Complete all six questions.

Show all work for full credit.

You may use a scientific calculator during this exam. Graphing calculators are not permitted. Also, other electronic devices are not allowed, and should be turned off and put away for the duration of the exam.

You do not need to simplify your answers.

If you use a trial-and-error or guess-and-check method when a more rigorous method is available, you will not receive full credit.

You may use one hand-written double-sided 8.5” by 11” page of notes.

You have 80 minutes to complete the exam.
1. [4 points per part] Compute the derivative of each function.

   (a) \( f(x) = \sqrt{\sin(x)} + x^2 + 2 \)

   (b) \( h(x) = 5^x \arcsin(x) \)

   (c) \( y = (x^4 + 9)^{\sec(x)} \)
2. [10 points] Consider the following parametric curve, over the domain \( t > 0 \):

\[
x(t) = 2^t + 7 \\
y(t) = \ln(t^{50}) - t^2
\]

Find the coordinates of a point on the curve at which the tangent line is \textit{horizontal}. You do not need to simplify your answer.

3. [8 points] Compute the linearization of the following function \( f \) at \( a = 0 \):

\[
f(x) = \arctan(4x) + \cos(x)
\]
4. **[10 points]** Find the equation for the tangent line to the following curve at the point (3, 0):

\[ 3e^y + x^2 y = x \]

5. **[5 points]** Consider the curve \( f \) pictured below:

Let \( h(x) = \ln(f(x)) \). Compute \( h'(4) \).

(An estimate is okay. Show your work by explaining your reasoning, or by clearly marking the relevant information on the graph.)
6. [15 points] Ilana runs along the ground at a speed of 7 feet per second, while carrying one end of a 26-foot-long rope. The other end of the rope is tied to a weight through a pulley system. The top of the pulley is 12 feet off the ground, so the weight rises higher in the air as Ilana runs away from the pulley.

When the weight is six feet off of the ground, how quickly is it rising into the air?

In other words, let $h$ be the height of the weight above the ground. Find $\frac{dh}{dt}$ when $h = 6$.

(Ignore Ilana’s height; you can pretend that she’s zero feet tall, or that she’s holding onto the rope by tying it to her shoe.)