Zhouzhuang Waterway Problem (Revised)

The water level in one of Zhouzhuang's canals can be modeled by the function h(x)=xsin(x^2), where h is the height of the water in meters and x is the time in hours since midnight.

A local historian wants to determine the total change in water level from 2 hours after midnight to 4 hours after midnight.

a) Find the integral of h(x) over the interval [2, 4].

b) To evaluate the integral, use the substitution u=x^2

c) Determine the corresponding change of variables and the new limits of integration.
d) Calculate the total change in water level over the given time interval using the substitution method.
e) Interpret the result in the context of the problem.

West Lake Boat Ride Problem

A boat operator at West Lake in Hangzhou offers scenic boat rides around the lake. The speed of the boat, in meters per minute, as a function of time t (in minutes) since the start of the ride, is given by $v(t)=t^2 \cos(5t^3)$

a) A group of tourists is interested in finding out the total distance covered by the boat from the 2nd minute to the 4th minute of the ride.

b) Find the integral of v(t) over the interval [2, 4] to determine the distance covered.

c) To evaluate the integral, use the substitution $u=5t^3$

d) Determine the corresponding change of variables and the new limits of integration.

e) Calculate the total distance covered by the boat over the given time interval using the substitution method.

f) Interpret the result in the context of the boat ride around West Lake.