

*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;  $2\pi$  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.