**Quiz** Name:
**Math 112L**
**3/8/19** Circle Your Instructor: Weifan Liu Ryan Gunderson Chung-Ru (Frank) Lee

3.01 The Rule of Pythagoras
3.04 Special Relativity is a Minus Sign in the Rule of Pythagoras
3.05 The Light Cone
3.06 The Universality of the Speed of Light
3.07 World Lines and the Twin "Paradox"
3.08 Boosts are Rotations in Space and Time

**Problem 1.** State and prove the Rule of Pythagoras. Anything close to a proof will count as full credit. Write your answer in essay form, with figures, as if you were explaining the proof to a friend.

Identify each of the vectors below as either (A) future timelike, (B) past timelike, (C) spacelike, or (D) null. **CIRCLE the correct answer.** Each vector has the coordinates $(t, x, y, z)$.

**Problem 2.** $\vec{v} = (2, 1, 1, 1)$. (A) future timelike, (B) past timelike, (C) spacelike, (D) null.

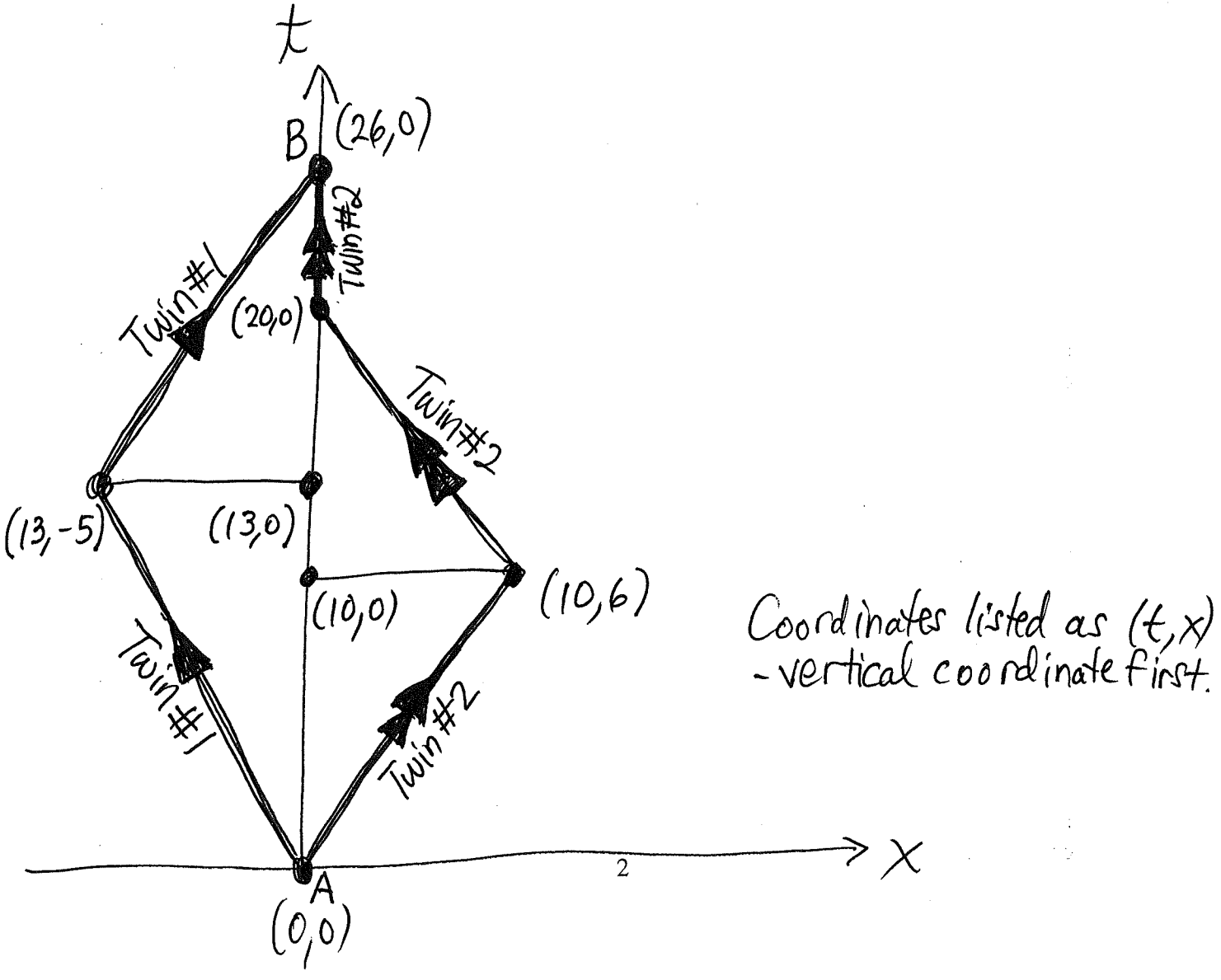
**Problem 3.** $\vec{v} = (-3, 4, 5, 6)$. (A) future timelike, (B) past timelike, (C) spacelike, (D) null.

**Problem 4.** $\vec{v} = (13, 4, -12, 3)$. (A) future timelike, (B) past timelike, (C) spacelike, (D) null.

**Problem 5.** $\vec{v} = (-5, 0, 0, 4)$. (A) future timelike, (B) past timelike, (C) spacelike, (D) null.

**Problem 6.** In the picture below, how much time does Twin #1 experience, moving between points A and B as shown?

**Problem 7.** In the picture below, how much time does Twin #2 experience, moving between points A and B as shown?




Coordinates listed as (t,x)
- vertical coordinate first.