Worksheet 6.2.3

Double Substition Into $y = ab^x + c$ ← 12 asymptote

1. An exponential function, with asymptote y=12, passes through (1, 18) and 4, 32.25). Determine the equation of the appropriate exponential function.

$18 = ab^1 + 12$; -12 ; -12

$6 = ab$

$a = \dfrac{6}{b}$

$32.25 = ab^4 + 12$; -12 ; -12

$20.25 = ab^4$

$20.25 = \dfrac{6}{b} \cdot b^4$

$6b^3 = 20.25$

$b = \sqrt[3]{\dfrac{20.25}{6}} = 1.5$

$a = \dfrac{6}{1.5} = 4$

$\boxed{y = 4(1.5)^x + 12}$

2. Use log properties to solve each equation.

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

condense

$\log(8x) = 2$

$10^2 = 8x$

$x = \dfrac{100}{8} = 12.5$

b) $-6\log_3(x-3) = -24$

divide

$\log_3(x-3) = 4$

$3^4 = x - 3$

$x = 84$

c) $\underbrace{\log x + \log 7}$ $= \log 37$

$\log(7x) = \log(37)$

So 7x must be equal to 37

$7x = 37$

$x = \dfrac{37}{7}$

d) $\log(-2a+9) = \log(7-4a)$

$-2a + 9 = 7 - 4a$; $+4a$; $+4a$

$2a + 9 = 7$; -9 ; -9

$2a = -2$

$a = -1$

4) Convert the log expression $\log_2 30$ to one with base 8

$$\log_2(30) = \frac{\log(30)}{\log(2)} = \boxed{\frac{\log_8(30)}{\log_8(2)}}$$

base 10

5) Solve each equation. Leave each answer exact in terms of base 10 AND round to 3 decimal places. can solve by converting to log form or by taking log of both sides.

a) $3^b = 17$

$b = \log_3(17)$

$= \boxed{\dfrac{\log(17)}{\log(3)}}$

≈ 2.579

b) $5 \cdot 18^{6x} = 26$

divide

$18^{6x} = \dfrac{26}{5}$

$\log(18^{6x}) = \log(26/5)$

$6x \cdot \log(18) = \log(26/5)$

$\boxed{x = \dfrac{1}{6} \cdot \dfrac{\log(26/5)}{\log(18)}} \approx .095$

c) $16^{n-7} + 5 = 24$; -5 ; -5

$16^{n-7} = 19$

$n - 7 = \log_{16}(19)$

$n = \log_{16}(19) + 7$

$\boxed{n = \dfrac{\log(19)}{\log(16)} + 7} \approx 8.062$

6) Solve the quadratic equation, $x^2 - 4x + 1 = 0$, using:

a) The quadratic formula

$a = 1$
$b = -4$
$c = 1$

$$X = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(1)}}{2(1)}$$

$$= \frac{4 \pm \sqrt{12}}{2} \leftarrow \sqrt{12} = \sqrt{4} \cdot \sqrt{3}$$

$$= \frac{4 \pm 2\sqrt{3}}{2}$$

$$= 2 \pm \sqrt{3}$$

Same!

b) Completing the Square

$$x^2 - 4x = -1$$

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

$$(x-2)^2 = 3$$

$$\sqrt{} \qquad \sqrt{}$$

$$x - 2 = \pm\sqrt{3}$$

$$x = 2 \pm \sqrt{3}$$

7) Simplify $\frac{a^2}{a+5} + \frac{10a+25}{a+5}$ and $\frac{x^2}{x-y} - \frac{2xy-y^2}{x-y}$

$$\frac{a^2 + 10a + 25}{a+5}$$

$$= \frac{(a+5)\cancel{(a+5)}}{\cancel{a+5}}$$

$$= a+5$$

	x	$-y$
x	x^2	$-xy$
$-y$	$-xy$	y^2

x^2y^2 $-2xy$ $-xy$ $-xy$

$$\frac{x^2 - [2xy - y^2]}{x-y}$$

$$\downarrow$$

$$\frac{x^2 - 2xy + y^2}{x-y} \nearrow \frac{(x-y)\cancel{(x-y)}}{\cancel{x-y}}$$

$$= x - y$$

8) Find the algebraic inverse

$p(x) = 3(x^3 + 6) - 5$

$y = 3(x^3+6) - 5$

reverse

$X = 3(y^3+6) - 5$

$+5 \qquad +5$

$3(y^3+6) = x+5$

divide

$$y^3 + 6 = \frac{x+5}{3}$$

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

$$\sqrt[3]{} \qquad \sqrt[3]{}$$

$$y = \sqrt[3]{\frac{x+5}{3} - 6}$$