

Functions · supported focus

Supported focus · HL

Supported scope

- Supported HL 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.

Functions · 1.1

Reasoning

A square-root model returns a real output only for some inputs. Its formula alone does not specify a complete function. This lesson studies domain : The set of allowed inputs to a function.

Functions · 2.1

Reasoning

State the domain and range. For an inverse, first ensure the function is one-to-one on its domain. Composition fg means apply g first, then f ; the intermediate output must be an allowed input to f . State the allowed inputs and units before calculating. An equation should express the relationship, not just record a calculator entry.

Functions · 3.1

Reasoning

Use the displayed relationship within its stated domain.

$$f(g(x)) = (f \circ g)(x), \quad f^{-1}(f(x)) = x$$

Functions · 3.2

Reasoning

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

Functions · 3.3

Reasoning

For $f(x)=\sqrt{(x-2)}$, $x\geq 2$ and the range is $y\geq 0$. From $y=\sqrt{(x-2)}$, $x=y^2+2$. Thus f inverse $(x)=x^2+2$ with $x\geq 0$. For $g(x)=x+3$, $fg(1)=f(4)=\sqrt{2}$.

Functions · 4.1

Reasoning

Squaring can introduce extraneous solutions. Restricting a parabola's domain is essential before claiming an inverse. A horizontal translation inside f has the opposite sign to the graph's movement. When a shortcut fails, identify the assumption it breaks. Keep an exact value until the requested final rounding.

Functions · 4.2

Reasoning

Every quadratic function on all real numbers has an inverse function. This claim is false. Explain which definition or assumption it violates.

Functions · 5.1

Reasoning

Check $f(f^{-1}(x))=x$ on the inverse domain. Use a sketch to test whether a horizontal line meets the original graph more than once. A complete solution gives the mathematical result and explains what it means. Check that it is possible in the stated context.

Functions · 6.1

Reasoning

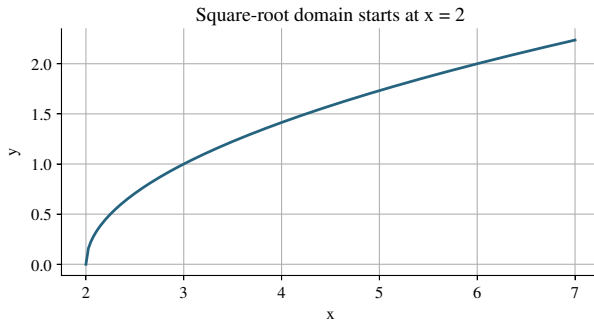
Current first-assessment-2021 Analysis and Approaches HL. This is authored concept support; the full guide is needed to certify every objective. Give the method before the final answer, and use the paper's calculator and formula rules. Review a wrong answer by locating the first invalid step.

Functions · 6.2

Reasoning

The set of allowed inputs to a function. Choose the relationship, show the method, check its assumptions and interpret the result.

Functions · diagram



- Original teaching diagram: Domains, inverses and composition
- Use the labels and the stated model together.

Functions · original transfer

Your turn

For $f(x)=x^2$ on $x \geq 0$ and $g(x)=x-3$, find $f(g(x))$ and its domain, then find f inverse(16). Explain why the restriction matters.

Functions · transfer reasoning

Method and interpretation

Composite = $(x-3)^2$ with $x \geq 3$ because $g(x)$ must lie in f 's domain. Inverse $16=4$.
Without restriction x^2 is not one-to-one and the inverse would not be a function on the full real domain.

Logs · 1.1

Reasoning

A medicine concentration falls by the same percentage each hour. A constant subtraction would eventually predict a negative amount. This lesson studies half-life
: The time for a decaying quantity to fall to half its initial value.

Logs · 2.1

Reasoning

For $y=Ae^{(kt)}$, k is a proportional rate. Taking logs gives $\ln y=\ln A+kt$. Logarithms require positive arguments, and $\log(x+y)$ is not $\log x+\log y$. State the allowed inputs and units before calculating. An equation should express the relationship, not just record a calculator entry.

Logs · 3.1

Reasoning

Use the displayed relationship within its stated domain.

$$y = Ae^{kt}, \quad \ln y = \ln A + kt$$

Logs · 3.2

Reasoning

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

Logs · 3.3

Reasoning

If $y=80e^{(-0.2t)}$, $y=40$ gives $e^{(-0.2t)}=1/2$. Hence $t=\ln 2/0.2 \approx 3.466$. For $3^x=20$, $x=\ln 20/\ln 3$. Plotting $\ln y$ against t linearises this exponential model.

Logs · 4.1

Reasoning

A fitted exponential is a model, not a guarantee. Specify the time units and range of use. A negative k describes decay; a negative starting amount usually contradicts the context. When a shortcut fails, identify the assumption it breaks. Keep an exact value until the requested final rounding.

Logs · 4.2

Reasoning

For positive x and y , $\ln(x+y) = \ln x + \ln y$. This claim is false. Explain which definition or assumption it violates.

Logs · 5.1

Reasoning

Compare actual observations with the model. Systematic departures may indicate changing conditions. In a report, explain what the rate and initial value mean, rather than giving a bare equation. A complete solution gives the mathematical result and explains what it means. Check that it is possible in the stated context.

Logs · 6.1

Reasoning

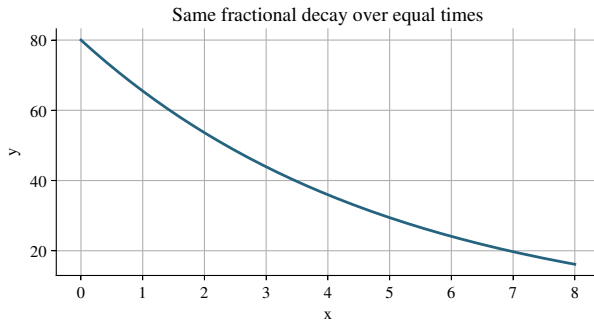
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Logs · 6.2

Reasoning

The time for a decaying quantity to fall to half its initial value. Choose the relationship, show the method, check its assumptions and interpret the result.

Logs · diagram



- Original teaching diagram: Exponentials, logarithms and modelling
- Use the labels and the stated model together.

Logs · original transfer

Your turn

A fictional quantity follows $80 \exp(-0.2 t)$. Find when it reaches 20, retaining an exact expression; explain why the half-life does not depend on 80.

Logs · transfer reasoning

Method and interpretation

$t = \ln 4 / 0.2 \approx 6.931$ time units. Half-life $\ln 2 / 0.2$ follows from a ratio $1/2$; the initial multiplier cancels. Extrapolation assumes the exponential model continues.

Check yourself

- Explain domain using the stated model.
- Explain half-life using the stated model.
- Change one value in the original transfer; explain which assumption still matters.