Pre-Calculus 12 Solving Exponential Equations

> **Steps (Without a Common Base):**
> 1. Apply logarithms to both sides.
> 2. Apply the laws of logarithms.
> 3. Solve for x
> 4. Evaluate logs with calculator (last step only)

Ex. 1) Solve for x:

a) $4^x = 12$

$$\log 4^x = \log 12$$
$$x \cdot \log 4 = \log 12$$
$$x = \frac{\log 12}{\log 4}$$
$$x = 1.792$$

① Apply logs
② Power law
③ Solve for x

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b) $2(3^x) = 5$
$\underline{\text{product}}$

$$\log[2(3^x)] = \log 5$$
$$\log 2 + x \log 3 = \log 5$$
$$x \log 3 = \log 5 - \log 2$$
$$x = \frac{(\log 5 - \log 2)}{\log 3}$$
$$x = 0.834$$

① Apply logs
② Log laws (Product law and Power Law)
③ Isolate term with x
④ Solve for x

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c) $3^{x+1} = 6^x$

$\log 3^{x+1} = \log 6^x$ ① Apply logs

$(x+1)\log 3 = x\log 6$ ② Power law (watch brackets)

$x\log 3 + \log 3 = x\log 6$ ③ Distribute

$\log 3 = x\log 6 - x\log 3$ Note $\log(x+1) \neq \log x + \log 1$

$\log 3 = x(\log 6 - \log 3)$;Illegal !!

$\dfrac{\log 3}{(\log 6 - \log 3)} = x$ ④ Collect terms with x

    ⑤ Factor (GCF is x)

brackets $1.585 = x$ ⑥ Solve for x
on
calc   ⑦ Evaluate w/ calc.

d) $19^{x-5} = 3^{x+2}$

$\log 19^{x-5} = \log 3^{x+2}$

$(x-5)\log 19 = (x+2)\log 3$

$x\log 19 - 5\log 19 = x\log 3 + 2\log 3$

$x\log 19 - x\log 3 = 2\log 3 + 5\log 19$

$x(\log 19 - \log 3) = 2\log 3 + 5\log 19$

$x = \dfrac{(2\log 3 + 5\log 19)}{(\log 19 - \log 3)}$ Calc used for last step only!

$x = 9.166$

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