Check even answers 4.4

4.4 #2

The logarithm of a quotient of two numbers is the same as the **DIFFERENCE** of the logarithms of these numbers.

So $\log_5 \dfrac{25}{125} = \underline{\log_5 25} - \underline{\log_5 125} = 2 - 3 = -1$

4.4 #8

(a) $\log \dfrac{A}{B}$ is the same as $\log A - \log B$ TRUE

(b) $\dfrac{\log A}{\log B}$ is the same as $\log A - \log B$ FALSE

Check work for 4.4

17. $\log_2 6 - \log_2 15 + \log_2 20$

$\log_2 \frac{6}{15} + \log_2 20$

$\log_2 \frac{6}{15}(20)$

$\log_2 \frac{120}{15}$

$\log_2 8 = x$

$2^x = 8$

$2^x = 2^3$

$\boxed{x = 3}$

$2^x = 2^3$

$\boxed{x = 3}$

Check work for 4.4

47. $\log\left(\dfrac{x^2+4}{(x^2+1)(x^3-7)^2}\right)^{\frac{1}{2}}$

$\frac{1}{2}\left[\log(x^2+4) - \log(x^2+1)(x^3-7)^2\right]$

$\frac{1}{2}\left(\log(x^2+4) - \left(\log(x^2+1) + \log(x^3-7)^2\right)\right)$

$= \boxed{\frac{1}{2}\log(x^2+4) - \frac{1}{2}\log(x^2+1) - 2\cancel{\left(\frac{1}{2}\right)}\log(x^3-7)}$

or $\frac{1}{2}\left[\log(x^2+4) - \log(x^2+1) - 2\log(x^3-7)\right]$

book answer

Applying Properties (Laws) of Logarithms

1. $\log_3 x$, $\log_6 x$, $\log_2 x$, and $\log_5 x$ are all examples of general logarithms.

2. A ***COMMON*** logarithm has a base of 10.
   Therefore it can be written as $\log_{10} x$, but is usually abbreviated as $\boxed{\log x}$

CHECK ANSWERS:

$-\frac{49}{25}$ $-\frac{3}{2}$ $-\frac{1}{4}$

$\frac{1}{5}$ $\frac{1}{4}$ $\frac{1}{3}$

$\frac{4}{3}$ $\frac{7}{2}$ $\frac{15}{4}$

2.718 10

e 8 $64e^5$

$\log_{10} x$ $\log x$

$\log_e x$ $\ln_e x$

$\ln x$ 81 81

0 1 1

general

undefined

undefined

3. A ***NATURAL*** logarithm has a base of e.

Therefore it can be written as $\log_e x$ or $\ln_e x$,

but is usually abbreviated as $\boxed{\ln x}$

4. a) The number $e \approx 2.718$

$10^1 = 10$ $\quad$ $e^1 = e$ $\quad$ $10^0 = 1$

b) $\log 10 = 1$ $\quad$ c) $\ln e = 1$ $\quad$ d) $\log 1 = 0$

e) $\log 0 =$ undef $\quad$ f) $\log -10 =$ undefined

$10^x = 0$ not possible

$10^x = -10$ not possible

CHECK ANSWERS:

$-\frac{49}{25}$ $\quad$ $-\frac{3}{2}$ $\quad$ $-\frac{1}{4}$

$\frac{1}{5}$ $\quad$ $\frac{1}{4}$ $\quad$ $\frac{1}{3}$

$\frac{4}{3}$ $\quad$ $\frac{7}{2}$ $\quad$ $\frac{15}{4}$

2.718 $\quad$ 10

e $\quad$ 8 $\quad$ $64e^5$

$\log_{10} x$ $\quad$ $\log x$

$\log_e x$ $\quad$ $\ln_e x$

$\ln x$ $\quad$ 81 $\quad$ 81

0 $\quad$ 1 $\quad$ 1

general

undefined

undefined

Solve for x using properties of logarithms. Show all steps by applying one property at a time. NO CALCULATOR!

5. $\frac{1}{2}\log x + \log 3 = \log 27$

first

$\log x^{\frac{1}{2}} + \log 3 = \log 27$

$\log 3x^{\frac{1}{2}} = \log 27$

$3x^{\frac{1}{2}} = 27$

$(x^{\frac{1}{2}})^2 = (9)^2$

$\boxed{x = 81}$

CHECK ANSWERS:

$-\frac{49}{25}$ $-\frac{3}{2}$ $-\frac{1}{4}$

$\frac{1}{5}$ $\frac{1}{4}$ $\frac{1}{3}$

$\frac{4}{3}$ $\frac{7}{2}$ $\frac{15}{4}$

2.718 10

e 8 $64e^5$

$\log_{10} x$ $\log x$

$\log_e x$ $\ln_e x$

$\ln x$ 81 81

0 1 1

general

undefined

undefined

6. $\frac{1}{2}\ln x + \ln 3 = \ln 27$

7. $2\log_2 x + \log_2 9 = 4$

→ *Careful!! "Merge" logs together on the left side of the equation then solve by rewriting in exponential form.*

$\log_2 x^2 + \log_2 9 = 4$

$\log_2 9x^2 = 4$

$2^4 = 9x^2$

$16 = 9x^2$

$\pm\sqrt{\frac{16}{9}} = \sqrt{x^2}$

$\boxed{\frac{4}{3}}$ or $-\frac{4}{3} = x$ undef

only this solution

? (extraneous)

CHECK ANSWERS:

$-\frac{49}{25}$	$-\frac{3}{2}$	$-\frac{1}{4}$
$\frac{1}{5}$	$\frac{1}{4}$	$\frac{1}{3}$
$\frac{4}{3}$	$\frac{7}{2}$	$\frac{15}{4}$
2.718	10	
e	8	$64e^5$
$\log_{10} x$	$\log x$	
$\log_e x$	$\ln_e x$	
$\ln x$	81	81
0	1	1
general		
undefined		
undefined		

Use properties of logarithms to evaluate each expression. Clearly show all steps by applying one property at a time. NO CALCULATOR.

15. Given that $\log 16 = 1.204$, find $\log 400$.

$$\log 400 = \log(4)(100)$$
$$= \log 4 + \log 100$$
$$= \log 16^{\frac{1}{2}} + \log 10^2$$
$$= \frac{1}{2}\log 16 + 2\log 10$$

given

$\log 10 = 1$

$$\frac{1}{2}(1.204) + 2(1)$$
$$= .602 + 2$$
$$= \boxed{2.602}$$