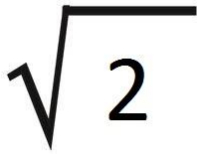


## Unit 12 Square Roots



### 1. Pre-listening. Try to explain the meaning of these words:

scale st up or down      disproportionate      cult  
disciple      suppress      tension

### 2. Listening. Watch the video and answer the questions below.

<https://www.youtube.com/watch?v=5sKah3pJnHl> (0.00 – 5:30)

- a) How is the square root of 2 related to the A4 paper?  
.....
- b) How is the square root of 2 connected to the Pythagoras Theorem?  
.....
- c) How big is A0 paper? .....
- d) What is James trying to show? .....
- e) What was the fundamental belief of the Pythagoreans?.....
- f) Which other strange views did they hold? .....
- g) What did Hippasus find out? .....
- h) What happened to Hippasus and why? .....
- i) Which similar problem do people have today? .....

### 3. Exact calculations and approximations of square roots – Language Practice

**Read the following text and underline useful expressions:**

Some square roots may be calculated exactly,

e.g.  $\sqrt{4} = 2$

$\sqrt{6.25} = 2.5$

$\sqrt{14.44} = 3.8$

Other square roots may be calculated only approximately,

e.g.  $\sqrt{2} = 1.414213\dots$

$\sqrt{3} = 1.7320508\dots$

$\sqrt{5} = 2.236068\dots$

These approximate square roots are called irrational numbers, i.e. we can continue the numbers after the decimal point as long as we wish.

**4. Look at the following and say whether they can be calculated exactly or only approximately:**

- |                |                   |                          |                    |
|----------------|-------------------|--------------------------|--------------------|
| a) $\sqrt{9}$  | c) $\sqrt{12.25}$ | e) The area of a circle  | g) $\sqrt{110.25}$ |
| b) $\sqrt{13}$ | d) $\pi$          | f) Any irrational number | h) $\sqrt{23.5}$   |

**5. Approximations to square roots: read the following algorithm and fill in the gaps with the missing words:**

To find  $\sqrt{7}$ :

First, we \_\_\_\_\_ a value for  $\sqrt{7}$ , say 2.5.

$7/2.5 = 2.8$ , \_\_\_\_\_ 2.5 is too small.

So we try a value half-way \_\_\_\_\_ 2.5 and 2.8, i.e. 2.65.

$7/2.65 = 2.64$ , thus 2.65 is slightly too \_\_\_\_\_.

So we try  $(2.65 + 2.64)/2 = 2.645$ .

$7/2.645 = 2.646$ .

$\sqrt{7}$  may be calculated to an \_\_\_\_\_ degree of accuracy, i.e. we can calculate it to any \_\_\_\_\_ degree of accuracy, but 2.645 is a reasonably good approximation.

**6. How is approximation and estimation useful in everyday life? Discuss and give concrete examples from these areas.**

- a) personal finance
- b) time management
- c) decision-making
- d) travelling
- e) cooking
- f) sports

**7. Guessing game. Each question is to be answered approximately, by choosing the most suitable unit of time from among the following:**

<https://www.pleacher.com/mp/puzzles/mathpuz/secndans.html>

Seconds, Minutes, Hours, Days, Weeks, Months, Years, Decades, Centuries

1. With your rubber flippers on, how long would it take to swim around the equator? 8.7 MONTHS
2. How long would it take you to write the first and last names of one million people? 2.3 MONTHS
3. What is the average life-span of an ordinary housefly? 4 WEEKS
4. A cement company has just built a sidewalk from your front door to the sun. After you've put on your hiking boots, how long will it take you to walk to the sun? 35 CENTURIES
5. How long would it take you to count all the beans in an eight-ounce can of baked beans? 5 MINUTES
6. One by one, how long would it take you to pull out every hair on the average human's head? (Ouch.) 15 HOURS
7. How long would it take Samuel Slugg, a Parisian snail, to climb the Eiffel Tower? 2.6 DAYS
8. You're relaxing on the moon and gazing toward Earth, whence a friend is supposed to send you a signal by special, very powerful flashlight. How long after your earth-bound friend turns on his flashlight will you be able to see the light beam? 1.3 SECONDS
9. You're sunning yourself on the roof of a building that is as tall as Mount Everest, which is more than five miles high. If you were to drop a bottle of suntan lotion from the top of this building, how long would it take the bottle to hit the street below? 42.6 SECONDS
10. If you throw a ball straight up into the air as high as you can, how long will it take before the ball hits the ground? 3 SECONDS
11. How long does it take for a 2 1/2 inch birthday candle to burn itself out? 11 MINUTES
12. You own a square mile of land. If one-tenth inch of rain falls on your land and you catch all the water before it hits the ground, how long will it take you to drink all the water? 15.9 CENTURIES

### Language Focus

**8. Transformations – active X passive. Complete each new sentence so that it has a similar meaning to the original sentence.**

*Example:* We can calculate the solution exactly.

The solution can be calculated exactly.

a) The textbook described an interesting proof of the Pythagoras Theorem.

An interesting proof of the Pythagoras Theorem ..... in the textbook.

b) Prof. Smith will give the lecture on Monday.

The lecture on Monday ..... by prof. Smith.

c) The lecturer has presented a new theory.

A new theory ..... by the lecturer.

d) We must finish the project by Friday.

The project ..... by Friday.

**9. Word Formation – Exam practice. Complete the sentences using the word given in brackets to form a word that fits in the gap.**

*Example:* The solution can be calculated exactly. (EXACT)

a)  $\sqrt{7}$  may be calculated to an arbitrary degree of ..... (ACCURATE)

b) Some square roots may be calculated only ..... (APPROXIMATION)

c) This result is a ..... good approximation. (REASONABLE)

d) He asked about entry ..... for studying maths. (REQUIRE)

e) The research has shown why certain surgical ..... for the relief of epilepsy can have disastrous effects on certain types of memory. (PROCEED)

f) The teacher clearly indicated to students the .....and weaknesses of the work submitted. (STRONG)

g) The ..... of the bay is approximately 200 miles. (LONG)

h) The doctor has made an initial diagnosis but there will be an .....examination by a specialist. (ADDITION)

i) He didn't seem very .....in what he was saying. (INTEREST)

j) Our neighbours have been always very.....with us. (FRIEND)

k) Could you .....your point? I don't understand it completely. (CLEAR)

l) His .....is statistics. (SPECIAL)

m) My father works as a.....(LIBRARY)

n) The article has met the..... for being published. (REQUIRE)

o) Driving after alcohol is an example of.....behaviour. (RESPONSE)

p) The Earth is not perfectly.....(SPHERE)

q) I'd like to have the.....to remember everything. (ABLE)

r) Thank you for the book, it was very.....(HELP)

s) She smiled.....when she heard the news. (HAPPY)

t) We cannot continue without you, we are .....on your work. (DEPEND)

u) The singer gave an exciting.....(PERFORM)

**10. Exam Practice:** Sentence Transformation: Rewrite the second sentence so that it has the same meaning as the first sentence

1. There are more girls than boys in the course.

There aren't as \_\_\_\_\_ in the course.

2. I'll wash my hands. Then I'll eat my lunch.

Before \_\_\_\_\_ (1 word) my lunch, I'll wash my hands.

3. It isn't necessary for you to get up early on Saturday.

You \_\_\_\_\_ get up early on Saturday.

4. "I must go to London," she said.

She told me she \_\_\_\_\_ to London.

5. I regret not going to the party last weekend.

I wish I \_\_\_\_\_ to the party last weekend.

6. You will find this book helpful.

You will benefit \_\_\_\_\_ reading this book.

7. I did not study for the test and I failed it.

If I had studied for the test I \_\_\_\_\_ it.

8. What are the major reasons why we are selling fewer books?

What are the major reasons \_\_\_\_\_ we are selling fewer books?

9. I'll submit the thesis next month.

She promised \_\_\_\_\_ the thesis next month.

10. Both Susan and John study biology

\_\_\_\_\_ John study physics.

11. This is the first time I have been to the VIDA Center.

I \_\_\_\_\_ to the VIDA Center before.

12. The earthquake has killed a lot of people.

A lot of people \_\_\_\_\_ by the earthquake.

13. It was absolutely necessary for us to finish the lab report last week.

We \_\_\_\_\_ finish the lab report last week.

14. We spent two days writing the thesis proposal.

Writing the thesis proposal \_\_\_\_\_ two days.

15. How long has it been since you went to the library?

When \_\_\_\_\_ to the library.