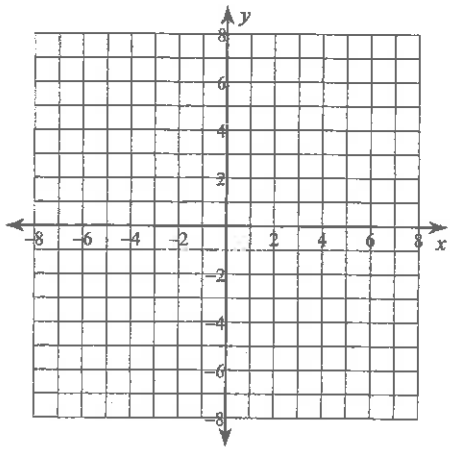
MATH 5 SN Name_____

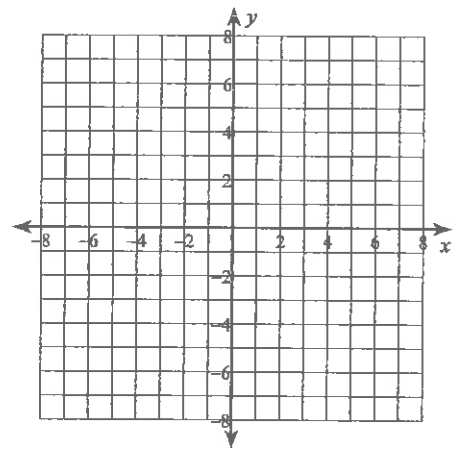
PRETEST LOGARITHMIC FUNCTIONS PART 2

Sketch the graph of each function and perform a complete study, including equation of asymptote.

1) $f(x) = \log_5 (4x + 14) - 2$



2) $f(x) = \log_{\frac{1}{4}} (4x - 11) + 5$



Solve each equation.

3) $\log_3 (n + 9) = \log_3 (4n + 6)$

4) $\log (-3n + 1) = \log -4n$

5) $\log_{16} (42 - 3p^2) = \log_{16} (-2p^2 + p)$

6) $\log_{11} (p^2 + 1) = \log_{11} (4p - 2)$

7) $\log_6 2 + \log_6 3x^2 = 2$

8) $\log_5 (x + 5) - \log_5 x = \log_5 74$

9) $\log_8 2 + \log_8 (x^2 - 9) = 4$

10) $\log_8 x - \log_8 (x + 4) = \log_8 75$

11) $2^x = 5^{x+2}$

12) $3^x = 7^{x-1}$

13) If $\log_c 5 = x$ and $\log_c 2 = y$, what is $\log_c (100c^5)$? (in terms of x and y)

14) Simplify $\log_4 8 + \log_5 625 - \log_8 8^8 + \log_{\frac{1}{2}} 8$

15) What is the rule of a logarithmic function ($y = \log_c (x-h) + k$) if $h = 1$, passing through $(4,2)$ and $(10,3)$?

16) How long will it take a \$2000 investment to triple its value, if its interest rate is 6%, compounded monthly?

17) A car purchased for \$15000 depreciates by 20% yearly. In how many years will it be worth \$500?

18) A town's population increased from 11211 people to 96627 at an annual rate of 4.18%. How many years did this take?

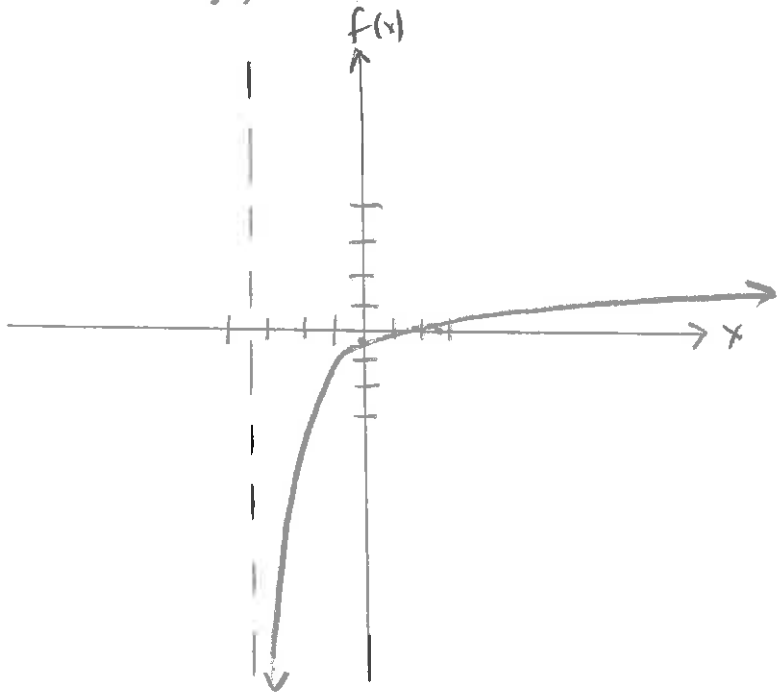
Logarithmic Functions

pretest – PART 2

①

1) $f(x) = \log_5(4x+14) - 2$

$= \log_5 4\left(x + \frac{7}{2}\right) - 2$



let $x = 0$

$f(x) = \log_5 14 - 2$

≈ -0.36

let $f(x) = 0$

$\log_5(4x+14) - 2 = 0$

$\log_5(4x+14) = 2$

$4x + 14 = 25$

$4x = 11$

$x = \frac{11}{4}$

domain $\left]-\frac{7}{2}, +\infty\right[$ ✓

range $]-\infty, +\infty[$ ✓

Vertical asymptote $x = -\frac{7}{2}$ ✓

y int $\approx \{-0.36\}$ ✓

x int $\left\{\frac{11}{4}\right\}$ ✓

✓

max none ✓

min none

↑ domain ✓

↓ none ✓

+ $[11/4, +\infty[$ ✓

− $\left]-\frac{7}{2}, \frac{11}{4}\right]$ ✓

✓

2) $f(x) = \log_{\frac{1}{4}}(4x-11) + 5$

$= -\log_4(4x-11) + 5$

$= -\log_4 4\left(x - \frac{11}{4}\right) + 5$

let $x = 0$

$f(x) = -\log_4(-11) + 5$

no solution

let $f(x) = 0$

$-\log_4(4x-11) + 5 = 0$

$-\log_4(4x-11) = -5$

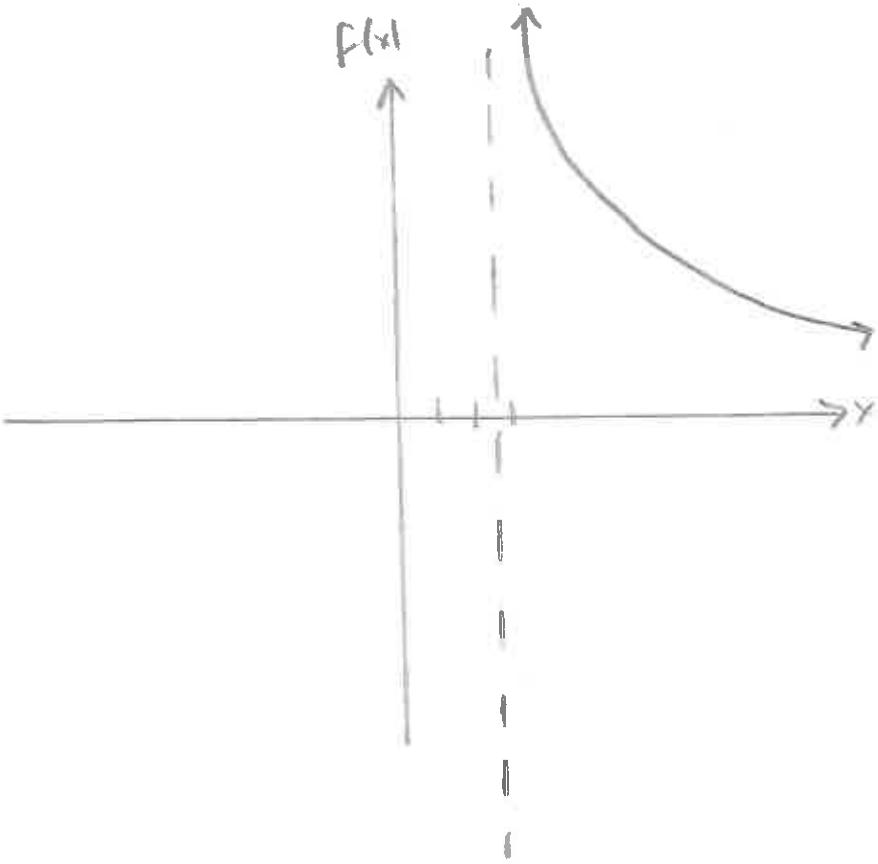
$+\log_4(4x-11) = +5$

$4x - 11 = 4^5$

$4x = 11 + 4^5$

$x = \frac{11+4^5}{4}$

$= 258.75$



domain $\left[\frac{11}{4}, +\infty\right[$ ✓

range $]-\infty, +\infty[$ ✓

Vertical asymptote $x = \frac{11}{4}$ ✓

y int - None ✓

x int - $\{258.75\}$ ✓

max none ✓

min none ✓

↑ none ✓

↓ domain ✓

+ $\left]\frac{11}{4}, 258.75\right]$ ✓

- $[258.75, +\infty[$ ✓

3) $\log_3(n+9) = \log_3(4n+6)$

$n+9 = 4n+6$

$3 = 3n$

$1 = n$ verify ✓

$\{1\}$

✓

4) $\log(-3n+1) = \log -4n$

$-3n+1 = -4n$

$n = -1$ verify ✓

$\{-1\}$

✓

5) $\log_{16}(42-3p^2) = \log_{16}(-2p^2+p)$

$42-3p^2 = -2p^2+p$

$0 = p^2+p-42$

$(p+7)(p-6)=0$

$p = -7$ verify NO

$p = 6$ verify NO

NO SOLUTION

✓

6) $\log_{11}(p^2+1) = \log_{11}(4p-1)$

$p^2+1 = 4p-1$

$p^2-4p+3=0$

$(p-3)(p-1)=0$

$p = 3$ verify ✓

$p = 1$ verify ✓

$\{1, 3\}$

✓

7) $\log_6 2 + \log_6 3x^2 = 2$

$\log_6 2 \cdot 3x^2 = 2$

$6x^2 = 6^2$

$6x^2 = 36$

$x^2 = 6$

$x = \sqrt{6}$ verify ✓

$x = -\sqrt{6}$ verify ✓

$\{-\sqrt{6}, \sqrt{6}\}$ ✓

8) $\log_5 (x+7) - \log_5 x = \log_5 74$

$\log_5 \frac{x+5}{x} = \log_5 74$

$\frac{x+5}{x} = 74$

$x + 5 = 74x$

$5 = 73x$ ✓

$x = \frac{5}{73}$ verify ✓

$\{5/73\}$

9) $\log_8 2 + \log_8 (x^2-9) = 4$

$2(x^2-9) = 8^4$

$x^2 - 9 = \frac{8^4}{2}$

$x^2 = 9 + \frac{8^4}{2} = 2057$ ✓

$x = \sqrt{2057} = \sqrt{121}\sqrt{17} = 11\sqrt{17}$ verify ✓

$x = -\sqrt{2057} = -11\sqrt{17}$ verify ✓ $\{-11\sqrt{17}, 11\sqrt{17}\}$

10) $\log_3 x - \log_3 (x+4) = \log_3 75$

$\log_3 \frac{x}{x+4} = \log_3 75$

$\frac{x}{x+4} = 75$

$x = 75x + 300$

$-300 = 74x$

$\frac{-300}{74} = x$ verify No ✓

no solution

11) $2^x = 5^{x+2}$

$2^x = 5^x \cdot 5^2$

$\left(\frac{2^x}{5^x}\right) = 25$

$\left(\frac{2}{5}\right)^x = 25 \longrightarrow \log_{\frac{2}{5}} 25 = x$ ✓

12) $3^x = 7^{x-1}$

$\frac{3^x}{1} = \frac{7^x}{7^1}$

$7 \cdot 3^x = 7^x$

$7 = \frac{7^x}{3^x}$

$\left(\frac{7}{3}\right)^x = 7$

$\log_{\frac{7}{3}} 7 = x$ ✓

13) $\log_c(100c^5) = \log_c 100 + \log_c c^5$

$= \log_c(25 \cdot 4) + \log_c c^5$

$= \log_c 5^2 + \log_c 2^2 + \log_c c^5$

$= 2\log_c 5 + 2\log_c 2 + 5\log_c c$

$= 2x + 2y + 5$ ✓

14) $\log_4 (4^3)^{\frac{1}{2}} + \log_5 5^4 - \log_8 8^8 + \log_{\frac{1}{2}} \left(\frac{1}{2}\right)^{-3}$

$\frac{3}{2} + 4 - 8 - 3 = \frac{3+8-16-6}{2} = \frac{-11}{2}$ ✓

15) $y = \log_c(x-1) + k$

$2 = \log_c(4-1) + k \longrightarrow k = 2 - \log_c(3)$

$3 = \log_c(10-1) + k \longrightarrow k = 3 - \log_c 9$

$2 - \log_c 3 = 3 - \log_c 9$

$\log_c 9 - \log_c 3 = 3 - 2$

$\log_c\left(\frac{9}{3}\right) = 1$

$c^1 = 3 \qquad \boxed{c = 3}$

$k = 2 - \log_3 3 = 2 - 1 = 1 \qquad \boxed{k = 1}$

$\boxed{y = \log_3(x-1) + 1}$ ✓

16) $A = P\left(1 + \frac{i}{n}\right)^{nt}$

$3\cancel{(2000)} = \cancel{2000}\left(1 + \frac{0.06}{12}\right)^{12t}$

$3 = (1.005)^{12t}$

$\log_{1.005} 3 = 12t$

$t = \frac{1}{12}\left(\frac{\log 3}{\log 1.005}\right) = \boxed{18.4 \text{ years}}$ ✓

17) $y = ac^x \longrightarrow 15000(0.7)^x = 500$

$0.7^x = 0.0333$

$\log_{0.7} 0.0333 = x \qquad \boxed{x = 9.53 \text{ years}}$ ✓

18) $y = ac^x \longrightarrow (11211)(1.0418)^x = 96627$

$1.0418^x = 8.6189$

$\log_{1.0418} 8.6189 = x$

$\boxed{x = 52.6 \text{ years}}$ ✓