

Free Response Question 6
Calculator NOT Permitted

Consider the logarithmic equation $f(x) = -2 + \log_3(4 - 2x)$ to answer the following questions.

- a. Suppose $f(x) = 0$. Find the value of x . Show your work and explain what the work represents in terms of the graph of the equation.

$0 = -2 + \log_3(4 - 2x)$ $2 = \log_3(4 - 2x) \quad (\text{LOG Form})$ $3^2 = 4 - 2x \quad (\text{EXP Form})$ $9 = 4 - 2x$ $5 = -2x$ $-5/2 = x$		<p>when $f(x) = 0$, the graph crosses the x-axis</p> <p>$\therefore f(x)$ has an x-intercept of $(-5/2, 0)$</p>
+		+

- b. Determine the domain and range of the function, $f(x)$.

<p><u>Domain</u></p> $4 - 2x > 0$ $-2x > -4$ $x < 2$	<p>Domain $(-\infty, 2)$ +</p> <p>Range $(-\infty, \infty)$ +</p>
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- c. The inverse function, $f^{-1}(x)$, is an exponential function. Will the graph of $f^{-1}(x)$ lie above or below its horizontal asymptote? Explain your reasoning.

Range $(-\infty, 2)$ +

$\therefore f^{-1}(x)$ lies below the HA +

- d. Find the exponential function, $f^{-1}(x) = a \cdot b^{x+c} + d$, that is the inverse of the logarithm function, $f(x)$.

$$x = -2 + \log_3(4 - 2y) \quad +$$

$$x + 2 = \log_3(4 - 2y)$$

$$3^{x+2} = 4 - 2y \quad +$$

$$3^{x+2} - 4 = -2y$$

$$-\frac{1}{2} \cdot (3)^{x+2} + 2 = y$$

$$f^{-1}(x) = -\frac{1}{2} (3)^{x+2} + 2 \quad +$$