

Precalculus is graded on describing behaviour precisely: not “the graph goes up”, but “increasing at a decreasing rate”. The definitions below are the vocabulary that description requires, and using it verbatim is what earns the communication points. 微积分预备课重在精确描述函数行为, 必须使用规范术语。

Describing functions

Function 函数 — a rule assigning exactly one output to each input in the domain

Domain 定义域 — the set of all inputs for which a function is defined

Range 值域 — the set of all outputs the function actually produces

Increasing on an interval 在区间上递增 — as input increases across the interval, output increases; concavity then says whether it does so at an increasing or a decreasing rate

Concave up 下凸 — the rate of change is itself increasing, so the graph bends upward

Point of inflection 拐点 — a point where concavity changes

Average rate of change 平均变化率 — the change in output divided by the change in input over an interval – the slope of the secant line

Zero of a function 零点 — an input at which the output is zero, corresponding to an x-intercept

Polynomial and rational functions

Multiplicity 重数 — the number of times a factor appears; an even multiplicity touches the x-axis, an odd one crosses it

End behaviour 端行为 — what the output approaches as the input increases or decreases without bound, set by the leading term

Vertical asymptote 垂直渐近线 — a line $x = a$ that the graph approaches where the denominator is zero and the numerator is not

Horizontal asymptote 水平渐近线 — a value the output approaches as the input grows without bound, determined by comparing the degrees of numerator and denominator

Hole (removable discontinuity) 可去间断点 — a point where a common factor cancels, so the function is undefined at that input though the graph elsewhere is continuous

Exponential, logarithmic and trigonometric functions

Exponential function 指数函数 — a function of the form ab^x , in which output is multiplied by a constant factor for each unit increase in input

Logarithm 对数 — the inverse of an exponential: $\log_b(x)$ is the exponent to which b must be raised to give x

Semi-log plot 半对数图 — a plot with a logarithmic vertical axis, on which an exponential relationship appears linear

Period 周期 — the horizontal length of one complete cycle of a periodic function

Amplitude 振幅 — half the difference between the maximum and minimum values of a sinusoid

Midline 中位线 — the horizontal line halfway between the maximum and minimum of a sinusoid

Phase shift 相移 — a horizontal translation of a periodic function

Radian 弧度 — the angle subtending an arc equal in length to the radius; 2π radians is one full revolution

Functions in context

Describe behaviour with BOTH direction and rate: “increasing at a decreasing rate” is a complete description; “increasing” is half of one.

When a model is fitted to data, state the meaning of each parameter IN CONTEXT and give its units.

Say whether a model’s prediction is an interpolation or an extrapolation, and note that extrapolation beyond the data is unreliable.