INTRODUCTION TO THE CHINESE LANGUAGE

I. SCRIPT AND TRANSLITERATION

1. Characters

In this primer we use only the modern simplified characters, since these have now been officially adopted not only in the People's Republic of China but also in Singapore.

The characters of the Chinese script were originally painted with a brush. Each of the following parts of a character is considered to be one brush stroke:

\[ \text{characters} \]

Here are some examples of characters, with their respective numbers of brush strokes:

\[ \begin{array}{ccccccccc}
\text{一} & \text{七} & \text{力} & \text{上} & \text{也} & \text{计} & \text{边} & \text{限} & \text{商} \\
1 & 2 & 2 & 3 & 3 & 4 & 5 & 8 & 11 \\
\end{array} \]

In the Index all characters occurring in the primer are ordered according to the total number of strokes (with the numbers of the word lists in which they appear displayed on their right). By scrutinizing some of these, the reader will soon be able to determine the number of strokes in any character, perhaps with an initial error of one stroke more or less.

This method of arranging the characters is practicable here merely because of the limited number of characters in our lists. Ordinarily, to 'look up' a character in a Chinese-English dictionary, when the corresponding spoken sound is unknown, one determines first its radical or fundamental part. Characters with the same radical are then listed according to the number of additional strokes needed to build up the entire character. There are just over 200 recognized radicals.

In a number of cases the radical is the left-hand component of the character. For example, the characters

\[ \text{论} \quad \text{代} \quad \text{阶} \quad \text{设} \quad \text{性} \quad \text{过} \quad \text{换} \quad \text{行} \quad \text{线} \]

have the radicals:

\[ \begin{array}{cccccccc}
\text{论} & \text{代} & \text{阶} & \text{设} & \text{性} & \text{过} & \text{换} & \text{行} & \text{线} \\
10 & 21 & 33 & 40 & 41 & 47 & 55 & 62 & 77 \\
\end{array} \]
In such cases the radical is apparent. Unfortunately there are many cases in which the radical is not at all obvious, and the method based on radicals can then be much more time-consuming than simply counting the total number of strokes.

In the examples given above we have written below each radical its number in *The Pinyin Chinese-English Dictionary* (Commercial Press, Hongkong, 1985). In the index of this primer we have enclosed in brackets, at the left of each character, the number of its radical in the same dictionary. Moreover, characters with the *same* number of strokes are ordered according to the numbers of their radicals. This will assist the reader to locate in the dictionary other characters besides those which actually appear here. It should be mentioned that the numbering of radicals is not completely standardized, and so the numbers shown here may differ from those in another dictionary.

2. **Spoken sounds**

Each character represents a monosyllable of the spoken language. However, each monosyllable may have one of four tones. A method of transcribing the spoken sounds into roman script has been officially adopted by the People's Republic of China. This method, known as *pinyin* (phonetic spelling), is used throughout our primer. Its phonetic values are those of standard (Mandarin) Chinese.

In pinyin the four tones are denoted by

```
- / \ \ (1st tone) (2nd tone) (3rd tone) (4th tone)
```

The tone marks do in fact correspond respectively to a high level tone, a rising tone, a falling-rising tone and a falling tone. The tone mark is always placed over a vowel. It is placed over the middle vowel if there are three, while if there are two vowels it is placed over the first, except when the first vowel is *i* or *u*:

```
běn, biǎo, bāo, xià, xué.
```

Those who do not aspire to speak Chinese may read these simply as

```
ben-3, biao-3, bao-1, xia-4, xue-2.
```
The pinyin transcriptions of the characters illustrated above are

一 七 力 上 也 计 边 限 商
yī qī lì shàng yě jì biān xiàn shāng

论 代 阶 没 性 过 换 行 线
lùn dài jiē mì xìng guò huàn háng xiàn

A few grammatical particles and suffixes are atonal, and their pinyin transcriptions have no tone mark:

了 着 的 地 么 们
le zhe de de me men

The exact phonetic values of the pinyin transcriptions will not be considered here. In fact the differences between the phonetic values of xì and shì, or qī and chī, or bō and pō, are not as marked as they appear to English speakers. Consequently those who do not aspire to speak Chinese may prefer to read the pinyin forms simply as though they were English words, with x and q pronounced as the letters themselves.

There are over 6000 different characters in Chinese, but only about 400 different monosyllables. Thus, even taking account of tones, it is inevitable that different characters, with different meanings, will often correspond to the same spoken sound (homophones) and have the same pinyin transcription. An example is the two xìàn's shown above. Some other examples are

不 步 部
bù

示 式 事 是
shì

必 毕 闭
bì

合 何 核 和
hé
On the other hand, there are some cases in which the same character corresponds to more than one spoken sound:

行 还 奇 得
háng, xíng hái, huán jī, qí dé, děi

The characters in our primer are always accompanied by their pinyin transcriptions. Besides providing immediate access to the resources of a dictionary, this is also an important aid in committing the characters to memory.

3. Words

Some single characters in Chinese represent a word, or unit of meaning:

大 小 是 有 和 或 向
da xiǎo shì yǒu hé huò xiàng
big small be have and or towards

人数点线量值边
rén shù diǎn xiàn liàng zhí biān
person number point line quantity value side

More commonly, words are represented by combinations of two or more characters. Characters may be combined for a number of different reasons. One basic reason is to express more complex notions:

大学 数学 同时 向量 定向 三角形
da xué shù xué tóng shí xiàng liàng dìng xiàng sān jiǎo xíng
university mathematics simultaneous vector orientation triangle
Some other important examples for the mathematician are:

<table>
<thead>
<tr>
<th>定义</th>
<th>引理</th>
<th>定理</th>
<th>推论</th>
<th>使得</th>
<th>只要</th>
</tr>
</thead>
<tbody>
<tr>
<td>dìng yì</td>
<td>yǐn lǐ</td>
<td>dìng lǐ</td>
<td>tuīlùn</td>
<td>shǐdé</td>
<td>zhǐyào</td>
</tr>
<tr>
<td>[fix meaning]</td>
<td>[lead truth]</td>
<td>[fix truth]</td>
<td>[deduce statement]</td>
<td>[use get]</td>
<td>[only want]</td>
</tr>
<tr>
<td>definition</td>
<td>lemma</td>
<td>theorem</td>
<td>corollary</td>
<td>so that</td>
<td>so long as</td>
</tr>
</tbody>
</table>

Characters are sometimes repeated for emphasis:

人人 事事 处处 仅仅 常常
rén rén shì shì chù chù jǐn jǐn cháng cháng
everybody everything everywhere only often

Combinations of opposites are also quite common:

<table>
<thead>
<tr>
<th>大小</th>
<th>多少</th>
<th>反正</th>
<th>左右</th>
<th>矛盾</th>
</tr>
</thead>
<tbody>
<tr>
<td>dà xiǎo</td>
<td>duō shǎo</td>
<td>fān zhèng</td>
<td>zuǒ yòu</td>
<td>máo dùn</td>
</tr>
<tr>
<td>[big small]</td>
<td>[much little]</td>
<td>[contrary correct]</td>
<td>[left right]</td>
<td>[lance shield]</td>
</tr>
<tr>
<td>magnitude</td>
<td>how much?</td>
<td>in any case</td>
<td>or thereabouts</td>
<td>contradiction</td>
</tr>
</tbody>
</table>

Another important reason for combining characters is to avoid ambiguity in speech. We can distinguish one simple character from another with the same spoken sound, but a different meaning, by combining it with an additional simple character whose meaning is related to its own. Thus to distinguish

限 xiàn, limit from 线 xiàn, line

we combine it with

极 jí, extreme to obtain 极限 jí xiàn, limit,

the latter being the usual expression for limit in the mathematical sense. Some other examples of this construction are:
Finally, characters may be combined for reasons which are no longer so relevant:

<table>
<thead>
<tr>
<th>条件</th>
<th>代数</th>
<th>函数</th>
<th>微分</th>
<th>积分</th>
</tr>
</thead>
<tbody>
<tr>
<td>tiáo jiàn</td>
<td>dài shù</td>
<td>hán shù</td>
<td>wèi fēn</td>
<td>jī fēn</td>
</tr>
<tr>
<td>[item document]</td>
<td>[substitute number]</td>
<td>[letter number]</td>
<td>[tiny fraction]</td>
<td>[accumulate fraction]</td>
</tr>
<tr>
<td>condition</td>
<td>algebra</td>
<td>function</td>
<td>differential</td>
<td>integral</td>
</tr>
</tbody>
</table>

II. GRAMMAR

The structure of Chinese is quite different from that of English, or other modern European languages with which the reader may be familiar. Consequently one cannot translate from Chinese into English simply on a word-for-word basis. It is necessary to consider the sentence as a whole or even a group of sentences.

In particular, the distinction between different parts of speech, especially between nouns and verbs, is not as clear-cut in Chinese as in English. Nevertheless our discussion of Chinese grammar will largely be based on parts of speech, simply because they will be familiar to the reader. On the other hand, since our concern is with translation from Chinese into English, we will not attempt to analyse all situations in which a particular construction may be used. It is enough to recognize the construction when one meets it.

Since we are especially concerned with the translation of mathematical articles, we do not discuss some topics - such as exclamations and imperatives - which will be met only rarely.

4. Nouns

Nouns do not have different singular and plural forms in Chinese (unlike book, books). Whether a noun is singular or plural is either left unspecified or made clear by some additional
word. Thus a plural may be indicated by placing 些 xiē, some before the noun or 都 dōu, all or both after the noun in a situation where their use is not demanded in English. An example is given in the final section on word order.

New nouns may be formed by means of the agent suffix 家 jiā, -er (literally, family):

数学家
shù xué jiā
mathematician

科学家
kē xué jiā
scientist

They may also be formed by means of the prefixes 子 zi, sub- (literally, child) and 半 bàn, semi- or half-:

<table>
<thead>
<tr>
<th>子集</th>
<th>子区间</th>
<th>子空间</th>
<th>半圆</th>
<th>半稳定</th>
<th>半轴</th>
</tr>
</thead>
<tbody>
<tr>
<td>zǐjí</td>
<td>zǐ qū jiān</td>
<td>zǐ kōng jiān</td>
<td>bàn yuán</td>
<td>bàn wěn dīng</td>
<td>bàn zhóu</td>
</tr>
<tr>
<td>subset</td>
<td>subinterval</td>
<td>subspace</td>
<td>semi-circle</td>
<td>semi-stable</td>
<td>semi-axis</td>
</tr>
</tbody>
</table>

Generality of a noun is expressed, in particular, by the adjectives

任何 任意 某一 一切 各 每一
rèn hé rèn yì mǒu yī yī qiè gè měi yī
any arbitrary some, certain all each every

as in the following examples:

对任何 C 对于任意 x 某一 T 值
duì rèn hé duì yú rèn yì mǒu yī zhí
for any C for arbitrary x some values (of) T

一切系数 在各邻域 从每一直线
yī qiè xī shù zài gě lín yù cóng měi yī zhí xiàn
all coefficients in each neighbourhood from every [straight] line
Diversity may be expressed by the adjectives

<table>
<thead>
<tr>
<th>其他</th>
<th>另外</th>
<th>别</th>
<th>不同</th>
<th>异</th>
<th>反</th>
</tr>
</thead>
<tbody>
<tr>
<td>qǐ tā</td>
<td>lìng wài</td>
<td>bié</td>
<td>bù tóng</td>
<td>yì</td>
<td>fǎn</td>
</tr>
<tr>
<td>other</td>
<td>other</td>
<td>another</td>
<td>different</td>
<td>different</td>
<td>opposite</td>
</tr>
</tbody>
</table>

as in the examples:

<table>
<thead>
<tr>
<th>其他形式</th>
<th>另外方法</th>
<th>别的证明</th>
</tr>
</thead>
<tbody>
<tr>
<td>qǐ tā xíng shì</td>
<td>lìng wài fāng fǎ</td>
<td>bié de zhèng mínɡ</td>
</tr>
<tr>
<td>other forms</td>
<td>other methods</td>
<td>another proof</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>异号</th>
<th>反定向</th>
<th>不同的相图</th>
</tr>
</thead>
<tbody>
<tr>
<td>yì hào</td>
<td>fǎn dìng xiànɡ</td>
<td>bù tóng de xiànɡ tú</td>
</tr>
<tr>
<td>opposite sign</td>
<td>opposite orientation</td>
<td>a different phase portrait</td>
</tr>
</tbody>
</table>

5. Measure words

A particular feature of Chinese is that a measure word is placed between a number and the noun it qualifies, and that many nouns have their own special measure words. Thus

条 tiáo 张 zhānɡ

are measure words for long thin objects and objects with flat two-dimensional surfaces respectively:

<table>
<thead>
<tr>
<th>两条线</th>
<th>四张平面</th>
</tr>
</thead>
<tbody>
<tr>
<td>liǎnɡ tiáo xiàn</td>
<td>sì zhānɡ pínɡ miàn</td>
</tr>
<tr>
<td>[two MW line]</td>
<td>[four MW plane]</td>
</tr>
<tr>
<td>two lines</td>
<td>four planes</td>
</tr>
</tbody>
</table>
A measure word with a wider range of applications (mostly non-mathematical) is 件 jiàn:

一件事
yī jiàn shì
a matter

However, by far the most commonly used measure word is 个 gé:

三个奇点 至少一个极限环
sān gè qí diǎn zhì shǎo yī gè jí xiàn huán
three singular points at least one limit cycle

二十三个问题 最多两个焦点
èr shí sān gè wèn tí zuì duō liǎng gè jiāo diǎn
twenty-three problems at most two foci

Ordinal numbers do not require a measure word; they are formed from the corresponding numerals by attaching the prefix 第 dì:

第一类 第二情况 第四象限
dì yī lèi dì èr qíng kuàng dì sì xiàng xiàn
the first kind the second case the fourth quadrant

On the other hand a measure word, determined by the corresponding noun, is used with the demonstratives

这 zhè, this 那 nà, that 哪 nǎ, which?, what?

as in the examples:

这件事 那个问题 哪条线?
zhè jiàn shì nà gè wèn tí nǎ tiáo xiàn
the matter that problem which line?
These demonstratives have a plural, formed by adding 些 xiē:

这些 zhè xiē, these 那些 nà xiē, those 哪些 nǎ xiē, which?, what?

However, xiē acts as a measure word itself, and an additional measure word is not now required:

这些事 那些问题 一些注意
zhè xiē shì nà xiē wèn tí yī xiē zhù yì
these matters those problems some remarks

It may be noted here that these demonstratives are converted into place words by adding

里 lǐ

这里 zhè lǐ, here 那里 nà lǐ, there 哪里 nǎ lǐ, where

For example:

这里假设 在那里王说明
zhè yì jiǎ shè zài nà lǐ wáng shuō míng
here (we) assume [in] there Wang explains

More colloquial, but still acceptable, expressions are:

这儿 zhèr, here, now 那儿 nàr, there, then 哪儿 nàr, where

(Since the two characters are pronounced as a monosyllable, ér is contracted to -r.)

A measure word is also used with certain quantifiers, such as

几 jǐ, a few, how many? 整 zhěng, whole
For example:

几个方法  在整个平面
jǐ gè fāng fǎ  zài zhěng zhāng píng miàn
several methods  in (the) whole plane

There are no words in Chinese corresponding to the English articles a and the. However, they are sometimes replaced respectively by the numeral — yī, one and the demonstratives 这 zhè, this or 那 nà, that, as in the examples a matter and the matter above.

6. Pronouns

The various personal pronouns are given in List 20. Unlike nouns, they do have a plural form, namely the suffix 们 men:

我 我们 你 你们
wǒ wǒ men nǐ nǐ men
I we you(s.) you (pl.)

Pronouns do not change according to case in Chinese (unlike he, him), but the particle 的 de is placed after a pronoun to make it possessive:

关于他的猜测 在她的文中 因为它的困难
guān yú tā de cāi cè zài tā de wén zhōng yīn wéi tā de kùn nán
concerning his conjecture in her article because of its difficulty

On the other hand, the pronoun 其 qí, which may refer to either persons or things, does not require 的 de to become possessive:

在其邻域
zài qí lín yù
in its neighbourhood
We note also the useful expression 中数，in which:

```
其中数D负
```

$q^\prime \text{zh}\text{\-ng sh\text{-\textcircled{\textminus}u}}$  fur

where (the) number $D$ (is) negative

A pronoun is made reflexive by placing after it 自己 zì jǐ:

```
闭区间到它自己的连续变换
```

$\text{bǐ qū jiān dào tā zì jǐ de lián xù biàn huàn}$

[closed interval to itself of continuous transformation]

A continuous transformation of a closed interval into itself

Pronouns are mainly used for persons in Chinese. When they are used for things it is generally for a grammatical reason, such as after a preposition. Moreover, pronouns cannot be qualified by a measure word or any other phrase.

Where a pronoun would be used in English, to avoid repetition of a noun, it is often simply omitted in Chinese:

```
如果有，必为 稳定环
```

$\text{rú guǒ yǒu, bì wèi wěn dìng hu\text{-\textcircled{\text{-}}}án}$

If (it) exists, (it) must be (a) stable cycle

However, a pronoun may be used to draw attention to the noun for which it stands. Thus in relative clauses the role of the English who or which is normally taken by the connecting particle 的 de, but it may be replaced by the appropriate personal pronoun for more emphasis:

```
极限环的内部包含最多一个奇点它一定是焦点
```

$\text{jí xiàn huán de nèi bù bāo hàn zuì duō yī gè qí diǎn lǐ yī dìng shì jī\text{-\textcircled{\text{-}}}án}$

[limit cycle of interior contain at most one singular point it must be focus]

The interior of a limit cycle contains at most one singular point, which is necessarily a focus.
7. The three de's

A noun may be converted into an adjective by placing after it the particle 的 de or into an adverb by placing after it the particle 地 de:

<table>
<thead>
<tr>
<th>Chinese</th>
<th>Pinyin</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>严格</td>
<td>yán gē</td>
<td>rigour</td>
</tr>
<tr>
<td>严格的</td>
<td>yán gē de</td>
<td>rigorous</td>
</tr>
<tr>
<td>严格地</td>
<td>yán gē de</td>
<td>rigorously</td>
</tr>
<tr>
<td>困难</td>
<td>kùn nán</td>
<td>difficulty</td>
</tr>
<tr>
<td>困难的</td>
<td>kùn nán de</td>
<td>difficult</td>
</tr>
<tr>
<td>困难地</td>
<td>kùn nán de</td>
<td>with difficulty</td>
</tr>
</tbody>
</table>

The same distinction between adjectives and adverbs is observed even when the corresponding noun is not the primitive concept:

<table>
<thead>
<tr>
<th>Chinese</th>
<th>Pinyin</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>直接</td>
<td>zhí jiē</td>
<td>directness</td>
</tr>
<tr>
<td>直接的</td>
<td>zhí jiē de</td>
<td>direct</td>
</tr>
<tr>
<td>直接地</td>
<td>zhí jiē de</td>
<td>directly</td>
</tr>
</tbody>
</table>

To save space the adjectival and adverbial particles are omitted in our word lists, even though the translation given is an adjective or adverb. In Chinese itself the particle is often omitted if the adjective or adverb immediately precedes the word it qualifies:

<table>
<thead>
<tr>
<th>Chinese</th>
<th>Pinyin</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>开集</td>
<td>kā jí</td>
<td>open set</td>
</tr>
<tr>
<td>闭曲线</td>
<td>bì qū xiàn</td>
<td>closed curve</td>
</tr>
<tr>
<td>奇点</td>
<td>qí diǎn</td>
<td>singular point</td>
</tr>
<tr>
<td>复数</td>
<td>fù shù</td>
<td>complex number</td>
</tr>
<tr>
<td>实部</td>
<td>shí bù</td>
<td>real part</td>
</tr>
<tr>
<td>正号</td>
<td>zhèng hào</td>
<td>positive sign</td>
</tr>
</tbody>
</table>
The particle 的 de has other important roles. Its use in forming possessive pronouns has already been noted. Similarly it may be used to connect two nouns with the meaning of, although the order of the nouns is that used in English with 's rather than with of:

例 2 的方法  变数 的 更 换
li de fang fa  bian shu de ge ng huan
[example 2 - method]  [variable - change]
the method of Example 2  change of variables

点 的 邻机  坐标的 原点
dian de lin yu  zuo biao de yuan dian
[point - neighbourhood]  [coordinate - origin]
neighbourhood of a point  origin of coordinates
Nevertheless, 的 de is not required in many cases where of is used in English:

方程组 相交角
fāng chéng zǔ xiāng jiāo jiǎo
[equation system] [intersection angle]
system of equations angle of intersection

More generally, a noun phrase or relative clause which modifies a noun must precede it and be linked to it by the particle 的 de:

与 L 相交的轨迹 已经得到的公式 (1)
yǔ xiāng jiāo de guǐ xiàn yǐ jīng dé dào de gōng shì
[with L intersect - trajectory] [already obtain - formula]
the trajectories intersecting L the formula (1) which we have already obtained

一些没有极限环的二次系统
yī xiē méi yǒu jí xiàn huán de èr xì tǒng
[some not have limit cycle - quadratic system]
some quadratic systems without limit cycles

Finally we note the alias forms 的 dì, target and 地 dì, earth as in:

目的 mù dì, aim, purpose 地方 dì fāng, place

The third particle 得 de is placed between a verb and its complement to indicate result, possibility or degree:

因为 C 可以取得任意大
yīn wèi kě yǐ qǔ de rèn yì dà
Because C can be taken arbitrarily large
However, the alias forms 得 dé, obtain and 得 děi, must are no less common:

由 (1) 可得到 选取 a, b 使得 a < x < b 以及 b - a < 1
yóu (1) kě dé dào xuǎn qǔ shǐ dé yǐjí
Because of (1) (we) can obtain Choose a, b so that a < x < b and b - a < 1

所以我们得采用其他方法
suǒ yǐ wǒ men cǎi yòng qí tā fāng fǎ
Therefore we must adopt other methods

8. Comparison and degree

Adjectives form the comparative with either 较 jiào or 更 gèng, and the superlative with 最 zuì:

<table>
<thead>
<tr>
<th>小</th>
<th>较小</th>
<th>最小</th>
</tr>
</thead>
<tbody>
<tr>
<td>xiǎo</td>
<td>jiào xiǎo</td>
<td>zuì xiǎo</td>
</tr>
<tr>
<td>small</td>
<td>smaller</td>
<td>smallest</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>多</th>
<th>较多</th>
<th>最多</th>
</tr>
</thead>
<tbody>
<tr>
<td>duō</td>
<td>jiào duō</td>
<td>zuì duō</td>
</tr>
<tr>
<td>many, much</td>
<td>more</td>
<td>most</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>好</th>
<th>更好</th>
<th>最好</th>
</tr>
</thead>
<tbody>
<tr>
<td>hǎo</td>
<td>gèng hǎo</td>
<td>zuì hǎo</td>
</tr>
<tr>
<td>good</td>
<td>better</td>
<td>best</td>
</tr>
</tbody>
</table>

Besides its use in forming comparatives, 较 jiào is often used in the less specific sense of quite, rather. Other adverbs which may be used to express degree are

仅 只 相当 颇 很 非常 甚 极
jǐn zhǐ xiāng dāng pō hěn fēi cháng shèn jí
only only quite rather very, quite very very, extremely extremely
For example:

仅一个 只有两个 相当困难 颇复杂
jǐn yī gè zhǐ yǒu liǎng gè xiāng dāng kùn nán pō fū zá
only one only two quite difficult rather complicated

很有用 非常容易地 甚高频 极小值
hěn yǒu yòng fēi cháng róng yì de shèn gāo pín jí xiǎo zhí
very useful very easily very high frequency minimum [value]

When two objects are being compared in manner or degree, the preposition 比 bǐ substitutes for the English than. It is placed between the two objects, and the second is followed by a description of the difference:

这一结果比 [2] 的 (更) 好
zhè yī jié guǒ bǐ de (gèng) hǎo
This result (is) better than (that) of [2].

However, 比 bǐ does not replace than in other situations:

多于三个的正根
duō yú sān gè de zhēng gēn
more than three positive roots

Furthermore, 比 bǐ is not used for negative comparisons. The construction in this case is illustrated by the counterpart of the previous example (the characters in brackets may be omitted):

这一结果没有 [2] 的 (那么) 好
zhè yī jié guǒ méi yǒu (nà me) hǎo
This result is not as good as (that) of [2].
9. Negatives

The most common way of expressing negation is to put 不, *not* before the word or phrase it qualifies:

<table>
<thead>
<tr>
<th>不等</th>
<th>不全</th>
<th>不定积分</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>bù děng</strong></td>
<td><strong>bù quán</strong></td>
<td><strong>bù dìng jì fēn</strong></td>
</tr>
<tr>
<td>un-equal</td>
<td>in-complete</td>
<td>in-definite integral</td>
</tr>
</tbody>
</table>

不但是...而且... 然而证明是不正确的

**bù dàn ér qǐ**
not only...but also...
ran ér zhèng míng shì bù zhèng què de
However, the proof is not correct.

Other adverbs which are used in place of 不 in certain situations are

无 wú
未 wèi
非 fēi

For example:

无界的   无限的   未知量   非线性
**wú jiè de**   **wú xiàn de**   **wèi zhī liàng**   **fēi xiàn xìng**
[not bounded]   [not limited]   [not know quantity]   [not line property]
unbounded   infinite   unknown (n.)   nonlinear

All verbs but one can be negated by 不. The verb 有, *have or exist* is exceptional in that it forms its negative only with 没 méi. Either 没 méi immediately precedes 有 yǒu, or有 yǒu is omitted and 没 méi stands in its place:

因此方程 (3) 没 (有) 实根

yǐn cǐ fāng chéng   méi (yǒu) shí gēn
Hence equation (3) does not have real roots.
Moreover, with or without 有 you, can be used with another verb to deny completion of an action (like the English has not):

但这一点没有解释清楚
dàn zhè yī diǎn méi yǒu jiě shì qīng chǔ
But this point has not been explained clearly

The negatives of verbs in situations involving aspect are discussed in Section 10.

10. Verbs

Verb forms in Chinese do not change according to whether the subject is singular or plural:

他有 tā yǒu, he has 他们有 tā men yǒu, they have

Verb forms also do not change according to tense. The same sentence may represent past, present or future action:

我是数学家 Poincaré是数学家
wǒ shì shù xué jiā shì shù xué jiā
I am a mathematician Poincaré was a mathematician

If the meaning is not sufficiently clear from the context, a time word or phrase may be inserted:

以后我们选择合适常数
yǐ hòu wǒ men xuǎn zé hé shì cháng shù
Afterwards we (shall) choose a suitable constant

On the other hand, various aspect markers may be placed before or after the verb to relate the time of action to the matter under discussion. The following three particles are placed after the verb:

了 le, to indicate completed action
着 zhe, to indicate action in progress
过 guò, to indicate experienced action
For example:

Poincaré studied this problem

I am learning Chinese

He has been (to) Beijing

Another way of indicating action in progress is to place 在 zài before the verb:

She is studying this problem

We may think of a sentence in Chinese containing 过 guò as answering a question in English containing the word ever. Often 了 le will correspond to the English -ed, and 着 zhe and 在 zài will correspond to the English -ing. But it is important to note that whether an action is completed or in progress depends on the internal world of the discourse, rather than the external world of the speaker:

After we have finished the proof of the theorem, we will illustrate it with examples.
In negative statements the constructions are different and depend on the aspect:

- an affirmative statement of the form
  -void, ~ le
  -着, ~ zhe
  -过, ~ guò
  -在, ~ zài

- has a negative counterpart of the form
  -没有 ~, méi (yǒu) ~
  -没有, méi yǒu
  -没(有)~ 过, méi (yǒu) ~ guò
  -不在 ~ bù zài ~

where ~ represents the verb and (yǒu) denotes that the inclusion of yǒu is optional. For example:

他们 也没有 考 虑 这个情况

They too did not consider this case

tā men yě méi yǒu kǎo lǜ zhè gè qíng kuàng

他没 去 过 北京

He has not been (to) Beijing

tā méi qù guò běi jīng

It should be noted that the particle 了 le may also be placed at the end of a sentence to signal a changed state of affairs or to indicate a past event (rather than completed action), and that 过 guò can also mean *over or pass*. Moreover 在 zài can also mean *exist*, especially in the combination 存在 cún zài, and *at or in*, especially in many phrases denoting position (see List 4).

Many nouns in Chinese serve equally as verbs:

<table>
<thead>
<tr>
<th>表示</th>
<th>代换</th>
<th>变换</th>
<th>应用</th>
<th>注意</th>
</tr>
</thead>
<tbody>
<tr>
<td>biǎo shì</td>
<td>dài huàn</td>
<td>biàn huàn</td>
<td>yìng yòng</td>
<td>zhù yì</td>
</tr>
<tr>
<td>representation</td>
<td>substitution</td>
<td>transformation</td>
<td>application</td>
<td>remark</td>
</tr>
<tr>
<td>express</td>
<td>substitute</td>
<td>vary</td>
<td>apply</td>
<td>take note of</td>
</tr>
</tbody>
</table>
Verbs can also be formed from nouns and adjectives by adding the suffix 正 规化 huà, corresponding to the English -ize or -ify:

正 规化
zhèng guī huà
normalize

简化
jiǎn huà
simplify

Finally we mention that sometimes when a verb is followed both by a direct object and by an adverbial phrase the verb is repeated after the direct object.

11. Some important verbs

The verb 是 shì, be has a more restricted use in Chinese than in English. It is not used as an auxiliary verb (as in I am studying or it was shown), and is generally omitted when the predicate is an adjective or adjectival phrase:

但证明很困难
dàn zhèng míng hěn kùn nán
but the proof (is) very difficult

然而论证 无效
rán ér lùn zhèng wú xiào
However, the demonstration (is) invalid

其中 A 的系数不等于零
qí zhōng de xì shù bù děng yú lǐng
[in which of coefficient not equal to zero]
where the coefficient of A is not equal to zero

即直线与积分曲线相切
jí zhí xiàn yǔ jī fēn qū xiàn xiāng qiē
i.e. the straight line and the integral curve (are) tangent to one another

On the other hand, it is used when the predicate is a noun:

原点是中心点
yuán diǎn shì zhōng xīn diǎn
the origin is a centre

如果 f(x) 是 x 的递减函数
rú guǒ shì de dì jì jiǎn shù
[if be of decreasing function]
if f(x) is a decreasing function of x
It is also used for affirmation or emphasis when the predicate is not a noun:

这也是不可能的 论证是容易的
zhè yě shì bù kě néng de lùn zhèng shì róng yì de
This also is impossible The demonstration is an easy one

The emphatic use of 是 shì is similar to the English do (as in he did go):

轨道 L 是位于 G

guǐ dào shì wèi yú

the trajectory L does lie in G

Unlike other verbs, 是 shì is used without aspect particles and is negated only by 不 bù.

The basic meaning of 是 shì is (it) is true that, rather than (it) exists. In fact it can also be used as an adjective, correct or right.

Existence is more commonly rendered by the verb 有 yǒu. In particular, it can begin a sentence, corresponding to the English there is (or are):

有闭轨迹线 或分界线环绕在原点周围

yǒu bì guì xiàn huò fēn jiè xiàn huán zài yuán diǎn zōu wéi

There is a closed trajectory or a separatrix cycle surrounding the origin

The other basic meaning of 有 yǒu, have or possess, is illustrated by the examples:

此方程有两个奇点 它具有下列性质

cǐ fāng chéng yǒu liǎng gè qí diǎn tā jù yǒu xià liè xìng zhì

this equation has two singular points it possesses the following properties

It has already been mentioned that the negative of 有 yǒu is formed with 没 méi.
The flexibility of Chinese is illustrated by 要 yào. It can be either a verb, want or need, or an adjective, important:

重 要 的 书
zhòng yào de shū
an important book

我们 要 证 明 这 不 可 能 的
wǒ men yào zhèngmíng zhè bù kě néng de
We want to show (that) this (is) impossible

It can also be used as a conjunction, if, and it can serve to indicate the near future, like the English going to:

其次 我们 要 讨论 它 的 稳 定 性
qí cì wǒ men yào tǎo lùn tā de wěn dìng xìng
Next we are going to discuss its stability.

In fact the previous example admits the alternative interpretation We are going to show...

The verbs of motion

来 去 到 走 进 出
lái qù dào zǒu jìn chū
come go arrive leave enter exit

also have several other meanings. In particular, 到 dào, to can serve as a preposition. Other verbs which can serve as prepositions are

在 给 对 跟
zài gěi duì gēn
exist give answer follow
at, in to, for to with

12. Auxiliary verbs

Main verbs are preceded by such auxiliary verbs as
25

能   会   应当   得
néng  huì  yīng dāng  děi
can    be able to   should    must

能够   可以   应该   必须
néng gòu  kě yǐ   yīng gāi  bì xū
to be capable of   may    ought to    have to

For example:

半稳定环会消失
bàn wěn dìng huán huì xiāo shī

a semi-stable cycle may disappear

首 先 应该注意
shǒu xiān yīng gāi zhù yì
First (it) should (be) observed

We note that 可 kě is used both as a verb, can and as a prefix (like the English suffix -able):

仿 前 可证       连续可微函数
fǎng qián kě zhèng  lián xù kě wēi hán shù
As before (we) can prove continuously differentiable function

13. Conditional statements

Conditional sentences typically begin with such words as

设 假  如果   若  当   虽然   除非
shè  jiǎ  rú guǒ   ruò  dāng  suīrán  chú fēi
suppose  assume  if    if   when, if although unless
For example:

```plaintext
qí cì shè chéng lì xià liè táo jiàn

Suppose next that the following conditions hold
```

```plaintext
ruò zài gǎi wèi dàn réng shè zé

If again (we) change $A < B$ to $A > B$, but still assume $m < 0$, then
```

```plaintext
ruò guò cún zài, jìù yǐ dèng wèi yǐ
dǎng qiě jǐn dāng yǐ

If (it) exists, [then] (it is) necessarily unique
```

```plaintext
suī rán zhè gè zhèng míng hěn jiǎn yào, hái qīng chū
dàn cí zhè běn shēn shì guī xiàn

Although this proof (is) very concise, [still] (it is) clear
```

```plaintext
chú fēi gāi zhí xiàn běn shēn shì guī xiàn

unless the straight line is itself a trajectory
```

14. Questions

For confirmatory questions, i.e. questions requiring only a yes or no answer, the particle `ma` may be placed at the end of a sentence to make it interrogative:

```plaintext
zhè bǐ yào tiáo jiàn shì yě chǐng fēn de ma

Is this necessary condition also sufficient?
```
Confirmatory questions may also be asked by placing the negative form of a verb immediately next to its affirmative form:

意 义 是 不 是 明 显 的？
yì yì shì bù shì míng xiǎn de
[meaning be not be clear]
Is the meaning clear?

This construction is similar to the English *The meaning is clear, isn't it?*

For *disjunctive* questions, i.e. questions asking *either...or...?*, the two options are connected by 还是 hái shì, or. The answer is given by simply repeating one of the options.

In *information* questions, when pronouns and adverbs such as

谁 shuí, who? 什么 shén me, what? 哪儿 nǎr, where? 几 jǐ, how many?

are used interrogatively, they are put in the place of the word giving the answer:

例子是什么？ 方程 有几解法？
lì zì yì shì shén me fāng chéng yǒu jǐ jiě fǎ
[example be what] [equation has how many solutions]
What is an example? How many solutions does the equation have?

The non-interrogative meanings are slightly different:

谁 shuí, whoever 什么 shén me, or whatever 哪儿 nǎr, wherever 几 jǐ, a few

The replacements for the English *who* and *what* in relative clauses have already been considered in Sections 6 and 7. For reference we include here also

怎么 为什么 什么时候
zhěn me wèi shén me shén me shí hòu
*how?* *why?* *when?*
15. Passives

Chinese often uses an active mode of expression, where the passive voice is preferred in English (cf. this sentence). A common replacement for the passive is the topic-comment construction, in which the object is placed at the beginning of the sentence, in the position normally reserved for the subject:

These problems have been solved

However, a genuine passive construction is the use of 被 bèi, placed after the recipient of the action and before the agent (if the latter is not omitted):

This result was generalized by Chen Zhong-wei

At one time 被 bèi was used only in situations of adversity, but this restriction is disappearing. Sometimes one of the following is used in place of 被 bèi:

give, give
call, jiào
let, ràng

Another passive construction is 为 wéi, followed by 所 suǒ:

A similar result was also obtained in [4].
16. Word order

A sentence in Chinese often begins with a word or phrase which provides a framework for it. We have already encountered examples involving some of the time adverbs

首先 现在 今 其次 然后 后来 最后 最近
shǒu xiān xiàn zài jīn qí cì rán hòu hòu lái zuì hòu zuì jīn
first now now next then later finally recently

and some of the linking words

而且 然而 但 如此 因此 因为 为了 又
ér qí cì rán ér dàn rú cǐ yīn wèi wèi le yòu
moreover however but thus hence because in order to again

此外 不过 可是 由此 于是 由于 所以 则
cǐ wài bù guò kě shì yú cǐ yú shì yóu yú suǒ yǐ zé
in addition nevertheless but thus consequently since therefore then

Some other common initial phrases are

当然 其实 即 例如 特别 同样 下面
dāng rán qí shí jí lì rú tè bié tóng yàng xià miàn
of course in fact that is for example in particular similarly in the following

显见 实际上 再 也许 根据 另一方面
xiǎn jiàn shí jí shàng zài yě xǔ gēn jù lìng yī fāng miàn
obviously actually again perhaps according to on the other hand

Conditional sentences may begin with one of the words discussed in Section 13.
The other main way in which a sentence may begin is with its *topic* - what the sentence is about. The topic is often the subject of the sentence, but not invariably. (Indeed the subject is sometimes omitted). However, we may regard subject-verb-object as the standard word order, especially in complex sentences. Sometimes, in order to make a stronger statement, the object is placed before the verb and this may be signalled by placing immediately before the object the preposition 把 bā. An example of this construction appeared in Section 10.

As a general rule, the 'modifier' precedes the 'modified'. Thus both adjectives and demonstratives precede the noun they qualify. Also, as we have seen in Section 7, noun phrases and relative clauses, that in English would be formed with *who* or *which*, always come before the main noun and are typically linked to it by the particle 的 de. Again, negative words such as 不 bù precede the word or phrase they negate; a word or phrase placed before the negative is not negated. Similarly an adverb precedes the verb or adjective it qualifies, and the main verb is preceded by an auxiliary verb. An exception to the general rule of this paragraph is that 也 yě, too and 都 dōu, all refer to a preceding noun phrase:

与 C 相 交 的 轨 线 都 从 它 的 外 部 穿 过 向 它 的 内 部
yu xiāng jiāo de guǐ xiàn dōu cóng wài bù chuān guò xiàng tā de nèi bù
[with C intersect trajectory all from its exterior cross to its interior]
(all) the trajectories intersecting C cross from its exterior to its interior

Adverbs which describe the manner in which the subject carries out an activity are placed after the subject and before the verb:

李 [7] 独立地得到了同一的结果
lǐ dú lì de dé dào le tóng yī de jié guǒ
Li [7] obtained the same result independently.

Another feature of Chinese is that two or more clauses may be juxtaposed without anything to indicate the relation between them. In such a case the clauses are regarded as parts of one inclusive entity. For example:
Combining the (various) formulas (1)-(3), we at once obtain the inequality.

Using this formula to compute \( D \), we see immediately that \( M \) is a saddle.

Our concluding example is intended to show that we have learnt much, but not all:

Finally we note that, when \( a \) is positive, the singular point becomes unstable, and (so) a limit cycle appears.

The theorem is completely proved.