1. Do the following:
   a) Rewrite the statement $\log 4 = 0.602$ using an exponent instead of a log. (2 points)
   b) Rewrite the statement $e^4 = 54.5982$ using a natural logarithm. (2 points)
   c) Use properties of logarithms to solve $\log (4 \cdot 3^x) = 10$ for $x$. (3 points)
   d) Solve $e^{x+4} = 12$ exactly for $x$. (3 points)
   e) Find the doubling time if a city is growing annually by 15% per year. (4 points)
   f) Find the half-life of a substance that decays by 20% in 6 hours. (4 points)
   g) Show that the graph of the function $h(x) = \dfrac{1+x^2}{x-x^3}$ is symmetric about the origin. (3 points)

2. The world's population is aging. The approximate world population age 80 or older is given in the table to the right.

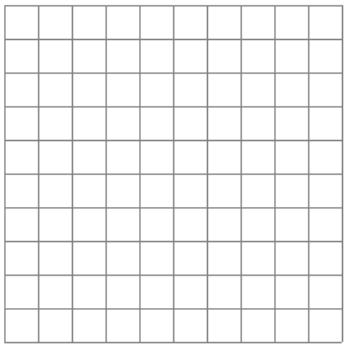
| $t$ (year) | 2005 | 2006 | 2007 |
|---|---|---|---|
| $P$ (millions) | 89.144 | 92.175 | 95.309 |

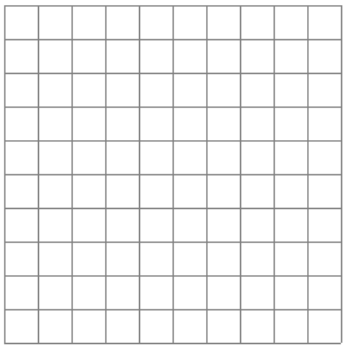
   a) Find a formula for $P$, the number of people in the world age 80 or older, in millions, as a function of the time, $t$, in years since 2005. Use the form $P = a \cdot b^t$. (4 points)
   b) Convert to the form $P = a \cdot e^{kt}$. Give the value of $k$ accurate to four decimal places. What is the continuous percent increase per year? (3 points)

3. A graph $f(x)$ contains the point (4, -5). (2 points each)
   a) What point must be on the graph $f(x+2) - 4$?
   b) What point must be on the graph $-f(x)$?
   c) If $f(x)$ is even what point must also be on $f(x)$?
   d) If $f(x)$ is odd what point must also be on $f(x)$.

4. The function $P(t)$ gives the number of people in a certain area in year $t$. Interpret each of the following in terms of population. (3 points each)
   a) $P(t) + 100$
   b) $P(t + 100)$

5. Let $g(x) = 2^x$. (4 points each)
   a) Use the first grid to the right to graph the function obtained from $g$ by first translating to the left two units, then reflecting about the $y$-axis. Write a formula for the resulting function.
   b) Use the second grid to the right to graph the function obtained from $g$ by first reflecting about the $y$-axis then moving the graph two units to the left. Write a formula for the resulting function.





6. Let $P(t)$ be the population of a country, in millions, $t$ years after 1990, with $P(6) = 3.21$ and $P(13) = 3.75$
   a) Find a formula for $P(t)$ assuming it is linear. (4 points) Describe in words the country's annual population growth given this assumption. (2 points)

b) Find a formula for $P(t)$ assuming it is exponential. (4 points) Describe in words the country's annual population growth given this assumption. (2 points)