Exponentials, logarithms and numerical roots

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A sample from this topic. The complete topic collection contains three different resources and worked solutions.

Read the worked example, then show each step in the practice questions. Show the mathematical steps. A calculator, graphing tool or CAS may be used to check results where useful.

What you will practise

• Exponential and logarithmic functions; logarithm laws; Newton’s method

Useful starting skills: Year 10 algebra, factorisation, functions, indices, geometry and elementary probability.

An exponential model multiplies by a fixed factor over equal intervals. Logarithms invert exponentiation and help solve for the exponent.

Newton’s method uses the tangent update $x_{n+1}=x_n-f(x_n)/f'(x_n)$. It needs a nonzero derivative at each update and a sensible starting value; convergence is not guaranteed.

Worked example

Solve $3\times2^x=24$.

Divide by 3 to get $2^x=8=2^3$.

Answer: $x=3$.

Try it yourself

Name: _____ Date: _____

1. Simplify $\log_{10}(1000)$ and $\log_{2}(1/8)$.

2. Solve $5^{x}=20$ exactly.

Answers and explanations

Check the method as well as the final answer. An alternative correct method is also valid.

1. 3 and -3.

$10^3=1000$; $2^{(-3)}=1/8$.

2. $x=\ln 20/\ln 5$.

Take logarithms and use the power law.

Curriculum reference: Mathematical Methods Units 1–2 — Exponential and logarithmic functions; logarithm laws; Newton’s method

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