

4. [12 points] Katya and Miles are sailing in the ocean, which is represented by the xy -plane. Katya's position, t hours after 12:00pm, is given by

$$x = 3t, \quad y = \sin\left(\frac{\pi t}{2}\right),$$

while Miles' position, t hours after 12:00pm, is given by

$$x = t^2 + 2, \quad y = \cos(\pi t) - 1.$$

In this problem, x and y have units in kilometers. All above equations are valid for $0 \leq t \leq 6$.

- a. [2 points] What is **Miles'** position at 3:00pm?

$$x = \underline{\hspace{2cm}} \quad y = \underline{\hspace{2cm}}$$

- b. [4 points] Will Katya and Miles ever collide during their journey? If so, at what time(s) will this occur? Justify your answer.

$$\text{The time(s) is/are } \underline{\hspace{3cm}}$$

- c. [3 points] What is the slope of the tangent line to **Katya's** path at $t = 4$?

$$\text{The slope is } \underline{\hspace{2cm}}$$

- d. [3 points] Write an expression involving one or more integrals that gives the distance, in kilometers, **Miles** traveled between 1:00pm and 4:00pm. Do not evaluate your integral(s).

$$\text{The distance is } \underline{\hspace{4cm}}$$