Analytical Applications of Differentiation

AP Calculus AB · Vocabulary in context

Word	Example
Mean Value Theorem /miːn ˈvæljuː ˈθɪərəm/	The **Mean Value Theorem** says somewhere the slope equals the average slope.
average rate of change /ˈævrɪdʒ reɪt ɒv tʃeɪndʒ/	The **average rate of change** is the change in y divided by the change in x. $\frac{y}{x}$
continuous /kənˈtɪnjuːəs/	The beta particles have a **continuous** range of energies. β
differentiable /ˌdɪfərenʃiəbl/	A function is **differentiable** at a point if it has a slope there.
interval /ˈɪntəvl/	The **interval** from 2 to 5 includes every number between them. $2 \quad 5$
tangent line /ˈtændʒənt laɪn/	The **tangent line** touches the curve at one point and has the same slope there.
parallel /ˈpærəlel/	**Parallel** lines have equal gradients and never meet.
endpoints	The **endpoints** of [1, 4] are 1 and 4. [1, 4] $1 \quad 4$
Extreme Value Theorem /ekˈstriːm ˈvæljuː ˈθɪərəm/	The **Extreme Value Theorem** says a continuous function on [a, b] has a highest and a lowest value. [a, b]
closed interval	A **closed interval** like [1, 4] includes its endpoints. [1, 4]
absolute maximum	The **absolute maximum** is the highest value on the whole interval.
absolute minimum	The **absolute minimum** is the lowest value on the whole interval.

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critical point /ˈkrɪtɪkl pɔɪnt/	A **critical point** is where $f'(x)$ is zero or undefined. $f'(x)$
interior point	An **interior point** lies inside the interval, not at an end.
domain /dəˈmeɪn/	Leave zero out of the **domain** when x is on the bottom of a fraction. x
local (relative) extrema /ˈləʊkl ekˈstremə/	**Local (relative) extrema** are the highest or lowest points in their area.
extremum	A maximum or a minimum is called an **extremum**.
candidates	The **candidates** for the maximum are the critical points and the endpoints.
first derivative	The **first derivative** tells you where f is rising or falling. f
increasing /ɪnˈkriːsɪŋ/	A sequence is **increasing** if each term is bigger than the last.
decreasing /ˈdiːkriːsɪŋ/	A sequence is **decreasing** if each term is smaller than the last.
local maximum /ˈləʊkl ˈmæksɪməm/	At a **local maximum**, the gradient is zero and the second derivative is negative.
local minimum /ˈləʊkl ˈmɪnɪməm/	At a **local minimum**, the gradient is zero and the second derivative is positive.
sign change /saɪn tʃeɪndʒ/	A **sign change** in f' from $+$ to $-$ shows a maximum. f' $+$ $-$
justification	Give a **justification**: explain why your answer is right.

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candidates test /ˈkændɪdeɪts test/	The **candidates test** checks f at each critical point and endpoint. f
second derivative /ˈsekənd dɪˈrɪvətɪv/	The **second derivative** tells us how the gradient changes.
concave up /kɒnˈkeɪv ʌp/	The graph is **concave up** when it bends like a cup.
concave down /kɒnˈkeɪv daʊn/	The graph is **concave down** when it bends like a hill.
point of inflection /pɔɪnt ɒv ɪnˈflekʃn/	At a **point of inflection**, the curve changes from bending one way to the other.
inconclusive /ɪŋkənˈkluːsɪv/	If $f'' = 0$, the second-derivative test is **inconclusive**: it tells you nothing. $f'' = 0$
first derivative test /fɜːst dɪˈrɪvətɪv test/	The **first derivative test** checks how f' changes sign at a critical point. f'
Optimization /ˌɒptɪmaɪˈzeɪʃn/	**Optimization** finds the largest or smallest possible value.
constraint /kənˈstreɪnt/	The weight limit is a **constraint** on the design.
implicitly defined /ɪmˈplɪsɪtli dɪˈfaɪnd/	The curve $x^2 + y^2 = 25$ is **implicitly defined**. $x^2 + y^2 = 25$
horizontal tangent	A **horizontal tangent** has slope zero.
undefined	The slope is **undefined** when we would divide by zero.
vertical tangent /ˈvɜːtɪkl ˈtændʒənt/	A **vertical tangent** is a straight up-and-down tangent line.

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Word	Example
second-derivative test	The **second-derivative test** says $f'' > 0$ at a critical point gives a minimum. $f'' > 0$

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