PASSIVE

The passive forms of a verb are created by combining a form of the verb "to be" with the past participle of the main verb. Other helping verbs are also sometimes present: *The measure could have been killed in committee.* The passive can be used, also, in various tenses. Let's take a look at the passive forms of "design".

Tense	Subject	Auxiliary	Past Participle
Present	The car/cars	is/are	designed
Present Perfect	The car/cars	has been/have been	designed
Past	The car/cars	was/were	designed
Past Perfect	The car/cars	had been	designed
Future	The car/cars	will be	designed
Future Perfect	The car/cars	will have been	designed
Present Continuous	The car/cars	is being/are being	designed
Past Continuous	The car/cars	was being/were being	designed

INFINITIVE FORMS

	With to	Without to
Infinitive	to do	do
Perfect Infinitive	to have done	have done
Continuous Infinitive	to be doing	be doing
Passive Infinitive	to be done	be done
Passive Continuous Infinitive	to being done	being done
Passive Perfect Infinitive	to have been done	have been done

Task 7

Rewrite the sentences using the passive.

1. We won't discuss the older and more familiar methods in this article.
2. Did Philips and Sony market the first CDs in 1982?
3. Joseph Swan invented the light bulb in 1879.
4. People are using computers in all kinds of places these days.
5. We include the battery pack and charger in the price.
6. A team of European scientists are doing the research..
7. The committee hasn't yet announced the names of Nobel Prize winners.
8. We can't possibly complete this work overnight.
9. Do I have to give in my application before the end of the week?
10. How much have Blur earned from their new album?

Task 8

Sometimes a passive construction is preferred to an active. This is especially so when the agent of the active sentence is unknown, not relevant or if we want to be discreet as to his or her identity. Whereas in active sentences the focus is on the agent, in passive sentences the focus is on the action. In the following sentences a passive would be appropriate. Fill in the passive construction in the textbox that is provided.

1. Someone told me that you bake the best bread in town, sir.
2. They have planted thousands of trees alongside the E19 motorway.
3. They will crown Eddy Merdox sportsman of the century.
4. They have to work out a publicity campaign to restore the image of Belgium in the world.
5. They should do everything to bring war criminals to justice.
6. We require suitable candidates to be bilingual.
7. The Chairman of the Board asked the Managing Director to remain in charge for another year.
8. The entire press corps is interviewing him right now.
9. They must have stolen the painting between 2 and 3 A.M.
10. Didn't anyone tell you to wear a jacket and tie in the restaurant?

Task 9

Answer to these questions changing the Active Voice into the Passive

1. Where did you find this article? (in your journal).
2. When did you hold the conference? (two days ago).
3. When will he take his exam in physics? (next week).
4. What can you see at their laboratory? (very interesting tests).
5. What is his research adviser telling him? (to present his thesis).
6. What kind of research does he do? (important).
7. To whom did he speak about the advantages of their plan? (some foreign scientist).
8. When will the professor read the abstract of the text? (next week).
9. Where did they build the new computer? (at our Institute).
10. What was she teaching you? (German).
11. When did he write his abstract? (last month)
12. When will you begin the lesson? (at 9 o'clock).
13. What do they deal with? (philosophy).
14. Whom were you meeting at the conference? (a friend).

Task 10

Turn the following senteces into the Active Voice.

1. The recent book by this philosopher and mathematician is being made ready for publication.
2. Such buildings are being reconstructed.
3. These laws are being studied by children.
4. This statement was being made by one of the administrators.
5. Such information is not being produced now.
6. The result of their work was being discussed during the recent meeting.
7. Numbers are being multiplied, divided, added, and subtracted with the help of a calculator.
8. They were being asked about their recent research when we came.

Passive Constructions are common with certain verbs

	is said	to change	*Yra žinoma, kad*
	is supposed	(to be changing)	*Manoma, kad....*
	is expected	(to have changed)	*Tikimasi, kad...*
This value	is assumed		*Sakoma, kad....*
	is reported		*Pranešama, kad*
	is considered		*Manoma, kad....*
	is proved		*Įrodyta, kad....*
	is found		*Atrasta, kad...*
	seems	to change	*Turbūt,*
	appears	(to be changing)	*veikiausiai....*
This value	turns out	(to have changed)	*Pasirodo....*
	proves		*Pasirodo ....*
	is likely		*Pasirodo...*
	is unlikely		*Tikėtina....*
	is sure		*Mažai tikėtina....*
			Neabejotina....
			Užtikrintai,
			tikrai..

Task 11
Read and translate the sentences.

1. Light is proved to travel in straight lines. 2. Light intensity proves to be measurable. 3. The speed of light in free space is proved to be a measured constant. 4. This property seems to refer to a restricted number of materials. 5. The property appears to have been mentioned frequently in the past. 6. They are likely to be familiar with this phenomenon. 7. The sum is assumed to provide an appropriate solution to the problem.

Task 12
Transform the sentences according to the model.

The value increases. (assume) ➤ *The value is assumed to increase.*
1. These values are in good agreement with the experimental ones. (consider) 2. This density changes with temperature. (know) 3. The magnitude proves slow shift in energy. (be likely) 4. The product contains two components. (assume) 5. The distance is shown indirectly. (expect) 6. The altitude is uniform during this period of time. (seem) 7. The path is reduced twice. (appear) 8. The value is derived from the above equation. (suppose).

Task 13
Translate the sentences.

1. Manoma, kad šis poaibis yra baigtinis. 2. Pasirodo, kad atkarba AB yra lygiagreti atkarpai CD. 3. Manoma, kad liniuotės kraštas yra tiesės modelis. 4. Neabejotina, kad tiesė GD gali būti praplėsta abiem kryptimi. 5. Pasirodo, kad šios geometrinės figūros visos kraštinės yra lygios. 6. Sakoma, kad bukas trikampio kampas turi daugiau nei 90 laipsnių. 7. Manoma, kad fizika yra įdomi, tačiau sudėtinga mokslo šaka. 8. Veikiausiai, kad nei spindulys, nei rodyklė neturi kraštinių.

Causative form: *Have smth. done*
We use have + object + past participle to say that we arrange for someone to **do**
something for us.

Task 14
Rewrite the sentences using ***have something done.***

1. The money was deposited in his bank account by the company.
He had the money deposited in his bank account.
2. Sarah's new fridge will be delivered tomorrow.
3. Tim's car was serviced last week.
4. Mrs. Scott's cat was examined by the vet yesterday.
[illegible] eyes are tested by the optician.
[illegible] has been treated for fleas.
[illegible]es have been mended.
[illegible]ing dress will be made by a famous designer.
[illegible]ew furniture is being delivered this afternoon.
[illegible]er has just been repaired.

11. Sam's teeth are checked twice a year.
12. My hair is cut every five weeks.
13. Jason's house will be painted next week.
14. Caroline's book was published last year.
15. Tina's car is being serviced at the moment.

Task 15

Complete the second sentence so that it has a similar meaning to the first sentence.

Use the word in bold and other words. Use two to five words.

1. I pay someone to wash my car every week.
have I *have my car -washed* every week.
2. A builder is modernising our bungalow for us.
having We..by a builder.
3. Does Giovanni design your clothes for you?
designed Do ....by Giovanni?
4. Nobody checked my homework last night.
not I did...last night.
5. An accountant will have to check these books for you.
get You will ....these books checked by an accountant.
6. She has never made her own breakfast.
always She has...for her.
7. I'm having my son taught chess by a grandmaster.
teaching A grandmaster...chess.
8. The surgeon is not going to remove your appendix.
have You are not going ....removed.
9. Didn't you ask someone to translate this report yesterday?
get Didn't you...yesterday?
10. My cat loves it when I scratch its head.
having My cat...scratched.

Task 16

Complete the sentences using the words in brackets.

1. We will *have the documents delivered* (the documents/deliver) to you by motorcycle.
2. She couldn't understand the letter so she .... (it/translate) by her German friend.
3. How often............(you/your eyes/test)?
4. Why............(you/this film/not develop) yesterday? Did you forget?
5. I will never............(my nose/pierce). I'm too frightened.

6. Our dog is very naughty. We should............(it/train) when it was a puppy.
7. They............(a new bathroom/fit) upstairs next week.
8. Look at Susan's hair! She must............(it/dye).
9. Your car is making a lot of noise.............(you/it/service) recently?
10. If we............(new computers/not install) soon, we will go out of business.

Task 17

Fill in the spaces by inserting the correct form of *have*, the past participle of the verb in brackets and, where necessary, a pronoun.

1. Your ankle is very swollen. You'd better......it... .(x-ray)
2. Your roof is leaking, you should......it... .(repair)
3. The trousers are too long; I must... (shorten)
4. No one will be able to read your notes. I know; I......them ... .(type)
5. That's a good piano but you should ... it... .(tune)
6. Why don't you......the document... ?(photocopy)
7. He didn't like the colour of the curtains so he ... .(dye)
8. He went to a garage to......the tire ... .(mend)
9. His arm was broken so he had to go to hospital to ... .(set)
10. The battery is all right now. I......just......it... .(recharge)
11. It's a beautiful photo. I'm going to ... .(enlarge)
12. Be careful of those knives. I ... just... .(sharpen)

Key words: *observation (n), measurement (n), further step, link (v), indicate (v), precisely (adv), reproduce (v), obtain (v), desired (adj), density (n), volume (n), quantity (n), interrelated (adj), time (v), unit (n), derive (v), fundamental (adj), possess (v), foot (feet pl.) (n), inch (n), convert (v), carry out (v), originally (adv), equator (n), concept (n), constant (adj).*

TEXT 2

Task 1

Read the text and retell it. Say what the main systems and units of measurement are according to the text:

UNITS OF MEASUREMENTS

Real science has various recognized steps. It always begins with **observation** followed by classification and **measurement**. Classification has [illegible] the first step towards understanding of a new phenomenon. [illegible] **known** and unknown have to be put in some order before [illegible] **can be done** with them. One **further step** in the process of putting [illegible] **order is measurement**, which **links** science on the one hand and with

VII UNIT - DISCRETE MATHEMATICS

I Put a, an, or the where needed:

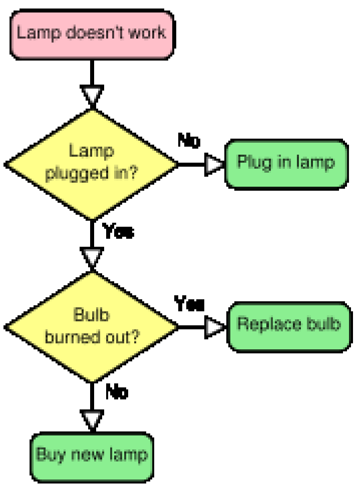
_____ discrete mathematics, also called _____ finite mathematics, is _____ study of mathematical structures that are fundamentally discrete in the sense of not supporting or requiring _____ notion of continuity. _____ objects studied in finite mathematics are largely countable sets such as _____ integers, _____ finite graphs, and _____ formal languages.

II Read the text and decide if the statements below are true or false:

Algorithms

No generally accepted *formal* definition of "algorithm" exists yet. We can, however, derive an informal meaning of the word from the following quotation from Boolos and Jeffrey: "No human being can write fast enough, or long enough, or small enough to list all members of an enumerably infinite set by writing out their names, one after another, in some notation. But humans can do something equally useful, in the case of certain enumerably infinite sets: They can give explicit instructions for determining the n^{th} member of the set, for arbitrary finite n. Such instructions are to be given quite explicitly, in a form in which they could be followed by a computing machine, or by a human who is capable of carrying out only very elementary operations on symbols".

Flowcharts may often used to graphically represent algorithms.



Algorithms are essential to the way computers process information, because a computer program is essentially an algorithm that tells the computer what specific steps to perform (in what specific order) in order to carry out a specified task, such as calculating employees' paychecks or printing students' report cards. Thus, an algorithm can be considered to be any sequence of operations that can be performed by a system.

1. Algorithms are quite easy to define. ________
2. Algorithms represent a set of operations or instructions that a system can perform. ________
3. Algorithms have found useful applications in many areas of everyday life and business. ________
4. Computers couldn't function without the application of algorithms. ________
5. According to Boolos and Jeffrey, people could list members of all infinite sets if they used some notation. ________
6. The flowchart suggests that one should never buy a new lamp if the old one does not work. ________

II Find the words in the text that have the following meanings:

- a diagram that shows the connections between the different stages of a process or parts of a system: ______________
- something that has no end: ______________
- completely necessary; extremely important in a particular situation or for a particular activity: ______________
- not seeming to be based on a reason, system or plan: ______________
- to do and complete a task: ______________
- to get sth from sth: ______________
- to calculate sth exactly: ______________
- a system of signs or symbols used to represent information, especially in mathematics, science and music: ______________

III Find the antonyms of the following words:

refuse	______________	specific	______________
informal	______________	capable	______________
infinite	______________	specified	______________
explicit	______________	elementary	______________

IV Choose the option which expresses the same meaning as the proposed clauses and sentences:

1. We can, however, derive an informal meaning of the word from the following quotation.
a) we have the possibility to derive…
b) we are supposed to derive…
c) we are allowed to derive…

2. No human being can write fast enough…
a) No human has the possibility to write fast enough…
b) No human is able to write fast enough…
c) No human is allowed to write fast enough…

3. Flowcharts may often used to graphically represent algorithms.
a) Flowcharts can often be used to graphically represent algorithms.
b) We can maybe often use flowcharts to graphically represent algorithms.
c) We are capable of often using flowcharts to graphically represent algorithms.

4. An algorithm can be considered to be any sequence of operations that can be performed by a system.
a) An algorithm is any sequence of operations that can be performed by a system.
b) An algorithm is maybe any sequence of operations that can be performed by a system.
c) An algorithm is capable of being any sequence of operations that can be performed by a system.

V The Language of Proof.

A theorem and its proof are typically laid out as follows:

> **Theorem** (name of person who proved it and year of discovery, proof or publication).
> *Statement of theorem*.
> **Proof**.
> Description of proof.

The end of the proof may be signalled by the letters Q.E.D. or by one of the tombstone marks "□" or "■", introduced by Paul Halmos following their usage in magazine articles.

Example:

If $A \subset B$ *and* $B \subset C$ ***then*** $A \subset C$.

To show that $A \subset C$ we need to show that $\forall x \in A, x \in C$. So we **suppose** $x \in A$. **By hypothesis**, $A \subset B$, **so** $x \in B$. **Also** by hypothesis, $B \subset C$, so $x \in C$. **Since** this was true for any **arbitrary** $x \in A$, **we have shown that** $A \subset C$.

*$A \subset C$. *A is a subset of C*

$\forall x \in A, x \in C$. *For any/each x which is an element of A, x is an element of C*

VI Complete the following proofs with appropriate items:

a) which concluses the proof   if   also   then   let

__________ *A and B are finite sets such that A = B* __________ |*A*|=|*B*|.

Here we take advantage of the fact that *A* is a finite set. __________ *n* be the integer such that |*A*| = *n*. You should then index the elements of *A* so that $A = \{x_1, x_2, \ldots, x_n\}$. Now $\forall i = 1, 2, \ldots, n, x_i \in B$, so we see that *B* has at least *n* elements, that is $|B| \geq n$. __________, every element of *B* is in *A*, so it follows that there are no more elements in *B* than there are in *A*, so $|B| \leq n$, thus |*B*| = *n* = |*A*|, __________.

* *{a, b, c} - the set of a, b and c*

| | *the cardinality of the set A*

b)   and   if   then   either   so
let   assume   consider   this shows

__________ *A and B are finite sets* __________ $|A| \neq |B|$ __________ $A \neq B$.

We __________ that we have two finite sets *A* and *B* and that they do not have the same number of elements. __________ *n* = | *A* | and *m* = | *B* | . Then, number the elements in *A* and *B*, so $A = \{a_1, a_2, \ldots, a_n\}$ and $B = \{b_1, b_2, \ldots, b_m\}$. Since $n \neq m$, __________ *n* < *m* or *m* < *n*. Without loss of generality, we assume that *n* < *m*. __________ the set *B* − *A*. Since *A* has only *n* elements, we can take out at most n elements from B, leaving at least m-n elements in B-A. __________ that there is at least one element in B that is not in A, __________ $B \neq A$.

** ≠ is not equal to; does not equal*

VII Fill the texts using only one word per gap:

Failed Mathematician

________ great mathematician David Hilbert ________ once asked ________ a certain former student. "For ________ mathematician he ________ not have enough imagination," Hilbert remarked. "But he ________ become a poet and now he ________ doing fine."

* Hilbert, David (1862-1943) German mathematician and professor

Proof of Death

"My friend, G. H. Hardy, who ________ professor ________ pure mathematics," Bertrand Russell recalled, "told me once that if he could find a proof ________ I was going ________ die in five minutes he would ________ course be sorry to lose me, but this sorrow ________ be quite outweighted ________ pleasure in the proof. I entirely sympathised with him and was not at ________ offended."

* Russell, Bertrand Arthur William (1872-1970) British philosopher, mathematician, social critic and writer

UNIT 9 – GREAT MATHEMATICIANS

I Pre-reading task. Complete the following quiz on famous mathematicians[6]:

1. This great Greek mathematician from 287-212 BC, is very famous for his attempts at the measurement of the circle.

Aristotle	Pythagoras	Plato	Archimedes

2. Greek philosopher whose theorem about the length of the hypotenuse is famous to many students.

Pythagoras	Euclid	Archimedes	Einstein

3. This family had eight great mathematicians. One of the sons, Daniel, had a very famous theorem.

Erdos	Fibonacci	Bernoulli	Riemann

4. Name one of the two men credited with discovering Calculus.

Answer: ______________________________

5. This young genius made contributions to group theory, but was killed in a duel battling for the heart of a lover at the age of 20.

Carl Gauss	Evariste Galois	Leonhard Euler	Augustin Cauchy

6. He is the founder of set theory and introduced the concept of infinite numbers and cardinal numbers.

Leonard Euler	Carl Gauss	Georg Cantor	Leonardo Fibonacci

7. The French philosopher born in 1596 whose work, 'La Geometrie,' led to Cartesian geometry.

Pierre de Fermat	Blaise Pascal	Henri Poincare	Rene Descartes

8. A French lawyer and government official, he had us stumped with his last theorem for centuries.

Rene Descartes	Pierre de Fermat	Galileo Galilei	Augustin Caucy

9. Born in Italy in 1564, a pioneer of modern applied mathematics, physics and astronomy, he is called the Father of Modern Science. Most students will know him for his work with pendulums and the dropping of different sized weights.

Evariste Galois	Galileo Galilei	Bernhard Riemann	Leonardo Fibonacci

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[6] Adapted from www.funtrivia.com and http://www.liz.richards.btinternet.co.uk/webpage4a.htm

10. The schizophrenic American mathematician who lived on to win a Nobel Prize and was portrayed by Russel Crowe in the movie, 'A Beautiful Mind.'

Paul Erdos	John Nash	Albert Einstein	Isaac Newton

11. He was a Greek Mathematician known for shouting "Eureka!" in his bathtub

Galileo	Pythagoras	Archimedes	Euclid

12. He dropped different weight balls from the tower of Pisa to show that they would hit the ground at the same time.

Isaac Newton	Galileo	Pythagoras	Euclid

13. He is known as the "Father of Geometry".

Isaac Newton	Galileo	Pythagoras	Euclid

14. This "Prince of Mathematicians" once quickly solved a problem where he was asked to add the first 100 numbers together.

Gauss	John Nash	Isaac Newton	Galileo

15. This Italian mathematician made telescopes to look at the moon.

Gauss	Isaac Newton	Pythagoras	Galileo

II READING:

AN INTERVIEW WITH LEONARDO FIBONACCI[7]

Fibonacci was the greatest mathematician of his age. He did not simply master the arts of geometry, arithmetic, trigonometry, and algebra, but also made his knowledge useful to all the businesses involving math. He eliminated use of complex Roman numerals and made mathematics more accessible to the public because he brought the Hindu-Arabic system (including zero) to Western Europe.

[7] Adapted from: http://www.3villagecsd.k12.ny.us/wmhs/Departments/Math/OBrien/fibonacci2.html

Q. What is your name and its origin?

A. "In actuality my original name was Leonardo, and back then people named each other according to location so I was Leonardo of Pisa. Yes, it is the same city as the famous leaning tower. Anyway, I decided to adopt the more professional name of Fibonacci, or "son of Bonacci", as Guilielmo Bonacci was my father.

Q. When were you born?

A. "Sometime around 1175. My memory clouds now that I am around 800 years old; please forgive my vague personal knowledge. I don't even remember my wife's name. Anyway, I was born during the Dark Ages. I was a merchant and I traveled to the East and North Africa and was the one who popularized these new systems and modified them slightly. I remember that my interest in the Arabs and their strange numbers was part of what gave me so much advantage back home."

Q. Where were you raised and how did this affect you?

A. "I was raised in Pisa, Italy. It was already an independent republic, a small city-state with a pretty large commerce and seaport. My father found work there and instructed me a bit in accounting."

Q. What do you think people see you as?

A. "Most know me as a very serious scholar. I suppose that everyone currently knows about what kind of scholar; namely a mathematician, but I am also very interested in the laws and patterns of nature."

Q. Can you give any examples of how your mathematics are seen in nature?

A."The Fibonacci Sequence is 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, etc. The formula basically is a guide to adding the previous two numbers in the Hindu-Arabic system to get a new number ad infinitam. Interestingly enough, this is found everywhere in living things because of the way things grow exponentially in nature. Also, did you notice how much art and music have to do with the sequence? If you look at piano keys or famous works of art you will always see recurring patterns obviously of the "Golden numbers." We take the ratio of two successive numbers in Fibonacci's series, (1, 1, 2, 3, 5, 8, 13) and we divide each by the number before it, we will find the following series of numbers: = 1, 2/1 = 2, 3/2 = 1.5, 5/3 = 1.666..., 8/5 = 1.6, 13/8 = 1.625, 21/13 = 1.61538... The ratio seems to be settling down to a particular value, which we call the golden ratio or the golden number. It has a value of approximately 1.61804."

Q. What are your basic achievements?

A." My most important was my role in bringing Eastern mathematics into Western mathematics. You may even be familiar with the fact that I introduced the fractional bar because the numbers were otherwise rather confusing in accountant notation."

Q. What do you think your greatest contribution has been to the world?

A. "I believe that my book, Liber Abbaci, was the most important thing I put into creation. It seriously aided the introduction of Hindu-Arabic numerals to Western Europe and set a solid example for arithmetic, geometry, and algebra, but more importantly a sturdy foundation for purely theoretical applications of math. The cool thing is that it was noticed by the more common people and actually used. That is the greatest thing a mathematician can hope for- the integration of his work into the systems of the world!"

I Decide whether the following statements are true or false:

1. Fibonacci's works found useful applications in everyday life.
2. Fibonacci invented the Arabic numeral notation.
3. He was named after his father.
4. He lived in the 11^{th} century in Italy.
5. Fibonacci was instructed in accounting and travelled widely, which helped him to bring his mathematical work into creation.
6. He was interested only in mathematics.
7. He introduced the fractional bar in the notation system.
8. This is a true interview with one of the greatest mathematicians of all times.

II Match the synonyms:

ordinary	ad infinitam
infinitely	master
strong	slightly
a little	sturdy
learn	vague
at the moment	currently
unclear	common

III Match the words with their meanings:

recurring	value	pattern	approximately	contribution
achievement	ratio	successive	accessible	foundation

1. the relationship between two groups of people or things that is represented by two numbers showing how much larger one group is than the other __________________
2. a regular arrangement of lines, shapes, colours, etc. as a design on material, carpets, etc __________________
3. how much sth is worth __________________
4. following immediately one after the other __________________
5. to be similar or close to sth in nature, quality, amount, etc., but not exactly the same __________________
6. an action or a service that helps to cause or increase sth __________________
7. that can be reached, entered, used, seen, etc __________________
8. happening again __________________
9. a principle, an idea or a fact that sth is based on and that it grows from __________________
10. a thing that sb has done successfully, especially using their own effort and skill __________________

IV Use the following words from the text to best complete the sentences:

achievement	*accounting*	*fractional bar*	*contribution*
ratio	*value*	*pattern*	*approximately*

1. Fractions can be expressed as a decimal or as two numbers separated by a _______________.
2. The symbol π is used to show the ______________ of the circumference of (= distance around) a circle to its diametre (= distance across). Its ______________ is ______________ 3.14159.
3. One of Fibonacci's greatest ______________ was to bring Eastern mathematics into Western mathematics.

GRAMMAR AND VOCABULARY REVISION[8]

I Complete the texts using the correct form of the verb in brackets:

A) Charles Babbage

The English mathematician Charles Babbage, famed for his invention of an early mechanical computer (the so-called "Analytical Engine"), once ____________ (take) issue with one of Tennyson's poems. The poet soon ______________ (receive) a letter from the logician:
"In your otherwise beautiful poem," Babbage wrote, "one verse ______________ (read),
Every moment dies a man,
Every moment one ______________ *(be) born.*
"If this ______________ (be) true, the population of the world ______________ (be) at a standstill. In truth, the rate of birth is slightly in excess of that of death. I would suggest:
Every moment ______________ *(die) a man,*
Every moment 1 1/16 is born.
"Strictly ______________ (speak)," Babbage ______________ (add), "the actual figure is so long I cannot get it into a line, but I ______________ (believe) the figure 1 1/16 ______________ (be) sufficiently accurate for poetry."

B) Isaac Newton

"The popular idea of mathematics is that it ______________ (concern, largely) with calculations. What many people ______________ (not, realize) - and mathematicians at parties ______________ (give up) correcting them - is that mathematicians ______________ (be) often no better calculators, and sometimes worse, than the average non-mathematician...
"Even the giants of mathematics ______________ (suffer) from this minor disability: 'Sir Isaac Newton,' ______________ (say) one observer, 'though so deep in algebra and fluxions, ______________ (not, can) make up a common account; and, he used to get somebody else ______________ (make up) his accounts for him.'"

II Rewrite the sentences in the italics using indirect speech:

Gauss

The brilliant mathematician Karl Friedrich Gauss once visited his professor and claimed to have constructed a septendecagon (a seventeen-sided figure). "Nonsense," the professor replied. "*That is impossible*." "Well, then,"

[8] All texts in this section have been adapted from: www.anecdotage.com

Gauss persisted. "*I have just figured out how to resolve a seventeenth degree polynomial*." "Bah, trivial," the professor replied. "*I've done it myself*."
Gauss later repaid this professor, an amateur poet, with a dubious compliment: "*He is the finest poet among mathematicians, and the finest mathematician among poets*."

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III Put articles where needed:

Simple Arithmetic
Incredibly, _________ great number theorist Ernst Kummer was so inept at _________ simple arithmetic that he often asked _________ students to help him in class. On one occasion, Kummer sought _________ result of a simple multiplication. "Seven times nine," he began. "Seven times nine is er - ah - ah - seven times nine is..." "Sixty-one," _________ mischievous student suggested and Kummer wrote the "answer" on _________ blackboard. "Sir," another one interrupted, "it should be sixty-nine." "Come, come, _________ gentlemen, it can't be both," Kummer exclaimed. "It must be _________ one or _________ other!"

IV Choose the correct option:

A) Paul Erdos

1. _____________ was Paul Erdos's mathematical aptitude 2. _____________ he was hailed as a genius even by his most gifted colleagues:
"Erdos, who 3. _____________ the year at the Institute of Advanced Study, was in the audience but he half-dozed through most of my lecture," Mark Kac once 4. _____________. "The subject matter was too far removed 5. _____________ his interests. 6. _____________ the end I described briefly my difficulties with the number of prime 7. _____________. At the mention of number theory Erdos perked up and asked me 8. _____________ once again what the difficulty was. 9. _____________ the next few minutes, even before the lecture was over, he interrupted to announce that he had the 10. _____________!"

1.	a) so	b) such	c) that	d) as
2.	a) what	b) which	c) that	d) so
3.	a) has spent	b) was spending	c) spent	d) spends
4.	a) had recalled	b) recalling	c) has recalled	d) recalled
5.	a) to	b) on	c) in	d) from
6.	a) towards	b) wards	c) onward	d) forward
7.	a) divisors	b) numerators	c) divisibility	d) division
8.	a) explained	b) to explain	c) explaining	d) explain
9.	a) after	b) at	c) within	d) in
10.	a) solvution	b) solution	c) solving	d) solve

B) John von Neumann

The 1. __________ mathematician (and father of computing) John von Neumann 2. __________ in the habit of simply 3. __________ the answers to homework assignments on the blackboard (the solution 4. __________, of course, 'obvious').
One day, 5. __________ wily (=cunning) student tried 6. __________ some useful information from the professor by 7. __________ whether there was another way of solving a certain problem. Von Neumann 8. __________ for a moment before 9. __________ his reply: "Yes."

1. a) fame	b) notorious	c) famed	d) popular
2. a) is	b) has been	c) was	d) had been
3. a) write	b) being written	c) to write	d) writing
4. a) being	b) has been	c) will be	d) to be
5. a) the	b) a	c) an	d) –
6. a) to get	b) get	c) to have got	d) got
7. a) ask	b) to ask	c) asked	d) asking
8. a) think	b) has thought	c) was thought	d) thought
9. a) give	b) gave	c) giving	d) to give

V Complete the text using the given words:

David Hilbert

foundations *expert* *created* *mathematician* *area*
contribution *invented* *work* *theory* *results*

The notoriously absent-minded _________________ David Hilbert once found himself talking with Helmut Hasse. When Hasse began to talk about his recent _________________ to class-field _________________, Hilbert interrupted him, insisting that he explain the theory's basic concepts and _________________. Hasse agreed and Hilbert grew progressively enthusiastic. "This is extremely beautiful," he finally exclaimed. "Who _________________ it?" Hasse's reply was as great a shock to Hilbert as the question was to Hasse; the theorem's creator, of course, was none other than David Hilbert!

Unit 1. HISTORY OF MATHEMATICS

Key words: notation (n), adorned (adj), artifact (n), sequence (n), multiplication (n), sparsity (n), inscribed (adj), metrology (n), linear (adj), equation (n), approximation (n), facilitate (v), place-value system, infer (v), merge (v), composite and prime numbers, underpinning (n), cotangent (n), coin (v), instantaneous (adj)

Part 1

The area of study known as the **history of mathematics** is primarily an investigation into the origin of discoveries in mathematics and, to a lesser extent, an investigation into the mathematical methods and **notation** of the past.

Before the modern age and the worldwide spread of knowledge, written examples of new mathematical developments have come to light only in a few locales. The most ancient mathematical texts available are *Plimpton 322* (Babylonian mathematics c. 1900 BC), the *Moscow Mathematical Papyrus* (Egyptian mathematics c. 1850 BC), and the *Rhind Mathematical Papyrus* (Egyptian mathematics c. 1650 BC). All of these texts concern the so-called Pythagorean theorem, which seems to be the most ancient and widespread mathematical development after basic arithmetic and geometry.

The Greek and Hellenistic contribution, influenced as it was by Egyptian and Babylonian mathematics, is generally considered the most important for greatly refining the methods (especially the introduction of mathematical rigor in proofs) and expanding the subject matter of mathematics. Islamic mathematics, in turn, developed and expanded the mathematics known to these ancient civilizations. Many Greek and Arabic texts on mathematics were then translated into Latin, which led to further development of mathematics in medieval Europe.

From ancient times through the Middle Ages, bursts of mathematical creativity were often followed by centuries of stagnation. Beginning in Renaissance Italy in the 16th century, new mathematical developments, interacting with new scientific discoveries, were made at an ever increasing pace, and this continues to the present day.

Long before the earliest written records, there are drawings that indicate some knowledge of elementary mathematics and of time measurement based on the stars. For example, paleontologists have discovered ochre rocks in a South African cave that were about 70,000 years old, **adorned** with scratched geometric patterns. Also prehistoric **artifacts** discovered in Africa and France, dated between 35,000 and 20,000 years old, suggest early attempts to quantify time.

There is evidence that women devised counting to keep track of their menstrual cycles; 28 to 30 scratches on bone or stone, followed by a distinctive marker. Moreover, hunters and herders employed the concepts of *one*, *two*, and *many*, as well as the idea of *none* or *zero*, when considering herds of animals.

The Ishango bone, found near the headwaters of the Nile river (northeastern Congo), may be as much as 20,000 years old. One common interpretation is that the bone is the earliest known demonstration of **sequences** of prime numbers and of Ancient Egyptian **multiplication**. Predynastic Egyptians of the 5th millennium BC pictorially represented geometric spatial designs. It has been claimed that megalithic monuments in England and Scotland, dating from the 3rd millennium BC, incorporate geometric ideas such as circles, ellipses, and Pythagorean triples in their design.

Babylonian mathematics

Babylonian mathematics refers to any mathematics of the people of Mesopotamia (modern Iraq) from the days of the early Sumerians until the beginning of the Hellenistic period. It is named Babylonian mathematics due to the central role of Babylon as a place of study, which ceased to exist during the Hellenistic period. From this point, Babylonian mathematics merged with Greek and Egyptian mathematics to give rise to Hellenistic mathematics. Later under the Arab Empire, Mesopotamia, especially Baghdad, once again became an important center of study for Islamic mathematics.

In contrast to the **sparsity** of sources in Egyptian mathematics, our knowledge of Babylonian mathematics is derived from more than 400 clay tablets unearthed since the 1850s. Written in Cuneiform script, tablets were **inscribed** whilst the clay was moist, and baked hard in an oven or by the heat of the sun. Some of these appear to be graded homework.

The earliest evidence of written mathematics dates back to the ancient Sumerians, who built the earliest civilization in Mesopotamia. They developed a complex system of **metrology** from 3000 BC. From around 2500 BC onwards, the Sumerians wrote multiplication tables on clay tablets and dealt with geometrical exercises and division problems. The earliest traces of the Babylonian numerals also date back to this period.

The majority of recovered clay tablets date from 1800 to 1600 BC, and cover topics which include fractions, algebra, quadratic and cubic equations, and the calculation of regular reciprocal pairs. The tablets also include multiplication tables and methods for solving **linear** and quadratic **equations**. The Babylonian tablet YBC 7289 gives an **approximation** to $\sqrt{2}$ accurate to five decimal places.

Babylonian mathematics were written using a sexagesimal (base-60) numeral system. From this we derive the modern day usage of 60 seconds in a minute, 60 minutes in an hour, and 360 (60 x 6) degrees in a circle, as well as the use of seconds and minutes of arc to denote fractions of a degree. Babylonian advances in mathematics were **facilitated** by the fact that 60 has many **divisors**. Also, unlike the Egyptians, Greeks, and Romans, the Babylonians had a true **place-value system**, where digits written in the left column represented larger values, much as in the decimal system. They lacked, however, an equivalent of the decimal point, and so the place value of a symbol often had to be **inferred** from the context.

Egypt. Egyptian mathematics

Egyptian mathematics refers to mathematics written in the Egyptian language. From the Hellenistic period, Greek replaced Egyptian as the written language of Egyptian scholars, and from this point Egyptian mathematics **merged** with Greek and Babylonian mathematics to give rise to Hellenistic mathematics. Mathematical study in Egypt later continued under the Arab Empire as part of Islamic mathematics, when Arabic became the written language of Egyptian scholars.

The oldest mathematical text discovered so far is the Moscow papyrus, which is an Egyptian Middle Kingdom papyrus dated c. 2000–1800 BC. Like many ancient mathematical texts, it consists of what are today called *word problems* or *story problems*, which were apparently intended as entertainment.

The Rhind papyrus (c. 1650 BC) is another major Egyptian mathematical text, an instruction manual in arithmetic and geometry. In addition to giving area formulas and methods for multiplication, division and working with unit fractions, it also contains evidence of other mathematical knowledge, including **composite** and **prime numbers**; arithmetic, geometric and harmonic means; and simplistic understandings of both the Sieve of Eratosthenes and perfect number theory (namely, that of the number 6). It also shows how to solve first order linear equations as well as arithmetic and geometric series.

Also, three geometric elements contained in the Rhind papyrus suggest the simplest of **underpinnings** to analytical geometry: (1) first and foremost, how to obtain an approximation of π accurate to within less than one percent; (2) second, an ancient attempt at squaring the circle; and (3) third, the earliest known use of a kind of **cotangent**.

Medieval European mathematics (c. 500–1400)

Medieval European interest in mathematics was driven by concerns quite different from those of modern mathematicians. One driving element was the belief that mathematics provided the key to understanding the created order of nature, frequently justified by Plato's *Timaeus* and the apocryphal biblical passage (in the *Book of Wisdom*) that God had *ordered all things in measure, and number, and weight.*

Early Middle Ages (c. 500–1100)

Boethius provided a place for mathematics in the curriculum when he **coined** the term *quadrivium* to describe the study of arithmetic, geometry, astronomy, and music. He wrote *De institutione arithmetica*, a free translation from the Greek of Nicomachus's *Introduction to Arithmetic*; *De institutione musica*, also derived from Greek sources; and a series of excerpts from Euclid's *Elements*. His works were theoretical, rather than practical, and were the basis of mathematical study until the recovery of Greek and Arabic mathematical works.

Rebirth of mathematics in Europe (1100–1400)

In the 12th century, European scholars traveled to Spain and Sicily seeking scientific Arabic texts, including al-Khwarizmi's *The Compendious Book on Calculation by Completion and Balancing*, translated into Latin by Robert of Chester, and the complete text of Euclid's *Elements*, translated in various versions by Adelard of Bath, Herman of Carinthia, and Gerard of Cremona.

These new sources sparked a renewal of mathematics. Fibonacci, writing in the *Liber Abaci*, in 1202 and updated in 1254, produced the first significant mathematics in Europe since the time of Eratosthenes, a gap of more than a thousand years. The work introduced Hindu-Arabic numerals to Europe, and discussed many other mathematical problems.

The fourteenth century saw the development of new mathematical concepts to investigate a wide range of problems. One important contribution was development of mathematics of local motion.

Thomas Bradwardine proposed that speed (V) increases in arithmetic proportion as the ratio of force (F) to resistance (R) increases in geometric proportion. Bradwardine expressed this by a series of specific examples, but although the logarithm had not yet been conceived, we can express his conclusion anachronistically by writing: $V = \log (F/R)$. Bradwardine's analysis is an example of transferring a mathematical technique used by al-Kindi and Arnald of Villanova to quantify the nature of compound medicines to a different physical problem.

One of the 14th-century Oxford Calculators, William Heytesbury, lacking differential calculus and the concept of limits, proposed to measure **instantaneous** speed "by the path that **would** be described by [a body] **if**... it were moved uniformly at the same degree of speed with which it is moved in that given instant".

(Source: http://en.wikipedia.org/wiki/History_of_mathematics)

Task 1. Complete the sentences with the key words.

1. In mathematics, a ____ is an ordered list of objects or events. Like a set, it contains members (also called *elements* or *terms*), and the number of terms (possibly infinite) is called the *length* of the ____. Unlike a set, order matters, and the exact same elements can appear multiple times at different positions in the ____.

2. A ____ equation is an algebraic equation in which each term is either a constant or the product of a constant and (the first power of) a single variable. ____ equations can have one or more variables. ____ equations occur with great regularity in applied mathematics.

3. A ____ ____ is a positive integer which has a positive divisor other than one or itself. In other words, if $n > 0$ is an integer and there are integers $1 < a, b < n$ such that $n = a \times b$ then n is composite.

4. In mathematics, a ____ ____ is a natural number which has exactly two *distinct* natural number divisors: 1 and itself.

5. ____ is the mathematical operation of scaling one number by another. ____ is defined for whole numbers in terms of repeated addition.

6. An ____ (usually represented by the symbol ≈) is an inexact representation of something that is still close enough to be useful. Although _____ is most often applied to numbers, it is also frequently applied to such things as mathematical functions, shapes, and physical laws.

7. A ____ ____ assigns a certain value to the spatial location of a number in a series. For example, in the decimal system, a number's position relative to others in a series defines its category as being in the tens, hundreds, thousands, ten-thousands, and so on.

Task 2. Match the two columns.

A	B
1 underpinning	**A** a system of written symbols used in mathematics
2 artifact	**B** ratio of the adjacent to the opposite side of a right-angled triangle
3 merge	**C** a mathematical statement that two expressions are equal
4 metrology	**D** A support or foundation
5 notation	**E** to invent a new word or expression,
6 coin	**F** the scientific study of measurement
7 cotangent	**G** to combine or join together
8 equation	**H** an object that is made by a person, especially one that is of historical interest

Task 3.

Part A. Insert the missing words: **dates, solutions, wide, ancient, varying, latter, owner.**

Moscow Mathematical Papyrus

The Moscow Mathematical Papyrus is a(n) ______ Egyptian mathematical papyrus, also called the Golenischev Mathematical Papyrus, after its first ______, Egyptologist Vladimir Goleniščev. It later entered the collection of the Pushkin State Museum of Fine Arts in Moscow, where it remains today. Based on the palaeography of the hieratic text, it probably ________ to the Eleventh dynasty of Egypt. Approximately 18 feet long and ________ between 1 1/2 and 3 inches ________, its format was divided into 25 problems with _________ by the Soviet Orientalist Vasily Vasilievich Struve in 1930. It is one of the two well-known mathematical papyri along with the Rhind Mathematical Papyrus. The Moscow Mathematical Papyrus is older than the Rhind Mathematical Papyrus, while the _________ is the larger of the two.

Part B. Insert the missing words: **yet, to, the, manuscript, problems, sources, shares, purchased, defined, to obtain, excavations, scribe, division, progressions, calculated.**

Rhind Mathematical Papyrus

The Rhind Mathematical Papyrus (RMP) is named after Alexander Henry Rhind, a Scottish antiquarian, who ______ the papyrus in 1858 in Luxor, Egypt; it was apparently found during illegal _______ in or near the Ramesseum. It dates ______ around 1650 B.C. The British Museum, where the papyrus is now kept, acquired it in 1864 along with the Egyptian Mathematical Leather Roll, also owned by Henry Rhind; there are a few small fragments held by the Brooklyn Museum in New York. It is one of the two well-known Mathematical Papyri along with the Moscow Mathematical Papyrus.

The Rhind Mathematical Papyrus is the best example of Egyptian mathematics. It was copied by the ______ Ahmes. Written in the hieratic script, this Egyptian _______ is 33 cm tall and over 5 meters long, and began to be transliterated and mathematically translated in the late 19th century.

The papyrus begins with the RMP 2/n table and follows with 84 _______, written on both sides. Taking up roughly one third of the manuscript is the RMP 2/n table which expresses 2 divided by the odd numbers from 5 to 101 in a sum of Egyptian fractions using Egyptian multiplication and _______ methods. The sum given in the papyrus optimized to use few fractions, but it does not always use the sum with the fewest fractions.

Two arithmetical ______ (A.P.) were solved, one being RMP 64. The method of solution followed the method defined in the Kahun Papyrus. The problem solved sharing 10 hekats of barley, between 10 men, by a difference of 1/8th of a hekat finding 1 7/16 as the largest term. The second A.P. was RMP 40, the problem divided 100 loaves of bread between five men such that the smallest two _______ (12 1/2) were 1/7 of the largest three shares' sum (87 1/2). The problem asked Ahmes to find the shares for each man, which he did without finding the difference (9 1/6) or the largest term (38 1/3). All five shares 38 1/3, 29 1/6, 20, 10 2/3 1/6, and 1 1/3) were ______ by first finding the five terms from a proportional A.P. that summed to 60. The median and the smallest term, x1, were used to find the differential and each term. Ahmes then multiplied each term by 1 2/3 ______ the sum to 100 A.P. terms. In reproducing the problem in modern algebra, Ahmes also found the sum of the first two terms by solving x + 7x = 60.

In the Rhind Papyrus we first encounter the remen which is ______ as the proportion of the diagonal of a rectangle to its sides when its other sides are whole units. _____, a singular arithmetic proportion formula reported in the RMP offer an additional example beyond the remen's diagonal of a square, with its sides a cubit. We also find problems using the unit rise to run proportion. Typical of the Classical orders of the Greeks and Romans, it was built upon ______ canon of proportions derived from the inscription grids of the Egyptians.

This document is one of the main ______ of our knowledge of Egyptian mathematics.

Part 2

Key words: cumbersome (adj), precedent (n), credit to (v), extant (adj), trigonometry (n), sine(n), cosine (n), plot (v) predecessor (n), calculus (n), endeavor (n), set the groundwork combinatorics (n), ratio (n), circumference (n), function (n), convergence (n), postulate (n), manifold (n), straightedge (v), trisect (v), arbitrary (adj), set theory, conjecture (n), exposit (v), coherent (adj), algorithm, conjecture (v), asymptotics (n)

Early modern European mathematics (c. 1400–1600)

In Europe at the dawn of the Renaissance, mathematics was still limited by the **cumbersome** notation using Roman numerals and expressing relationships using words, rather than symbols: there was no plus sign, no equal sign, and no use of *x* as an unknown.

In 16th century European mathematicians began to make advances without **precedent** anywhere in the world, so far as is known today. The first of these was the general solution of cubic equations, generally **credited to** Scipione del Ferro c.

1510. From this point on, mathematical developments came swiftly, contributing to and benefiting from contemporary advances in the physical sciences. This progress was greatly aided by advances in printing. The earliest mathematical books printed were Peurbach's *Theoricae nova planetarum* (1472), followed by a book on commercial arithmetic, the Treviso Arithmetic (1478), and then the first **extant** book on mathematics, Euclid's *Elements*, printed and published by Ratdolt in 1482.

Driven by the demands of navigation and the growing need for accurate maps of large areas, **trigonometry** grew to be a major branch of mathematics. Bartholomaeus Pitiscus was the first to use the word, publishing his *Trigonometria* in 1595. Regiomontanus's table of **sines** and **cosines** was published in 1533.

By century's end mathematics was written using Hindu-Arabic numerals and in a form not too different from the notation used today.

17th century

The 17th century saw an unprecedented explosion of mathematical and scientific ideas across Europe. Galileo, an Italian, observed the moons of Jupiter in orbit about that planet, using a telescope based on a toy imported from Holland. Tycho Brahe, a Dane, had gathered an enormous quantity of mathematical data describing the positions of the planets in the sky. His student, Johannes Kepler, a German, began to work with this data. In part because he wanted to help Kepler in his calculations, John Napier, in Scotland, was the first to investigate natural logarithms. Kepler succeeded in formulating mathematical laws of planetary motion. The analytic geometry developed by René Descartes (1596–1650), a French mathematician and philosopher, allowed those orbits to be **plotted** on a graph, in Cartesian coordinates.

Building on earlier work by many **predecessors**, Isaac Newton, an Englishman, discovered the laws of physics explaining Kepler's Laws, and brought together the concepts now known as **calculus**. Independently, Gottfried Wilhelm Leibniz, in Germany, developed calculus and much of the calculus notation still in use today. Science and mathematics had become an international **endeavor**, which would soon spread over the entire world.

In addition to the application of mathematics to the studies of the heavens, applied mathematics began to expand into new areas, with the correspondence of Pierre de Fermat and Blaise Pascal. Pascal and Fermat **set the groundwork** for the investigations of probability theory and the corresponding rules of **combinatorics** in their discussions over a game of gambling. Pascal, with his **wager**, attempted to use the newly developing probability theory to argue for a life devoted to religion, on the grounds that even if the probability of success was small, the rewards were infinite. In some sense, this foreshadowed the development of utility theory in the 18th–19th century.

18th century

The most influential mathematician of the 1700s was arguably Leonhard Euler. His contributions range from founding the study of graph theory with the Seven Bridges of Königsberg problem to standardizing many modern mathematical terms and notations. For example, he named the square root of minus 1 with the symbol i, and he popularized the use of the Greek letter π to stand for the **ratio** of a circle's **circumference** to its diameter. He made numerous contributions to the study of topology, graph theory, calculus, combinatorics, and complex analysis, as evidenced by the multitude of theorems and notations named for him.

19th century

Throughout the 19th century mathematics became increasingly abstract. In the 19th century lived Carl Friedrich Gauss (1777–1855). Leaving aside his many contributions to science, in pure mathematics he did revolutionary work on **functions** of complex **variables**, in geometry, and on the **convergence** of series. He gave the first satisfactory proofs of the fundamental theorem of algebra and of the quadratic reciprocity law.

This century saw the development of the two forms of non-Euclidean geometry, where the parallel **postulate** of Euclidean geometry no longer holds. The Russian mathematician Nikolai Ivanovich Lobachevsky and his rival, the Hungarian mathematician Janos Bolyai, independently defined and studied hyperbolic geometry, where uniqueness of parallels no longer holds. In this geometry the sum of angles in a triangle add up to less than 180°. Elliptic geometry was developed later in the 19th century by the German mathematician Bernhard Riemann; here no parallel can be found and the angles in a triangle add up to more than 180°. Riemann also developed Riemannian geometry, which unifies and vastly generalizes the three types of geometry, and he defined the concept of a **manifold**, which generalize the ideas of curves and surfaces.

The 19th century saw the beginning of a great deal of abstract algebra. Hermann Grassmann in Germany gave a first version of vector spaces, William Rowan Hamilton in Ireland developed noncommutative algebra. The British mathematician George Boole devised an algebra that soon evolved into what is now called Boolean algebra, in which the only numbers were 0 and 1 and in which, famously, $1 + 1 = 1$. Boolean algebra is the starting point of mathematical logic and has important applications in computer science.

Also, for the first time, the limits of mathematics were explored. Niels Henrik Abel, a Norwegian, and Évariste Galois, a Frenchman, proved that there is no general algebraic method for solving polynomial equations of degree greater than four. Other 19th century mathematicians utilized this in their proofs that **straightedge** and compass alone are not sufficient to **trisect** an **arbitrary** angle, to construct the side of a cube twice the volume of a given cube, nor to construct a

square equal in area to a given circle. Mathematicians had vainly attempted to solve all of these problems since the time of the ancient Greeks.

In the later 19th century, Georg Cantor established the first foundations of **set theory,** which enabled the rigorous treatment of the notion of infinity and has become the common language of nearly all mathematics. Cantor's set theory and the rise of mathematical logic initiated a long running debate on the foundations of mathematics.

20th century

The 20th century saw mathematics become a major profession. Every year, thousands of new Ph.D.s in mathematics are awarded, and jobs are available in both teaching and industry. In a 1900 speech to the International Congress of Mathematicians, David Hilbert set out a list of 23 unsolved problems in mathematics. These problems, spanning many areas of mathematics, formed a central focus for much of 20th century mathematics. Today, 10 have been solved, 7 are partially solved, and 2 are still open. The remaining 4 are too loosely formulated to be stated as solved or not.

Famous historical **conjectures** were finally proved. In 1976, Wolfgang Haken and Kenneth Appel used a computer to prove the four color theorem. Andrew Wiles, building on the work of others, proved Fermat's Last Theorem in 1995. Paul Cohen and Kurt Gödel proved that the continuum hypothesis is independent of (could neither be proved nor disproved from) the standard axioms of set theory.

Mathematical collaborations of unprecedented size and scope took place. A famous example is the classification of finite simple groups (also called the "enormous theorem"), whose proof between 1955 and 1983 required 500-odd journal articles by about 100 authors, and filling tens of thousands of pages. A group of French mathematicians, including Jean Dieudonné and André Weil, publishing under the pseudonym "Nicolas Bourbaki," attempted **to exposit** all of known mathematics as a **coherent** rigorous whole. The resulting several dozen volumes has had a controversial influence on mathematical education.

Entire new areas of mathematics such as mathematical logic, topology, complexity theory, and game theory changed the kinds of questions that could be answered by mathematical methods.

At the same time, deep insights were made about the limitations to mathematics. In 1929 and 1930, it was proved the truth or falsity of all statements formulated about the natural numbers plus one of addition and multiplication, was decidable, i.e., could be determined by **algorithm**. In 1931, Kurt Gödel found that this was not the case for the natural numbers plus both addition and multiplication; this system, known as Peano arithmetic, was in fact incompletable. (Peano arithmetic is adequate for a good deal of number theory, including the notion of prime number.)

A consequence of Gödel's two incompleteness theorems is that in any mathematical system that includes Peano arithmetic (including all of revolutionary and geometry), truth necessarily outruns proof; there are true statements that cannot be proved within the system. Hence mathematics cannot be reduced to mathematical logic, and David Hilbert's dream of making all of mathematics complete and consistent died.

One of the more colorful figures in 20th century mathematics was Srinivasa Aiyangar Ramanujan (1887–1920) who, despite being largely self-educated, **conjectured** or proved over 3000 theorems, including properties of highly composite numbers, the partition function and its **asymptotics**, and mock theta functions. He also made major investigations in the areas of gamma functions, modular forms, divergent series, hypergeometric series and prime number theory.

Task 4. Make a plan of the text and speak on it.

Task 5. Complete the definitions with the words.

Precedent	**conjecture**	**postulate**	**sine**	**circumference**
cosine	**function**	**calculus**	**trigonometry**	**ratio**

1) Any act, decision, or case that serves as a guide or justification for subsequent situations.
2) (In a right triangle) the ratio of the side opposite a given acute angle to the hypotenuse.
3) (In a right triangle) the ratio of the side adjacent to a given angle to the hypotenuse.
4) The branch of mathematics that is concerned with limits and with the differentiation and integration of functions
5) The branch of mathematics that deals with the relationships between the sides and the angles of triangles and the calculations based on them
6) The relative magnitudes of two quantities (usually expressed as a quotient); proportion
7) The length of the closed curve of a circle
8) A mathematical relation such that each element of a given set (the domain of the function) is associated with an element of another
9) Speculation, a hypothesis
10) Something assumed without proof as being self-evident or generally accepted

Task 6. Fill in the table with the missing words.

Noun	Verb	Adjective
	to conjecture	
classification		
		incompletable
addition		
		revolutionary

Task 7. Write questions to the underlined words.

Mathematics is the science and study of quantity, structure, space, and change. Mathematicians seek out (1) patterns, formulate new conjectures, and establish truth by (2) rigorous deduction from appropriately chosen axioms and definitions.

There is debate over whether mathematical objects such as numbers and points exist naturally or are human creations. The mathematician Benjamin Peirce called mathematics (3) "the science that draws necessary conclusions". (4) Albert Einstein, on the other hand, stated that "as far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality."

(5) Through the use of abstraction and logical reasoning, mathematics evolved from counting, calculation, measurement, and the systematic study of the shapes and motions of physical objects. Practical mathematics has been a human activity (6) for as far back as written records go. Rigorous arguments first appeared in (7) Greek mathematics, most notably in Euclid's *Elements*. Mathematics continued to develop in fitful bursts until (8) the Renaissance, when mathematical innovations interacted with new (9) scientific discoveries, leading to an acceleration in research that continues to the present day.

Today, mathematics is used throughout the world as an essential tool in many fields, including natural science, engineering, medicine, and the social sciences. Applied mathematics, the branch of mathematics concerned with application of mathematical knowledge to other fields, inspires and makes use of new mathematical discoveries and sometimes leads to (10) the development of entirely new disciplines. Mathematicians also engage in pure mathematics, or mathematics for its own sake, without having any application in mind, although practical applications for what began as pure mathematics are often discovered later.

(Source: http://en.wikipedia.org/wiki/Mathematics)

Task 8. Explain the following words: *successors, contrivances, hoisted, goldsmith, spurious, affliction, siege*

Topic sentences of the paragraphs have been removed. Put them in the correct places.

ARCHIMEDES (287-212 B.C.)

(1) ____________ He was born about 287 B.C. and died during the Roman pillage of Syracuse in 212 B.C. He was the son of an astronomer and was in high favor with (perhaps even related to) King Hiero of Syracuse. There is a report that he spent time in Egypt, in all likelihood at the University of Alexandria, for he numbered among his friends Conon, Dositheus, and Eratosthenes; the first two were **successors** to Euclid, the last was a librarian at the University. Many of Archimedes' mathematical discoveries were communicated to these men.

(2) ____________ Among these are the descriptions of the ingenious **contrivances** devised by Archimedes to aid the defend of Syracuse against the siege directed by the Roman general Marcellus. There were catapults with adjustable ranges, movable projecting poles for dropping heavy weights on enemy ships that approached too near the city walls, and great grappling cranes that **hoisted** enemy ships from the water. The story that he used large burning glasses to set the enemy's vessels afire is of later origin, but it could be true. There also is the story of how he lent credence to his statement, "Give me a place to stand on and I will move the earth."

(3) ______________. The frequently told story of King Heron's crown and the suspected **goldsmith** is typical. It seems that King Hiero had a goldsmith fashion him a crown from a given weight of gold. Fearing that the goldsmith may have replaced some of the gold by hidden silver, and not wanting to cut the crown apart to find out, the king referred the matter to Archimedes, who, when in the public baths one day, hit upon a solution by discovering the first law of hydrostatic that, when immersed in a fluid, a body is buoyed up by a force equal to the weight of the displaced fluid. It his excitement, forgetting to clothe himself, he rose from his bath and ran home through the streets shouting, "Eureka, eureka!"("I have found it, I have found it!"). He placed the crown on one pan of a balance and an equal weight of gold on the other, and then set the whole thing under water. The pan containing the crown rose, showing that the crown contained some **spurious** material less dense that gold.

(4) ___________ In fact, it is said that he met his end during the sack of Syracuse, while preoccupied with a diagram drawn on a sand tray. According to one version, he ordered a pillaging Roman soldier to stand clear of his diagram, whereupon the incensed looter ran a spear through the old man.

(5) ____________ The city's defenses were finally broken only when, during a celebration within the city, the overconfident Syracusans relaxed their watches. Marcellus had built up an immense respect for his ingenious adversary, and when he finally managed to breach the city walls, he gave strict orders that no harm must come to the illustrious mathematician. Marcellus' **affliction** was very great upon hearing of Archimedes' death, and with all due honor and veneration, he buried the famous scholar in the city cemetery. Archimedes, justly proud of one of his great geometrical discoveries (to be described later) had expressed a desire that a figure showing a sphere and a circumscribed right circular cylinder be engraved upon his tombstone. Marcellus saw to it that Archimedes' request was carried out.

Topic sentences:

A) Archimedes worked much of his geometry from figures drawn in the ashes of the hearth or in the after-bathing oil smeared on his body.
B) Roman historians have related many picturesque stories about Archimedes.
C) Because of Archimedes' defense machines, Syracuse resisted the Roman **siege** for close to three years.
D) One of the greatest mathematicians of all time, and certainly the greatest of antiquity, was Archimedes, a native of the Greek city of Syracuse on the island of Sicily.
E) Apparently, Archimedes was capable of strong mental concentration, and tales were told of his obliviousness to surroundings when engrossed by a problem

Noun + preposition combinations

Here is a list of **nouns and the prepositions** normally used with them:

		Experience of, in
Advantage of	Advice on	Invitation to
Application for	Benefit of	Reply to
Cheque for	Lack of	Solution to
Need for	Trouble with	Opinion of
Price of	Alternative to	
Request for	Cause of	

Words referring to increases and decreases can e followed by **in** or **of**. **In** refers to something that has risen or fallen; **of** refers to a quantity or a amount:
There has been a large fall in unemployment ever the last few months.
There has been a fall of 9.7%.

Here is a list of some common **preposition and noun** combinations:

		On the phone
At a profit/loss	**In writing**	**On order**
At short notice	**In advance**	**Out of date**
By return	**In general**	**Out of order**
By hand	**On application**	**With reference to**
In stock	**On the whole**	
In bulk	**On business**	

This matter is very urgent. Please reply by return.
Could you please confirm your order in writing?

Task 9. Complete the sentences using a noun from box A and a preposition from box B.

A		B	
difference	solution	of	to
request	invitation	of	for
experience	reply	of	for
trouble	advantage	to	between
cheque	price	to	with

1. Thank you very much for the *invitation to* the launch party.
2. At the moment the bank is considering our ___ ___a larger overdraft, and it will let us have a decision next week.
3. In my opinion, the ___ ___ having a credit card is that you can pay for things over the phone.
4. Have we received a ___ ___ that letter we sent them last week?
5. Yes, they have paid us. We received a ___ ___ $8000 a few days ago.
6. I don't think he would be suitable for the job in Tokyo. He has had very little ___ ___ working overseas.
7. In the long term inflation is link to the ___ ___ raw materials.
8. Is there any ___ ___ these two fax machines? They look the same to me.
9. We had a lot of ___ ___ one of our customers who wouldn't pay us, so we took legal advice.
10. Let me know if you can think of a ___ ___ the problem.

Adjective + preposition combinations

Accustomed to	**Related to**	**Popular with**
Used to	**Serious about**	**Similar to**
Attached to	**Suspicious of**	**Answerable to**
Dependent on	**Aware of**	**Opposed to**

These adjectives and prepositions may be followed by a noun or noun phrase:
*The engineers were very **excited about** the results of the test.*

When followed by a verb, the –ing form must be used:
*Please let me know whether you would be **interested in arranging** meeting.*

Some adjectives can be followed by either two or more prepositions. Look aat these common examples and at the differences in meaning:

Good/bad at smth *I'm very bad at mathematics.*
Good/bad for smth Another *cut in interest rates would be good for industry.*
Good/bad with smth *She should be in Personnel. She's good with people.*

Responsible to someone *The export Manager is responsible to the Sales Director.*

Responsible for smth *Who is responsible for making conference arrangements?*

Sorry about smth *I am sorry about the job. It'a a shame you didn't get it.*
Sorry for doing smth *He said he was sorry for keeping me waiting.*
(feel) sorry for someone *I feel very sorry for Peter. He has been fired.*

Task 10. Complete this letter from a conference centre to a potential customer, using the words in the box.

Accustomed	aware	capable	famous	interested
popular	proud	responsible	good	rich

Dear Miss Harman,

I was delighted to hear that you may choose Warner Park Hotel as the venue for your next conference, and I am writing to introduce myself as the person 1) responsible for liaising with potential conference organizers.

We are 2) ___ of the very high level of service we offer and are 3) ___ to organizing conferences of up to two thousand delegates. As you will see from the enclosed brochure, we are 4) ___ of organizing anything from an AGM to a major international conference. Past clients have included BT, ICI, and Hanson, and these firms believe that a successful conference can be very 5) ___ for business in the following year.

The hotel has an excellent range of facilities and no doubt you will be 6) ___ of the fact that the local area is 7) ___ in cultural interest. In addition, our restaurant is 8) ___ for its excellent cuisine, and I am enclosing samples of menus that have been 9) ___ with conference delegates in the past.

Please let me know whether you would be 10) ___ in taking the matter further, and I will be happy to meet you to discuss any special requirements you may have.

I look forward to hearing from you.

Yours sincerely,

Lionel Royston

(Managing Director)

Domain, Range and Codomain

In its simplest form the *domain* is all the values that go into a function, and the *range* is all the values that come out.But in fact they are very important in **defining** a function.

Functions

A function ***relates*** an input to an output:
Example: a tree grows 20 cm every year, so the height of the tree is ***related*** to its age using the function
h:***h*****(age) = age × 20**
So, if the age is 10 years, the height is *h*(10) = 200 cm
Saying "***h*****(10) = 200**" is like saying 10 is related to 200. Or 10 → 200

Input and Output

But not all values may work!

- The function may not work if we give it the wrong values (such as a negative age),
- And knowing the values that can come out (such as always positive) can also help

So we need to say all the values that **can go into** and **come out of** a function.
This is best done using **sets.**In fact, a function is defined in terms of sets:**A function relates each element of a set with exactly one element of another set(possibly the same set).**

Domain, Codomain and Range

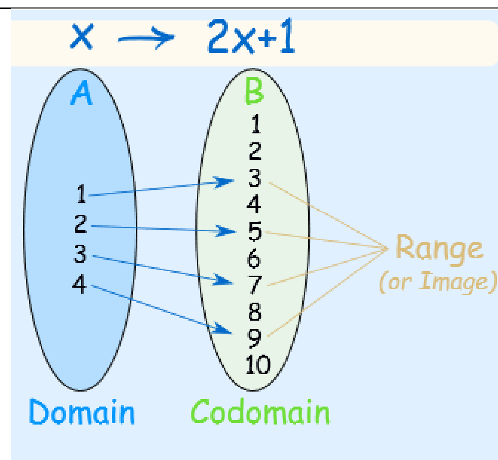
There are special names for **what can go into**, and **what can come out** of a function:

- What can go **into** a function is called the **Domain**
- What **may possibly come out** of a function is called the **Codomain**
- What **actually comes out** of a function is called the **Range**

Example

• The set "A" is the **Domain**,
• The set "B" is the **Codomain**,
• And the set of elements that get pointed to in B (the actual values produced by the function) are the **Range**, also called the Image.
And we have:

- Domain: {1, 2, 3, 4}
- Codomain: {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
- Range: {3, 5, 7, 9}



Part of the Function

Now, what comes **out***(the Range)* depends on what we put **in***(the Domain)* ...
... but **WE** can define the Domain!
In fact, the Domain is an essential part of the function. Change the Domain and we have a different function.
Example: a simple function like $f(x) = x^2$ can have the **domain** (what goes in) of just the counting numbers {1,2,3,...}, and the **range** will then be the set {1,4,9,...}
And another function $g(x) = x^2$ can have the domain of integers {...,-3,-2,-1,0,1,2,3,...}, in which case the range is the set {0,1,4,9,...}

Even though both functions take the input and square it, they have a **different set of inputs**, and so give a different set of outputs.
In this case the range of g(x) also includes 0.

Also they will have different properties.
For example f(x) always gives a unique answer, but g(x) can give the same answer with two different inputs (such as **g(-2)=4**, and also **g(2)=4**)

So, the domain is an essential part of the function.

Codomain vs Range

The Codomain and Range are both on the output side, but are subtly different.
The Codomain is the set of values that could **possibly** come out. The Codomain is actually **part of the definition** of the function.
And The Range is the set of values that **actually do** come out.
Example: we can define a function ***f(x)=2x*** with a domain and codomain of integers (because we say so).
But by thinking about it we can see that the range (actual output values) is just the **even** integers.
So the codomain is integers (we defined it that way), but the range is even integers.
The Range is a subset of the Codomain.
Why both? Well, sometimes we don't know the ***exact*** range (because the function may be complicated or not fully known), but we know the set it ***lies in*** (such as integers or reals). So we define the codomain and continue on.

The Importance of Codomain

Let me ask you a question: Is *square root* a function?
If we say the codomain (the possible outputs) is **the set of real numbers**, then square root is **not a function**! ... is that a surprise?
The reason is that there could be two answers for one input, for example ***f(9) = 3*** or ***-3***
A function must be ***single valued***. It cannot give back 2 or more results for the same input. So "f(9) = 3 **or** -3" is not right!
But it can be fixed by simply **limiting the codomain** to non-negative real numbers.
√In fact, the radical symbol (like √**x**) always means the principal (positive) square root, so √**x** is a function because its codomain is correct.
So, **what we choose for the codomain** can actually affect whether something is a **function or not.**

How to read functions

f(x)	f of x		
f(1) = a	f of 1 equals a		
f: X → Y	f maps X to Y	or	f from X to Y
$\lim_{x \to c} f(x) = L$	the limit of *f* of *x* as *x* approaches *c* equals *L*		

I Complete using the right prepositions:

1. What actually comes ______ ________ a function is called the Range.

2. A function relates an input ___________ an output.
3. Sometimes we don't know the exact range, but we know the set it lies _________.
4. It can be fixed by simply limiting the codomain_________ non-negative real numbers.
5. Now, what comes out depends ______ what we put __________.
6. _________ fact, the domain is the essential part _________ the function.
7. A function is defined ________ terms __________ sets.

II Make the sentences passive:

1. We can limit the codomain to non-negative numbers.
   ____
2. F(x) always gives a unique answer.
   ____
3. We define a function in terms of sets.
   ____
4. What we choose for the codomain can actually affect whether something is a function or not.
   ____

III Complete using one word per gap:

The Codomain and Range are _________ on the output side, but are subtly different.
The Codomain is the ________ of values that could possibly come out. And The Range is the set of values that actually ________ come out.
Example: we can ____________ a function f(x)=2x with a domain and codomain of integers.
But _________ thinking about it we can see that the range is just the even integers.So the codomain is integers, but the range is ________ integers.The Range is a __________ of the Codomain.

IV Make sentences using indirect speech:

1. The teacher asked: “Is this a surprise?”
   ____
2. The teacher explained: “We can define a domain.”
   ____
3. The teacher said: “A function must be single valued.”
   ____
4. The teacher asked the question: “Is square root a function?”
   ____
5. The teacher explained: “Sometimes we don’t know the exact range.”
   ____
6. The teacher said: “What we choose for the codomain can affect whether something is a function or not.”
   ____
7. The teacher has said: “The function may not work if we give it the wrong values.”
   ____
8. The teacher said: “These functions will have different properties.”

____

9. The teacher says: “The Range is the set of values that actually do come out.”
   ____
10. The teacher said: “We finished the functions. Now we will talk about something else.”
   ____

V Choose the best option:

How to Write Functions

You can graph circles, ellipses, lines and parabolas and represent all these by 1. _______ in math. However, not all these equations are functions. In math, a function is an equation with only one output for each input. In the case of a circle, one input can give you two 2. ______ – one on each side of the circle. 3. ________, the equation for a circle is not a function and you cannot write it in function form.

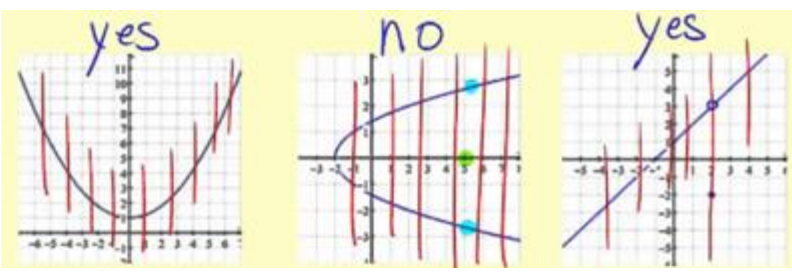
Apply the vertical line test to 4. ________ if your equation is a function. If you can move a vertical line along the x-axis and only 5. ________ one y at a time, your equation is a function as it follows the only one output for each input rule.

Solve your equation 6. _______ y. For instance, if your equation is y -6 = 2x, add 6 to both sides to get y = 2x + 6.

Decide on a name for your function. Most functions use a one-letter name such as f, g or h. Determine what variable your function depends 7. ________. In the example of y = 2x + 6, the function changes as the value of x changes, so the function is 8. ___________ upon x. The left side of your function is the name of your function followed by the dependent variable in 9. _________, f(x) for the example.

Write your function. The example becomes f(x) = 2x + 6.

1. a) inequalities b) equalities c) equations d) graphs
2. a) inputs b) outputs c) functions d) domains
3. a) thus b) although c) however d) in addition
4. a) find b) denote c) determine d) compute
5. a) intersect b) cross out c) find d) determine
6. a) by b) to c) on d) for
7. a) upon b) onto c) into d) up
8. a) independent b) dependent c) variable d) fixed
9. a) square brackets b) braces c) parenthesis d) subscript



Vertical line test

VI Complete using one word per gap:

You write functions with the function name followed ______ the dependent variable, such ______ f(x), g(x) or even h(t) if the function is dependent _______ time. You read the function f(x) _________ "f of x" and h(t) as "h of t". Functions do not have to ________ linear. The function g(x) = $-x^2$ -3x + 5 is _________ nonlinear function. The equation is nonlinear because of the __________ of x, but it is still a function because there is only one answer ________ every x. When evaluating a function for a specific value, you place the value in the parenthesis rather than the variable. For the example of f(x) = 2x + 6, if you wish to find the value when x is 3, you write f(3) = 12, ________ 2 times 3 plus 6 is 12. Similarly, f(0) = 6 and f(-1) = 4.

VI Complete using the right verb form:

History

In the 1690's Gottfried Leibniz and Johann Bernoulli used the word *function* in letters between them and so the modern concept _________ (begin) at the same time as calculus. In 1748 Leonhard Euler stated: "A function of a variable quantity

is an analytic expression _________ (compose) in any way whatsoever of the variable quantity and numbers or constant quantities."
Usually, Dirichlet __________ (credit) with the version which ___________ (use) in schools until the second half of the 20th century: "y is a function of a variable x, defined on the interval a < x < b, if to every value of the variable x in this interval there corresponds a definite value of the variable y. Also, it is irrelevant in what way this correspondence is established."
In 1939, the Bourbaki generalized the Dirichlet's definition and gave a set theoretic version of the definition as a correspondence between inputs and outputs; this __________ (use) in schools since about 1960. Finally in 1970, the Bourbaki ____________ (give) the modern definition.

VII READING

Here's why we care about attempts to prove the Riemann hypothesis
The latest effort shines a spotlight on an enduring prime numbers mystery
By Emily Conover 11:46am, September 25, 2018

A famed mathematical enigma is once again in the spotlight.
The Riemann hypothesis, posited in 1859 by German mathematician Bernhard Riemann, is one of the biggest unsolved puzzles in mathematics. The hypothesis, which could unlock the mysteries of prime numbers, has never been proved. But mathematicians are buzzing about a new attempt.
Esteemed mathematician Michael Atiyah took a crack at proving the hypothesis in a lecture at the Heidelberg Laureate Forum in Germany on September 24. Despite the stature of Atiyah — who has won the two most prestigious honors in mathematics, the Fields Medal and the Abel Prize — many researchers have expressed skepticism about the proof. So the Riemann hypothesis remains up for grabs.
Let's break down what the Riemann hypothesis is, and what a confirmed proof — if one is ever found — would mean for mathematics.

______ The Riemann hypothesis is a statement about a mathematical curiosity known as the Riemann zeta function. That function is closely entwined with prime numbers — whole numbers that are evenly divisible only by 1 and themselves. Prime numbers are mysterious: They are scattered in an inscrutable pattern across the number line, making it difficult to predict where each prime number will fall.
But if the Riemann zeta function meets a certain condition, Riemann realized, it would reveal secrets of the prime numbers, such as how many primes exist below a given number. That required condition is the Riemann hypothesis. It conjectures that certain zeros of the function — the points where the function's value equals zero — all lie along a particular line when plotted. If the hypothesis is confirmed, it could help expose a method to the primes' madness.

______ Prime numbers are mathematical VIPs: Like atoms of the periodic table, they are the building blocks for larger numbers. Primes matter for practical purposes, too, as they are important for securing encrypted transmissions sent over the internet. And importantly, a multitude of mathematical papers take the Riemann hypothesis as a given. If this foundational assumption were proved correct, "many results that are believed to be true will be known to be true," says mathematician Ken Ono of Emory University in Atlanta. "It's a kind of mathematical oracle."

_____ Yep. It's difficult to count the number of attempts, but probably hundreds of researchers have tried their hands at a proof. So far none of the proofs have stood up to scrutiny. The problem is so stubborn that it now has a bounty on its head: The Clay Mathematics Institute has offered up $1 million to anyone who can prove the Riemann hypothesis.

_____ The Riemann zeta function is a difficult beast to work with. Even defining it is a challenge, Ono says. Furthermore, the function has an infinite number of zeros. If any one of those zeros is not on its expected line, the Riemann hypothesis is wrong. And since there are infinite zeros, manually checking each one won't work. Instead, a proof must show without a doubt that no zero can be an outlier. For difficult mathematical quandaries like the Riemann hypothesis, the bar for acceptance of a proof is extremely high. Verification of such a proof typically requires months or even years of double-checking by other mathematicians before either everyone is convinced, or the proof is deemed flawed.

_____ Various mathematicians have made some amount of headway toward a proof. Ono likens it to attempting to climb Mount Everest and making it to base camp. While some clever mathematician may eventually be able to finish that climb, Ono says, "there is this belief that the ultimate proof … if one ever is made, will require a different level of mathematics.

Match the questions to the paragraphs:

A. What will it take to prove the Riemann hypothesis?
B. Why is it so important?
C. Haven't people tried to prove this before?
D. What is the Riemann hypothesis?
E. Why is it so difficult to prove?

Match the words used in the text to their synonyms & definitions:

_________ a situation in which you get a lot of public attention
_________ to say that something is true or that something should be accepted as true
_________ the amount of public respect or popularity that someone or something has
if something is _____ ______ ________, it is available and many people are trying to get it
_________ to throw or drop things so that they spread over an area
_________ impossible to understand
_________ to mark points on a graph
_________ to allow something that is usually covered or hidden to be seen
_________ careful examination of someone or something
_________ money offered as a reward, especially for catching or killing a criminal
_________ a number that is a lot higher or lower than all the other numbers in a set of numbers that represent facts or measurements
_________ a difficult situation or problem, especially one in which you cannot decide what to do
_________ to say that someone or something is similar to someone or something else
_________ happening at the end of a process or activity

EXTRA READING
Interesting Facts

- The word 'mathematics' comes from the Greek máthēma, which means learning, study, science.
- Do you know a word known as Dyscalculia? Dyscalculia means difficulty in learning arithmetic, such as difficulty in understanding numbers, and learning maths facts!
- In America, mathematics is known as 'math', they say that 'mathematics' functions as a singular noun so as per them 'math' should be singular too.
- Notches (cuts or indentation) on animal bones prove that humans have been doing mathematics since around 30,000 BC.
- The word 'hundrath' in Old Norse (old language from where English language originated), from which word 'hundred' derives, meant not 100 but 120.
- Different names for the number 0 include zero, nought, naught, nil, zilch and zip.
- Zero (0) is the only number which cannot be represented by Roman numerals.
- The name 'zero' derives from the Arabic word sifr, which also gave us the English word 'cipher' meaning 'a secret way of writing' .

- The = sign ("equals sign") was invented by 16th Century Welsh mathematician Robert Recorde, who was fed up with writing "is equal to" in his equations.
- Googol (meaning & origin of Google brand) is the term used for a number 1 followed by 100 zeros and that it was used by a nine-year old, Milton Sirotta, in 1940. The name of the popular search engine 'Google' came from a misspelling of the word 'googol'.
- Plus (+) and Minus (-) sign symbols were used as early as 1489 A.D.
- The word "FRACTION" derives from the Latin " fractio - to break".
- In working out mathematical equations, the Greek mathematician Pythagoras used little rocks to represent numbers. Hence the name of Calculus was born which means pebbles in Greek.
- In many cultures no 13 is considered unlucky and there are many myths around it. One is that in some ancient European religions, there were 12 good gods and one evil god; the evil god was called the 13th god. Other superstition goes back to the Last Supper. There were 13 people at the meal, including Jesus Christ, and Judas was thought to be the 13th guest.

REVISION

Complete the sentences using the correct form of have something done and the words in brackets.

1 We usually _______________________ (the bedrooms / redecorate) every two years.
2 Sarah isn't making her own wedding dress, she _______________________ (it / make) by a designer in Italy.
3 _______________________ (you / ever/ anything / steal) from your house?
4 He didn't fix his car himself, he _______________________ (it / fix) at the garage.
5 Your hair is too long. You need _______________________ (it / cut).
6 I'm going to do my food shopping online and I _______________________ (the food / deliver) to my house.
7 If you can't see properly, you should _______________________ (your eyes / test).
8 Are they going to paint the kitchen themselves, or _______________________ (it / paint)?
9 I went to the hairdresser's to _______________________. (hair/cut)
10 You should take your car to the mechanic to _______________________ (brakes/repair).
11 For their wedding anniversary, Mary ______________________ which they ate at a large party. (big cake/make)
12 I have to _______________________, otherwise I can't work on my thesis. (computer/repair)
13 "Did John repair your roof?" "No, we _______________________ that he knows." (it/do/builder)
14 We _______________________ and he said it was worth over a thousand dollars. (statue/value/art expert)
15 We should _______________________ before the summer begins. It's looking dirty. (pool/clean)
16 The local council want all dog owners to _______________________to reduce the problem of strays. (dogs/tag)
17 I broke the heel on my shoe this morning and now I need to _______________________. (it/repair)
18 After the car accident, Cynthia had to _______________________and looked as she did before. (nose/reshape/famous plastic surgeon)

Different tenses in personal passive constructions.

Present active:
People believe that Mr Brown ***owns*** *a lot of land in the north.*
Present personal passive construction:
Mr Brown is believed ***to own*** *a lot of land in the north.*

Future active:
people expect that a new law **will be introduced** next year.
Future personal passive construction:
A new law is expected **to be introduced** next year.

Past active:
People believed that Mr Brown ***owned*** *a lot of land in the north.*
They thought that the prisoners ***had escaped****.*
Present personal passive construction:
Mr Brown was believed ***to have owned*** *a lot of land in the north.*
The prisoners were thought ***to have escaped****.*

Finish the sentences using personal and impersonal passive constructions.

1. It is said that this orchestra is the best in the world.
This orchestra ___________________________________
2. It is believed that the thieves have left the country.
The thieves ___________________________________
3. The fire is reported to have started by accident.
It ___________________________________
4. He is known to be making a lot of money.
It ___________________________________
5. It is expected that they will arrive in time for dinner
They ___________________________________
6. She is said to know a lot about gardening.
It ___________________________________
7. It is thought that he will be attending the meeting.
He ___________________________________
8. It is believed that we are able to win the competition.
We ___________________________________
9. The company is thought to be making a big profit.
It ___________________________________
10. It is reported that the government has reached a decision
The government ___________________________________
11. It is said that they were responsible for the damage.
They ___________________________________
12. She is expected to break the world record.
It ___________________________________
13. He is known to have several foreign bank accounts.
It ___________________________________
14. They are reported to have financial problems.
It ___________________________________