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Niharika Prasad    Weekly Challenge - Curve Fitting    Age 9.

$g(x) = b\,e^{-\frac{(x-c)^2}{d}}$, $f(x) = \left(\frac{a}{x}\right)^x$

Let $g(x) = b\, g_1(x)$ — (1)

$g_1(x) = e^{-\frac{(x-c)^2}{d}}$

We see that the maximum value of $g_1(x) = 1$

$\therefore$ at the maxima of $g_1(x)$

$1 = e^{-\frac{(x-c)^2}{d}}$

or $\frac{(x-c)^2}{d} = 0$

or $(x-c)^2 = 0$

or $x = c$

$\therefore$ And the value of x when g(x) is at its maxima is also c. The value of x when g(x) is at its maxima is $\approx 7$.

$\therefore \boxed{c \approx 7}$

From (1) we know that

When $x \approx 7$ $g(x) = b$

At the point $(7, b)$, $g(x) \approx 1600$. $\boxed{\text{That is } b \approx 1600}$

To find d I choose a value of x and a corresponding g(x).

Here $x = 5$, $g(x) = 1000$

$\therefore g(x) = b\, e^{-\frac{(x-c)^2}{d}}$

or $\frac{g(x)}{b} = e^{-\frac{(x-c)^2}{d}}$

or $\log \frac{g(x)}{b} = \log e^{-\frac{(x-c)^2}{d}}$

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I know that $\log e^{*} = *$

$\therefore \log \frac{g(x)}{b} = \frac{-(x-c)^2}{d}$

Using numerical values we get

$\log \frac{5}{8} = \frac{-4}{d}$ (Using values of c, b)

or $-0.47 = \frac{-4}{d}$

or $0.47 = \frac{4}{d}$

or $\boxed{d = \frac{4}{0.47}}$

$f(x) = \frac{a^x}{x^x}$

To find a I must choose a certain x and a corresponding f(x). The cleverest choice of $x = 1$. If you had given finer graduations on the f(x) axis I could have used this x. You can use any x but will have to use the log function which I do not know well yet.