
You may not use a calculator for this test. Please answer all questions on the answer sheets provided, with questions 1, 2, and 3 on the graphing grids provided. You may keep this sheet.

Please note there are two pages.

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1. Let \( f(x) = \frac{(x + 1)^2(3x - 3)}{(x - 2)^3} \)

(A) Find the \( y \)-intercept, if any.
(B) Find the \( x \)-intercepts, if any.
(C) Find the vertical asymptotes, if any.
(D) Find the horizontal asymptotes, if any.
(E) Using the information from (A)-(D), sketch the graph of \( f(x) \).

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2. On the same set of axes, sketch and label the graph of:

\[
f(x) = 2^x; \quad g(x) = 4^x; \quad h(x) = \left(\frac{1}{2}\right)^x; \quad i(x) = \left(\frac{1}{2}\right)^x - 1
\]

Your graphs don’t have to be perfect, but you must label the asymptotes, if any, and make sure that your points for the small values are accurate on the grid.

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3. Let \( f(x) = 3 \cdot \sin \left(\frac{1}{2}(x + 2)\right) \). (A) What are the period and amplitude of \( f(x) \)? (B) What phase shift is applied, if any? (C) Sketch the graph of both \( f(x) \) and \( y = \sin x \) on the same axes.

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4. Below are the graphs of three functions: \( f(x) = \ln(x) \), \( g(x) = \ln(x - 5) \), and \( \ln(x) - 5 \). On your answer sheet, name the color (red, green, or blue) that corresponds to each.
5. Below is the graph of the function $y = \tan(kx)$ for some constant $k$. Determine $k$.

![Graph of $y = \tan(kx)$]

6. Find all solutions to the exponential equation: $\frac{1}{8} = 2^{x^2-4x+1}$

7. Find all solutions to the logarithmic equation: $1 + \log_3(2 \cdot (x + 1)^2) = 3 \log_3(x + 1)$. Be sure to check your answers.

8. Find the following values:
   
   (A) $\cot \frac{\pi}{3}$  
   (B) $\sec \frac{-3\pi}{2}$  
   (C) $\cos \frac{\pi}{3}$  
   (D) $\tan \frac{\pi}{6}$

9. Given that the terminal point of $t$ is in Quadrant II and $\sec t = \frac{5}{3}$, find $\tan t$. 
