Contextual Applications of Differentiation

AP Calculus BC · Vocabulary in context

Word	Example
instantaneous rate of change /ˌɪnstən'teɪnɪəs reɪt ɒv tʃeɪndʒ/	The **instantaneous rate of change** is the rate at one exact moment.
with respect to	Differentiate **with respect to** t, treating t as the variable. t t
• **particle** /'pɑːtɪkl/	Modelling the ball as a **particle** means we ignore its size and any rotation.
differentiation /ˌdɪfəˌrenʃi'eɪʃn/	**Differentiation** finds the derivative of a function.
position /pə'zɪʃn/	The **position** of the car is its distance from the start.
velocity /və'lɒsɪti/	The ball's **velocity** is 5 m/s to the left. 5 m/s
acceleration /əkˌselə'reɪʃn/	The car speeds up quickly, so its **acceleration** is large.
at rest /æt rest/	The particle is **at rest** when its velocity is zero.
changes direction	The particle **changes direction** when its velocity changes sign.
Speed /spiːd/	**Speed** is the size of the velocity, without the sign.
speeding up	The particle is **speeding up** when velocity and acceleration have the same sign.
related rates /rɪ'leɪtɪd reɪts/	**Related rates** problems link how fast two quantities change.
chain rule /tʃeɪn ruːl/	Use the **chain rule** for a function inside another function.

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× **product rule** /ˈprɒdʌkt ruːl/	Use the **product rule** to differentiate $x \cdot \sin x$. $x \cdot \sin x$
÷ **quotient rule** /ˈkwəʊʃənt ruːl/	Use the **quotient rule** to differentiate $\sin x / x$. $\sin x / x$
geometric /ˌdʒiːəʊˈmetrɪk/	Draw a **geometric** picture, such as a triangle, to link the quantities.
volume /ˈvɒljuːm/	The **volume** of the box is $2\text{ m} \times 1\text{ m} \times 1\text{ m} = 2\text{ m}^3$. $2\text{ m} \times 1\text{ m} \times 1\text{ m} = 2\text{ m}^3$
instant	Find the rate at the **instant** when the radius is 3 cm. 3 cm
Pythagoras' theorem /paɪˈθægərəs ˈθɪərəm/	**Pythagoras' theorem** says $a^2 + b^2 = c^2$. $a^2 + b^2 = c^2$
• **point of tangency**	The **point of tangency** is where the tangent line touches the curve.
smooth curve	A **smooth curve** has no corners or breaks.
↗ **tangent line** /ˈtændʒənt laɪn/	The **tangent line** touches the curve at one point and has the same slope there.
local linearity /ˈləʊkl lɪˈnɪərɪti/	**Local linearity** means a curve looks like a straight line when you zoom in.
linear approximation /ˈlɪnɪə əˌprɒksɪˈmeɪʃn/	A **linear approximation** uses the tangent line to estimate a value.
↗ **linearization** /ˌlɪnɪəraɪˈzeɪʃn/	A **linearization** uses the tangent line to estimate values near a point.
concavity /kənˈkævɪti/	The second derivative tells you the **concavity**: which way the curve bends.
☺ **concave up** /kɒnˈkeɪv ʌp/	The graph is **concave up** when it bends like a cup.

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underestimate /ˌʌndəˈrestɪmət/	A tangent line on a concave-up curve gives an **underestimate**.
concave down /kɒnˈkeɪv daʊn/	The graph is **concave down** when it bends like a hill.
overestimate /ˌəʊvəˈrestɪmət/	A tangent line on a concave-down curve gives an **overestimate**.
direct substitution /daɪˈrekt ˌsʌbstɪˈtjuːʃn/	For a polynomial, use **direct substitution**: just put the number in.
indeterminate form /ˌɪndɪˈtɜːmɪnət fɔːm/	0/0 is an **indeterminate form**: it does not tell you the limit. 0/0
L'Hospital's Rule /ˈelhɒspɪtlz ruːl/	Use **L'Hospital's Rule** for 0/0: differentiate the top and the bottom. 0/0
numerator /ˈnjuːmərəɪtə/	The **numerator** is the top of a fraction.
denominator /dɪˈnɒmɪneɪtə/	The **denominator** is the bottom of a fraction.
differentiable /ˈdɪfərenʃɪəbl/	A function is **differentiable** at a point if it has a slope there.
one-sided	Check the **one-sided** limits from the left and from the right.
exponential /ˌekspəˈnenʃl/	e^x grows in an **exponential** way: faster and faster. e^x
polynomial /ˌpɒlɪˈnəʊmɪəl/	$3x^2 + 2x - 1$ is a **polynomial**. $3x^2 + 2x - 1$

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