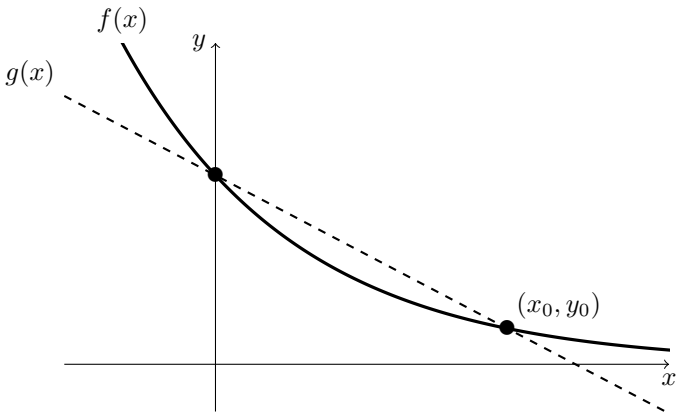
8. [12 points] Let $f(x) = a^x$ and $g(x) = c + dx$ where a, c and d are constants. The graph of $y = f(x)$ and $y = g(x)$ are shown below. The point of intersection not lying on the y-axis has coordinates (x_0, y_0).



a. [10 points] In each of the bullet points below, you are asked to **circle** the option that must be true based on the graph above. If there is not enough information to decide on any of the options in a given row, circle NOT ENOUGH INFORMATION.

- The constants a and c satisfy:

  $a > c$ | **(circled)** $a < c$ | $a = c$ | NOT ENOUGH INFORMATION

- The constants a and d satisfy:

  (circled) $a > d$ | $a < d$ | $a = d$ | NOT ENOUGH INFORMATION

- The constants c and d satisfy:

  (circled) $c > d$ | $c < d$ | $c = d$ | NOT ENOUGH INFORMATION

- If the constants a and c remain the same while the value of the constant d increases, then the value of x_0, the x-coordinate of the point of intersection of $f(x) = a^x$ and $g(x) = c + dx$:

  (circled) INCREASES | DECREASES | STAYS THE SAME | NOT ENOUGH INFORMATION

- If the constants a and c remain the same while the value of the constant d increases, then the value of y_0, the y-coordinate of the point of intersection of $f(x) = a^x$ and $g(x) = c + dx$:

  INCREASES | **(circled)** DECREASES | STAYS THE SAME | NOT ENOUGH INFORMATION

b. [2 points] The graph of the function $h(x)$ has a vertical intercept at $(0, -2)$ and is perpendicular to the graph of $g(x) = c + dx$. Find a formula for the function $h(x)$. Your formula may include any or all of the constants a, c and d.

Solution: The slope of $h(x)$ must be $-\frac{1}{d}$. Since it has vertical intercept -2, its equation must therefore be $h(x) = -\frac{1}{d}x - 2$.

$h(x) =$ $-\frac{1}{d}x - 2$