Math 131 In-Class Exam 1 Review

1. Find the domain of each function, f(x)=:

   a) $e^{x+1}$  
   b) $\ln(x^2 + 4)$  
   c) $\ln(x^2 - 4)$  
   d) $\ln(x - 2) + \ln(x + 2)$  
   e) $\sqrt[3]{x^2 - 25}$

2. A copier company charges 25 cents per page for the first 100 pages plus 20 cents per page for the remaining pages. Write the charge as a piecewise function of the number of pages, x.

3. $f(x)$ is a transformation of $y = x^2$. The vertex is at (3, 10) and $f(2)$=15. Without using an x-distortion, write the formula for $f(x)$.

4. Find the formula for the function:

   a) $f(x) = A + B\ln(x + C)$  
   \[ \lim_{{x \to -4^+}} f(x) = \infty \]  
   $f(-4) = 3$  
   $f(e^2 - 4) = 0$

   b) $f(x) = A + Be^{Cx}$  
   \[ \lim_{{x \to \infty}} f(x) = -2 \]  
   $f(0) = 0$  
   $f(1) = -1$

   c) $f(x)$ is the transformation of $g(x) = x^3 - x^4$ under the following transformations in the given order:
      1) shift down 4 units.  
      2) reflect across the x - axis.  
      3) stretch vertically by a factor of 5 and 4) shift down 6 units.

5. Find functions $f$ and $g$ so that: a) $f(g(x)) = e^{-2x} + 5e^{-x} + 1$  
   b) $f(g(x)) = \ln(x^2 + 3)$

6. A culture starts with 200 cells and increases by 50% every 3 hours.
   a) Find $N(t)$, the number of cells after t hours.
   b) Write $N(t)$ in base $e$.

7. The table shows the price of a U.S. postage stamp in cents for different years.

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<tbody>
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<td>Year-1919</td>
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<td>13</td>
<td>39</td>
<td>44</td>
<td>49</td>
<td>55</td>
<td>59</td>
<td>66</td>
<td>72</td>
<td>90</td>
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<tr>
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<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>10</td>
<td>15</td>
<td>22</td>
<td>29</td>
<td>42</td>
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   Let $x$ be the number of years past 1919.

   Find quartic regression and exponential regression models. Which is a better fit to the given data?

   Which looks better for future data?
8. Find the inverse function to: a) \( f(x) = 5e^{3x} \). b) \( g(x) = \ln(2x - 5) \).

9. Solve for \( x \):
   a) \( x = e^{4\ln2} \)  
   b) \( 4^x = \frac{1}{2} \)  
   c) \( \log_2(x + 3) - \frac{1}{5}\log_2(x + 4)^5 = 3 \)

10. Evaluate each limit or write DNE if it does not exist.

   \[
   f(x) = \frac{(2x^2 + 4x - 6)}{x^2 - 1}
   \]

   a) \( \lim_{x \to 1} f(x) \)  
   b) \( \lim_{x \to -1} f(x) \)  
   c) \( \lim_{x \to -3} f(x) \)

12. Evaluate each limit as a number, as plus infinity, minus infinity, or write DNE.

   a) \( \lim_{x \to 0^-} e\left(\frac{1}{x}\right) \)  
   b) \( \lim_{x \to 0^+} e\left(\frac{1}{x}\right) \)  
   c) \( \lim_{x \to \infty} \frac{4x^5 - 15x^2}{2x^2 - 5} \)

   d) \( \lim_{x \to -\infty} \frac{4x^5 - 15x^2}{2x^2 - 5} \)  
   e) \( \lim_{x \to \infty} \left(\sqrt{x^2 - 15x} - \sqrt{x^2 + 2x}\right) \)

   f) \( \lim_{x \to \infty} \frac{\sqrt{x} + 1}{3\sqrt{x} + 2} \)

13. Find the discontinuities of each function and give the reason for each discontinuity, graphically and from the definition of continuity.

   a) \( f(x) = \begin{cases} 
   \sin(2x) & x < \frac{\pi}{4} \\
   e^{\frac{x - \pi}{4}} & \frac{\pi}{4} \leq x
   \end{cases} \)

   b) \( g(x) = \frac{2x^2 + 4x - 6}{x^2 - 1} \)

   c) \( f(x) = \begin{cases} 
   e^x \cos x & x \leq 0 \\
   x \ln x & 0 < x
   \end{cases} \)