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MATH 2311
Pre-Calculus I
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11/19/2018.

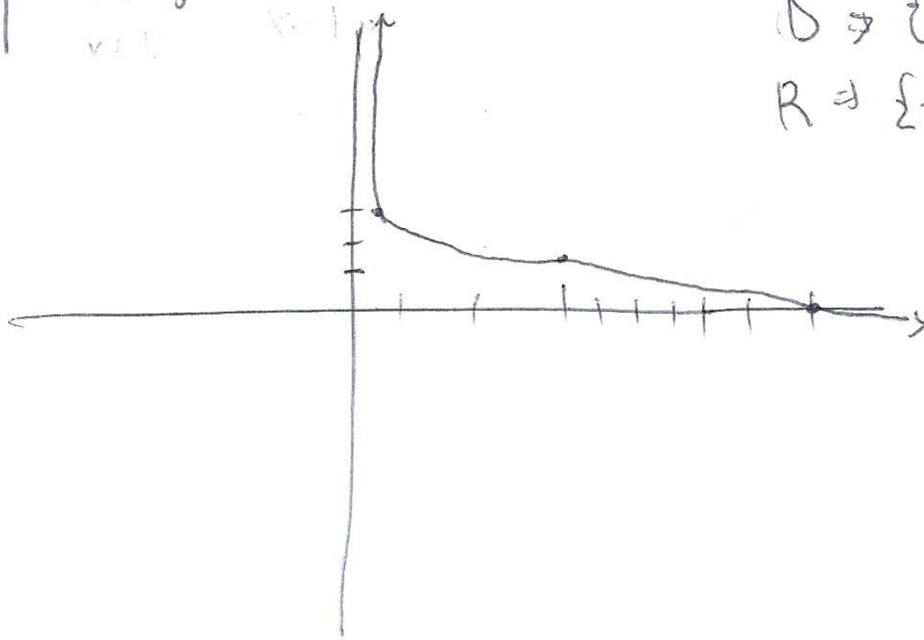
$f(x) = -\log_3(x) + 2.$

x	y
3	$-\log_3(3)+2 = -1+2 = 1$
$\frac{1}{3}$	$-\log_3(\frac{1}{3})+2 = -(-1)+2 = 3.$
9	$-\log_3(9)+2 = -2+2 = 0.$
1	$-\log_3(1)+2 = -0+2 = 2.$

V.A $\Rightarrow X = 0.$

D $\Rightarrow \{0, \infty\}.$

R $\Rightarrow \{-\infty, \infty\}.$



3.5 Solving Logarithmic and Exponential Equations.

Solving logarithmic equations:

- If you have a number floating about outside the logarithm, use exponential.

$$\log_b (x) = \#$$

Ex: $\log_2 (x+1) = 3.$

$\Rightarrow \quad 2^3 = x+1 \Rightarrow x+1 = 2^3.$

$\Rightarrow \quad x+1 = 8 \Rightarrow x = 7$

Check: $\log_2 (7+1) = 3.$

$\log_2 (8) = 3.$

positive $\Rightarrow$ good

Ex: Solve $\log_3 (x+3) = 1 + \log_3 (x+4).$

$\Rightarrow \quad \log_3 (x+3) - \log_3 (x+4) = 1.$

$\Rightarrow \quad \log_3 \left(\frac{x+3}{x+4}\right) = 1 \Rightarrow 3^1 = \frac{x+3}{x+4}.$

$\Rightarrow \quad 3(x+4) = x+4.$

$\Rightarrow \quad 3x + 12 = x + 4.$

$\Rightarrow \quad 2x = -8 \Rightarrow x = -4 \Rightarrow$ check.

Method 2: One-to-one Property.

$$\log_b(x) = \log_b(y).$$

$$x = y.$$

Ex: $\log_{17}(x+5) = \log_{17}(2)$.

$\Rightarrow$ $x+5=2$ $\Rightarrow$ $\boxed{x=-3}$.

Solve $\log_3(x-2) + \log_3(x) = \log_3(3)$.

$\Rightarrow$ $\cancel{(x-2)(x) = 3}$.

$\Rightarrow$ $\log_3(x^2-2x) = \log_3(3)$.

$\Rightarrow$ $x^2-2x = 3$ $\Rightarrow$ $x^2-2x-3=0$.

$(x+1)(x-3)=0$.

$\boxed{x=3}$, $\underbrace{x=-1}$.

Extraneous solution: When plugged back in, it gives us a negative number.

Exponential Equations:

Method 1: Uses one-to-one property.

$$b^x = b^y$$

$$\Rightarrow x = y.$$

Ex: $2^{x-3} = 4$

$$\Rightarrow 2^{x-3} = 2^2.$$

$$\Rightarrow x - 3 = 2.$$

$$\Rightarrow \boxed{x = 5}$$

Ex: $4^{3x-7} = \left(\frac{1}{8}\right)^{-2x+1}$

$$\Rightarrow \cancel{4^{3x-7} = \left(4^{-2}\right)^{-2x}}$$

$$\left(2^2\right)^{3x-7} = \left(2^{-3}\right)^{-2x+1}.$$

$$\Rightarrow 2^{6x-14} = 2^{6x-3}.$$

$$\Rightarrow 6x - 14 = 6x - 3.$$

$$6x - 6x = -11$$

$\boxed{0 = 11}$ $\Rightarrow$ no solution.

Method 2: Cannot get the same base, use Ln(x) or log(x).

Ex: $3^x = 5$.

$\ln(3^x) = \ln(5)$.

$x\ln(3) = \ln(5)$

$\boxed{x = \frac{\ln(5)}{\ln(3)}}$ exact ≈ 1.46 to the nearest hundreths.

Ex: $7^{x+2} = 11^{x-1}$.

$\Rightarrow \ln(7^{x+2}) = \ln(11^{x-1})$.

$(x+2)\ln(7) = (x-1)\ln(11)$.

$\Rightarrow x\ln(7) + 2\ln(7) = x\ln(11) - \ln(11)$.

$\Rightarrow x\ln(7) - x\ln(11) = -\ln(11) - 2\ln(7)$.

$\Rightarrow x(\ln(7) - \ln(11)) = -2\ln(7) - \ln(11)$.

$\Rightarrow \boxed{x = \frac{-2\ln(7) - \ln(11)}{\ln(7) - \ln(11)}}$