Part 2: These will be graded **only** if you have passed part 1. **Name:** _____

13. Find an antiderivative (that is, a function whose derivative is the given function) for each of the following functions:

3 points (a) $f(x) = 3x^3 - 6x^2 + x + e^2$

(a) _____

3 points (b) $g(x) = \sqrt{2+x}$

(b) _____

3 points (c) $h(x) = \dfrac{x}{5} - \dfrac{5}{x}$

(c) _____

3 points (d) $k(x) = \dfrac{2}{\sqrt{1-x^2}}$

(d) _____

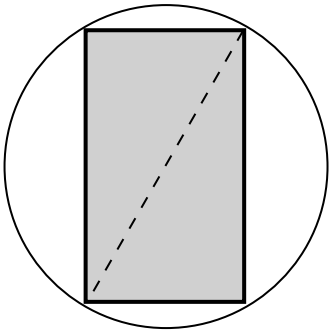
Part 2: These will be graded **only** if you have passed part 1. **Name:** _____

12 points

14. The strength of a rectangular beam of a given length is proportional to the width times the square of the height of a cross-section, that is,

$$S = w \cdot h^2$$

where S is the strength (in some appropriate units), w is the width, and h is the height.
Find the dimensions of the strongest beam that can be cut out of a log which has a circular cross-section with a 9" diameter (that is, the cross-section of the beam is a rectangle with a diagonal of 9").



Part 2: These will be graded **only** if you have passed part 1. **Name:** _____

8 points 15. (a) Find $\frac{dy}{dx}$ at the point $(1,1)$ if x and y satisfy $\frac{5y^2-2x}{4y^3-x^2} = x$.

(Hint: you do not need to use the quotient rule if you do some algebra first.)

4 points (b) Write the equation of the line tangent to the curve at the point $(1,1)$.

Part 2: These will be graded **only** if you have passed part 1. **Name:** _____

16. Consider the function $f(x) = 3x^{\frac{2}{3}} - 2x$.

4 points (a) Find the x-values of all critical points of $f(x)$

4 points (b) State the largest interval on which $f(x)$ is increasing.

4 points (c) Give the x-values at which the absolute maximimum and absolute minimum values of f occur when $-1 \leq x \leq 3$.
(You might find it helpful to know that $2^{\frac{2}{3}} \approx 1.59$, $3^{\frac{2}{3}} \approx 2.08$, and $4^{\frac{2}{3}} \approx 2.52$.)

Part 2: These will be graded **only** if you have passed part 1. **Name:** _____

17. Jimi Chiu makes "designer" shoes[1] that he sells at \$150 a pair. He knows that the number of pairs of shoes he sells is a function of the price he charges; let's denote this by $N(p)$, where p is the price per pair. Market research tells him that $N'(150)$ is about -10; that is, if he raises the price by one dollar, he should expect to sell 10 fewer pairs. The amount of revenue $R(p)$ he makes at a given price will be given by $R(p) = p \cdot N(p)$.

7 points

(a) If he typically sells 2000 pairs of shoes at \$150 each, what is $R'(150)$?

5 points

(b) Use your answer above to estimate his revenue if he raises the price to \$160 per pair (that is, estimate $R(160)$). Should he raise the price?

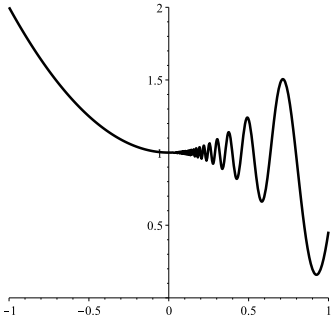
[1] No relation to Jimmy Choo shoes, unless you don't look very closely. Mr. Chiu is also fond of Rollexx watches.

Name: _____

18. Consider the function

$$Q(x) = \begin{cases} 1 + x^2 & x \leq 0 \\ 1 + x^2 \sin(10/x) & \text{otherwise} \end{cases}$$

with the graph shown at right.



6 points (a) Show that $Q(x)$ is continuous at every value of x.

6 points (b) Is $Q(x)$ differentiable at $x = 0$? If so, what is $Q'(0)$? If not, why not?