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• Apply the Change-of-Base Formula

- Change-of-Base Formula

Let a and b be positive real numbers such that $a \neq 1$ and $b \neq 1$. Then for any positive real number x,

$$\log_b x = \frac{\log_a x}{\log_a b}$$

"The up group, the down goes down"

Note: The change-of-base formula convert a logarithm of one base to a ratio of logarithm of a different base. For the purpose of using a calculator, we often apply the change-of-base formula with base 10 or base e.

$$\log_b x = \frac{\log x}{\log b}$$

original base is b

ratio of base 10 logarithms

$$\log_b x = \frac{\ln x}{\ln b}$$

original base is b

Ratio of base e logarithms

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- ALEKS Problems

(c) $\log_7 3 = \dfrac{\log_{10} 3}{\log_{10} 7} = \dfrac{\log 3}{\log 7} \approx 0.565$

(b) $\log_{\frac{1}{5}} 6 = \dfrac{\log 6}{\log \frac{1}{5}} \approx -1.113$

(a) $\log_{\frac{1}{4}} \frac{1}{4} = \dfrac{\log(1/4)}{\log(1/4)} \approx 0.631$

$\boxed{1.23}456789$

1/100 hundreth

1/10 tenths

1/1000 thousandths

4.3 Let's do Domain

① $f(x) = \log_2 (9 - x^2)$

① $\mathbb{R}$

② N/A

③ log argument > 0

$9 - x^2 > 0$

$9 > x^2$

$x^2 < 9$

$-3 < x < 3$

$(-3, 3)$

② $f(x) = \ln(x^2 + 4)$

$x^2 + 4 > 0$

$x^2 > -4$

$(-\infty, \infty)$

⑤ $f(x) = \ln\left(\frac{1}{x+6}\right)$

① $\mathbb{R}$
② N/A
③ log argument

$\frac{1}{x+6} > 0$

$\frac{\text{positive}}{?}$ = positive

must be positive
$x+6$ = positive
$x+6>0$
$x>-6$
$(-6,\infty)$

④ denom $\neq 0$
$x+6 \neq 0$
$x \neq -6$

We must remove -6 from the domain we had at the end of step 3. However, it was already removed in step 3.

$\boxed{\text{Final answer } (-6,\infty)}$

→ Extra Problems

① $\log_7\left(\frac{1}{x-9}\right) = (9,\infty)$

① $\mathbb{R}$ ② N/A
③ $\frac{1}{x-9} > 0$
must be positive
$x-9>0$
$x>9$
$(9,\infty)$
④ denom $\neq 0$
$x-9 \neq 0$
$x \neq 9$

② $\log_8(16-x^2)$
① $\mathbb{R}$
② N/A
③ log argument > 0
$16-x^2>0$
$16>x^2$
$x^2<16$
$-4<x<4$
$(-4,4)$

③ $\ln(x^2-16)$

① $\mathbb{R}$

② N/A

③ $x^2-16>0$

$x^2>16$

$-4 \quad x$

$4<x$

$-4>x>4$

$(-\infty,-4)\cup(4,\infty)$

④ $\log_3(x^2+1)$

③ log argument >0

$x^2+1>0$

$x^2>-1$

$(-\infty,\infty)$

⑤ $\ln\sqrt{x-2}$

① Even radican ≥ 0

$x-2\geq 0$

$x\geq 2$

$[2,\infty)$

③ log argument >0

$(\sqrt{x-2})^2>(0)^2$

$x-2>0$

$x>2$

$\boxed{(2,\infty)}$