HARROW INTERNATIONAL SCHOOL 哈罗国际学校 SHANGHAI 上海

LOWER SCHOOL • PROGRESSION FRAMEWORK

# Mathematics 数学

YEARS 5 & 6

*By the end of Years 5 and 6, pupils will be able to...*



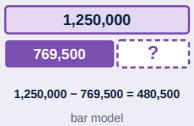

## Number and Place Value 数字和位值

### YEAR 5

- Understand and use place value to read, write and compare numbers up to 1,000,000
- Round numbers to the nearest 10, 100, 1,000, 10,000 and 100,000
- Perform calculations with whole numbers, including addition, subtraction, multiplication and division, using efficient methods
- Recognise and use negative numbers in context

### YEAR 6

- Read, write and compare numbers up to 10,000,000 and understand the value of each digit
- Round numbers to any place value and use rounding to estimate and check calculations
- Perform operations with large numbers and decimals, using a range of strategies and methods
- Solve problems involving percentages, including calculating percentages of quantities and percentage increase or decrease



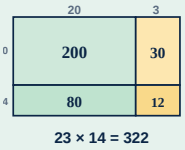

## Addition and Subtraction 加法和减法

### YEAR 5

- Add and subtract whole numbers with more than four digits, using formal written methods
- Perform mental calculations, including multi-step problems
- Use estimation to check the reasonableness of answers
- Solve problems involving addition and subtraction, including those with increasingly large numbers

### YEAR 6

- Use formal written methods to add and subtract numbers with up to seven digits
- Perform mental calculations and solve complex problems involving large numbers and decimals
- Use estimation and approximation to assess the reasonableness of answers
- Solve multi-step problems involving addition and subtraction, including those with fractions and decimals



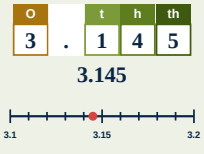

## Multiplication and Division 乘法和除法

### YEAR 5

- Multiply and divide whole numbers and decimals by 10, 100 and 1,000
- Perform multiplication and division calculations, including using formal written methods for two-digit by two-digit multiplication and short division
- Solve problems involving multiplication and division, including those with remainders
- Use estimation to check the reasonableness of answers and solve multi-step problems
- Understand and use prime numbers, square numbers and cube numbers

### YEAR 6

- Multiply and divide numbers up to four digits by a one- or two-digit number using long multiplication and long division
- Perform calculations involving decimals, including dividing decimals by whole numbers
- Solve complex problems involving multiplication and division, including multi-step problems and those with large numbers
- Use estimation and approximation to check answers and assess the reasonableness of results
- Understand and apply concepts of factors, multiples, prime numbers and common factors



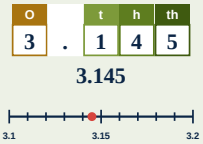

## Decimals 小数

### YEAR 5

- Understand and use numbers with up to three decimal places
- Compare and order decimals, and solve problems involving decimals
- Convert between decimals and fractions, and solve various problems involving decimals

# Mathematics 数学

YEARS 5 & 6

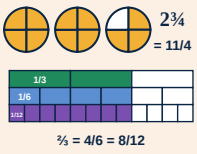



## Decimals 小数 *(continued)*

- Perform calculations with decimals, including addition, subtraction, multiplication and division
- Solve multi-step problems using decimals in calculations and applications

### YEAR 6

- Understand and use numbers with up to four decimal places
- Perform calculations with decimals, including addition, subtraction, multiplication and division
- Solve problems involving decimals and convert between fractions and decimals
- Compare and order different decimals, including solving complex decimal problems
- Apply decimals to solve multi-step problems, including practical and abstract problems



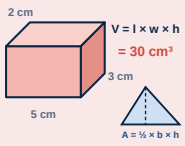

## Fractions 分数

### YEAR 5

- Compare and order fractions with different denominators, including those greater than one
- Add and subtract fractions with the same denominator and with different denominators by finding a common denominator
- Multiply proper fractions and mixed numbers by whole numbers
- Divide proper fractions by whole numbers
- Solve problems involving fractions, including those with mixed numbers and improper fractions
- Understand and use equivalent fractions, and simplify fractions where appropriate

### YEAR 6

- Compare and order fractions, including those with different denominators and mixed numbers
- Add and subtract fractions with different denominators, using a variety of methods
- Multiply and divide fractions and mixed numbers, including solving problems involving these operations
- Convert between improper fractions and mixed numbers
- Solve complex problems involving fractions, including those that combine fractions with other operations
- Understand and use percentages as a way of expressing fractions



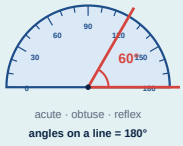

## Measurement 度量

### YEAR 5

- Convert between different units of measurement, including metric units (e.g. millimetres to centimetres, grams to kilograms) and imperial units (e.g. inches to feet)
- Calculate perimeter and area of various shapes, including compound shapes
- Use formulae to find the area of triangles and parallelograms
- Estimate, measure and compare lengths, mass, volume and time accurately
- Solve problems involving converting units of measurement and using measurements in practical contexts

### YEAR 6

- Convert between different units of measurement, including complex conversions between metric and imperial units
- Calculate the area and volume of a range of shapes, including cubes and cuboids, and apply these calculations to solve problems
- Use and apply formulae to find the area of complex shapes and the volume of solids
- Estimate, measure and compare measurements with a high degree of accuracy
- Solve multi-step problems involving measurement, including real-life contexts and compound units



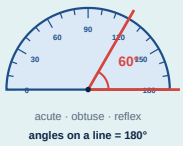

## Geometry 几何

### YEAR 5

- Identify and classify 2-D shapes based on their properties, including angles, sides and symmetry
- Recognise and describe properties of 3-D shapes, including vertices, edges and faces
- Understand and use the terms angle, right angle, acute angle and obtuse angle
- Draw and measure angles using a protractor, and estimate angles accurately
- Describe and plot points on a grid and use coordinates in the first quadrant
- Reflect shapes in vertical and horizontal lines of symmetry

# Mathematics 数学

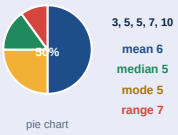
YEARS 5 & 6




## Geometry 几何 *(continued)*

### YEAR 6

- Classify 2-D shapes by their properties and understand the concept of parallel and perpendicular lines
- Describe and classify 3-D shapes, including their properties and the relationships between them
- Understand and calculate angles on a straight line, around a point and in various shapes
- Use a protractor to measure and draw angles with accuracy
- Translate, rotate and reflect shapes on the coordinate plane, including using negative coordinates
- Understand and apply properties of symmetry in shapes and patterns



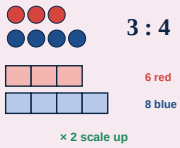

## Statistics 统计

### YEAR 5

- Collect, interpret and present data using various methods, including bar charts, line graphs and tables
- Calculate and interpret the mean, median, mode and range of a data set
- Use data to solve problems, including comparing different data sets and drawing conclusions
- Construct and interpret pie charts and use them to solve problems

### YEAR 6

- Collect, analyse and interpret data from a range of sources, presenting it using more complex charts and graphs
- Calculate and interpret measures of central tendency (mean, median, mode) and range for larger data sets
- Construct and interpret a variety of graphs, including line graphs with multiple lines, and more complex pie charts
- Solve problems involving data, including using statistical methods to make predictions and draw conclusions from data sets



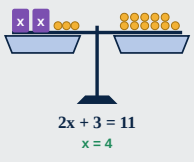

## Proportional Reasoning 比例推理

### YEAR 5

- Understand and use ratio language to describe relationships between quantities (e.g. 3:4, 2:5)
- Solve problems involving ratios, including simple scaling (e.g. doubling or halving quantities)
- Find ratios and proportions in practical contexts, such as recipes or measurements
- Use proportional reasoning to solve problems involving scaling and equivalent ratios

### YEAR 6

- Solve more complex ratio and proportion problems, including those involving scaling up or down
- Use ratio and proportion to solve problems with fractions, percentages and other quantities
- Understand and apply the concept of ratio in various contexts, including comparisons and proportions in recipes, maps and other real-life scenarios
- Work with direct and inverse proportionality to solve problems involving proportional relationships




## Algebra 代数

### YEAR 5

- Introduce and use simple algebraic expressions and formulae
- Generate and describe number sequences, including those with a given rule
- Use simple algebraic notation, such as using symbols to represent unknown values (e.g. finding the value of *x* in simple equations)
- Solve one-step problems involving addition, subtraction, multiplication or division using algebraic expressions

### YEAR 6

- Use and interpret algebraic notation, including expressions, equations and formulae
- Solve two-step equations involving addition, subtraction, multiplication and division
- Generate and describe sequences using algebraic rules and patterns
- Apply algebraic reasoning to solve problems, including those involving the use of formulae
- Understand and solve problems involving simple algebraic expressions and equations, including those with unknowns on both sides

# 数学 Mathematics

五、六年级

在五、六年级结束时，学生将能够……

## 数字和位值 Number and Place Value



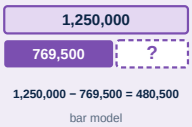

### 五年级

- 理解并运用位值来读、写和比较最高至 1,000,000 的数
- 将数四舍五入到最接近的 10、100、1,000、10,000 和 100,000
- 使用高效的方法进行整数的加、减、乘、除运算
- 在实际情境中认识并使用负数

### 六年级

- 读、写和比较最高至 10,000,000 的数，理解每一位数字的值
- 将数四舍五入到任意数位，并用四舍五入来估算和检查计算结果
- 使用多种策略和方法对大数和小数进行运算
- 解决涉及百分数的问题，包括计算数量的百分之几以及百分比的增加或减少

## 加法和减法 Addition and Subtraction




1,250,000 − 769,500 = 480,500

bar model

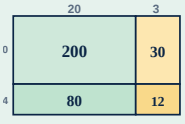
### 五年级

- 使用正式的书面方法加减超过四位的整数
- 进行心算，包括多步骤问题
- 用估算检查答案是否合理
- 解决涉及加减法的问题，包括数越来越大的问题

### 六年级

- 使用正式的书面方法加减最多七位的数
- 进行心算，并解决涉及大数和小数的复杂问题
- 通过估算和近似值判断答案是否合理
- 解决涉及加减法的多步骤问题，包括含有分数和小数的问题

## 乘法和除法 Multiplication and Division




23 × 14 = 322

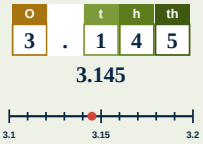
### 五年级

- 将整数和小数乘以或除以 10、100 和 1,000
- 进行乘除法计算，包括用正式的书面方法计算两位数乘两位数和短除法
- 解决涉及乘除法的问题，包括有余数的问题
- 用估算检查答案是否合理，并解决多步骤问题
- 理解并运用质数、平方数和立方数

### 六年级

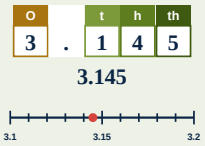
- 用长乘法和长除法计算最多四位数乘以或除以一位数或两位数
- 进行涉及小数的计算，包括小数除以整数
- 解决复杂的乘除法问题，包括多步骤问题和涉及大数的问题
- 通过估算和近似值检查答案，判断结果是否合理
- 理解并运用因数、倍数、质数和公因数的概念

## 小数 Decimals




### 五年级

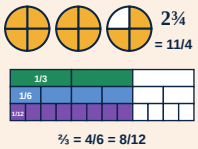
- 理解并使用最多三位小数的数
- 比较小数并排序，解决涉及小数的问题
- 在小数和分数之间转换，并解决涉及小数的各类问题
- 进行小数的加、减、乘、除运算
- 在计算和应用中使用小数解决多步骤问题




## 小数 Decimals *(续)*

### 六年级

- 理解并使用最多四位小数的数
- 进行小数的加、减、乘、除运算
- 解决涉及小数的问题，并在分数和小数之间转换
- 比较不同的小数并排序，包括解决复杂的小数问题
- 运用小数解决多步骤问题，包括实际问题和抽象问题



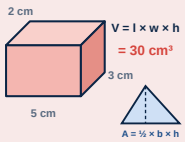

## 分数 Fractions

### 五年级

- 比较不同分母的分数并排序，包括大于 1 的分数
- 加减同分母分数，以及通过通分加减异分母分数
- 真分数和带分数乘以整数
- 真分数除以整数
- 解决涉及分数的问题，包括带分数和假分数
- 理解并使用等值分数，并在适当时约分

### 六年级

- 比较分数并排序，包括异分母分数和带分数
- 用多种方法加减异分母分数
- 分数和带分数的乘除法，包括解决涉及这些运算的问题
- 假分数与带分数互化
- 解决复杂的分数问题，包括分数与其他运算相结合的问题
- 理解并使用百分数作为表示分数的一种方式




## 度量 Measurement

### 五年级

- 在不同度量单位之间换算，包括公制单位（如毫米与厘米、克与千克）和英制单位（如英寸与英尺）
- 计算各种图形的周长和面积，包括组合图形
- 用公式求三角形和平行四边形的面积
- 准确地估计、测量和比较长度、质量、体积和时间
- 解决涉及单位换算以及在实际情境中运用测量的问题

### 六年级

- 在不同度量单位之间换算，包括公制与英制单位之间的复杂换算
- 计算多种图形的面积和体积，包括正方体和长方体，并运用这些计算解决问题
- 运用公式求复杂图形的面积和立体图形的体积
- 高度准确地估计、测量和比较测量值
- 解决涉及测量的多步骤问题，包括实际生活情境和复合单位




## 几何 Geometry

### 五年级

- 根据角、边和对称性等特征识别平面图形并分类
- 认识并描述立体图形的特征，包括顶点、棱和面
- 理解并使用角、直角、锐角和钝角等术语
- 用量角器画角和量角，并准确地估计角的大小
- 在网格上描述和描出点，使用第一象限的坐标
- 将图形沿竖直或水平的对称轴作轴对称（反射）

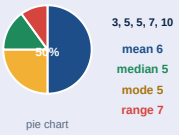
### 六年级

- 根据特征对平面图形分类，并理解平行线和垂直线的概念
- 描述立体图形并分类，包括其特征以及它们之间的关系




## 几何 Geometry （续）

- 理解并计算直线上的角、周角以及各种图形中的角
- 用量角器准确地量角和画角
- 在坐标平面上平移、旋转和反射图形，包括使用负坐标
- 理解并运用图形和图案中的对称性质



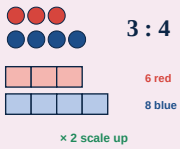

## 统计 Statistics

### 五年级

- 用多种方法收集、解读和呈现数据，包括条形图、折线图和表格
- 计算并解读一组数据的平均数、中位数、众数和极差
- 运用数据解决问题，包括比较不同的数据组并得出结论
- 绘制并解读饼图，并用饼图解决问题

### 六年级

- 从多种来源收集、分析和解读数据，用更复杂的图表呈现
- 计算并解读较大数据组的集中趋势量（平均数、中位数、众数）和极差
- 绘制并解读多种图表，包括多条折线的折线图和更复杂的饼图
- 解决涉及数据的问题，包括运用统计方法对数据组进行预测并得出结论



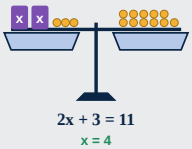

## 比例推理 Proportional Reasoning

### 五年级

- 理解并使用比的语言描述数量之间的关系（例如 3:4、2:5）
- 解决涉及比的问题，包括简单的缩放（例如数量加倍或减半）
- 在食谱或测量等实际情境中找出比和比例
- 运用比例推理解决涉及缩放和等比的问题

### 六年级

- 解决更复杂的比和比例问题，包括放大或缩小的问题
- 运用比和比例解决涉及分数、百分数和其他数量的问题
- 在各种情境中理解并运用比的概念，包括食谱、地图和其他生活场景中的比较和比例
- 运用正比例和反比例关系解决问题




## 代数 Algebra

### 五年级

- 初步认识并使用简单的代数式和公式
- 生成并描述数列，包括按给定规则生成的数列
- 使用简单的代数符号，例如用符号表示未知数（如在简单方程中求 *x* 的值）
- 用代数式解决涉及加、减、乘或除的一步问题

### 六年级

- 使用并解读代数符号，包括代数式、方程和公式
- 解涉及加、减、乘、除的两步方程
- 运用代数规则和规律生成并描述数列
- 运用代数推理解决问题，包括使用公式的问题
- 理解并解决涉及简单代数式和方程的问题，包括两边都有未知数的方程