1. Consider the following two equations.

$$(1) \quad e^x + x^4 = 0$$
$$(2) \quad e^x - x^4 = 0$$

Which of the following is true?

(A) Neither equation has a solution.

(B) (1) has a solution but (2) doesn't.

(C) (2) has a solution but (1) doesn't.

(D) Both equations have solutions.

2. True or False?

$$\frac{d}{dx} \int_0^{x^2} \ln(\sin t)\, dt = \ln(\sin x^2).$$

3.   The bacteria *E. coli* divides into two every 20 minutes. If there are initially 60 bacteria, how many bacteria are there after t hours?

(A) $60 \cdot 2^{20t}$

(B) $60 \cdot 2^{3t}$

(C) $60 \cdot 2^{t/3}$

(D) None of the above

4.   True or False?

The function
$$f(x) = \frac{x^5}{5} - \frac{4x^3}{3} + 4x$$
has exactly two critical points.

5. True or False?

The tangent line to the curve defined by

$$y \cos(y + x + x^2) = x^3$$

at the point $P = (0, \pi/2)$ is horizontal.

6.   True or False?

The function $f(x) = \sqrt{x + \ln x}$ has an antiderivative.

7. Let $f(x) = x^{\sin x}$. What is $f'(\pi/2)$?

(A) 0

(B) 1

(C) The derivative doesn't exist.

(D) None of the above.

8.   True or False?

The function

$$f(x) = x^2 + \ln(x)$$

has a vertical asymptote at $x = 0$.

9.   For how many values of $\lambda \geq 0$ does the equation $e^x = \lambda x$ have a unique solution?

(A) None

(B) 1

(C) 2 or more

10.   Find the dimensions of a cylinder of volume 1 m^3 of minimal cost if the top and bottom are made of material that costs twice as much as the material for the side.