Answer on Question #48975 – Math – Calculus

A boat on the the ocean is 9 km from the nearest point on a straight shoreline; that point is 20 km from a restaurant on the shore. A woman plans to row the boat straight to a point on the shore and then walk along the shore to the restaurant. If she walks at 5 km/h and rows at 4 km/h. How far will the point on shore be from the restaurant if she plans to minimize her total travel time

Solution.

Let A be a boat, B – the nearest point on the shoreline, C – landing point,

D – restorant.

Let AB = w=9 , BC = x , BD = y=20 , angle BAC = z

Distance over water = $\frac{w}{cosz} = \frac{9}{cosz}$ **.**

Distance over land = $20 - wtan\,z = 20 - 9tanz$ **.**

Time $t = \frac{9}{4cosz} + \frac{(20 - 9tan\,z)}{5}$

$$\frac{dt}{dz} = \frac{9sinz}{4cos^2z} - \frac{9}{5cos^2z} = 0 \rightarrow sinz = \frac{4}{5} \rightarrow cosz = \frac{3}{5} \rightarrow tanz = \frac{4}{3}$$

So, $x = 9tanz = 9 * \frac{4}{3} = 12$

Distance from restaurant $= y - x = 20 - 12 = 8\,km.$