

Calculus · supported focus

Supported focus · SL

Supported scope

- Supported SL focus. First assessment 2021; current through 2028.
First-assessment-2029 course is separate.. Remaining guide, assessment and practical requirements retain their recorded holds.
- State model conditions and distinguish fictional data from measurements.

Differentiation · 1.1

Reasoning

A curved road has different slopes at different positions. An average gradient cannot describe every point. This lesson studies derivative : The instantaneous rate of change, also the gradient of a tangent.

Differentiation · 2.1

Reasoning

For $y = ax^n$, $dy/dx = anx^{n-1}$. A stationary point satisfies $dy/dx = 0$. Check the sign change of the derivative, or the second derivative when it is nonzero, to classify it. State the allowed inputs and units before calculating. An equation should express the relationship, not just record a calculator entry.

Differentiation · 3.1

Reasoning

Use the displayed relationship within its stated domain.

$$\frac{d}{dx}(ax^n) = anx^{n-1}, \quad f'(x) = 0$$

Differentiation · 3.2

Reasoning

Check the result against the starting quantities. Substitute into the original relation, or compare the graph and numerical answer where appropriate.

Differentiation · 3.3

Reasoning

For $y=x^3-3x$, $dy/dx=3x^2-3$. At $x=1$, the gradient is 0 and $y=-2$. The second derivative is $6x$, positive at $x=1$, so this is a local minimum. At $x=-1$, $y=2$ and the second derivative is negative, giving a local maximum.

Differentiation · 4.1

Reasoning

A zero derivative does not always mean a maximum or minimum: $y=x^3$ is stationary at 0 but continues increasing. An endpoint can also produce an extreme value on a restricted domain. When a shortcut fails, identify the assumption it breaks. Keep an exact value until the requested final rounding.

Differentiation · 4.2

Reasoning

Every point with zero derivative is a local maximum or minimum. This claim is false. Explain which definition or assumption it violates.

Differentiation · 5.1

Reasoning

At GCSE/IGCSE use only the polynomial scope allowed by the tier; do not add chain, product or quotient rules there. At advanced level, connect the derivative to rates and optimization with a valid domain. A complete solution gives the mathematical result and explains what it means. Check that it is possible in the stated context.

Differentiation · 6.1

Reasoning

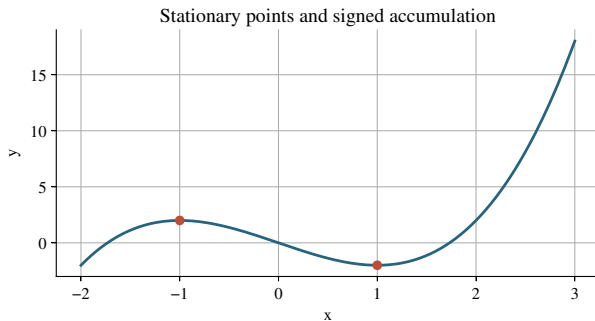
Current first-assessment-2021 Applications and Interpretation SL. This is authored concept support; the full guide is needed to certify every objective. Give the method before the final answer, and use the paper's calculator and formula rules. Review a wrong answer by locating the first invalid step.

Differentiation · 6.2

Reasoning

The instantaneous rate of change, also the gradient of a tangent. Choose the relationship, show the method, check its assumptions and interpret the result.

Differentiation · diagram



- Original teaching diagram: Derivatives and stationary points
- Use the labels and the stated model together.

Differentiation · original transfer

Your turn

For $y=x^3-3x$ on $[-2, 2]$, find the absolute maximum and minimum, including all candidates.

Differentiation · transfer reasoning

Method and interpretation

Derivative $3x^2 - 3 = 0$ at ± 1 . Values $y(-2) = -2$, $y(-1) = 2$, $y(1) = -2$, $y(2) = 2$.

Maximum 2 at $-1, 2$; minimum -2 at $-2, 1$. Checking only stationary points misses endpoint ties.

Numerical · 1.1

Reasoning

A nonlinear equation has no convenient exact solution. An approximation still needs evidence that it is reliable. This lesson studies iteration : A repeated update in which each new approximation is calculated from the previous one.

Numerical · 2.1

Reasoning

A continuous function with opposite signs at two endpoints has a root between them. Newton's method uses $x_{\text{next}} = x - f(x)/f'(x)$, with a nonzero derivative. The trapezium rule approximates a definite integral using endpoint heights. State the allowed inputs and units before calculating. An equation should express the relationship, not just record a calculator entry.

Numerical · 3.1

Reasoning

Use the displayed relationship within its stated domain.

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

Numerical · 3.2

Reasoning

Check the result against the starting quantities. Substitute into the original relation, or compare the graph and numerical answer where appropriate.

Numerical · 3.3

Reasoning

For $f(x)=x^2-2$ and $x_0=1.5$, Newton gives $x_1=1.5-(2.25-2)/3=1.4166667$. With $y=x^2$ on $[0,2]$ and two equal strips, $h=1$ and trapezium area $=(1/2)(0+2\times 1+4)=3$; the exact area is $8/3$.

Numerical · 4.1

Reasoning

A sign change across a discontinuity does not prove a root. Iteration can diverge or cycle. The trapezium rule's overestimate or underestimate depends on curvature, not just whether the function increases. When a shortcut fails, identify the assumption it breaks. Keep an exact value until the requested final rounding.

Numerical · 4.2

Reasoning

Every sign change proves a root, including one across a discontinuity. This claim is false. Explain which definition or assumption it violates.

Numerical · 5.1

Reasoning

Give a stopping criterion and report sensible accuracy. Confirm the approximated root by a sign bracket around the stated rounded answer; explain any failure of the chosen iteration. A complete solution gives the mathematical result and explains what it means. Check that it is possible in the stated context.

Numerical · 6.1

Reasoning

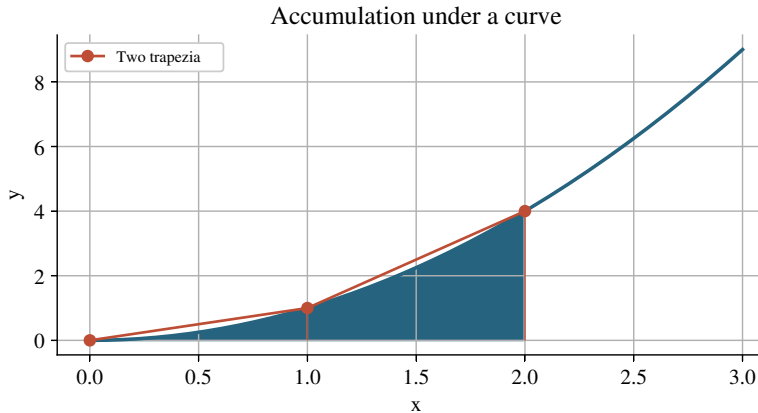
Current first-assessment-2021 Applications and Interpretation SL. This is authored concept support; the full guide is needed to certify every objective. Give the method before the final answer, and use the paper's calculator and formula rules. Review a wrong answer by locating the first invalid step.

Numerical · 6.2

Reasoning

A repeated update in which each new approximation is calculated from the previous one. Choose the relationship, show the method, check its assumptions and interpret the result.

Numerical · diagram



Trapezia replace the curve with straight chords.

Numerical · original transfer

Your turn

Apply one Newton step to $f(x)=x^3-2x+2$ from $x_0=0$ and then one more. What happens, and what does it teach about convergence?

Numerical · transfer reasoning

Method and interpretation

$x_1 = 0 - 2/(-2) = 1$; $x_2 = 1 - 1/1 = 0$. It cycles 0, 1 rather than converging. Newton requires suitable starting values/derivatives; use a bracketed method or inspect the function rather than assuming every iteration converges.

Check yourself

- Explain derivative using the stated model.
- Explain iteration using the stated model.
- Change one value in the original transfer; explain which assumption still matters.