Homework #1: Warming up for Calculus

Note: Your work can only be assessed if it is legible. You do not need a calculator to complete this assignment.

1. Simplify the following algebraic expressions. Be sure to show the algebraic steps required to find the final answer.

   (a) Simplify $\dfrac{1}{3^{-2}} - \dfrac{1}{3} + \dfrac{1}{4^{-1}}$.

   (b) Simplify $\dfrac{(x^2 y^{-3})^2}{(y^{-3} x^{-2})^{-2}}$.

   (c) Simplify $(4x^6)^{3/2}$.

   (d) Let $f(x) = x^2 + 2x$ and $h \neq 0$. Simplify $\dfrac{f(x+h) - f(x)}{h}$, the *difference quotient* of $f(x)$.

   (e) Rationalize $\dfrac{3}{x - \sqrt{x}}$.

2. Factor the following expressions fully.

   (a) $x^2 - 9$

   (b) $x^2 - 2x - 35$

   (c) $x^3 - a^2 x$

3. Simplify the following exponential functions.

   (a) $\dfrac{2^{5x}}{2^x}$

   (b) $e^{2x}e^{-3x}$

   (c) $\dfrac{e^{2x} - 1}{e^x - 1}$

   (d) $\sqrt[3]{5^{9x}}$

4. Evaluate $\log_4\left(\dfrac{1}{64}\right)$.

5. Solve for x exactly:

   (a) $\log_2(x) + \log_2(x - 2) = 3$

   (b) $\ln x - \ln(x^2) = 5$.

6. Write the following sets of numbers in interval notation

    (a) the open interval with endpoints 2 and 3

    (b) $2 \leqslant x \leqslant 3$

    (c) all real numbers x such that $x < -2$ and $x \geqslant 2$.

7. Evaluate the following trigonometric functions exactly.

    (a) $\sin(\pi/3)$

    (b) $\cos(\pi/3)$

    (c) $\sin(\pi)$

    (d) $\sin(3\pi)$

    (e) $\cos(100\pi)$

8. Simplify the following trigonemtric expression: $\sin(\arctan 2x)$.

9. Find the inverse of the following function and state its domain: $f(x) = \dfrac{x}{1 + 2x}$.

10. Below if a graph of $y = f(x)$. Sketch and label the following graphs.

   (a) $y = f(x + 1)$ (b) $y = f(x - 1)$ (c) $y = f(2x)$ (d) $y = 2f(x)$ (e) $y = f(x) + 1$.