

Functions · 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.

# 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

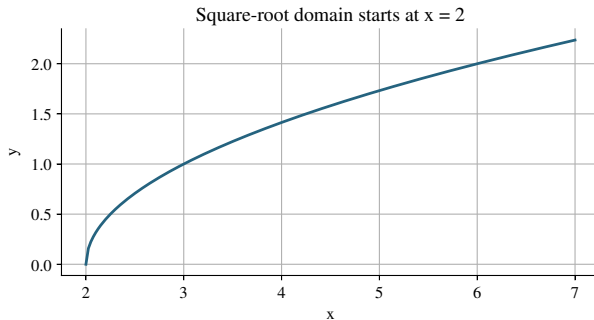
Current first-assessment-2021 Analysis and Approaches SL. This is authored concept support; the full guide is needed to certify every objective. Give the method before the final answer, and use the paper's calculator and formula rules. Review a wrong answer by locating the first invalid step.

## 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

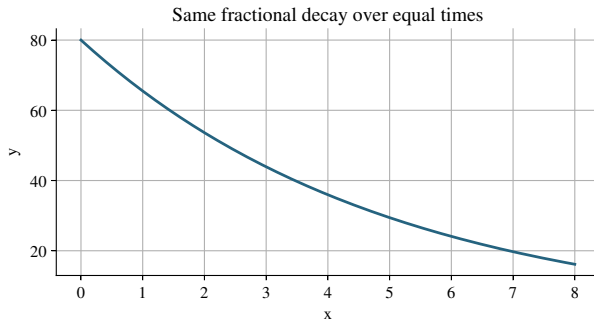
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# Logs · 6.2

## 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.