(1) (25 pts.) The Land & Sea Cable Company is connecting points $A$ and $B$ via point $C$. Over land, the cost per mile is $r$ dollars but over the river the cost is $R = \sqrt{5} r$ dollars per mile. The river is $W = 3$ miles wide and $D = 10$ miles is the distance from $A$ to the point opposite $B$. Write the cost function in terms of the distance $x$ and solve for the value of $x$ that minimizes the cost.
(2) (25 pts.) For the function \( f(x) = x^2 e^x \), find the following.

(a) The domain of \( f(x) \).
(b) Each \( x \)-intercept.
(c) Each horizontal asymptote.
(d) The intervals on which \( f(x) \) is increasing.
(e) The intervals on which \( f(x) \) is concave up.
(f) The local extrema. Classify each as a maximum or minimum.
(g) The inflection points.
(h) Sketch the graph of \( y = f(x) \).
(3) (10 pts.) \[ \lim_{x \to 0} (1 - 2x)^{\frac{1}{x}} = \]

(4) (15 pts.)
(a) Find the linearization \( L(x) \) of the function \( f(x) = x + \frac{1}{x} \) at \( a = 2 \).
(b) Use part (a) to approximate \( f(1.8) \).
(5) (10 pts.) \( \lim_{x \to 0} \frac{\sin 2x}{x + 1 - \cos x} = \)

(6) (15 pts.) For the function \( f(x) = \sin x + \sin^2 x \) on the interval \([0, 2\pi]\), find the critical points. Find the absolute maximum and absolute minimum values.