Functions and Notation

Computational Mathematics and Statistics Camp
University of Chicago
September 2018

1. Simplify the following expressions as much as possible:
   a. $(-x^4y^2)^2$
   b. $9(3^0)$
   c. $(2a^2)(4a^4)$
   d. $\dfrac{x^4}{x^3}$
   e. $(-2)^{7-4}$
   f. $\left(\dfrac{1}{27b^3}\right)^{1/3}$
   g. $y^7y^6y^5y^4$
   h. $\dfrac{2a/7b}{11b/5a}$
   i. $(z^2)^4$
2. Simplify the following expression:

$$(a+b)^2 + (a-b)^2 + 2(a+b)(a-b) - 3a^2$$

3. Which of the following functions are continuous? If not, where are the discontinuities?
   a. $f(x) = \dfrac{9x^3 - x}{(x-1)(x+1)}$
   b. $g(y,z) = \dfrac{6y^4z^3 + 3y^2z - 56}{12y^5 - 3zy + 18z}$
   c. $f(x) = e^{-x^2}$
   d. $f(y) = y^3 - y^2 + 1$
   e. $f(x) = \begin{cases} x^3 + 1, & x > 0 \\ \frac{1}{2}, & x = 0 \\ -x^2, & x < 0 \end{cases}$
4. Express each of the following as a single logarithm:
   a. $\log(x) + \log(y) - \log(z)$
   b. $2\log(x) + 1$
   c. $\log(x) - 2$
5. Find the roots (solutions) to the following quadratic equations. **Hint: Remember the quadratic formula.**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

   a. $4x^2 - 1 = 17$
   b. $9x^2 - 3x - 12 = 0$
   c. $x^2 - 2x - 16 = 0$
   d. $6x^2 - 6x - 6 = 0$
   e. $5 + 11x = -3x^2$