Worksheet 7

Math 251, Summer 2017

Name: ____

1. Find the derivatives of the following functions.

   (a) 4^x

   (b) $\log_{10}(x)$

   (c) $\arcsin(e^x)$

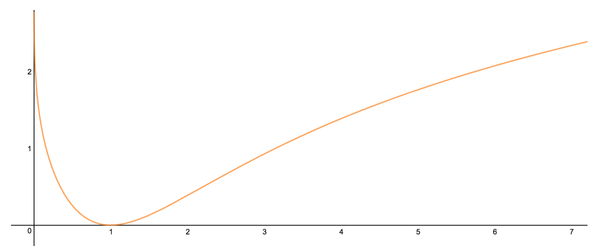
   (d) $x \arctan(x) - x$

   (e) $\frac{x}{\ln(x)}$

   (f) $\ln(x^2 e^x)$

2. Find the linearization for $f(x) = x^2 \ln(3x)$ at $x = 3$.

3. Find y' from the implicit equation $\ln(x) + 2^y = x$.



4. Optimize the function $g(x) = x^2 \ln(x)$ on the interval $[0.1, 1]$.

5. In this problem you will prove the formula $\frac{d}{dx}\arctan(x)$.

   (a) By letting $\theta = \arctan(x)$, draw a right triangle in order to simplify $\sec^2(\arctan(x))$.

   (b) Apply the formula for $(f^{-1})'$ to get the formula for $\frac{d}{dx}\arctan(x)$.

6. When electricity flows through a wire, you can measure the amount of charge, Q, at a spot along the wire (the shaded section of the figure below). Charges in the form of electrons move through the wire, so the amount of charge Q at the slice is really a function of time. In applications, one measures the *current*, defined as the rate of change of charge. That is, current is the *derivative* of charge.

$$I = \frac{dQ}{dt}.$$

Suppose that the amount of charge flowing in the wire is given by the function

$$Q(t) = 10.5\sin(2\pi 60t)$$

(which, say, represents the amount of charge coming through the sockets in your wall). Find the current $I(t)$ as a function of time.