MTH 30

Homework

Section 3.4 / 8, 16, 26, 42, 48, 54, 60, 70, 72, 78, 86.

№8 solve. $5^{3x-1} = 125$.

$5^{3x-1} = 5^{3}$ therefore $3x-1 = 3$ $\boxed{x = \frac{4}{3}}$

№16 solve $7^{\frac{x-2}{6}} = \sqrt{7}$

re-writing: $7^{\frac{x-2}{6}} = 7^{\frac{1}{2}}$

therefore $\frac{x-2}{6} = \frac{1}{2}$ or $2(x-2) = 1 \cdot 6$

or $2x - 4 = 6$

$\boxed{x = 5}$

№26 $e^{x} = 0.83$ - let's take ln of both sides

$\ln(e^{x}) = \ln 0.83$ ↘ by properties of logarithms $(\ln e^{b} = b)$

$\boxed{x = \ln 0.83}$

or $x \approx -0.186$

№42 $7^{2x+1} = 3^{x+2}$ - let's take ln of both sides:

$\ln 7^{2x+1} = \ln 3^{x+2}$ ↘ by properties of logs $(\log_b x^{n} = n \log_b x)$

$(2x+1)\ln 7 = (x+2)\ln 3$

- let's solve for x:

$2x \ln 7 + \ln 7 = x \ln 3 + 2 \ln 3$

$2x \ln 7 - x \ln 3 = 2 \ln 3 - \ln 7$

$x(2\ln 7 - \ln 3) = \ln 3^{2} - \ln 7$

$x(\ln 7^{2} - \ln 3) = \ln \frac{9}{7}$

$x \cdot \ln \frac{49}{3} = \ln \frac{9}{7}$

also $x = \frac{2\ln 3 - \ln 7}{2\ln 7 - \ln 3}$ is an answer.

$\boxed{x = \frac{\ln \frac{9}{7}}{\ln \frac{49}{3}} \approx 0.09}$

№48 $2^{2x} + 2^{x} - 12 = 0$

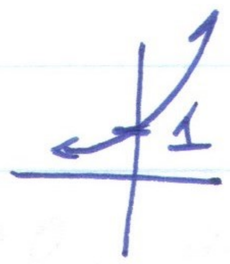
let $t = 2^x$, then we can re-write the original equation in the form:

$t^2 + t - 12 = 0$ - let's solve it:

$(t-3)(t+4) = 0$

$t = 3$ or $t = -4$.

$2^x = 3$ $\quad 2^x \neq -4$



$2^x > 0$

$\ln 2^x = \ln 3$

$x \ln 2 = \ln 3$

$\boxed{x = \frac{\ln 3}{\ln 2}}$ or $\boxed{x \approx 1.58}$

№54 $\log_5(x-7) = 2$

two ways:

$5^2 = x - 7$

$25 = x - 7$

$\boxed{x = 32}$

$\log_5(x-7) = \log_5 25$

$x - 7 = 25$

$\boxed{x = 32}$

checking! $32 - 7$ must be > 0 $(\log_5(x-7))$

$32 - 7 = 25 > 0$ - everything is OK

№68

$6\ln(2x) = 30.$

- first, get rid of coefficient 6:

$\ln(2x) = \frac{30}{6}$ or $\ln 2x = 5$

then there are again two ways there:

$e^5 = 2x$ | $\ln 2x = \ln e^5$

$\boxed{x = \frac{e^5}{2}}$ or $\boxed{x \approx 72.21}$

answer

checking: $2x > 0$: $2 \cdot 72.21 > 0$. good.

№72

$\log_4(x+2) - \log_4(x-1) = 1.$

first, let's join logarithms (compress)

$\log_4 \frac{x+2}{x-1} = 1$

then let's use one of the ways!

$4^1 = \frac{x+2}{x-1}$ or $4(x-1) = x+2$

$4x - 4 = x + 2$ $\quad 3x = 6$ $\quad \boxed{x = 2}$ ← answer

check: $x+2 > 0$ $\quad x-1 > 0$

$2+2 > 0$ ✓ $\quad 2-1 > 0$ ✓

N74 $3\log_2(x-1) = 5 - \log_2 4.$

$\log_2(x-1)^3 + \log_2 4 = 5$

$\log_2 4(x-1)^3 = 5$

$2^5 = 4(x-1)^3$ or $\frac{32}{4} = \frac{4(x-1)^3}{4}$ or

$(x-1)^3 = 8$ $\quad x-1 = \sqrt[3]{8}$ $\quad x-1 = 2$

$\boxed{x = 3}$

answer

checking: $x-1 > 0$

$3-1 > 0$ ✓

N880 $\log(2x-1) = \log(x+3) + \log 3$

$\log(2x-1) = \log 3(x+3)$

$2x-1 = 3(x+3)$ or $2x-1 = 3x+9$ or $\boxed{x = -10}$

checking: $2x-1 > 0$

$2\cdot(-10)-1 \not> 0$

Answer: no solutions

N88 $\log(x+3) + \log(x-2) = \log 14$

$\log(x+3)(x-2) = \log 14$

$(x+3)(x-2) = 14$ $\qquad x^2 + x - 6 = 14$

$x^2 + x - 20 = 0$ $\qquad (x-4)(x+5) = 0$

$\boxed{x = 4}$ $\qquad \boxed{x = -5}$

checking: $x + 3 > 0$ $\qquad x + 3 > 0$

$4 + 3 > 0$ ✓ $\qquad -5 + 3 \not> 0$

$x - 2 > 0$

$4 - 3 > 0$ ✓

Answer: $x = 4$