Worksheet 2015-12ℰE-00010(1) Equation of the exponential function

(1) Determine the equations of the exponential functions in the form $y = a.2^{x+p} + q$:

(a) with a = 2 through (2 ; -1) and with horizontal asymptote $y = -1$

x y

q

$y = a.2^{x+p} + q$

$y = 2.2^{x+p} + q$

$y = 2.2^{x+p} - 1$

$1 = 2.2^{2+p} - 1$

$1+1 = 2.2^{2+p}$

$\therefore 2.2^{2+p} = 2$

$2^{2+p} = \frac{2}{2} = 1 = 2^0$

$\therefore 2+p = 0$

$\therefore p = -2$

$\therefore y = 2.2^{x-2} - 1$

(b) with y-intercept 2, a horizontal asymptote of 6 and a = -1.

(0 ; 2)

x y

q

$y = a.2^{x+p} + q$

$y = -1.2^{x+p} + q$

$y = -1.2^{x+p} + 6$

$2 = -1.2^{0+p} + 6$

$2^p = 6-2$

$2^p = 4$

$2^p = 2^2$

$\therefore p = 2$

$\therefore y = -1.2^{x+2} + 6$

(2) Determine the equations of the exponential functions in the form $y = 3.b^{x+p} + q$:

(a) with p = 1 through (1 ; 7) and with horizontal asymptote $y = -5$.

$y = 3.b^{x+p} + q$

$y = 3.b^{x+1} + q$

$y = 3.b^{x+1} - 5$

$7 = 3.b^{1+1} - 5$

$7+5 = 3.b^2$

$\frac{12}{3} = b^2$

$\therefore b^2 = 4$

$b = \pm\sqrt{4} = \pm 2$, but $b > 0$ $\therefore b = 2$

$\therefore y = 3.2^{x+1} - 5$

(b) with y-intercept at 12, a horizontal asymptote at 0 and $b = \frac{1}{4}$.

$y = 3.b^{x+p} + q$

$y = 3.(\frac{1}{4})^{x+p} + q$

$y = 3(\frac{1}{4})^{x+p} + 0$

$12 = 3(\frac{1}{4})^{0+p}$

$\frac{12}{3} = (4^{-1})^p$

$\therefore 4^{-p} = 4^1$

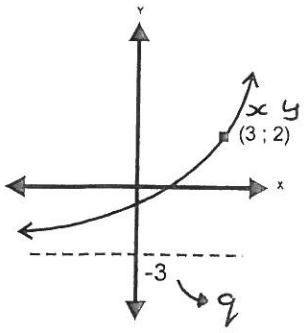
$\therefore -p = 1$

$\therefore p = -1$

$\therefore y = 3(\frac{1}{4})^{x-1}$

(3) Determine the equations of the following functions:

(a) $y = 5^{x+p} + q$



$y = 5^{x+p} + q$

$y = 5^{x+p} - 3$

$2 = 5^{3+p} - 3$

$2 + 3 = 5^{3+p}$

$\therefore 5^{3+p} = 5^{1}$

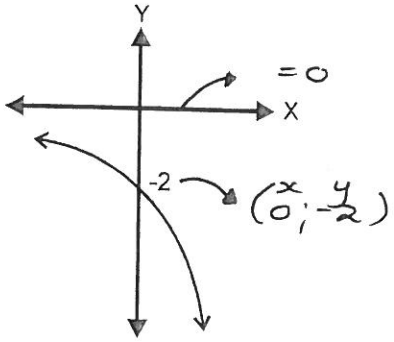
$\therefore 3 + p = 1$

$p = 1 - 3$

$p = -2$

$\therefore y = 5^{x-2} - 3$

(b) $y = -2 \cdot \left(\frac{1}{2}\right)^{x+p} + q$



$y = -2\left(\frac{1}{2}\right)^{x+p} + q$

$y = -2\left(\frac{1}{2}\right)^{x+p} + 0$

$-2 = -2\left(\frac{1}{2}\right)^{0+p}$

$\frac{-2}{-2} = \left(\frac{1}{2}\right)^{p}$

$1 = \left(\frac{1}{2}\right)^{p}$

$\left(\frac{1}{2}\right)^{0} = \left(\frac{1}{2}\right)^{p}$

$\therefore p = 0$

$\therefore y = -2\left(\frac{1}{2}\right)^{x}$