

3 March 2016

1. **Warm up:** Pretend you are a pirate on a ship. A cannonball is fired from a cannon on your ship toward another ship. You are tasked with determining if the cannonball will hit the other ship. Knowing that projectiles follow a parabolic path, write down three questions you would ask to solve this problem. Do you think these are enough to solve the problem?

2. Two atoms are moving in a plane. The position of the first atom is given by $(x_1(t), y_1(t))$ and the position of the second atom is given by $(x_2(t), y_2(t))$.
 - (a) What is the distance between the two atoms at time t ?

 - (b) How fast is the distance between the two atoms changing at time t ?

Now suppose that $x_1(t) = x_2(t) = t$ and $y_1(t) = -y_2(t) = \cos(t)$.

- (c) Draw a diagram of the position of both atoms from $t = 0$ to $t = 4\pi$.

- (d) How fast is the distance between the two atoms changing at time t ?

3. Consider the function $f(x) = \frac{6}{x^2+3}$.

(a) Find where f reaches its largest and smallest values.

(b) Find where the slopes of tangent lines of f are steepest and flattest.

4. (a) Find the smallest minimum of $f(x) = (x - 1)^2 + (x - 5)^2$ and its x -value.

(b) Find the smallest minimum of $f(x) = (x - a)^2 + (x - b)^2$ and its x -value.

(c) Find the smallest minimum of $f(x) = (x - a)^2 + (x - b)^2 + (x - c)^2$ and its x -value.

(d) What do you think is the x -value of the smallest minimum of $f(x) = \sum_{i=1}^n (x - a_i)^2$?