Last day's Work: Begin Review p. 510

#1c, 2d, 3d*graph too, 4, 5b, 6b, 8*, 9, 10abc, 11c, 12, 13

c ab

**the answer for 8d is 3.*

**the answer for 11c is 2.552*

p. 510 **8.** Use the laws of logarithms to evaluate.

a) $\log_6 42 - \log_6 7$

b) $\log_3 5 + \log_3 18 - \log_3 10$

c) $\log_7 \sqrt[3]{49}$

d) $2\log_4 8$

c) $\log_7 \sqrt[3]{49}$

$= \log_7 (7^2)^{\frac{1}{3}}$

$= \frac{2}{3}$

$\to \log_7 (49^{\frac{1}{3}})$

$= \log_7 (7^2)^{\frac{1}{3}}$

p. 510

12. Solve.

a) $4^x + 6(4^{-x}) = 5$

b) $8(5^{2x}) + 8(5^x) = 6$

12a) $4^x + 6(4^{-x}) = 5$

$4^x[4^x] + 4^x[6(4^{-x})] = 4^x[5]$

$4^{2x} + 6(4^0) = 5(4^x)$

$4^{2x} - 5(4^x) + 6 = 0$

Let $w = 4^x$ $\therefore w^2 - 5w + 6 = 0$

$(w-3)(w-2) = 0$

$\therefore (4^x - 3)(4^x - 2) = 0$

$4^x = 3 \qquad 4^x = 2$

$x = \frac{\log 3}{\log 4}$ or $x = \frac{\log 2}{\log 4}$

$\doteq 0.7924 \qquad = \frac{1}{2}$

$\doteq 0.792$

12b) $8(5^{2x}) + 8(5^x) = 6$

Let $w = 5^x$ $\therefore 8w^2 + 8w - 6 = 0$

$\therefore 4w^2 + 4w - 3 = 0$

$(2w+3)(2w-1) = 0$

$\therefore 2(5^x) + 3 = 0$ or $2(5^x) - 1 = 0$

$5^x = -\frac{3}{2} \qquad 5^x = \frac{1}{2}$

Not possible to get -ve or $x = \frac{\log \frac{1}{2}}{\log 5}$

$\doteq -0.4306$

$\doteq -0.431$

p. 510 **13.** The half-life of a certain substance is 3.6 days. How long will it take for 20 g of the substance to decay to 7 g?

13) half-life = 3.6 days

time for 20g → 7g

$M(t) = 20\left(\frac{1}{2}\right)^{\frac{t}{3.6}}$

$7 = 20\left(\frac{1}{2}\right)^{\frac{t}{3.6}}$

$\frac{7}{20} = \frac{1}{2}^{\frac{t}{3.6}}$

$\log \frac{7}{20} = \frac{t}{3.6} \log \frac{1}{2}$

$\therefore \frac{3.6 \log\left(\frac{7}{20}\right)}{\log \frac{1}{2}} = t$

$t \doteq 5.452$

$\doteq 5.45$ days

8.6 Solving Logarithmic Equations

"I can solve and check any equation with logarithmic expressions. I also know what the restrictions are in an equation."

(Desmos: 4U 8.6)

Recall: Given: $y = \log_b x$. Sketch

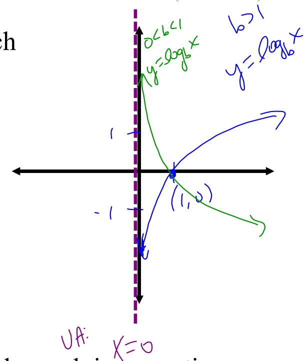
(Refer to p.450)

$D:\{x \in R \mid x > 0\}$

$R:\{y \in R\}$

$b > 0,\ b \neq 1$

x	y
1	0
b	1
$\frac{1}{b}$	-1



Since the domain of $y = \log_b x$ is $D:\{x \in R \mid x > 0\}$, when solving equations involving logarithms, one must always identify the restrictions on x.
It is best to do this **as soon as possible**.

For example, if one is asked to solve $\log_5(2x - 5) = \log_5 7$, then whatever the final solution is for x, it must be greater than $\frac{5}{2}$. Restriction: $2x-5>0$

$2x>5$

$x>\frac{5}{2}$

Ex. 1: Solve: $\log_5(2x - 5) = \log_5 7$ Rest.

Identities:

$b^m = b^n$

$\therefore m = n$

$\log_b m = \log_b n$

$\therefore m = n$

$\therefore 2x-5 = 7$

$2x = 7+5$

$2x = 12$

$x = 6$

(Check vs Restriction)

$\therefore 6 > \frac{5}{2}$ ✓

$\therefore x = 6$ is the solution.

Ex. 2: Solve:

a) $\log_3(x - 4) + \log_3 5 = \log_3 10$

Restriction: $x-4>0$

$x>4$

$\log_3[(x-4)5] = \log_3 10$

$5(x-4) = 10$

$5x-20=10$

$5x = 10+20$

$5x = 30$

$x = 6$

$\log_2 H = 3$

$2^3 = H$

(Check vs Restriction)

$\therefore 6 > 4$ ✓

$\therefore x=6$ is the solution.

b) $\log_2(x - 3) + \log_2(x + 4) = 3$

R: $x-3>0$ AND $x+4>0$

$x>3$ $\cap$ $x>-4$

-4 0 3 $\mathbb{R}$

$\therefore x>3$ (overlap)

$\log_2(x-3)(x+4) = 3$

$2^3 = (x-3)(x+4)$

$8 = x^2+x-12$

$0 = x^2+x-12-8$

$= x^2+x-20$

$= (x+5)(x-4)$

(Check vs Restriction)

$x=-5$ or $x=4$ ✓

$\therefore -5 \not> 3$ ✗ $\therefore 4>3$

$\therefore x=-5$ is an extraneous root (inadmissible)

$\therefore x=4$ is the solution.

pp. 491–492 #1de, 2de, 4de, 5cef, 7bdef, 9, 12, 13, 14, 20
Also **READ** pp. 494–499 (For Tomorrow)