1. (16 points) Answer each of the following unrelated problems.

   (a) Given $\tan\theta = 10$ and $\csc\theta < 0$, what is $\cos\theta$?

   (b) Find all values x in the interval $[0, 2\pi]$ that satisfy $\tan x \sec x = 4\sin x$.

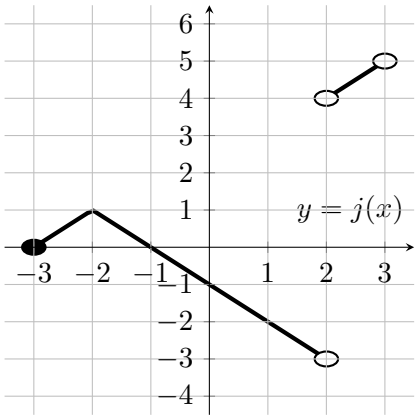
2. (23 points) Evaluate the following limits and simplify your answers. If a limit does not exist, clearly state this. If you use a theorem, clearly state its name and show that its hypotheses are satisfied.
   (Reminder: You may not use L'Hopital's Rule or Dominance of Powers in any solutions on this exam.)

   (a) $\lim_{x\to 7}(5x + 1 - |x - 7|)$

   (b) $\lim_{x\to 4}\dfrac{2-\sqrt{x}}{x^2-4x}$

   (c) $\lim_{\theta\to\pi/4}\dfrac{\cos^2\theta - \sin^2\theta}{\cos\theta - \sin\theta}$

3. (15 points) Use the graph of $y = j(x)$ provided here to answer each of the problems below. A brief justification is only required on (g). (Note that the entire graph of $y = j(x)$ is represented in the graph below.)



   (a) Find $\lim_{x\to -2} j(x)$, if it exists. (If it does not exist, state Does Not Exist.)

   (b) Find $\lim_{x\to 2^-}\sqrt{j(x)}$, if it exists. (If it does not exist, state Does Not Exist.)

   (c) Find $\lim_{x\to 2^+}\sqrt{j(x)}$, if it exists. (If it does not exist, state Does Not Exist.)

   (d) State the domain of $j(x)$ using interval notation.

   (e) State the range of $j(x)$ using interval notation.

   (f) Is $y = j(x)$ odd, even, or neither?

   (g) Note that $j(1) < 0$ and $j(2.5) > 0$. Does the Intermediate Value Theorem imply $j(c) = 0$ for some c in $[1, 2.5]$? Why or why not?

4. (22 points) Consider the functions $f(x) = \dfrac{x^2-9}{x-3}$ and $g(x) = \dfrac{|x^2-9|}{x-3}$. Answer each of the following:

(a) Identify all discontinuities of $f(x)$ as a removable discontinuity, a jump discontinuity, or an infinite discontinuity. For each, justify using appropriate limits.

(b) Write $g(x)$ as a piecewise defined function where each piece is a polynomial.

(c) Identify all discontinuities of $g(x)$ as a removable discontinuity, a jump discontinuity, or an infinite discontinuity. For each, justify using appropriate limits.

5. (24 points) Consider the function $h(x) = \dfrac{\sqrt{4x^2 - 2}}{x + 6}$.

(a) State the domain of $h(x)$ using interval notation.

(b) Determine all vertical asymptotes of $y = h(x)$ and justify each with the appropriate limit.

(c) Determine all horizontal asymptotes of $y = h(x)$ and justify each with the appropriate limit.