19.) $-3e^{2x} + 16 = 5$

$\ln e^{2x} = \ln \frac{11}{3}$

$2x = \ln \frac{11}{3}$

$x = \frac{\ln \frac{11}{3}}{2}$

.6496

.650

52) $2^{2x} - 12 \cdot 2^x + 32 = 0$

$a = 2^x$

$a^2 - 12a + 32$

$(a-8)(a-4) = 0$

$a = 8 \quad a = 4$

$2^x = 8 \quad 2^x = 4$

$x = 3 \quad x = 2$

4.6 cont.


Just what I wanted--
a Platonic solid!
Ho, ho, ho!
Happy Holidays!
2009 ©

REVIEW: Condense.

$$\log(x-2)+2\log x-3\log(x-1)$$

REVIEW: Evaluate.

a) $\log_3\left(\frac{1}{9}\right)$

b) $\frac{\log 36}{\log 6}$

c) $\log_8(-8)$

d) $\log 0$

Domain of Logarithmic Functions

$$y = \log_b\left(f(x)\right)$$

Domain: $f(x) > 0$

ex: State the domain in set notation.

a) $y = \log_2(x-1)$ $\quad \{x \mid x > 1\}$

$x - 1 > 0$

$x > 1$

ex: State the domain in set notation.

b) $y = 3 - \ln(-x)$

$-x > 0$

$x < 0$

$\{x \mid x < 0\}$

c) $y = \log_9(x^2 + 9)$

$x^2 + 9 > 0$

?

$\{x \mid x \in \mathbb{R}\}$

Solving Logarithmic Equations

Two Types:

1. 1 Logarithm

$$\text{ex: } 2-\log_2(x+1)=4$$

2. More than 1 Logarithm

$$\text{ex: } \log_3(x^2-3)=\log_3 2+\log_3 x$$

3. Quadratic Form

When solving type 1 or 2, rewrite the equation with ONE TERM on each side of the equation.

ex: Solve.

a) $\log_{36} x + \frac{1}{2} = 2$

D: $x > 0$

$36^{\log_{36} x} = 36^{\frac{3}{2}}$

Method 1:
take the base of both sides

$x = 36^{3/2}$

216

Method 2:
rewrite as an exponential

$\log_{36} x = \frac{3}{2}$

$36^{3/2} = x$

ex: Solve.

b) $\log_{12}(x^2-4) = \log_{12}(3x)$

$x^2 - 4 = 3x$

$x^2 - 3x - 4 = 0$

$(x-4)(x+1) = 0$

Check! $x = 4, -1$

ex: Solve.

c) $\log_{31}(4x-5)-\log_{31}(2x-1)=0$

$\log_{31}(4x-5)=\log_{31}(2x-1)$

$4x-5=2x-1$

$x=2$

Check:

$\log_{31}3-\log_{31}3=\log_{31}\left(\frac{3}{3}\right)=\log_{31}1=0$

$\log_{31}\frac{4x-5}{2x-1}=0$

$31^0=\frac{4x-5}{2x-1}$

$1=\frac{4x-5}{2x-1}$

$2x-1=4x-5$

$x=2$

ex: Solve.

d) $\log_2(4x-5)-\log_2(2x-1)=3$

Condense $\rightarrow$ $\log_2 \frac{4x-5}{2x-1} = 3$

$2^{\log_2 \frac{4x-5}{2x-1}} = 2^3$

$\frac{4x-5}{2x-1} = 8$

$4x-5 = 16x-8$

$x = \frac{1}{4}$

$\emptyset$

ex: Solve.

e) $\log 18 - \log 3x = \log 2$

$\log_{10} \frac{18}{3x} = \log_{10} 2$

$\frac{18}{3x} = \frac{2}{1}$

$x = 3$ ✓

ex: Solve.

f) $\frac{\ln(-x)}{2} + 4 = 5$

$e^{\ln(-x)} = e^{2}$

$-x = e^{2}$

$x = -e^{2}$

ex: Solve.

g) $2\log x = \log 2 + \log 8$

$\log x^2 = \log 16$

10 10

$x^2 = 16$

$x = 4, -4$

ex: Solve.

h) $\log_5 \sqrt{x-2} = 1$

$\frac{1}{2}\log_5 (x-2)^{\frac{1}{2}} = 1$

$\log_5 (x-2) = 2$

$x-2 = 25$

$x = 27$ ✓

$\log_5 \sqrt{x-2} = 1$

$\sqrt{x-2} = 5$

$x-2 = 25$

$x = 27$ ✓

ex: Solve.

i) $3\log_x 49 - 2 = 4$

$\log_x 49 = 2$

$x \quad\quad x$

$49 = x^2$

$7, -7 = x$

ex: Solve.

j) $\left(\log_2 x\right)^2 - 4\left(\log_2 x\right) - 5 = 0$

$a = \log_2 x$

$a^2 - 4a - 5 = 0$

$(a-5)(a+1) = 0$

$a = 5 \qquad a = -1$

$\log_2 x = 5 \qquad \log_2 x = -1$

$x = 32 \qquad \frac{1}{2}$

Review

ex: Let

$$x = \log 7 \qquad y = \log 14$$

Rewrite in terms of x and y.

$$\log 2$$

Review

ex: Solve.

$$9^{3x^2-6x} = 3^{x+5}$$

$2^{3x} = 5^{x+1}$

$\frac{-\log 5}{\log 5 - \log 8}$

$X = 3.424$

$X = \frac{\log 5}{\log 8 - \log 5}$

$\frac{\log 5}{\log\left(\frac{8}{5}\right)}$

$2^{-3x} = 5^{x-1}$

$X = .436$

$X = \frac{\log 5}{\log 5 + 3\log 2}$

$= \frac{\log 5}{\log 40}$

Review

ex: Solve.

$6^{7x} = 2^{x+1}$

$\log 6^{3-6x} = \log 3^{x+5}$

$(3-6x)(\log 6) = (x+5)(\log 3)$

$-.00994$

$3(\log 6) - 6x(\log 6) = x(\log 3) + 5(\log 3)$

$3(\log 6) - 5(\log 3) = 6x(\log 6) + x(\log 3)$

$3(\log 6) - 5(\log 3) = x(6(\log 6) + (\log 3))$

$\frac{3\log 6 - 5\log 3}{6\log 6 + \log 3} = x$

$$X = \frac{3\log 6 - 5\log 3}{6\log 6 + \log 3}$$

$$X = \frac{\log 216 - \log 243}{\log(6^6 \cdot 3)}$$

$$X = \frac{\log \frac{216}{243}}{\log(139968)} = -.00994$$

Review

ex: Expand.

$$\log_5 \sqrt{\frac{x-2}{25y^3x^7}}$$