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) $f(x) = 2x^3 - 6x^2 + 8x + e^2$

(a) _____

3 points (b) $g(x) = e^{2x} + \sin(3x)$

(b) _____

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

(c) _____

3 points (d) $k(x) = \dfrac{5}{1+x^2}$

(d) _____

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

12 points 14. A company plans to build a pipeline from its drilling station, which is located in the ocean 2 miles south from a straight shoreline running east-west, to a pumping station which is located 6 miles east from the point on the shore directly opposite the drilling station. The pipeline will cost \$600/mile to run under the water and \$200/mile to run under the land. Where should the pipeline intersect the shore to be built for the minimum cost?

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

8 points 15. (a) For the curve given by $x^3 - 3y^4 = 4x^2y^3 - 6$, find dy/dx when $x = 1$ and $y = 1$.

5 points (b) Use your answer to the previous part to estimate the y-value of a point on the curve with $x = 1.2$.

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

16. Consider the function $f(x) = 4x^5 + 5x^4 - 40x^3$.

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 decreasing.

4 points (c) Give the x-values at which the absolute maximimum and absolute minimum values of f occur when $-1 \leq x \leq 3$.

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

12 points 17. Sand is falling from a chute at the rate of 144ft^3 per minute, and is forming a conical pile whose diameter is always three times its height. Find the rate at which the height of the pile is growing when the pile is 1 foot high. You might find it useful to know that the volume of a cone of radius r and height h is $\pi r^2 h/3$, its surface area is $\pi r\left(r+\sqrt{r^2+h^2}\right)$, or that ice cream cone was invented in 1896 by Italo Marchiony. Or maybe not.

Name: _____

18. Let $R(x) = \dfrac{e^{2x} - 1}{\pi x}$.

8 points

(a) Find a value k so that if we define $R(0) = k$, the resulting function is continuous. Fully justify your answer.

5 points

(b) Is the function in the previous part differentiable at all values of x? Fully justify your answer.