Final PRACTICE Exam

MA141-008   12/17/2018   **Name:** _____

Instructor: Michael Medvinsky

TA: Wesley Nelson

Read all of the following information before starting the exam:

- Complete each problem. Show all of your work clearly and in order and justify your answers, as partial credit will be given when appropriate and there may be NO credit given for problems without supporting work. **Circle or otherwise indicate your final answers your final answers.** All answers should be completely simplified, unless otherwise stated.

  You may not use calculator.

1.   An electrical company at a point A needs to run a wire from a generator to a factory that is on the other side of a one mile wide river and 10 miles downstream at a point C. It costs \$600 per mile to run the wire on towers across the river and \$400 per mile to run the wire over land along the river. The wire will cross the river from A to a point X and then travel over land from X to C. Let x be the distance from a point B directly across the river from point A to the point X. Write a function $C(x)$ representing the total cost in terms of x and use that function to find the value of x that minimizes the cost.

2.   A plane is flying directly away from you at 500 mph at an altitude of 3 miles. How fast is the plane's distance from you increasing at the moment when the plane is flying over a point on the ground 4 miles from you?

3.   Find $\frac{dy}{dx}$ of $y = \arcsin(\arccos x)$

4.   Evaluate following integrals.

1. $\int_0^2 x\sqrt{2x^2 + 1}\,dx$

2. $\int \ln(x) x^2 \, dx$

5.   Find the following limits or show that they don't exist.

1. $\lim\limits_{x \to \infty} \frac{\ln^n x}{x} =$

2. $\lim\limits_{x \to 4} \left(\dfrac{1}{\sqrt{x} - 2} - \dfrac{4}{x - 4} \right)$

   $=$

3. $\lim\limits_{x \to 0} (\cot x)(x^2 + 5x) =$

6.   Show that there is a positive real solution to the equation $x^2 + 2 = 10^x$.

7. Find all critical points, local extrema, inflection points, intervals of increasing and decreasing, and intervals of concavity for the function $f(x) = \dfrac{x^2}{x^2 + 3}$.

8. Find the equation of the tangent line to the curve given by $x^2y^2 + y^3 = 2$ at the point $(1, 1)$ on the graph. Express your answer in slope-intercept form, i.e. $y = mx + b$.

9. Find the area of the region enclosed by the curves $x + y^2 = 0$ and $x + 3y^2 = 2$.

10. Find the volume of the solid obtained by rotating the region bounded by the given curves about the specified line. Sketch the region.

1. $y = 1 - x^2$, $y = 0$; about x-axis.

2. $y = 7$, $y = \sqrt{x}$, $x = 0$, $x = 4$; about the y axis.

Good luck!