity 3. Find My Principal!

Determine the principal root of the following:

1.  $\sqrt{0.04}$

2.  $\sqrt{0.64}$

3.  $\sqrt{\frac{25}{81}}$

4.  $\sqrt{1}$

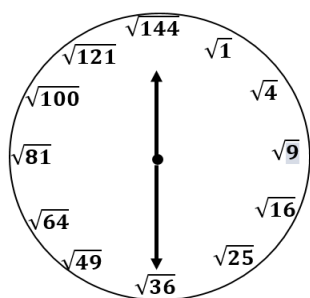
5.  $\sqrt{144}$



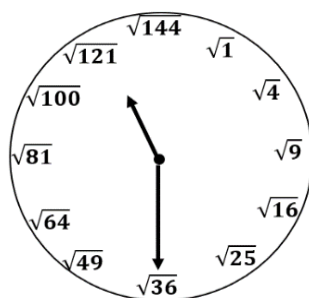
## Deepen

### Activity 4. Tell me the Time!

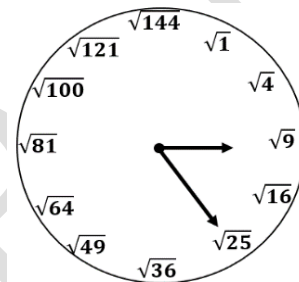
Determine the time shown in the clock by getting the principal root and applying the rules in using analog clock.



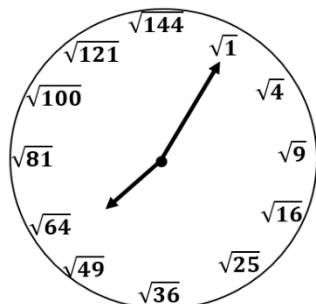
1. \_\_\_\_\_



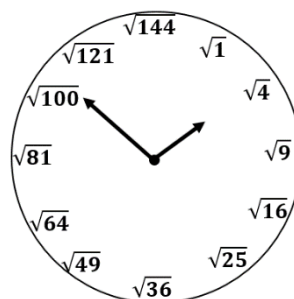
2. \_\_\_\_\_



3. \_\_\_\_\_



4. \_\_\_\_\_



5. \_\_\_\_\_

## Lesson 2: Rational and Irrational Numbers



### ***Jumpstart***

#### **Activity 5: Calculate It!**

Using a scientific calculator (or your android phone), input the following and get the value. Look for this symbol ( $\sqrt{\quad}$ ) and type the number as given. Round your answer to the nearest hundredths.

1.  $\sqrt{6} = \underline{\hspace{2cm}}$       2.  $\sqrt{49} = \underline{\hspace{2cm}}$       3.  $\sqrt{64} = \underline{\hspace{2cm}}$

4.  $\sqrt{16} = \underline{\hspace{2cm}}$       5.  $\sqrt{63} = \underline{\hspace{2cm}}$       6.  $\sqrt{75} = \underline{\hspace{2cm}}$

Did you get a perfect score? Take note of your mistakes in these activities because we will unlock it after this lesson.



## Discover

**Rational Number** is a number that can be expressed in the form  $\frac{a}{b}$ , where  $a$  and  $b$  are integers and  $b$  is not equal to zero.

**Irrational Number** is a number whose decimal representation is neither terminating nor repeating. This number cannot be expressed as a quotient of integers.

Perfect squares are numbers that have rational numbers as square roots. **The square roots of perfect squares are rational numbers while the square roots of numbers that are not perfect squares are irrational numbers.**

Given	Perfect Square or Not (Radicand)	Rational or Irrational
$\sqrt{\frac{9}{100}}$	Perfect Square ( $\frac{3}{10} \cdot \frac{3}{10} = \frac{9}{100}$ )	Rational
$\sqrt{\frac{10}{25}}$	Not Perfect Square (because numerator 10 is not a perfect square number)	Irrational
$\sqrt{\frac{7}{11}}$	Not Perfect Square	Irrational
$\sqrt{\frac{16}{49}}$	Perfect Square	Rational
$\sqrt{0.01}$	Perfect Square ( $0.1 \cdot 0.1 = 0.01$ )	Rational
$\sqrt{0.1}$	Not Perfect Square (0.1 is not a perfect square number)	Irrational
$\sqrt{0.12}$	Not Perfect Square	Irrational
$\sqrt{2.44}$	Perfect Square	Rational
$\sqrt{49}$	Perfect Square	Rational

$\sqrt{65}$	Not Perfect Square	Irrational
$\sqrt{169}$	Perfect Square	Rational
$\sqrt{400}$	Perfect Square	Rational

Other examples of irrational numbers are those decimals which are non – repeating and non- terminating.  $\pi$  (**Pi**) is also an irrational number.

**Examples:** 0.4525189...      1.235842...      3.2519886...

In your activity 5, if you had used calculator, you can say that some answers are decimals which are non-repeating and non- terminating. Those radical numbers are irrational numbers.





## Explore

### Activity 6. Rational or Irrational.

Tell whether the principal root of each number is rational or irrational. Write **Rational** or **Irrational**. \_

1)  $\sqrt{\frac{1}{25}}$

2)  $\sqrt{529}$

3)  $\sqrt{0.5}$

4)  $\sqrt{600}$

5)  $\sqrt{0.81}$



**Deepen**

### Activity 7. Did You Know!

Determine which numbers are irrational or rational by shading the irrational number while the remaining unshaded boxes are rational numbers. Match the letters to the principal root of the rational number to the answer box to reveal the answer.

*Who was the mathematician who developed a computing device to help the staff in his father's business of frequently made errors in computation?*

$\sqrt{\frac{16}{169}}$ J	$\sqrt{\frac{19}{300}}$ R	$\sqrt{\frac{36}{289}}$ O	$\sqrt{0.25}$ H	$\sqrt{2.52}$ O	$\sqrt{3.42}$ Y
$\sqrt{4.41}$ N	$\sqrt{4.9}$ D	$\sqrt{5.25}$ U	$\sqrt{6}$ L	$\sqrt{6.25}$ N	$\sqrt{25}$ A
$\sqrt{50}$ C	$\sqrt{129}$ E	$\sqrt{225}$ P	$\sqrt{300}$ H	$\sqrt{484}$ I	$\sqrt{800}$ A
$\sqrt{833}$ R	$\sqrt{900}$ I	$\sqrt{926}$ K	$\sqrt{1849}$ E	$\sqrt{2000}$ O	$\sqrt{2500}$ R

**Answer box:**

$\frac{4}{13}$	$\frac{6}{17}$	0.5	2.1

2.5	5	15	22	43	50

## Lesson 3: Determining Between What Two Integers the Square Root of a Number Is



### ***Jumpstart***

#### **Activity 8. Before and After!**

Determine between what two whole numbers each of the following decimal lie.

Example: 5 , 5.7908387, 6

1. \_\_\_\_\_, 1.647357, \_\_\_\_\_

2. \_\_\_\_\_, 2.930531, \_\_\_\_\_

3. \_\_\_\_\_, 8.500144, \_\_\_\_\_

4. \_\_\_\_\_, 86.500874, \_\_\_\_\_

5. \_\_\_\_\_, 100.273001, \_\_\_\_\_



## Discover

If a principal root is an irrational number, the easiest way you can do is to determine between what two integers the square root of a number lie.

Now, let us start with our discussion on how to determine the two consecutive integers where the square root of a number lie.

The principal roots of the radicals below are between two integers. Find the closest perfect square integers before and after the radicand.

### Examples:

Given	Irrational or Not	Perfect square number before and after	Principal Root of the Perfect square numbers before and after	Conclusion
$\sqrt{2}$	The radicand is <i>not a perfect square</i> number, so the principal root is <b>irrational</b>	The <u>perfect square</u> <i>before and after</i> the integer 2 is <b>1</b> and <b>4</b>	The <u>principal root of 1 and 4</u> is <b>1</b> and <b>2</b> respectively	Therefore, the square root of the number <b>lies between 1 and 2</b>
$\sqrt{19}$	Irrational	<b><u>16</u></b> < 19 < <b><u>25</u></b> <b>16</b> and <b>25</b>	$\sqrt{16} = 4$ $\sqrt{25} = 5$ <b><u>4</u></b> and <b><u>5</u></b>	Therefore, the square root of the number <b>lies between 4 and 5</b>
$\sqrt{57}$	Irrational	<b><u>49</u></b> < 57 < <b><u>64</u></b> <b>49</b> and <b>64</b>	$\sqrt{49} = 7$ $\sqrt{64} = 8$ <b><u>7</u></b> and <b><u>8</u></b>	Therefore, the square root of the number <b>lies between 7 and 8</b>

$\sqrt{109}$	Irrational	$\underline{100} < 109 < \underline{121}$ <b>100</b> and <b>121</b>	$\sqrt{100} = \mathbf{10}$ $\sqrt{121} = \mathbf{11}$ <u><b>10</b></u> and <u><b>11</b></u>	Therefore, the square root of the number <b>lies between 10 and 11</b>
$\sqrt{1509}$	Irrational	$\underline{1444} < 1509 < \underline{1521}$ <b>1444</b> and <b>1521</b>	$\sqrt{1444} = \mathbf{38}$ $\sqrt{1521} = \mathbf{39}$ <u><b>38</b></u> and <u><b>39</b></u>	Therefore, the square root of the number <b>lies between 38 and 39</b>



## Explore

### Activity 9: I Have Five Hearts!

*What animals have five hearts?*

To answer that question, determine between what two consecutive integers the square root of each number lie, then write the letter in the box that corresponds to your answer.

$\sqrt{42}$   
**T**

$\sqrt{99}$   
**O**

$\sqrt{812}$   
**S**

$\sqrt{102}$   
**E**

$\sqrt{297}$   
**W**

$\sqrt{3}$   
**R**

$\sqrt{27}$   
**A**

$\sqrt{502}$   
**H**

$\sqrt{78}$   
**M**

**Answer box:**

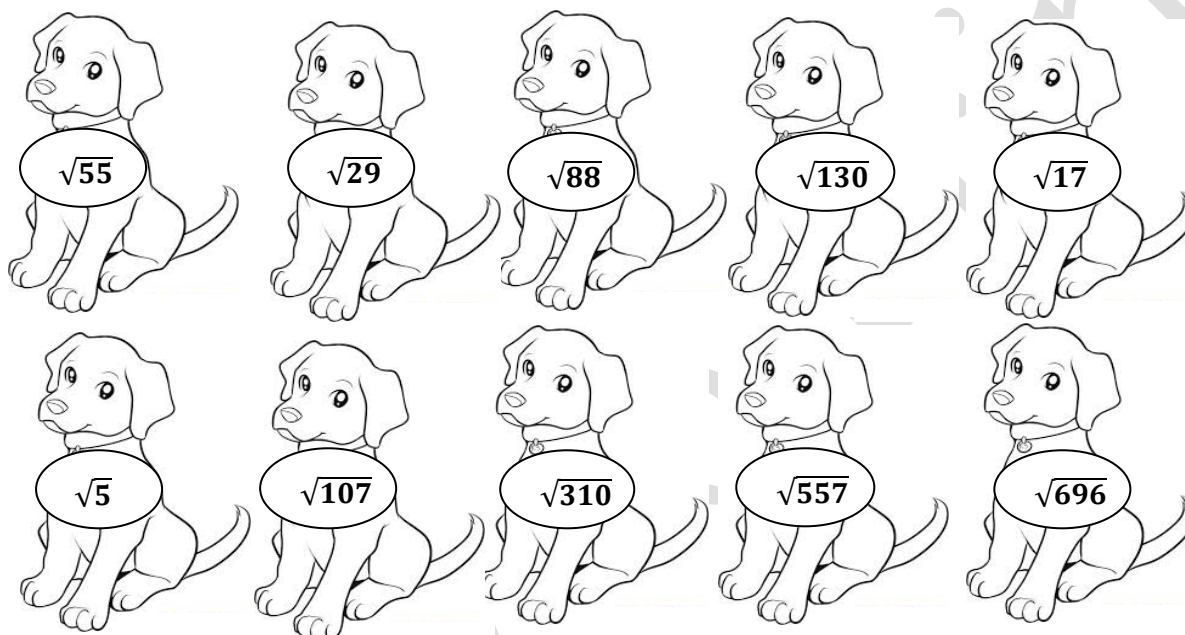
10 and 11	5 and 6	1 and 2	6 and 7	22 and 23	17 and 18	9 and 10	1 and 2	8 and 9	28 and 29



**Deepen**

### Activity 10: You're My Pet!

Choose your pet by determining the radical expression to make the inequality correct. Write your answer on the blank. The first one is done for you.



1)  $11 < \sqrt{130} < 12$

2)  $7 < \underline{\hspace{1cm}} < 8$

3)  $4 < \underline{\hspace{1cm}} < 5$

4)  $23 < \underline{\hspace{1cm}} < 24$

5)  $17 < \underline{\hspace{1cm}} < 18$

6)  $5 < \underline{\hspace{1cm}} < 6$



## Gauge

**Directions:** Read each statement below carefully. Select the letter of the correct answer. Write your answer on a separate sheet of paper.

1. The value of  $\sqrt{144}$  is 12, what do you call the value 12?  
A. Perfect Square    B. Principal Root    C. Radical    D. Radicand
2. What do you call a number that can be expressed in the form  $\frac{a}{b}$ , where  $a$  and  $b$  are both integers but  $b$  is not equal to zero?  
A. Integers    B. Irrational    C. Natural    D. Rational
3. Which of the following refers to a number that cannot be expressed as a quotient of integers and whose decimal representation is neither terminating nor repeating?  
A. Integers    B. Irrational    C. Natural    D. Rational
4. Which of the numbers is classified as perfect square integer?  
A. 12    B. 29    C. 33    D. 49
5. What is the principal root of  $\sqrt{64}$  ?  
A. 4    B. 8    C. 16    D. 24
6. What is the principal root of  $\sqrt{400}$  ?  
A. 4    B. 10    C. 20    D. 40
7. Which of the following describes the principal root of  $\sqrt{23}$  ?  
A. Integers    B. Irrational    C. Natural    D. Rational
8. Which of the following is a rational number ?  
A.  $\sqrt{10}$     B.  $\sqrt{24}$     C.  $\sqrt{36}$     D.  $\sqrt{50}$
9. Which of the following is **NOT** a rational number?  
A.  $\sqrt{\frac{25}{81}}$     B.  $\sqrt{0.25}$     C.  $\sqrt{45}$     D.  $\sqrt{81}$
10. Between what two consecutive integers does  $\sqrt{210}$  lie?  
A. 8 and 9    B. 10 and 11    C. 12 and 13    D. 14 and 15
11. Which of the following numbers lies between 3 and 4 ?  
A.  $\sqrt{2}$     B.  $\sqrt{12}$     C.  $\sqrt{22}$     D.  $\sqrt{42}$
12. Between what two consecutive integers does  $\sqrt{58}$  lie?  
A. 5 and 6    B. 7 and 8    C. 8 and 9    D. 9 and 10



13. Which of the following square roots lies between 5 and 6?

- A.  $\sqrt{17}$                       B.  $\sqrt{28}$                       C.  $\sqrt{33}$                       D.  $\sqrt{41}$

14. Which of the following statements is true about the value of  $\sqrt{75}$  ?

- A. It is a rational number and the principal root is 7.
- B. It is a rational number and the principal root is 9.
- C. It is an irrational number and it lies between 7 and 8.
- D. It is an irrational number and it lies between 8 and 9.

15. Which of the following statements is true about the value of  $\sqrt{121}$  ?

- A. It is a rational number and the principal root is 11.
- B. It is a rational number and the principal root is 12.
- C. It is an irrational number and it lies between 11 and 12.
- D. It is an irrational number and it lies between 12 and 13.

# References

## A. Books

- Oronce, Orlando A. & Mendoza, Marilyn O. E-Math 7 Wortex in Mathematics. Rex Books Store, Inc (RSBI). Revised Edition 2015. ISBN 978 – 971-23 – 6941-4
- Mathematics – Grade 7 Learner's Material. DepEd IMCS. First Edition, 2013 .ISBN: 978-971-9990-60-4

## B. Online Resources

- [https://www.google.com/url?sa=t&source=web&rct=j&url=https://znnhs.zdnorte.net/wp-content/uploads/2020/11/MAT7\\_Q1\\_W6.pdf&ved=2ahUKEwlu9K7CvczyAhXOA94KHcqHDNwQFnoECAMQBg&usg=AOvVaw39CWs\\_82sjC9OEsnmpM83x](https://www.google.com/url?sa=t&source=web&rct=j&url=https://znnhs.zdnorte.net/wp-content/uploads/2020/11/MAT7_Q1_W6.pdf&ved=2ahUKEwlu9K7CvczyAhXOA94KHcqHDNwQFnoECAMQBg&usg=AOvVaw39CWs_82sjC9OEsnmpM83x)
- <https://themathpage.com/Alg/radicals.htm>
- <https://www.purplemath.com/modules/radicals.htm>

**For inquiries or feedback, please write or call:**

Department of Education – SDO La Union  
Curriculum Implementation Division  
Learning Resource Management Section  
Flores St. Catbangan, San Fernando City La Union 2500  
Telephone: (072) 607 - 8127  
Telefax: (072) 205 - 0046  
Email Address:  
launion@deped.gov.ph  
lrm.launion@deped.gov.ph