I. Introduction to Algebra

**Algebra** is one of the broad parts of mathematics, together with number theory, geometry and analysis. In its most general form, algebra is the study of mathematical symbols and the rules for manipulating these symbols; it is a unifying thread of almost all of mathematics.As such, it includes everything from elementary equation solving to the study of abstractions such as groups, rings, and fields. The more basic parts of algebra are called elementary algebra, the more abstract parts are called abstract algebra or modern algebra. Elementary algebra is generally considered to be essential for any study of mathematics, science, or engineering, as well as such applications as medicine and economics. Abstract algebra is a major area in advanced mathematics, studied primarily by professional mathematicians.

**代数**是数学中涉及比较广泛的一部分，其他部分还包括数论、几何和分析。广义上来说，代数是研究数学符号和运用这些数学符号所形成的原理；这几乎是数学各个部分统一的思路。它包括从基本方程求解到抽象的研究群、环和域的研究。代数最基本的部分叫做初等代数，抽象的部分被称为抽象代数或现代代数。初等代数研究通常是学习数学、科学或工程以及医学和经济学等的基础知识。抽象代数是高等数学的主要内容和范围，主要由数学专家进行研究。

II. vocabulary (wordlist)

**Unit 1 Foundation for Func**tions

|  |  |  |  |
| --- | --- | --- | --- |
| 单词 | 词性 | 英文解释 | 中文解释 |
| Dependent variable | ***n.*** | A variable in a logical or mathematical expression whose value depends on the independent variable. | 因变量 |
|  | ***e.g.*** | The dependent variables were the participants’ accuracy and indices that traced their judgmental policy. |  |
| Domain | ***n.*** | The set of input values for a relation. | 定义域 |
|  | ***e.g.*** | When graphing exponential functions in an appropriate domain, you may need to adjust the range a few times to show the key points. |  |
| Independent variable | ***n.*** | A variable whose values are independent of changes in the values of other variables | 自变量 |
|  | ***e.g.*** | However, the report stops short of comparing individual states with one another, noting that population ate and economic output are not independent variables. |  |
| Element | ***n.*** | A collection of items | 元素 |
|  | ***e.g.*** | Unlike planets, chemical elements and human diseases, almost anything goes with wildlife. |  |
| Empty set | ***n.*** | A set containing no elements | 空集 |
|  | ***e.g.*** |  |  |
| Finite set | ***n.*** | A definite, or finite, number of elements | 有限集 |
|  |  |  |  |
| Function | ***n.*** | A relation in which the first coordinate is never repeated. | 函数 |
|  | ***e.g.*** | In a **function**, there is only one output for each input, so each element of the domain is mapped to exactly one element in the range. |  |
| Parent function | ***n.*** | The simplest function with the defining characteristics of the family. | 母函数 |
|  | ***e.g.*** | Identity the **parent function** for *g* from its function rule. |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Function notation | ***n.*** | A set of ordered pairs described by an equation satisfies the definition of a function | 函数符号 |
|  | ***e.g.*** | **Function notation** is a simplification of equation. |  |
| Infinite set | ***n.*** | An unlimited , or infinite, number of elements | 无限集 |
|  | ***e.g.*** | As an **infinite set** of each element, although inexhaustible, yet each different |  |
| Interval notation | ***n.*** | The symbols are used to include an endpoint in an interval, and the symbol are used to exclude an end point from an interval | 区间符号 |
|  | ***e.g.*** |  |  |
| Like radical terms | ***n.*** | Square roots that have the same radicand | 同类项 |
|  | ***e.g.*** | To add or subtract square roots, first simplify each radical term and then combine **like radical terms** by adding or subtracting their coefficient. |  |
| Principal root |  | The positive square root of a number | 主根 |
|  |  |  |  |
| Radicand | ***n.*** | The number or expression under the radical symbol | 被开方数 |
|  | ***e.g.*** | A square root expression is in simplest form when the **radicand** has no perfect-square factors (except1) and there are no radicals in the denominator.. |  |
| Radical symbol |  | √ | 根号 |
|  |  |  |  |
| Range | ***n.*** | The set of values of the dependent variable for which a function is defined | 值域 |
|  | ***e.g.*** | The **range** went from 6 percent of patients to nearly 85 percent, the researchers reported. |  |
| Rationalize the denominator | ***n.*** | If a fraction has a denominator that is a square root, you can simplify it by rationalize the denominator | 分母  有理化 |
|  | ***e.g.*** |  |  |
| Fraction | ***n.*** | A number used to name a part of a group or a whole. The number below the bar is the denominator, and the number above the bar is the numerator. | 分数 |
|  | ***e.g.*** | The first step is to rationalize the denominator of a **fraction**. |  |
| Reflection | ***n.*** | A transformation in which the direction of one axis is reversed | 翻折 |
|  | ***e.g.*** | A **reflection** is a transformation that flips a figure across a line called the line of reflection. |  |
| Relation | ***n.*** | A pair of input values with output value | 关系 |
|  | ***e.g.*** | **Relation** is a pairing of input values with output value. |  |
| Roster notation | ***n.*** | In which the elements of a set are list between braces | 枚举法 |
|  | ***e.g.*** | You can also use **roster notation**, in which the elements of a set are listed between braces, {}. |  |
| Scientific notation | ***n.*** | A method of writing numbers by using powers of 10. | 科学计  数法 |
|  | ***e.g.*** | You can use the properties of exponents to calculate with numbers expressed in **scientific notation**. |  |
| Set | ***n.*** | An abstract collection of numbers or symbols | 集合 |
|  | ***e.g.*** | A set can be finite like the set of billiard ball numbers or infinite like the natural numbers{1,2,3…}. |  |
| Subset | ***n.*** | A set whose elements all belong to anotherset. | 子集 |
|  | ***e.g.*** | The diagram shows some important **subsets** of the real numbers. |  |
| Set-builder notation | ***n.*** | Using the properties of the elements in the set to define the set. | 描述法 |
|  | ***e.g.*** | Another way to represent sets is **set-builder notation**. |  |
| Stretch | ***n.*** | Pulling the point away from the y-axis | 拉伸 |
| Compression | ***n.*** | Pulling the point towards the y-axis | 压缩 |
|  |  | Stretching and compressing functions. |  |
| Transformation | ***n.*** | A change in the position, size, or shape of a figure | 变形 |
|  | ***e.g.*** | A reflection is a **transformation** that flips a figure across a line called the line of reflection. |  |
| Translation | ***n.*** | A transformation that moves each point in a figure | 平移 |
|  | ***e.g.*** | Perform the given translation on the point (2,-1). |  |

III. Extended Reading

POUR some water into a partly full bathtub and the level in the tub will rise. Calculating how much it will rise is straightforward, as long as the surface area of what was already there and the amount being added are known. The same should apply to working out how much the sea level will rise as the world’s ice sheets melt in response to rising global temperatures. But in practice it is not that easy. Though geographers know the surface area of the oceans, measuring how the masses of the world’s ice sheets are changing has proved hard. Aurélien Mordret of the Massachusetts Institute of Technology, however, thinks he has found a way to make it simpler. He proposes to do it using the vibrations created by ocean waves.

At the moment, geographers monitor the mass of ice sheets in two ways. One employs aircraft to fly over such sheets and reflect laser beams from their surfaces, to record their topography. The other uses satellites to track gravitational fluctuations caused by variations in the amount of ice present. Both techniques work, but both have limitations. Laser overflights create high-resolution images but are expensive, so can be done only a few times a year. Satellites pass overhead more often, but generate fuzzier pictures.

Dr Mordret, however, knew from work conducted by other research groups that vibrations created by waves crashing onto the shore are transmitted inland through the Earth’s crust, sometimes travelling thousands of kilometres from the coast. These vibrations can be picked up by seismometers of the sort used to monitor earthquakes. He also knew that the speed at which the vibrations propagate varies with the amount of pressure being exerted on the crust by mountains or glaciers sitting above. That gave him his idea.

Propagation speeds vary because many types of rock have small voids within their structure. These lower the velocity of passing vibrations. The greater the proportion of a rock’s volume that is void, the more slowly vibrations will travel through it. If a piece of rock is dry, compressing it will shrink the voids and speed the vibrations up. Water, though, is famously incompressible—more so than most rock-forming minerals. If the voids are filled with water, they will thus resist compression. So, putting pressure on wet rock increases the relative volume of the voids, which slows down any passing vibrations.

IV Sentence Completion

elements function reflection subsets compression range

like radical terms dependent variables roster notation

1. If you push the points towards the y-axis, you would create horizontal \_\_\_\_\_\_\_\_\_.

2. Unlike planets, chemical \_\_\_\_\_\_\_\_ and human diseases, almost anything goes with wildlife.

3. In a \_\_\_\_\_\_\_\_\_\_, there is only one output for each input, so each element of the domain is mapped to exactly one element in the range.

4. The \_\_\_\_\_\_\_\_\_\_ went from 6 percent of patients to nearly 85 percent, the researchers reported.

5. A \_\_\_\_\_\_\_\_\_\_\_ is a transformation that flips a figure across a line called the line of reflection.

6. You can also use\_\_\_\_\_\_\_\_\_\_\_, in which the elements of a set are listed between braces, {}.

7. The diagram shows some important \_\_\_\_\_\_\_\_\_\_\_ of the real numbers.

8. The first step is to rationalize the denominator of a \_\_\_\_\_\_\_\_\_\_.

9. To add or subtract square roots, first simplify each radical term and then combine \_\_\_\_\_\_\_\_\_\_\_\_ by adding or subtracting their coefficient.

10. The \_\_\_\_\_\_\_\_\_\_\_were the participants’ accuracy and indices that traced their judgmental policy.

**Keys:**

1. compression

2. elements

3. function

4. range

5. reflection

6. roster notation

7. subsets

8. fraction

9. like radical terms

10. dependent variables

**Unit 2 Linear Function**

|  |  |  |  |
| --- | --- | --- | --- |
| Absolute value | ***n.*** | Absolute value of a number *x,* written |*x*|, is the distance from *x* to zero on the number line. | 绝对值 |
|  | ***e.g.*** | Experiments have shown that the mass must be larger than zero, but have not been able to calculate its **absolute value.** |  |
| Absolute-value function | ***n.*** | A function whose rule contains an absolute –value expression. | 绝对值  方程 |
|  | ***e.g.*** | The **absolute-value parent function** is composed of two linear pieces. |  |
| Boundary line | ***n.*** | Dividing the coordination plane into two regions. | 界限 |
|  | ***e.g.*** | Shade the region below the **boundary line** to show *y=1/2x+1* |  |
| Conjunction | ***n.*** | A compound statement that uses the word *and.* | 交集 |
|  | ***e.g.*** | The solution is a **conjunction**. |  |
| Contradiction | ***n.*** | An equation that has no solution. | 反例 |
|  | ***e.g.*** | 3=5 is a **contradiction** because there are no values that make it true. |  |
| Correlation | ***n.*** | The strength and direction of the linear relationship. | 相关 |
|  | ***e.g.*** | Identify the **correlation**, sketch a line of best fit, and find its equation. |  |
| Correlation coefficient | ***n.*** | A measure of a how well the data set is fit by a model. | 相关系数 |
|  | ***e.g.*** | You can use a graphing calculator to perform a linear regression and find the correlation **coefficient** *r*. |  |
| Disjunction | ***n.*** | A compound statement that uses the word *or.* | 并集 |
|  | ***e.g.*** | Solving absolute-value inequalities with **disjunctions**. |  |
| Equation | ***n.*** | A mathematical statement that two expressions are equivalent. | 方程 |
|  | ***e.g.*** | The variable in a linear **equation** in not an exponent and is not in a denominator. |  |
| Identity | ***n.*** | An equation that is true for all of the variable. | 恒等式 |
|  | ***e.g.*** | An equation that is true for all values of the variable, such as *x=x*, is an **identity**. |  |
| Inequality | ***n.*** | A statement that compares two expression by using the symbols<,>, ≤, ≥,≠. | 不等式 |
|  | ***e.g.*** | If you multiply both sides of an **inequality** by the same negative quantity and reverse the inequality |  |
| Line of best fit | ***n.*** | A line that fits the data if there is a strong linear relationship between two variables. | 最适线 |
|  | ***e.g.*** | Make a scatter plot for the temperature data, identity the correlation, and then sketch **a line of best fit** and find its equation. |  |
| Linear equation in one variable | ***n.*** | *ax=b, a≠0* | 一元一次方程 |
|  |  |  |  |
| Linear function | ***n.*** | Functions with a constant rate of change. | 线性函数 |
|  | ***e.g.*** | A **linear function** can be written in the form f(x) |  |
| Linear inequality | ***n.*** | Relating to two variables using an inequality symbol. | 线性  不等式 |
|  | ***e.g.*** | Graphing **linear inequalities** using intercepts. |  |
| Point-slope form | ***n.*** | An equation of a line using any point on a line and the slope of the line. | 点斜式 |
|  | ***e.g.*** | I learned the **point-slope form** by relating t the formula for slope. |  |
| Proportion | ***n.*** | An equation stating that two ratios are equal. | 比率 |
|  | ***e.g.*** | The **proportion** of pregnant women testing positive for the virus has risen sevenfold since January, the agency said on Friday. |  |
| Rate | ***n.*** | A ratio that involve two different units. | 比例 |
|  | ***e.g.*** | The pregnancy **rate** among other women was just under 44 percent, CNN reported. |  |
| Ratio | ***n.*** | A comparison of two numbers and a proportion. | 比率 |
|  | ***e.g.*** | This happens when the lengths of their orbits are in a **ratio** of small whole numbers. |  |
| Regression | ***n.*** | The relation between selected values of x and observed values of y(from which the most probable value of y can be predicted for any value of x. | 回归 |
|  | ***e.g.*** | Fortunately, the correct value of 14.1 g d-1 was used in the comparative **regression** calculations. |  |
| Similar | ***adj.*** | Closely similar or comparable in degree | 相似的 |
|  | ***e.g.*** | Two figures are **similar** if their corresponding angles are congruent and corresponding sides are proportional. |  |
| Slope | ***n.*** | The property possessed by a line or surface that departs from the horizontal. | 斜率 |
|  | ***e.g.*** | Elite ski jumpers rely on extreme balance and power to descend the steep **slopes** that allow them to reach up to 100 kilometres per hour. |  |
| Slope-intercept form | ***n.*** | *y=mx+b* | 斜截式 |
| Solution set of an equation | ***n.*** | The value or values of the variable that make the equation true. | 方程解集 |
| X-intercept | ***n.*** | The point at which a line intersects a x-axis | x－截距 |
| Y-intercept | ***n.*** | The point at which a line intersects a y-axis | y－截距 |

III. Extended Reading

The students were split into two groups. Half got interleaved assignments on the first two problem types — linear equations and word problems — and regular, blocked assignments on the second two types. The other half got the reverse: blocked homework for linear equations and word problems, and interleaved for graphs and slopes. The students scored near zero on these kinds of problems at the beginning of the study.

For the teachers involved in the study, the mixed assignments seemed, essentially, like review work. “Sometimes we do what we call ‘bell work,’ which is where we give them a little review before each class,” said Brendan Paul, another Liberty math teacher who helped run the study. “The difference here is that the review is built into the homework, every day.”

Though the interleaved homework took longer at first, most of the students adjusted. “I usually need a lot of time to study for tests,” said Marigny Duga, who was a student in Mr. Paul’s class, “but doing this mixed homework, I felt like, when the test was coming I needed less time than usual, because everything was still pretty fresh in my head.”

Over nine weeks, each student in the study got 10 assignments with 12 problems each. Same students, same problems. But each student got half a semester of mixed homework, and half a semester of blocked.

Two weeks after the last homework assignment, the researchers gave a surprise cumulative test.

The results were striking. Students scored 72 percent, on average, on the interleaved material. They scored 38 percent on the homework-as-usual problems. This is a large difference, but it’s not unheard of in laboratory studies of interleaved practice, experts said.

Psychologists are not sure why mixed problem sets can improve learning. One possibility is that studying mixed platters of items makes a student ask, first, “What kind of problem am I looking at?” rather than blindly applying a single procedure to every problem in the assignment.

“Contrast this to a typical homework assignment, which might say ‘The Quadratic Formula’ right there at the top of the page,” Dr. Rohrer said. “They know what strategy to use before they read the problem.”

Another possible explanation is that interleaving reinforces the brain’s associations between specific types of problems (say, calculating slope) and a matching solution strategy (dividing the vertical change by the horizontal change, or “rise over run”). The problem and the solving strategy become a linked pair.

IV. Sentence Completion

contradiction disjunctions equation linear function

absolute value absolute-value parent function correlation

proportion ratio identity

1. Experiments have shown that the mass must be larger than zero, but have not been able to calculate its \_\_\_\_\_\_\_\_\_\_**.**
2. The \_\_\_\_\_\_\_\_\_\_ is composed of two linear pieces.
3. 3=5 is a \_\_\_\_\_\_\_\_\_\_because there are no values that make it true.
4. Identify the\_\_\_\_\_\_\_\_\_\_, sketch a line of best fit, and find its equation.
5. Solving absolute-value inequalities with \_\_\_\_\_\_\_\_\_\_.
6. The variable in a linear \_\_\_\_\_\_\_\_\_\_in not an exponent and is not in a denominator.
7. An equation that is true for all values of the variable, such as *x=x*, is an\_\_\_\_\_\_\_\_\_\_.
8. A\_\_\_\_\_\_\_\_\_\_ can be written in the form f(x)
9. The \_\_\_\_\_\_\_\_\_\_\_ of pregnant women testing positive for the virus has risen sevenfold since January, the agency said on Friday.
10. This happens when the lengths of their orbits are in a \_\_\_\_\_\_\_\_\_\_ of small whole numbers.

Keys:

1. absolute value
2. absolute-value parent function
3. contradiction
4. correlation
5. disjunctions
6. equation
7. identity
8. linear function
9. proportion
10. ratio

**Unit 3 Linear System**

|  |  |  |  |
| --- | --- | --- | --- |
| Constraint | ***n.*** | A given set of conditions. | 限定 |
|  | ***e.g.*** | The solution to the set of **constraints** can be graphed as a feasible region. |  |
| Dependent system | ***n.*** | Having equations with equal slopes and equal y-intercepts. | 相关方程式 |
|  | ***e.g.*** |  |  |
| Elimination | ***n.*** | With elimination, you get rid of one of the variables by adding or subtracting equation. | 消元法 |
|  | ***e.g.*** | Use **elimination** to solve each system of equations. |  |
| Feasible region | ***n.*** | The solution to the set of constraints. | 目标区域 |
|  | ***e.g.*** | In most linear programming problems, you want to do more than identify the **feasible region**. |  |
| Inconsistent system | ***n.*** | A set of equations or inequalities that has no solution. | 无解方程 |
|  |  |  |  |
| Independent system | ***n.*** | Having equations with different slopes. | 无关方程式 |
|  | ***e.g.*** | Because the slopes are different, the equations are **independent system** and has exactly one solution. |  |
| Linear programming | ***n.*** | A method of finding a maximum or minimum value of a function that satisfies a given set of conditions. | 线性规划 |
|  | ***e.g.*** | In most **linear programming** problems, you want to do more than identify the feasible region. |  |
| linear system | ***n.*** | A system of equations containing only linear equations | 线性方程 |
|  | ***e.g.*** |  |  |
| Objective function |  | Finding the best combination of values in order to mini | 目标函数 |
|  | ***e.g.*** | The **objective function** for these critical points are the same, regardless. |  |
| parameter | ***n.*** | The third variable except *x, y* | 参数 |
|  | ***e.g.*** | For the meanings of the **parameters**, see above  list. |  |
| Parametric equations | ***n.*** | The equations that define this relationship of *x y* and parameter. | 参数方程 |
|  | ***e.g.*** | Write **parametric equations** to model the location of the plane. |  |
| substitution | ***n.*** | In substitution, you solve one equation for one variable and then substitute this expression into the other equation. | 替代 |
|  | ***e.g.*** | Use **substitution** to determine if the given ordered pair is an element of the solution set for the system of equations. |  |
| system of equations | ***n.*** | A set of two or more equations containing two or more variables | 方程组 |
|  | ***e.g.*** | On the graph of the **system of two equations**, the solution is the set of points where the lines intersect. |  |
| System of linear inequalities | ***n.*** | A set of two or more linear inequalities with the same variables. | 线性不等式方程组 |
|  | ***e.g.*** | **System of linear inequalities** may contain more than two inequalities. |  |
| Three-dimensional coordinate system |  | Three coordinates of latitude, longitude, and elevation. | 三维坐标系 |

III. Extended Reading

**What Can Patients Do To Stay Safe?**

To avoid catastrophic events while in the hospital, it’s vital that you take steps to ensure your safety and the safety of loved ones. Here are some ways you can help reduce the risk of medical errors:

1. When a doctor orders a test, make sure to ask about the reason for it and how it could change treatment as well as what’s involved, including risks. Though bloodwork, medical imaging like CT scans, and other diagnostic and screening tools can enhance the practice of medicine, frequently they’re overused and ordered when not necessary. Ask your doctor how the result of the test will change the treatment plan. If the test will have no bearing on your treatment or prognosis, then don’t have it done.

2. If a nurse gives you medicine to take – either by mouth or through your IV – ask for the name the medication and the dose you are to receive as well as why you’re being given the medicine. Don’t take any medicine until you get all your questions answered. If something does not seem right, speak with the doctor who ordered the medicine before proceeding.

[See: How to Help Aging Parents Manage Medications.]

3. Always ask your physician why a particular treatment was selected, and discuss alternatives. Doctors should choose treatments based on the best available data from clinical trials and their experience with a particular treatment protocol.

4. Research your doctor. Make sure your doctor has been board certified in his or her specialty and underwent training at a reputable academic institution. Make sure that your physician is clinically active. If undergoing sugery, consider whether the doctor does a high volume of procedures, since the more cases a doctors performs, the more experienced and skilled he or she is likely to be.

IV. Sentence Completion

feasible region parameter linear programming constraints system of two equations elimination independent system objective function parametric equations substitution

1. Use \_\_\_\_\_\_\_\_\_\_\_to solve each system of equations.
2. In most linear programming problems, you want to do more than identify the**\_\_\_\_\_\_\_\_\_\_**.
3. Because the slopes are different, the equations are \_\_\_\_\_\_\_\_\_\_\_and has exactly one solution.
4. In most \_\_\_\_\_\_\_\_\_\_problems, you want to do more than identify the feasible region
5. The \_\_\_\_\_\_\_\_\_\_\_ for these critical points are the same, regardless.
6. Write **\_\_\_\_\_\_\_\_\_\_**to model the location of the plane.
7. On the graph of the\_\_\_\_\_\_\_\_\_\_\_, the solution is the set of points where the lines intersect.
8. Use **\_\_\_\_\_\_\_\_\_\_**to determine if the given ordered pair is an element of the solution set for the system of equations.
9. The solution to the set of \_\_\_\_\_\_\_\_\_\_can be graphed as a feasible region.

1. The third variable except *x, y* is called\_\_\_\_\_\_\_\_\_\_.

Keys:

1. elimination
2. feasible region
3. independent system
4. linear programming
5. objective function
6. parametric equations
7. system of two equations
8. substitution
9. constraints
10. Parameter

**Unit 4 Matrices**

|  |  |  |  |
| --- | --- | --- | --- |
| Address | ***n.*** | The address of an entry is its location in a matrix, expressed by using the lowercase matrix letter with the row and column number as subscripts. | 位置 |
|  | ***e.g.*** | The entry 0 appears at what two **addresses**? |  |
| Augmented matrix | ***n.*** | An **augmented matrix** consists of the coefficients and constant terms of a system of linear equation | 增广矩阵 |
|  | ***e.g.*** | Solving large system requires a different method using an **augmented matrix**. |  |
| Coefficient matrix | ***n.*** | The coefficient matrix for a system of linear equations in standard form is the matrix formed by the coefficients for the variables in the equations. | 系数矩阵 |
|  | ***e.g.*** | Find the determinant of the **coefficient matrix**. |  |
| Constant matrix | ***n.*** | In the matrix equation AX=B, where A is the coefficient matrix, X is the variable matrix, Bis the constant matrix. | 常数矩阵 |
|  | ***e.g.*** | A matrix equation usually includes coefficient matrix, variable matrix and **constant marix**. |  |
| Cramer’s rule | ***n.*** | P271 | 克莱姆法则 |
|  | ***e.g.*** |  |  |
| Determinant | ***n.*** | Every square matrix (*n* by *n*) has an associated value called its determinant | 行列式 |
|  |  | First, check that the **determinant** is zero or not. |  |
| Dimensions | ***n.*** | Matrix *A* has two rows and three columns. A matrix with *m* rows and *n* column has dimension m\*n, read” *m* by *n*” | 维度，尺寸 |
|  | ***e.g.*** | You can add or subtract two matrices only if they have the same **dimension**. |  |
| Entry | ***n.*** | Each value in a matrix is called an entry of the matrix | 元素 |
|  | ***e.g.*** | What is the **entry** at m32? |  |
| Main diagonal | ***n.*** | The diagonal from the upper left corner to the lower right corner. | 主对角线 |
|  | ***e.g.*** | The determinant has all of the entries along the **main diagonal** equal to 1 and all of the other entries equal to 0. |  |
| Matrix | ***n.*** | A rectangular array of numbers enclosed in brackets. | 矩阵 |
|  | ***e.g.*** | Finding **matrix** Sums and Differences. |  |
| Matrix equation | ***n.*** | AX=B | 矩阵方程 |
|  | ***e.g.*** |  |  |
| Matrix product | ***n.*** | The product of two or more matrices. | 矩阵乘积 |
|  | ***e.g.*** | The inner dimensions are equal (5=5), so the **matrix product** are defined. |  |
| Multiplication identity matrix | ***n.*** | Any square matrix, named with the letter I, that has all of the entries along the main diagonal equal to 1 and all of the other entries equal to 0. | 单位矩阵 |
|  | ***e.g.*** |  |  |
| Multiplicative inverse matrix | ***n.*** | If the product of the square matrix *A* and square matix*AA-1*=*A-1A*=I, and A-1 is the multiplication inverse matrix of *A*, or just the inverse of *A*. | 逆矩阵 |
|  | ***e.g.*** |  |  |
| Reduced row-echelon form | ***n.*** | The goal of row reduction is to get the coefficients to reduce to the identity matrix.P288 | 行简化梯形矩阵 |
|  | ***e.g.*** |  |  |
| Reflection matrix | ***n.*** | A matrix that create a mirror image by reflecting each vertex over a specified line of symmetry. | 翻折矩阵 |
|  | ***e.g.*** | Though **reflection matrix**, find the coordinates of the vertices of the image and graph. |  |
| Rotation matrix | ***n.*** | A matrix used to rotate a figure. | 旋转矩阵 |
|  | ***e.g.*** | The image is rotated 90o clockwise. It is a **rotation matrix.** |  |
| Row operation | ***n.*** | Creating a matrix equivalent to the original matrix. | 行运算 |
|  | ***e.g.*** |  |  |
| Row reduction | ***n.*** | The process of performing elementary row operations on an augmented matrix to solve a system. | 行简化 |
|  | ***e.g.*** |  |  |
| Scalar | ***n.*** | Multiplying a matrix by a number. | 量 |
|  | ***e.g.*** | Use a **scalar** product to find the marked-up prices. |  |
| Square matrix | ***n.*** | Any matrix that has the same number of rows as columns.it is an *n*\**n* matrix. | 方阵 |
|  | ***e.g.*** | Matrix I is the multiplicative identity when A is any **square matrix** and *AI=IA=A* |  |
| Translation matrix | ***n.*** | A matrix use to translate coordinate on the coordinate plane. | 平移矩阵 |
|  | ***e.g.*** |  |  |
| Variable matrix | ***n.*** | In the matrix equation AX=B, where A is the coefficient matrix, X is the **variable matrix**, B is the constant matrix. | 变量矩阵 |
|  | ***e.g.*** |  |  |

III. Extended Reading

What’s a Fiedler vector? This refers to the famous mathematician Miroslav Fiedler, who proved many results in the area of matrix algebra and other mathematical fields. He is most famous for proving a number of results on a vector that quantifies certain properties of graphs. For that reason, this vector was aptly named the Fiedler vector (I can only hope someone names such a thing after me). In one of my previous papers, and in my opinion, my biggest contribution to math to date, I extend and effectively end the conversation on some of the results he proved. You can find the abstract to that paper here.

What the Fiedler vector does is it assigns a number to each discrete object, so that if two objects are related, they are likely to be close in number. (This is just like football, by the way. Jersey numbers are assigned within a certain range based on their position.) The usefulness of such an assignment may not seem obvious at first. But let’s say you had a graph with thousands of discrete objects, and within that graph you had subgroups of hundreds of related objects. If you wanted to sort those objects out, you’d ideally want to want to divide it so that all the closely related objects were together, with as few relations to other parts of the graph as possible. This is referred to graph partitioning, or graph clustering. The Fiedler vector has proven to be a very good way to efficiently partition a graph into parts.

Now we’re left with only one more word to define: multigrid. Multigrid is a class of numerical techniques used to approximately solve complicated math problems (typically elliptic partial differential equations). These kinds of problems appear in everything from physics to biology to economic models. The beauty of multigrid is that it uses a multi resolution scheme to try to minimize the error on each level, thus minimizing the global error much faster than trying to solve the problem outright.

In my latest paper, I developed a type of multigrid method in which the Fiedler vector is solved for on a variety of different ‘coarse’ graphs. The coarse graphs were simpler approximations of an original, more complex graph which I was trying to compute the vector for. Basically, I was looking for a way to use simpler graphs to come up with approximate solutions that are close to the exact solution of the complex graph. Under ideal circumstances, I showed my technique to be uniformly convergent, meaning that it works well independently of the size of the problem. I was also able to provide numerical results that show my new method performs very well in comparison to other existing techniques. I won’t spoil too many of the details. That’s for you to read about!

Now that we’ve made it through the title of my paper, hopefully you’ve had some fun and learned just a little bit more about mathematics. Now you’re ready to tackle the whole thing. Best of luck!

IV. Sentence Completion

constant marix, determinant dimension reflection matrix

rotation matrix scalar variable matrix main diagonal

matrix product augmented matrix

1.An **\_\_\_\_\_\_\_\_\_\_** consists of the coefficients and constant terms of a system of linear equation.

2.A matrix equation usually includes coefficient matrix, variable matrix and **\_\_\_\_\_\_\_\_\_\_**.

3.First, check that the **\_\_\_\_\_\_\_\_\_\_** is zero or not.

4.You can add or subtract two matrices only if they have the same **\_\_\_\_\_\_\_\_\_\_**.

5. The determinant has all of the entries along the **\_\_\_\_\_\_\_\_\_\_** equal to 1 and all of the other entries equal to 0.

6. The inner dimensions are equal (5=5), so the **\_\_\_\_\_\_\_\_\_\_** is defined.

7. Though **\_\_\_\_\_\_\_\_\_\_**, find the coordinates of the vertices of the image and graph.

8. The image is rotated 90o clockwise. It is a **\_\_\_\_\_\_\_\_\_\_.**

9.Use a **\_\_\_\_\_\_\_\_\_\_** product to find the marked-up prices.

10. In the matrix equation AX=B, where A is the coefficient matrix, X is the **\_\_\_\_\_\_\_\_\_\_**, B is the constant matrix.

Keys:

1. augmented matrix
2. constant matrix
3. determinant
4. dimension
5. main diagonal
6. matrix product
7. rotation matrix
8. variable matrix

**Unit 5 Quadratic Functions**

|  |  |  |  |
| --- | --- | --- | --- |
| Absolute value of a complex | ***n.*** | |*a+bi*| | 复数的绝对值 |
|  | ***e.g.*** |  |  |
| Axis of symmetry | ***n.*** | The line through the vertex of a parabola that divides the parabola into two congruent halves. | 对称轴 |
|  | ***e.g.*** | The **axis of symmetry** is a vertical line through the vertex of the function’s graph. |  |
| Binomial | ***n.*** | Quadratic expressions with two terms. | 二项式 |
|  | ***e.g.*** | **Binomial** is an algebraic expression that is a sum or difference of two terms, as 3x + 2y and x 2 - 4 x |  |
| Completing the square | ***n.*** | If a quadratic expression of the form *x2+bx* cannot model a square, you can add a term to form a perfect square trinomial. | 配方 |
|  | ***e.g.*** | Can you **complete the squar**e of x2+6x? |  |
| Complex number | ***n.*** | *a+bi* | 复数 |
| Complex plane | ***n.*** | A set of coordinate axes in which the horizontal axis represents real numbers and the vertical axis represents imaginary numbers. | 复平面 |
|  | ***e.g.*** | The absolute value of a complex number *a+bi* is the distance from the origin to the point(*a,b*) in the **complex plane**, and is denoted |*a+bi*|. |  |
| Discriminant | ***n.*** | Part of the Quadratic Formula that you can use to determine the number of real roots of a quadratic equation. | 判别式 |
|  | ***e.g.*** | The **discriminant** of the quadratic equation ax2+bx+c=0 (a≠0) is b2\_4ac. |  |
| Imaginary number | ***n.*** | A number of the form a+bi where a and b are real numbers and i is the square root of -1 | 虚数 |
|  | ***e.g.*** | Thus **imaginary numbers** are in a sense numbers at right angles to ordinary real numbers. |  |
| Imaginary part | ***n.*** | *a+bi*. “*bi*” is a imaginary part | 虚部 |
|  | ***e.g.*** | There are imaginary numbers in imaginary part like i, 3i,-5i, √-7 |  |
| Imaginary unit | ***n.*** | √1=*i* | 虚数单位 |
|  | ***e.g.*** |  |  |
| Maximum value | ***n.*** |  | 最大值 |
|  | ***e.g.*** |  |  |
| Minimum value | ***n.*** |  | 最小值 |
|  | ***e.g.*** |  |  |
| Parabola | ***n.*** | The graph of the parent function f(x)=x2 is a U-shaped curve. | 抛物线 |
|  | ***e.g.*** | When a **parabola** opens upwards, the *y*-value of the vertex is the minimum value. |  |
| Quadratic function | ***n.*** | A function that can be written in the form *F(x)=a(x-h)2+k (a≠0)* | 二次函数 |
|  | ***e.g.*** | In Chapter 5, we will study the using transformation to graph **quadratic functions**. |  |
| Quadratic inequality in two variables | ***n.*** | y≧ax2+bx+c; y> ax2+bx+c;  y≦ax2+bx+c;y< ax2+bx+c; | 两个变量的二次函数不等式 |
| Quadratic model | ***n.*** | A quadratic function that represents a real data set. | 二次函数模型 |
|  | ***e.g.*** | In Chapter 5, you can use a graphing calculator to perform a quadratic model. |  |
| Quadratic regression | ***n.*** | A statistical method used to fit a quadratic model to a given data set. | 二次回归 |
|  | ***e.g.*** | Using the data and **quadratic function regression** to graph the data and function model. |  |
| Real part | ***n.*** | a+bi. “a” is a imaginary part | 实部 |
|  | ***e.g.*** | There are real numbers in real part like—,  1.73,0, π，—9.‾6 |  |
| Root of an equation | ***n.*** | Any value of the variable that makes the equation true. | 方程的根 |
|  | ***e.g.*** | You can find the **roots of some quadratic equations** by factoring and applying the Zero Product Property. |  |
| Standard form | ***n.*** | *ax2+bx+c=0(a≠0)* | 标准式 |
|  | ***e.g.*** |  |  |
| Trinomial | ***n.*** | A polynomial with three items. | 三项式 |
|  | ***e.g.*** | **Trinomial** is an expression that is a sum or difference of three terms, as 3x + 2y + z or 3x3 + 2x2 + x. |  |
| Vertex form |  | *F(x)=a(x-h)2+k (a≠0)* | 顶点式 |
|  | ***e.g.*** |  |  |
| Vertex of a parabola | ***n.*** | If a parabola opens upward, it has a lowest point. If a parabola opens downward, it has a highest point. This lowest or highest point is the vertex of a parabola. | 顶点 |
|  |  | You can identity the **vertex of a parabola** by analyzing the function in vertex form. |  |
| Zero of a function | ***n.*** | A zero of a function is a value of the input *x* that makes the output *f(x)* equal zero. The zeros of a function are the *x*-intercepts. | 函数零点 |
|  | ***e.g.*** | To find the **zeros of the function** f(x)=x2+2x-3, you can set the function equal to zero. |  |

III. Extended Reading

Between the ages of 11 and 14, I had an English teacher whom, for everybody’s sake, I will call Mr B. During those crucial years, he dominated my intellectual development, and today he is the little man in my head. Mr B taught he how to read and how to write. He was the man who taught me how to do the things that have become myself. He distorted me into the person I am.

I suppose a school in suburban Edmonton, Alberta, in western Canada in the 1980s, is as good a place as any to encounter a presiding spirit. The location could not have been less remarkable. The school itself, set down on an enormous field overlooking a freeway, looked like an abandoned strip mall with only one door. It was a private school in the sense that my parents paid for me to attend but it should by no means be confused with British private schools. We wore uniforms, but mainly because it was cheaper for our parents. It possessed the opposite of glamour.

The school was a stark somewhat Calvinist throwback, with an educational philosophy that can be summed up as “it was better the way it was.” We did logarithms rather than “the new math”. We read from The Canadian Readers, collections of imperialist tidbits published in the 1920s, rather than the new nationalist, multicultural anthologies that emerged in the wake of the signing of the Canadian constitution in 1982

IV. Sentence Completion

axis of symmetry Binomial complete the square Discriminant

parabola quadratic functions axis of symmetry Trinomial

vertex of a parabola zeros of the function

1. The\_\_\_\_\_\_\_\_\_\_is a vertical line through the vertex of the function’s graph.
2. \_\_\_\_\_\_\_\_\_\_ is an algebraic expression that is a sum or difference of two terms, as 3x + 2y and x 2 - 4x
3. Can you \_\_\_\_\_\_\_\_\_\_ of x2+6x?
4. The \_\_\_\_\_\_\_\_\_\_ of the quadratic equation ax2+bx+c=0 (a≠0) is b2\_4ac.
5. When a \_\_\_\_\_\_\_\_\_\_opens upwards, the *y*-value of the vertex is the minimum value.
6. In Chapter 5, we will study the using transformation to graph **\_\_\_\_\_\_\_\_\_\_\_**.
7. The **\_\_\_\_\_\_\_\_\_\_\_\_** is a vertical line through the vertex of the function’s graph.
8. \_\_\_\_\_\_\_\_\_\_\_ is an expression that is a sum or difference of three terms, as 3x + 2y + z or 3x3 + 2x2 + x.
9. You can identity the \_\_\_\_\_\_\_\_\_\_\_\_ by analyzing the function in vertex form.
10. To find the \_\_\_\_\_\_\_\_\_\_ f(x)=x2+2x-3, you can set the function equal to zero.

Keys：

1. axis of symmetry
2. Binomial
3. complete the square
4. Discriminant
5. parabola
6. quadratic functions
7. axis of symmetry
8. Trinomial
9. vertex of a parabola
10. zeros of the function

**Unit 6 Polynomial Functions**

|  |  |  |  |
| --- | --- | --- | --- |
| Degree of a monomial | ***n.*** | The sum of the exponents of the variables. | 单项式  次数 |
|  | ***e.g.*** | Identifying the **degree of a monomial**. |  |
| Degree of a polynomial | ***n.*** | The degree of the term in the polynomial that has the highest degree. | 多项式  次数 |
|  | ***e.g.*** | In standard form, the degree of the first term indicates the **degree of the polynomial**, and leading coefficient is the coefficient of the first term. |  |
| End behavior | ***n.*** | A description of the values of the function as x approaches positive infinity(x→∞) or negative infinity (x→∞) | 走势 |
|  | ***e.g.*** | It is helpful when you are graphing a polynomial function to know about the **end behavio**r of the function. |  |
| Leading coefficient | ***n.*** | The coefficient of the first term. | 首项系数 |
|  | ***e.g.*** | The degree and **leading coefficient** of a polynomial function determine its end behavior. |  |
| Local maximum | ***n.*** | For a function *f(x)*, *f(a)* is a local maximum if there is an interval around a such that *f(x)<f(a)* for every x-value in the interval except a. | 局部最大值 |
| Local minimum | ***n.*** | For a function *f(x)*, *f(a)* is a local minimum if there is an interval around a such that *f(x)>f(a)* for every x-value in the interval except a. | 局部最小值 |
|  | ***e.g.*** | Graph g(x) = 2*x*2-12*x*+6 on a calculator, and estimate the **local maxima and minima**. |  |
| Monomial | ***n.*** | A number or a product of numbers and variables with whole number exponents. | 单项式 |
|  | ***e.g.*** | Each **monomial** in a polynomial is a term. |  |
| Multiplicity | ***n.*** | The multiplicity of root is the number of times that x-r is a factor of P(x). | 相重数;阶 |
|  | ***e.g.*** | Identity the roots of each equation. State the **multiplicity** of each root. |  |
| Polynomial | ***n.*** | A monomial or a sum or difference of monomials. | 多项式 |
|  | ***e.g.*** | They need to understand the relationship between the zeros of a **polynomial** and its binomial factors. |  |
| Polynomial function | ***n.*** | A function whose rule is a polynomial. | 多项式函数 |
|  | ***e.g.*** | In this course, you will study only **polynomial functions** with one variable. |  |
| Synthetic division | ***n.*** | A shorthand method of dividing a polynomial by a linear binomial by using only the coefficients. | 综合除法 |
|  | ***e.g.*** | Using **synthetic division** to divide by a linear binomial. |  |
| Turning point | ***n.*** | Where a graph changes from increasing to decreasing or from decreasing to increasing. | 转折点 |
|  | ***e.g.*** | A turning point corresponds to a **local maximum or minimum.** |  |

III. Extended Reading

Youngblood said he found few surprises in the new PSAT, usually taken by 10th-graders as preparation for the SAT. The emphasis will be on algebra, particularly on linear and quadratic equations.

“Students really need to understand what makes up a linear equation,” Youngblood said. “They should be able to explain in words what a slope of a certain value means in the context of the problem. Many problems in the new test deal with these concepts.”

He found many more surprises in the prep book for the new SAT released in June. “Several of the math concepts included are typically taught in pre-calc [or pre-calculus] as opposed to Algebra 2,” Youngblood said. “Students need to understand the remainder theorem of polynomials. They need to understand the relationship between the zeros of a polynomial and its binomial factors. They must be able to take a quadratic equation or an equation of a circle in whatever form and convert it, perhaps by completing the square, to a form so that they can analyze the graph.”

Concepts will be important, he said. One practice question he saw gave the formula for the height of an object under ballistic motion as a function of its initial vertical velocity and time, and asked when the object would return to the ground.

“Other SAT topics that are either new or more difficult include histograms, scatter-plot interpretation, unit analysis, inference from a sample, two-way tables, exponential functions or compound interest,” he said.

Useful practice problems and tests developed by the Khan Academy can be found on the College Board Web site. Long before the SAT and ACT existed, students feared tests. But examinations, even those as annoying as the SAT, are part of the learning process. You are more likely to master facts and concepts if you review them later. That is what testing is all about.

I don’t see any lasting harm from the fright that such tests, from my 10th-grade geometry final to the SAT, have inflicted on students wanting to go to college.

Some parts of the application process, such as demonstrating interests pursued outside the classroom, help give teenage life needed depth.

Selective colleges’ demands for [extra-curricular activities](http://www.washingtonpost.com/blogs/class-struggle/post/how-sports-can-help-high-schools/2011/09/17/gIQANs6EaK_blog.html)help students persuade parents that taking homework time to play basketball, write songs, bake bread or design video games adds to their attractiveness to colleges. Those after-school activities, as well as teacher recommendations and grade-point standing in the high school class, will have more weight in admissions to a selective college than the SAT.

They also will have at least as much benefit as understanding the relationship between zeros of a polynomial and its binomial factors.

IV. Sentence Completion

end behavior leading coefficient multiplicity polynomial functions

synthetic division polynomial  monomial degree of the polynomial

local maximum or minimum degree of a monomial.

1. It is helpful when you are graphing a polynomial function to know about the\_\_\_\_\_\_\_\_\_\_ of the function.
2. The degree and **\_\_\_\_\_\_\_\_\_\_**of a polynomial function determine its end behavior.
3. Identity the roots of each equation. State the **\_\_\_\_\_\_\_\_\_\_**of each root.
4. In this course, you will study only \_\_\_\_\_\_\_\_\_\_with one variable.
5. Using **\_\_\_\_\_\_\_\_\_\_**to divide by a linear binomial.
6. They need to understand the relationship between the zeros of a **\_\_\_\_\_\_\_\_\_\_**and its binomial factors.
7. Each \_\_\_\_\_\_\_\_\_\_in a polynomial is a term.
8. In standard form, the degree of the first term indicates the **\_\_\_\_\_\_\_\_\_\_**, and leading coefficient is the coefficient of the first term.
9. A turning point corresponds to a **\_\_\_\_\_\_\_\_\_\_.**
10. Identifying the **\_\_\_\_\_\_\_\_\_\_\_.**

Keys:

1. end behavior
2. leading coefficient
3. 3.multiplicity
4. 4.polynomial functions
5. synthetic division
6. polynomial
7. monomial
8. degree of the polynomial
9. local maximum or minimum
10. degree of a monomial

**Unit 7 Exponential and Logarithmic Functions**

|  |  |  |  |
| --- | --- | --- | --- |
| Asymptote | ***n.*** | A line that a graphed function approaches as the value of x gets very large or very small. | 渐近线 |
|  | ***e.g.*** | The **Asymptote**. This representation of one of the coolest behaviors a function can have is also good for germaphobes afraid of physical contact. |  |
| Base | ***n.*** | F(x)=bx, b>0,b≠1, b is the base. | 底数 |
|  | ***e.g.*** |  |  |
| Common logarithm | ***n.*** | A logarithm with base 10 | 常用对数 |
|  | ***e.g.*** |  |  |
| Exponential decay | ***n.*** | A function of the form f(x)=abx,with a>0 and 0<b<1, the function is called an exponential decay function. | 指数衰减 |
|  | ***e.g.*** | Tell whether the function shows **exponential decay** or exponential growth. |  |
| Exponential function | ***n.*** | F(x)=bx, b>0,b≠1 | 指数函数 |
|  | ***e.g.*** | When graphing **exponential functions** in an appropriate domain, you may need to adjust the range a few times to show the key points. |  |
| Exponent growth | ***n.*** | A function of the form f(x)=abx,with a>0 and b>1, the function is called an exponential growth function. | 指数增长 |
|  | ***e.g.*** | Tell whether the function shows exponential decay or **exponential growth**. |  |
| Exponential regression | ***n.*** | The method of using data to find an exponential models. | 指数回归 |
|  | ***e.g.*** | Use **exponential regression** to find a function that models this data. |  |
| Inverse function | ***n.*** | Functions that undo each other are inverse functions. | 反函数 |
|  | ***e.g.*** | Writing **inverse functions** by using inverse operations. |  |
| Inverse relation | ***n.*** | Inverse to relations and functions. | 反比关系 |
|  | ***e.g.*** | To graph the **inverse relation**, you can reflect each point across the line *y=x.* |  |
| Logarithm | ***n.*** | The exponent to which a specified base is raise to obtain a given value. | 对数 |
|  | ***e.g.*** |  |  |
| Logarithmic equation | ***n.*** | An equation with a logarithmic expression that contains a variable. | 对数方程 |
|  | ***e.g.*** | You can write an **exponential equation** as a logarithmic equation and vice versa. |  |
| Logarithmic function | ***n.*** | inverse of an exponential function.  *y= log2x.* | 对数函数 |
|  | ***e.g.*** |  |  |
| Logarithmic regression | ***n.*** | The method of using data to find an logarithmic models. | 对数回归 |
|  | ***e.g.*** | Use **logarithmic regression** to find a function that models this data. |  |
| Natural logarithm | ***n.*** | A logarithm with a base of *e* | 自然对数 |
|  | ***e.g.*** | All of the properties of logarithms also apply to natural logarithms. |  |
| Natural logarithmic  function | ***n.*** | f(x)=ex {x| x>0} | 自然对数函数 |
|  | ***e.g.*** |  |  |

III. Extended Reading

Between the ages of 11 and 14, I had an English teacher whom, for everybody’s sake, I will call Mr B. During those crucial years, he dominated my intellectual development, and today he is the little man in my head. Mr B taught he how to read and how to write. He was the man who taught me how to do the things that have become myself. He distorted me into the person I am.

I suppose a school in suburban Edmonton, Alberta, in western Canada in the 1980s, is as good a place as any to encounter a presiding spirit. The location could not have been less remarkable. The school itself, set down on an enormous field overlooking a freeway, looked like an abandoned strip mall with only one door. It was a private school in the sense that my parents paid for me to attend but it should by no means be confused with British private schools. We wore uniforms, but mainly because it was cheaper for our parents. It possessed the opposite of glamour.

The school was a stark somewhat Calvinist throwback, with an educational philosophy that can be summed up as “it was better the way it was.” We did logarithms rather than “the new math”. We read from The Canadian Readers, collections of imperialist tidbits published in the 1920s, rather than the new nationalist, multicultural anthologies that emerged in the wake of the signing of the Canadian constitution in 1982.

IV. Sentence Completion

exponential decay exponential functions exponential regression

inverse relation exponential growth inverse functions

logarithmic regression exponential equation asymptote

1. Tell whether the function shows \_\_\_\_\_\_\_\_\_\_\_\_\_ or exponential growth.
2. When graphing **\_\_\_\_\_\_\_\_\_\_\_** in an appropriate domain, you may need to adjust the range a few times to show the key points.
3. Use \_\_\_\_\_\_\_\_\_\_\_ to find a function that models this data.
4. Writing \_\_\_\_\_\_\_\_\_\_\_ by using inverse operations.
5. To graph the **\_\_\_\_\_\_\_\_\_\_\_**, you can reflect each point across the line *y=x.*
6. You can write an **\_\_\_\_\_\_\_\_\_\_\_\_** as a logarithmic equation and vice versa.
7. Use **\_\_\_\_\_\_\_\_\_\_\_** to find a function that models this data.
8. Tell whether the function shows exponential decay or\_\_\_\_\_\_\_\_\_\_\_ .

9.The\_\_\_\_\_\_\_\_\_\_\_. This representation of one of the coolest behaviors a function can have is also good for germaphobes afraid of physical contact.

Keys:

1.exponential decay

1. exponential functions
2. exponential regression
3. inverse functions
4. inverse relation
5. exponential equation
6. logarithmic regression
7. exponential growth
8. Asymptote

**Unit 8 Rational and Radical Functions**

|  |  |  |  |
| --- | --- | --- | --- |
| Combined variation | ***n.*** | A relationship that contains both direct and inverse variations. |  |
|  | ***e.g.*** |  |  |
| Complex fraction | ***n.*** | A complex fraction contains one or more fractions in its numerator, its denominator, or both. | 复合分数 |
|  | ***e.g.*** | Multiply the numerator and denominator of the **complex fraction**. |  |
| Constant of variation | ***n.*** | In the form y=kx, where k≠o.k is the constant of variation. | 变量常数 |
|  | ***e.g.*** | A direct variation equation is a linear equation in the form *y=mx+b*, where *b*=0 and the **constant of variation** *k* is the slope. |  |
| Continuous function | ***n.*** | A function whose graph has no gaps or breaks. | 连续函数 |
|  | ***e.g.*** | The functions you have studied before this, including linear, quadratic, polynomial, exponential, and logarithmic functions, are **continuous functions.** |  |
| Direct variation | ***n.*** | A relationship between two variables *x* and *y* that can be written in the form y=kx, where k≠o. |  |
|  | ***e.g.*** | A **direct variation** equation is a linear equation in the form *y=mx+b*, where *b*=0 and the constant of variation *k* is the slope. |  |
| Discontinuous function | ***n.*** | A function whose graph has one or more gaps or breaks. | 间断函数 |
|  | ***e.g.*** | The hyperbola graphed above and many other rational functions are **discontinuous function**. |  |
| Extraneous solution | ***n.*** | A solution of an equation derived from an original equation that is not a solution of the original equation. | 额外解 |
|  | ***e.g.*** | When you solve a rational equation, it is possible to get **extraneous solutions.** |  |
| Hole (in a graph) |  | An omitted point in a graph. | 空白点 |
|  | ***e.g.*** | Identify **holes** in the graph of f(x)=x2-4/x+2 |  |
| Index | ***n.*** | The *n*th root of a real number *a* can be written as the radical expression n√a, where *n* is the index of the radical. | 指数 |
|  | ***e.g.*** | When a radical sign shows no **index**, it represents a square root. |  |
| Inverse variation | ***n.*** | A relationship between two variables x and y that can be written in the form *y=k/x*, *y* varies inversely as *x*. | 反函数 |
|  | ***e.g.*** | In **inverse variation**, the product of two quantities is constant. |  |
| Joint variation | ***n.*** | A relationship among three variables that can be written in the form *y=kxz*, where k is the constant of variation.For the equation *y=kxz*, *y* varies jointly as *x* and *z.* | 关联变量 |
|  | ***e.g.*** | A=*kbh* is a **joint variation**. |  |
| Radical function | ***n.*** | A function whose rule can be written as a ratio of two polynomials. | 根函数 |
|  | ***e.g.*** | Describe the transformation and graph each **radical function**. |  |
| Radical equation | ***n.*** | A radical equation contains a variable within radical. | 根方程 |
|  | ***e.g.*** | **Radical equations** can be solved by raising both sides to a power. |  |
| Rational expression | ***n.*** | A quotient of two polynomials. |  |
|  | ***e.g.*** | Because **rational expression** are ratios of polynomials, you can simplify them the same way as you simplify fractions. |  |
| Radical inequality | ***n.*** | An inequality that contains one or rational expressions. | 根不等式 |
|  | ***e.g.*** | One way to solve **rational inequality** is by using graphs and tables. |  |
| Rational equation | ***n.*** | An equation that contains one or more rational expressions. | 有理方程 |
|  |  | To solve a **rational equation**, start by multiplying each term of the equation by the least common denominator(LCD). |  |
| Rational exponent | ***n.*** | An exponent is an exponent that can be expressed as m/n, where m and n are integers and n≠0. Rational expressions can be written by using rational exponents. | 有理指数 |
|  | ***e.g.*** | Rational expressions can be written by using **rational exponent**. |  |
| Rational function | ***n.*** | A function whose rule is a radical expression. | 有理函数 |
|  | ***e.g.*** | The parent **rational function** is f(x)=1/x. |  |
| Rational inequality | ***n.*** | An inequality that contains one or more rational expressions. | 有理不等式 |
|  | ***e.g.*** | You can solve **radical inequalities** by graphing or by using algebra. |  |
| Square-root function | ***n.*** | A radical function involving √x.The square-root parent function is f(x)=√x. | 方根函数 |
|  | ***e.g.*** | This lesson will focus on transformation of **square-root function.** |  |

III. Extended Reading

**HIV Patient Zero cleared by science**

One of the most demonised patients in history - Gaetan Dugas - has been convincingly cleared of claims he spread HIV to the US, say scientists.

Mr Dugas, a homosexual flight attendant, gained legendary status in the history of HIV/Aids when he became known as Patient Zero.

But a study, [in the journal Nature](http://nature.com/articles/doi:10.1038/nature19827), showed he was just one of thousands of infected people in the 1970s.

It also showed New York was a crucial hub for the spread of the virus.

Aids only started to be recognised in 1981 when unusual symptoms started appearing in gay men.

But researchers were able to look further back in time by analysing stored blood samples, some of them containing HIV, from hepatitis trials in the 1970s.

The team at the University of Arizona developed a new method to reconstruct the genetic code of the virus in those patients.

And after screening 2,000 samples from New York and San Francisco, the researchers were able to get eight complete HIV genetic codes.

That gave scientists the information they needed to build HIV's family tree and trace when it arrived in the US.

Dr Michael Worobey, one of the researchers, said: "The samples contain so much genetic diversity that they could not have originated in the late 1970s.

"We can place the most precise dates on the origins of the US epidemic at about 1970 or 1971."

The researchers also analysed the genetic code of human immunodeficiency virus taken from Mr Dugas's blood.

Like a failed paternity test, the results showed that the virus in his blood was not the "father" of the US epidemic.

Dr Richard McKay, a science historian at the University of Cambridge, said: "Gaetan Dugas is one of the most demonised patients in history and one of a long line of individuals and groups vilified in the belief that they somehow fuelled epidemics with malicious intent."

The Air Canada employee was labelled Patient O (the letter, not the number) by the US Centres for Disease Control because he was a case "Out-of-California".

Over time the O became a 0 and the term Patient Zero was born. It is still used to this day to describe the index case of an outbreak [as with Ebola in west Africa.](http://edition.cnn.com/2014/10/28/health/ebola-patient-zero/)

Mr Dugas died in 1984, but was identified as Patient Zero in the book And the Band Played On.

IV. Sentence Completion

complex fraction inverse variation Radical equations

constant of variation discontinuous function radical function

rational inequality rational equation rational function index

1. Multiply the numerator and denominator of the \_\_\_\_\_\_\_\_\_\_\_\_.
2. A direct variation equation is a linear equation in the form *y=mx+b*, where *b*=0 and the \_\_\_\_\_\_\_\_\_\_ *k* is the slope.
3. The hyperbola graphed above and many other rational functions are \_\_\_\_\_\_\_\_\_\_\_.When you solve a rational equation, it is possible to get extraneous solutions**.**
4. When a radical sign shows no\_\_\_\_\_\_\_\_\_\_, it represents a square root.
5. In **\_\_\_\_\_\_\_\_\_\_**, the product of two quantities is constant.
6. Describe the transformation and graph each\_\_\_\_\_\_\_\_\_\_ .
7. \_\_\_\_\_\_\_\_\_\_can be solved by raising both sides to a power.
8. One way to solve\_\_\_\_\_\_\_\_\_\_ is by using graphs and tables.
9. To solve a \_\_\_\_\_\_\_\_\_\_ start by multiplying each term of the equation by the least common denominator(LCD).
10. The parent **\_\_\_\_\_\_\_\_\_\_\_** is f(x)=1/x.

Keys：

1. complex fraction
2. constant of variation
3. discontinuous function.
4. index
5. inverse variation
6. radical function
7. Radical equations
8. rational inequality
9. rational equation
10. rational function

**Unit 9 Properties and Attributes of Functions**

|  |  |  |  |
| --- | --- | --- | --- |
| Composition of functions | ***n.*** | Another function operation uses the output from one function as the input for a second function. | 函数的组合 |
|  | ***e.g.*** | The domain of **composition of functions** f(g(x))is all values of x in the domain of g such that g(x) is in the domain of f. |  |
| One-to-one function | ***n.*** | Each *y*-value is paired with exactly one *x*-value. | 一对一函数 |
|  | ***e.g.*** | In **one-to-one function**, each *y*-value is paired with exactly one *x*-value. |  |
| Piecewise function | ***n.*** | A function that is a combination of one or more functions. | 分段函数 |
|  |  | The rule for a **piecewise function** is different for different parts or pieces, of the domain. |  |
| Step function | ***n.*** | A piece function that is constant for each interval of its domain, such as the ticket price function, is called a step function. | 阶梯函数 |
|  |  | The solution for optimization based on other cases of **step function** is also discussed. |  |

IV. Sentence Completion

piecewise function composition of functions step function one-to-one function

1.The domain of \_\_\_\_\_\_\_\_\_\_ f(g(x))is all values of x in the domain of g such that g(x) is in the domain of f.

2.In \_\_\_\_\_\_\_\_\_\_, each *y*-value is paired with exactly one *x*-value.

3.The rule for a \_\_\_\_\_\_\_\_\_\_ is different for different parts or pieces, of the domain.

4.The solution for optimization based on other cases of **\_\_\_\_\_\_\_\_\_\_**is also discussed.

**Keys:**

1. composition of functions
2. one-to-one function
3. piecewise function
4. step function

**Unit 10 Conic Sections**

|  |  |  |  |
| --- | --- | --- | --- |
| Branch of a hyperbola | ***n.*** | A hyperbola contains two symmetrical parts. | 双曲线的分支 |
|  | ***e.g.*** | The conjugate axis of the symmetry separates the two **branches of the hyperbola**. |  |
| Circle | ***n.*** | A set of points in a plane that are a fixed distance,called the radius, from a fixed point, called the center. | 圆 |
|  | ***e.g.*** | He described a **circle**on the blackboard with a piece of chalk. |  |
| Conic section | ***n.*** | Conic sections are formed by the intersection of a double right cone and a plane. | 二次曲线 |
|  | ***e.g.*** | There are four types of **conic sections**: circle, ellipse, parabola and hyperbola. |  |
| Conjugate axis | ***n.*** | The conjugate axis of the symmetry separates the two branches of the hyperbola. | 坐标轴 |
|  | ***e.g.*** |  |  |
| Co-vertices of an ellipse | ***n.*** | The endpoints of the minor axis. | 椭圆的共顶点 |
|  | ***e.g.*** |  |  |
| Co-vertices of a hyperbola | ***n.*** | The endpoints of the conjugate axis. | 抛物线的共顶点 |
|  | ***e.g.*** |  |  |
| Directrix | ***n.*** | A parabola is the set of all points *P(x,y)* in a place that are an equal distance from both a fixed point, and fixed line, the directrix*.* | 准线 |
|  | ***e.g.*** | Select the **directrix** of the new conic. |  |
| Ellipse | ***n.*** | The set of points *P(x,y)* in a plane such that the sum of the distances from any point | 椭圆 |
|  | ***e.g.*** | Select the **ellipse** tool from the toolbox. |  |
| Foci of a hyperbola | ***n.*** | A set of points *P(x,y)* in a plane such that the difference of the distances from *P* to fixed points *F1*and *F2*., the foci, is constant. | 椭圆的焦点 |
|  | ***e.g.*** |  |  |
| Hyperbola | ***n.*** | A set of points *P(x,y)* in a plane such that the difference of the distances from P to fixed points *F1*and *F2.*, the foci, is constant. | 双曲线 |
|  | ***e.g.*** | we can still find points on the **hyperbola** and so on. |  |
| Major axis | ***n.*** | The longer axis of an ellipse. | 主对角线 |
|  | ***e.g.*** | The **major axis** of the ellipse passes through both foci. |  |
| Minor axis | ***n.*** | The longer axis of an ellipse and passes through both foci. | 次对角线 |
|  | ***e.g.*** | The major axis and **minor axis** are perpendicular and intersect at the center of the ellipse. |  |
| Nonlinear system of equations | ***n.*** | A system in which at least one of the equations is not linear. | 非线性方程组 |
|  | ***e.g.*** | Solving linear and **nonlinear system of equations** was presented in this paper. |  |
| Tangent | ***n.*** | A line in the same plane as the circle that intersects the circle at exactly one point. | 切线 |
|  | ***e.g.*** | Write the equation of the line that is **tangent** to the circle. |  |
| Transverse axis | ***n.*** | The transverse axis of symmetry contains the vertices and, if it were extended, the foci of the hyperbola. | 横轴 |
|  | ***e.g.*** | The **transverse axis** is not always longer than the conjugate axis. |  |
| Vertices of an ellipse | ***n.*** | The endpoints of the major axis. | 椭圆的顶点 |
|  | ***e.g.*** | How many **vertices** does an ellipse have? |  |
| Vertices of a hyperbola | ***n.*** | The endpoints of the transverse axis. | 双曲线的顶点 |

III. Extended Reading

**'Pre-reg' cars now widespread in UK**

The cars are then sold second-hand to the public at bargain prices.

Some experts say high levels of pre-registrations indicate new car sales are not as robust as they appear and some dealers are feeling the pressure.

A survey for the BBC has found around half of buyers are confused by pre-reg.

Motor suppliers trade body, the Society of Motor Manufacturers & Traders (SMMT), admits demand for brand new cars is beginning to "stabilise".

Secret

Pre-registration is legal but unofficial, so it is often referred to in the motor trade as the "secret of the car industry", a You and Yours investigation has found.

The cars are surplus stock, sold cheaply by suppliers to dealers, who then register them under their own business name.

After being kept off the road for 90 days the cars can then be sold to consumers, typically at discounts of 20% and more.

Trade bodies and government agencies do not collect an official record of the number of cars pre-registered by dealers, which are often classified in SMMT figures as 'fleet.'

The SMMT's fleet category is up 5.4% so far in 2016 compared to private new car registrations, which have stalled.

The SMMT collects figures for pre-registrations made by manufacturers, in accordance with the Supply of New Cars Order 2000, which regulates the industry.

However this is only around 2,000 cars per year.

IV. Sentence Completion

minor axis circle hyperbola branches of the hyperbola conic sections ellipse tangent

transverse axis nonlinear system of equations directrix

1. He described a \_\_\_\_\_\_\_\_\_\_on the blackboard with a piece of chalk.
2. There are four types of \_\_\_\_\_\_\_\_\_\_\_: circle, ellipse, parabola and hyperbola.
3. Select the \_\_\_\_\_\_\_\_\_\_\_ tool from the toolbox.
4. we can still find points on the  \_\_\_\_\_\_\_\_\_\_and so on.
5. The major axis and \_\_\_\_\_\_\_\_\_\_\_ are perpendicular and intersect at the center of the ellipse.
6. Write the equation of the line that is \_\_\_\_\_\_\_\_\_\_ to the circle.
7. The **\_\_\_\_\_\_\_\_\_\_** is not always longer than the conjugate axis.
8. Select the \_\_\_\_\_\_\_\_\_\_ of the new conic.
9. The conjugate axis of the symmetry separates the two \_\_\_\_\_\_\_\_\_\_\_.
10. Solving linear and \_\_\_\_\_\_\_\_\_\_ was presented in this paper.

Keys：

1. circle
2. conic sections
3. Ellipse
4. Hyperbola
5. minor axis
6. Tangent
7. transverse axis
8. directrix
9. branches of the hyperbola
10. nonlinear system of equations

**Unit 11 Probability and Statistics**

|  |  |  |  |
| --- | --- | --- | --- |
| Binominal experiment | ***n.*** | Consisting of *n* independent trials whose outcomes are either successes or failures. | 二项试验 |
|  | ***e.g.*** | If a **binomial experiment** has n trials in which p is the probability of success and q is the probability of failure in any given trial, then the binomial probability that there will be exactly success is:P(r)=nCr pr qn-1 |  |
| Binominal probability | ***n.*** | P(r)=nCr pr qn-1 | 二项式  概率 |
|  | ***e.g.*** |  |  |
| Combination | ***n.*** | A grouping of items in which order does not matter. | 组合 |
|  | ***e.g.*** | Each of the four cheeses was sampled before and after sips of each of the four wines, which meant 16 different wine-cheese **combinations**. |  |
| Complement | ***n.*** | The complement of an event E is the set of all outcomes in the sample space that are not in E. | 补充 |
|  | ***e.g.*** | The probability of the **complement** of event E is P(not E) = 1-P(E). |  |
| Compound event | ***n.*** | An event made up of two or more simple events. | 复合事件 |
|  | ***e.g.*** |  |  |
| Dependent events | ***n.*** | Events are dependent events if the occurrence of one event affects the probability of the other. | 相关事件 |
|  | ***e.g.*** | If A and B are **dependent events**, thenP(A and B) = P(A) ∙ P(B|A), where P(B|A) is the probability of B, on that A has occurred. |  |
| Equally likely outcomes | ***n.*** | Having the same chance of occurring. | 等可能结果 |
|  | ***e.g.*** |  |  |
| Event | ***n.*** | An outcome or set of outcomes. | 事件 |
|  | ***e.g.*** | The tragic **event** is sharply etched into my memory. |  |
| Expected value | ***n.*** | The weighted average of the possible outcomes.The weight for each outcome is its probability. | 期望值 |
|  | ***e.g.*** | Since the **expected value** at the selected path in the filter condition is only decided during execution, it needs to be defined as a variable. |  |
| Experimental probability | ***n.*** | The ratio of the number of times that the event occurs, the *frequency*, to the number of trials. | 实验概率 |
|  | ***e.g.*** | **Experimental probability** is often used to estimate theoretical probability and to make predictions. |  |
| Factorial | ***n.*** | The product of the natural numbers less than or equal to the number. 0!is defined as 1. | 阶乘 |
|  | ***e.g.*** | Like particles, you have to divide by N **factorial**. |  |
| Favorable outcomes | ***n.*** | Outcomes in a specified event. | 有利结果 |
|  | ***e.g.*** | Until now, the **favorable outcomes** have outweighed the bad. |  |
| Fundamental Counting principle | ***n.*** | If there are *n* items and *m1* wayschoose a first item*,*m2 ways to choose a second item after the first item has been chosen, and so on, then there are *m1∙m2∙...∙mn*ways to choose *n* items. | 计数原理 |
|  | ***e.g.*** | One way to find possible permutations is to use the **Fundamental Counting principle**. |  |
| Geometric probability | ***n.*** | A form of theoretical probability determined by a ratio of lengths, areas, or volumes. | 几何概率 |
|  | ***e.g.*** | In the section, we state the most useful methods of generating random variables with given p. d. f. and describe the acceptance and reject method by using **geometric probability**. |  |
| Inclusive events | ***n.*** | Events that have one or more outcomes in common. | 包含事件 |
|  | ***e.g.*** | Mutually **inclusive events** are the ones in which there are some common outcomes in between the given events. |  |
| Independent events | ***n.*** | Events are independent events if the occurrence of one event does not affect the probability of the other. | 独立事件 |
|  | ***e.g.*** | The theory of insurance is that ideally an insurance company wants to insure **independent events**. |  |
| Mutually exclusive events | ***n.*** | Events that cannot both occur in the same trial of an experiment. | 互斥事件 |
|  | ***e.g.*** | **Mutually exclusive events** are the ones when they cannot happen at same time |  |
| Outcome | ***n.*** | Each possible result of a probability experiment or situation. | 结果 |
|  | ***e.g.*** | The settling way will hang on the **outcome** of our discussion. |  |
| Outlier | ***n.*** | An extreme value that is much less than or much greater than the other data values. | 离群值  离群值 |
|  | ***e.g.*** | All clusters with an outlier degree above this threshold are marked as outlier clusters and all their members as **outliers.** |  |
| Permutation | ***n.*** | A selection of a group of object in which order is important. | 排列 |
|  | ***e.g.*** | The **permutation** is even if the number of in versions it contains is even. |  |
| Probability | ***n.*** | The measure of how likely an event is to occur. | 可能性 |
|  | ***e.g.*** | You can use the slider to vary this **probability.** |  |
| Probability distribution | ***n.*** | The function that pairs each outcome with its probability. | 概率分布 |
|  | ***e.g.*** | Or we could just look at the radial **probability distribution** itself and see how many nodes there are. |  |
| Sample space | ***n.*** | The set of all possible outcomes. | 样本空间 |
|  | ***e.g.*** | The sum of all probabilities in the **sample space** is 1. |  |
| Simple event | ***n.*** | An event that describes a single outcome. | 简单事件 |
|  | ***e.g.*** | A trading partner may only execute **simple event** queries. |  |
| Standard deviation | ***n.*** | Denoted by σ2, is the square root of the variance and is one of the most common and useful measures of variation. | 标准差 |
|  | ***e.g.*** | And you can calculate the standard deviation that way. |  |
| Theoretical probability | ***n.*** | The ratio of he number of favorable outcomes. | 理论概率 |
|  | ***e.g.*** | The simulations show that the efficiency of the algorithm is close to the **theoretical probability**. |  |
| Trial | ***n.*** | Each repetition of an experiment. | 试验 |
|  | ***e.g.*** | This method of manufacture evolved out of a long process of **trial**. |  |
| Variance | ***n.*** | Denoted by σ2, is the average of the squared differences from the mean. | 方差 |
|  | ***e.g.*** | For all of the above discussion to be practical, the team must find a way to compute the **variance** of the project parameters. |  |

III. Extended Reading

# **Humans sense 10 basic types of smell, scientists say**

Prof Jason Castro, of Bates College, and Prof Chakra Chennubhotla, of the University of Pittsburgh, used a computerized technique to whittle down smells to their most basic essence.

They told the PLoS One journal they had then tested 144 of these and found they could be grouped into 10 categories.

The findings are contentious - some say there are thousands of permutations.

The 10 proposed smells

Fragrant

Woody/resinous

Fruity (non-citrus)

Chemical

Minty/peppermint

Sweet

Popcorn

Lemon

Pungent

Decayed

Prof Castro said: "You have these 10 basic categories because they reflect important attributes about the world - danger, food and so on.

"If you know these basic categories, then you can start to think about building smells.

"We have not solved the problem of predicting a smell based on its chemical structure, but that's something we hope to do."

He said it would be important to start testing the theory on more complex aromas, such as perfumes and everyday smells.

In reality, any natural scent was likely to be a complex mix - a blend of the 10 different categories, he said.

Prof Tim Jacob, a UK expert in smell science at Cardiff University, said: "In the 1950s a scientist called John Amoore proposed a theory which involved seven smell categories based upon molecular shape and size.

"He eventually withdrew it, to the poorly suppressed glee of his rival R W Moncrieff, who said there was 'never much solid evidence to support it, and there were difficulties all along the line, but it did stimulate a lot of useful thought'.

"I'm sure that Castro et al's paper will 'stimulate a lot of useful thought'."

IV. Sentence Completion

event trial permutation independent events expected value outcome probability distribution

factorial favorable outcomes inclusive events

1. The tragic \_\_\_\_\_\_\_\_\_\_ is sharply etched into my memory.
2. Since the\_\_\_\_\_\_\_\_\_\_at the selected path in the filter condition is only decided during execution, it needs to be defined as a variable.
3. Like particles, you have to divide by N \_\_\_\_\_\_\_\_\_\_
4. Until now, the \_\_\_\_\_\_\_\_\_\_ have outweighed the bad.
5. Mutually \_\_\_\_\_\_\_\_\_\_ are the ones in which there are some common outcomes in between the given events.
6. The theory of insurance is that ideally an insurance company wants to insure \_\_\_\_\_\_\_\_\_\_.
7. The settling way will hang on the \_\_\_\_\_\_\_\_\_\_ of our discussion.
8. The **\_\_\_\_\_\_\_\_\_\_\_** is even if the number of in versions it contains is even.
9. Or we could just look at the radial \_\_\_\_\_\_\_\_\_\_\_ itself and see how many nodes there are.
10. This method of manufacture evolved out of a long process of **\_\_\_\_\_\_\_\_\_\_\_**.

Keys:

1. event
2. expected value
3. Factorial
4. favorable outcomes
5. inclusive events
6. independent events
7. Outcome
8. Permutation
9. probability distribution
10. Trial

**Unit 12 Sequences and Series**

|  |  |  |  |
| --- | --- | --- | --- |
| Arithmetic sequence | ***n.*** | A group of numbers in which any two consecutive or successive terms have a common difference. | 等差数列 |
|  | ***e.g.*** | We can think of an **arithmetic sequence** as a linear function with sequential natural number as the domain. |  |
| Arithmetic series | ***n.*** | An arithmetic series is the sum of an arithmetic sequence. | 等差级数 |
|  | ***e.g.*** | You can derive a general formula for the sum of an **arithmetic series** by writing the series in forward and reverse order and adding the results. |  |
| Converge | ***n.*** | When |r|<1 and the partial sum approached a fixed number, the series is said to converge. | 收敛 |
|  | ***e.g.*** | These lines **converge** at a certain point. |  |
| Diverge | ***n.*** | When |r|≧1 and the partial sum does not approach a fixed number, the series is said to diverge. | 发散 |
|  | ***e.g.*** | The path **diverges** just after the house. |  |
| Explicit formula | ***n.*** | An explicit formula defines the *n*th term of a sequence as a function of *n*. | 显式（通项）公式 |
|  | ***e.g.*** | An **explicit formula** for the basic reproductive number is derived by analyzing the local stability of the trivial equilibrium. |  |
| Geometric means | ***n.*** | The terms between any two nonconsecutive terms of a geometric sequence. | 等比中项 |
|  | ***e.g.*** | A **geometric mean** formula is first derived for the equivalent seismic velocity of EDA media. |  |
| Geometric sequence | ***n.*** | In a geometric sequence, the ratio of successive terms is a constant called the common ratio r(r≠1). | 等比数列 |
|  | ***e.g.*** | The results indicates the grow rates sequence of the simulation of NFGM model is a **geometric sequence**. |  |
| Geometric series | ***n.*** | The indicated sum of the terms of a geometric sequence. | 等比级数 |
|  | ***e.g.*** | Evaluate the partition function as and check that the result agrees with the standard **geometric series** sum. |  |
| Infinite geometric series | ***n.*** | An infinite geometric series has infinitely many terms. | 无限等比级数 |
|  | ***e.g.*** |  |  |
| Infinite sequence | ***n.*** | Continuing without end, such as the natural numbers. | 无穷数列 |
|  | ***e.g.*** | A construct that is sometimes useful to have, for perfectly practical reasons, is an **infinite sequence** of numbers. |  |
| Iteration | ***n.*** | Each step in this repeated process. | 迭代  循环 |
|  | ***e.g.*** | As you can see, moving from one iteration to the next is very simple. |  |
| Limit | ***n.*** | The number that the partial sums approach, as *n* increase, is called a limit. | 极限 |
|  | ***e.g.*** |  |  |
| Mathematical induction | ***n.*** | The formulas that you used for such sums can be proved by using a type of mathematical proof. | 数学  归纳法 |
|  | ***e.g.*** | Methods The analytical and **mathematical induction** methods are used. |  |
| Partial sum | ***n.*** | The sum of a specified number of terms of a sequence. | 部分和 |
|  | ***e.g.*** |  |  |
| Recursive formula | ***n.*** | A rule in which one or more previous terms are used to generate the next term. | 递推公式 |
|  | ***e.g.*** | Given a digital input to the **recursive formula**, a digital response can be measured. |  |
| Sequence | ***n.*** | An ordered set of numbers. | 数列 |
|  | ***e.g.*** | If I want to create a set or a **sequence** representing these things, I simply insert into that list. |  |
| Series | ***n.*** | A series is the indicated sum of the terms of a sequence. | 级数 |
|  | ***e.g.*** | You can derive formulas for the sums of some common **series**. |  |
| Summation notation | ***n.*** | Denoting the sum of a sequence defined by a rule. | 求和公式 |
|  | ***e.g.*** | Write each series in **summation notation**. |  |
| Term of a sequence | ***n.*** | Each number in the sequence is a term of the sequence. | 项 |
|  | ***e.g.*** | Find t**erms of a sequence** by using an explicit formula. |  |

III. Extended Reading

**Man is shot dead by security guard after trying to stab customers in store, LAPD says**

A security guard at a Sylmar store shot and killed a man who police say threatened customers with a shard of glass.

The shooting was reported about 3:40 p.m. in the 13700 block of Foothill Boulevard, according to Officer Tony Im of the [Los Angeles Police Department](http://www.latimes.com/topic/crime-law-justice/law-enforcement/los-angeles-police-department-ORGOV000939-topic.html" \o "Los Angeles Police Department).

The man, 45, came into a store in the San Fernando Valley neighborhood and attempted to stab customers, Im said.

The security guard opened fire and shot the man, Im said. The man was pronounced dead at the scene. His name was not released pending notification of his family.

The sequence of events leading up to the shooting was unclear.

Aerial footage from KTLA-TV showed paramedics and fire crews had responded to the street in front of a large shopping center. A body covered by a white tarp lay in the middle of Foothill Boulevard.

No customers were injured during the incident, which is under investigation by LAPD officers.

The security guard’s identity also was not released.

This story will be updated as more information becomes available.

IV. Sentence Completion

geometric mean arithmetic sequence infinite sequence

mathematical induction diverges terms of a sequence

recursive formula Converge Series arithmetic series

1. We can think of an \_\_\_\_\_\_\_\_\_\_\_ as a linear function with sequential natural number as the domain.
2. A \_\_\_\_\_\_\_\_\_\_ formula is first derived for the equivalent seismic velocity of EDA media
3. The path \_\_\_\_\_\_\_\_\_\_\_ just after the house.
4. These lines \_\_\_\_\_\_\_\_\_\_\_ at a certain point.
5. A construct that is sometimes useful to have, for perfectly practical reasons, is an **\_\_\_\_\_\_\_\_\_\_\_** of numbers.
6. Methods The analytical and **\_\_\_\_\_\_\_\_\_\_\_\_** methods are used.
7. Given a digital input to the, a digital response can be measured.
8. You can derive formulas for the sums of some common \_\_\_\_\_\_\_\_\_\_.
9. Find by using an explicit formula.
10. You can derive a general formula for the sum of an\_\_\_\_\_\_\_\_\_\_\_\_\_ by writing the series in forward and reverse order and adding the results.

Keys:

1. arithmetic sequence
2. geometric mean
3. diverges
4. Converge
5. infinite sequence
6. mathematical induction
7. recursive formula
8. Series
9. terms of a sequence
10. arithmetic series

**Unit 13 Trigonometric Functions**

|  |  |  |  |
| --- | --- | --- | --- |
| Angle of rotation | ***n.*** | Rotating the terminal side and keeping the initial side in place. | 旋转角 |
|  | ***e.g.*** | If the terminal side is rotated clockwise, the **angle of rotation** is negative. |  |
| Cosecant | ***n.*** | Ratio of the hypotenuse to the opposite side of a right-angled triangle. | 余割 |
|  | ***e.g.*** |  |  |
| Cosine | ***n.*** | The cosine (cos) of angle θ is the ratio of the length of the adjacent leg to the length of the hypotenuse. | 余弦 |
|  | ***e.g.*** | Above, we plotted both the sine and **cosine** on the same graph. |  |
| Cotangent | ***n.*** | Ratio of the adjacent to the opposite side of a right-angled triangle. | 余切 |
|  | ***e.g.*** |  |  |
| Coterminal angles | ***n.*** | Angles in standard position with the same terminal side. | 共边角 |
|  | ***e.g.*** | One way to find the **coterminal angles** is coterminal with an angle θ ist to add or subtract integer multiples of 360◦. |  |
| Initial side | ***n.*** | The **initial side** of the angle is the ray on the x-axis | 始边 |
|  |  |  |  |
| Inverse sine function | ***n.*** | Sin-1a=θ, where Sin θ=a. | 反正弦  函数 |
| Inverse cosine function | ***n.*** | Cos-1a=θ, where Cos θ=a. | 反余弦  函数 |
| Inverse tangent function | ***n.*** | Tan-1a=θ, where Tan θ=a. | 反正切  函数 |
| Radian | ***n.*** | A radian is a unit of angle measure based on arc length. | 弧度 |
|  | ***e.g.*** | A **radian** is the angle subtended by an arc of a circle whose length is just equal to the radius. |  |
| Reference angle | ***n.*** | The reference angle is the positive acute angle formed by the terminal side of θ and the x-axis. | 基准角 |
|  | ***e.g.*** | You can learn how to use **reference angle**s to find trigonometric values of angles measuring greater than 90◦ or less than 0◦. |  |
| Secant | ***n.*** | The secant (sec) of angle θ is the reciprocal of the cosine function. | 正切 |
|  | ***e.g.*** | Most of us can’t tell our **secant** from our cotangent. |  |
| Sine |  | The sine (sin) of angle θ is the ratio of the length of the opposite leg to the length of the hypotenuse. | 正弦 |
|  | ***e.g.*** | Let us plot both the **sine** and the cosine curves. |  |
| Standard position | ***n.*** | An angle is in standard position when its vertex is at the origin and one ray is on the position *x*-axis. | 标准位置 |
|  | ***e.g.*** | Position 2 is the**standard position.** |  |
| Tangent | ***n.*** | The tangent (tan) of angle θ is the ratio of the length of the opposite leg to the length of the adjacent leg. | 正切 |
|  | ***e.g.*** | We are replacing the graph by its**tangent**   plane. |  |
| Terminal side | ***n.*** | The initial side of the angle is the ray on the x-axis. The other ray is called the terminal side of the angle. | 终边 |
|  | ***e.g.*** | If the **terminal side** is rotated counterclockwise,the angle of rotation is positive. |  |
| Trigonometric function | ***n.*** | A function whose rule is given by a trigonometric ratio. | 三角函数 |
|  | ***e.g.*** | Teaching goal: Makes the student to further understand the **trigonometric function** the definition, and using... |  |
| Unit circle | ***n.*** | A circle with a radius of 1 unit. | 单位圆 |
|  | ***e.g.*** | On the **unit circle**, F is tangent to the curve. |  |

III. Extended Reading

**Motion sensors to help students visualize math**

[TRAVERSE CITY](http://www.washingtontimes.com/topics/traverse-city/), Mich. (AP) - [Jodi Murphy](http://www.washingtontimes.com/topics/jodi-murphy/)’s math students at Traverse City High School will have new technology available to help them learn in the fall.

[Murphy](http://www.washingtontimes.com/topics/jodi-murphy/) received a grant from the Association of American Educators Foundation to buy four Texas Instruments motion sensors to use in her math classes. The motion sensors, which cost about $100 each, measure the distance from the sensor to an object and then plot the distance as a data point on a graphing calculator.

[Murphy](http://www.washingtontimes.com/topics/jodi-murphy/) teaches math to freshmen through seniors. She told the Traverse City Record-Eagle (http://bit.ly/1jEXh9H ) that the sensors will help students better understand graphing concepts, particularly sine and cosine waves in her trigonometry unit. Sine and cosine waves are the most common trigonometric functions.

“That’s a really important concept for students,” [Murphy](http://www.washingtontimes.com/topics/jodi-murphy/) said. “A lot of times they just look at the graph and they don’t know where that data is coming from, so it’s nice to add a visual.”

[Murphy](http://www.washingtontimes.com/topics/jodi-murphy/) plans to use the sensors next year to keep her classes fun and engaging. She has one activity already planned that involves hanging a basketball from the ceiling.

“You swing the basketball, and then the basketball will get closer to that motion sensor and farther away, and it will make a sine wave or a cosine wave. Then students will create a graph that will match that wave,” [Murphy](http://www.washingtontimes.com/topics/jodi-murphy/) said. “It’s a nice team project.”

Another reason [Murphy](http://www.washingtontimes.com/topics/jodi-murphy/) is happy to have new technology available to her students is because it aligns with Common Core standards, she said.

“Part of the new Common Core standards are that students need to be able to use the technology to help them problem solve in math,” she said.

[Murphy](http://www.washingtontimes.com/topics/jodi-murphy/) will begin incorporating the motion sensors into her curriculum in the fall.

IV. Sentence Completion

coterminal angles terminal side secant angle of rotation

cosine trigonometric function reference angles

Sine radian unit circle

1. If the terminal side is rotated clockwise, the \_\_\_\_\_\_\_\_\_\_ is negative.
2. Above, we plotted both the sine and **\_\_\_\_\_\_\_\_\_\_**on the same graph.
3. One way to find the **\_\_\_\_\_\_\_\_\_\_** is coterminal with an angle θ ist to add or subtract integer multiples of 360◦
4. A **\_\_\_\_\_\_\_\_\_\_**is the angle subtended by an arc of a circle whose length is just equal to the radius.
5. You can learn how to use **\_\_\_\_\_\_\_\_\_\_** to find trigonometric values of angles measuring greater than 90◦ or less than 0◦.
6. Most of us can’t tell our **\_\_\_\_\_\_\_\_\_\_**from our cotangent.
7. If the **\_\_\_\_\_\_\_\_\_\_** is rotated counterclockwise,the angle of rotation is positive.
8. Teaching goal: Makes the student to further understand the **\_\_\_\_\_\_\_\_\_\_\_**the definition, and using...
9. On the **\_\_\_\_\_\_\_\_\_\_**, F is tangent to the curve.
10. Let us plot both the **\_\_\_\_\_\_\_\_\_\_** and the cosine curves.

Keys：

1. angle of rotation
2. cosine
3. coterminal angles
4. radian
5. reference angles
6. Secant
7. terminal side
8. trigonometric function
9. unit circle
10. sine

**Unit 14 Trigonometric Graphs and Identities**

|  |  |  |  |
| --- | --- | --- | --- |
| Amplitude | ***n.*** | The amplitude of sine and cosine functions is half of the difference between the maximum and minimum values of the function. | 振幅 |
|  | ***e.g.*** | The **amplitude** is always positive. |  |
| Cycle | ***n.*** | Repeating exactly in regular intervals. | 周期 |
|  | ***e.g.*** | Notice that a **cycle** may begin at any point on the graph of a function. |  |
| Frequency | ***n.*** | Frequency is the number of cycles in a given unit of time, so it is the reciprocal of the period of a function. | 频率 |
|  | ***e.g.*** | Hertz(Hz) is the standard measure of **frequency** and represents one cycle per second. |  |
| Period | ***n.*** | The length of the cycle. | 周期 |
|  | ***e.g.*** | There were many important events in this **period**. |  |
| Periodic function | ***n.*** | Functions that repeat exactly in regular intervals called cycles. | 周期函数 |
|  | ***e.g.*** | Examine the graphs of the **periodic function** and nonperiodic function below. |  |
| Phase shift | ***n.*** | A phase shift is a horizontal translation of a periodic function. | 相移 |
|  | ***e.g.*** | A **phase shift** of *h* units moves the graph left(*h*<0) or right (*h*>0). |  |
| Rotation matrix | ***n.*** | If P(x,y) is any point in a plane, then the coordinates P'(x', y' ) of the image after a rotation of θ degrees counterclockwise about the origin can be found by using the rotation matrix. | 旋转  矩阵 |

IV. Sentence Completion

periodic function amplitude frequency

cycle phase shift period

1. There were many important events in this **\_\_\_\_\_\_\_\_\_\_**.
2. Notice that a **\_\_\_\_\_\_\_\_\_\_** may begin at any point on the graph of a function.
3. Hertz(Hz) is the standard measure of **\_\_\_\_\_\_\_\_\_\_** and represents one cycle per second.
4. The **\_\_\_\_\_\_\_\_** is always positive.
5. Examine the graphs of the **\_\_\_\_\_\_\_\_\_** and nonperiodic function below.
6. A **\_\_\_\_\_\_\_\_\_\_**of *h* units moves the graph left(*h*<0) or right (*h*>0).

Keys:

1. period
2. cycle
3. frequency
4. amplitude
5. periodic function
6. phase shift