Integration and Accumulation of Change

AP Calculus BC · Vocabulary in context

Word	Example
derivative /dɪ'rɪvətɪv/	Use the **derivative** to find the curve's slope at this point.
integral /'ɪntɪgrəl/	Use an **integral** to find the area under a curve.
accumulation /əˌkjuːmjʊ'leɪʃn/	Integration measures **accumulation**: how much builds up over time.
area /'eərɪə/	The integral gives the **area** under the curve.
integral calculus	**Integral calculus** studies areas and totals.
Riemann sum /'riːmən sʌm/	A **Riemann sum** adds the areas of thin rectangles under a curve.
rectangles	The **rectangles** get thinner as we use more of them.
subintervals /ˌsʌbɪn'tɜːvlz/	Split [0, 4] into four **subintervals** of width 1. [0, 4] 1
• **midpoint** /'mɪdpɔɪnt/	The **midpoint** of (0, 0) and (4, 6) is (2, 3). (0, 0) (4, 6) (2, 3)
trapezoidal sum /'træpɪzɔɪdl sʌm/	A **trapezoidal sum** uses trapezoids instead of rectangles.
trapezoids	**Trapezoids** often fit the curve better than rectangles.
overestimate /ˌəʊvə'restɪmət/	A tangent line on a concave-down curve gives an **overestimate**.
underestimate /ˌʌndə'restɪmət/	A tangent line on a concave-up curve gives an **underestimate**.

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summation notation /sʌ'meɪʃn nəʊ'teɪʃn/	**Summation notation** uses Σ to show a sum. Σ
definite integral /'defɪnət 'ɪntɪgrəl/	A **definite integral** has limits and gives a number, such as an area.
limits of integration /'lɪmɪts ɒv ˌɪntɪ'greɪʃn/	In ∫ from 1 to 3, the **limits of integration** are 1 and 3. 1 3 ∫ 1 3
accumulation function /əˌkjuːmjʊ'leɪʃn 'fʌŋkʃn/	An **accumulation function** adds up area from a fixed start to x. x
Fundamental Theorem of Calculus (FTC) /ˌfʌndə'mentl 'θɪərəm ɒv 'kælkjʊləs/	The **Fundamental Theorem of Calculus (FTC)** links derivatives and integrals.
integrand	In $\int x^2\,dx$, the **integrand** is x^2. $\int x^2\,dx$ x^2
upper limit	The **upper limit** is the top number on the integral sign.
chain rule /tʃeɪn ruːl/	Use the **chain rule** for a function inside another function.
add over adjacent intervals	You can **add over adjacent intervals**: 0 to 2 plus 2 to 5 gives 0 to 5. 0 2 2 5 0 5
antiderivative /ˌæntɪdɪ'rɪvətɪv/	Check an **antiderivative** by differentiating it.
net change /net tʃeɪndʒ/	The integral of a rate gives the **net change** in the amount.
indefinite integral /ɪn'defɪnət 'ɪntɪgrəl/	An **indefinite integral** always includes a constant of integration, + c. + c

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constant of integration /ˈkɒnstənt ɒv ˌɪntɪˈgreɪʃn/	The **constant of integration** c is there because every curve $y = x^2 + c$ has the same gradient 2x. $y = x^2 + c$ 2x c
power rule /ˈpaʊə ruːl/	The **power rule** says the derivative of x^n is nx^{n-1}. x^n nx^{n-1}
u-substitution /juː ˌsʌbstɪˈtjuːʃn/	Use **u-substitution** to replace the inner function with u. u
rational /ˈræʃənl/	A **rational** function is a fraction of two polynomials.
long division	Use **long division** when the top degree is not lower than the bottom.
polynomial /ˌpɒlɪˈnəʊmɪəl/	$3x^2 + 2x - 1$ is a **polynomial**. $3x^2 + 2x - 1$
proper fraction /ˈprɒpə ˈfrækʃn/	After division, you get a polynomial plus a **proper fraction**.
Completing the square /kəmˈpliːtɪŋ ðə skweə/	**Completing the square** turns $x^2 + 4x + 5$ into $(x + 2)^2 + 1$. $x^2 + 4x + 5$ $(x + 2)^2 + 1$
denominator /dɪˈnɒmɪneɪtə/	The **denominator** is the bottom of a fraction.
arctangent	The integral of $1/(1 + x^2)$ is **arctangent** of x. $1/(1 + x^2)$ x
Integration by parts /ˌɪntɪˈgreɪʃn baɪ pɑːts/	**Integration by parts** helps with products like $x \cdot e^x$. $x \cdot e^x$
Partial fractions /ˈpɑːʃl ˈfrækʃnz/	**Partial fractions** split one fraction into simpler ones.
logarithm /ˈlɒgərɪθəm/	Take the **logarithm** of both sides.

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Word	Example
logistic differential equation	The **logistic differential equation** models growth that slows down near a limit.
improper integral /ɪmˈprɒpə ˈɪntɪgrəl/	An **improper integral** has an infinite limit or an infinite value inside.
infinite discontinuity /ˈɪnfɪnət dɪskɒntɪˈnjuːɪti/	$1/x$ has an **infinite discontinuity** at $x = 0$. $1/x$ $x = 0$
converges /kənˈvɜːdʒɪz/	The series $1 + ½ + ¼ + \ldots$ **converges** to 2. $1 + ½ + ¼ + \ldots$ 2
diverges /daɪˈvɜːdʒɪz/	The series $1 + 2 + 4 + 8 + \ldots$ **diverges**, because its sum grows without limit. $1 + 2 + 4 + 8 + \ldots$
singularity	A **singularity** is a point where the function blows up.
vertical asymptote /ˈvɜːtɪkl ˈæsɪmptəʊt/	A **vertical asymptote** inside the interval makes the integral improper.
signed area /saɪnd ˈeərɪə/	**Signed area** counts area below the x-axis as negative. x