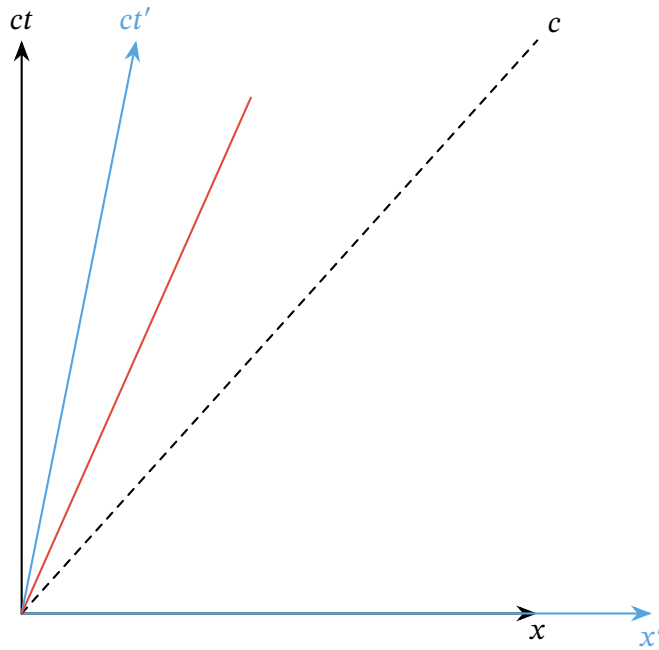


Worksheet: Minkowski Diagrams for Galilean Relativity



Q1:

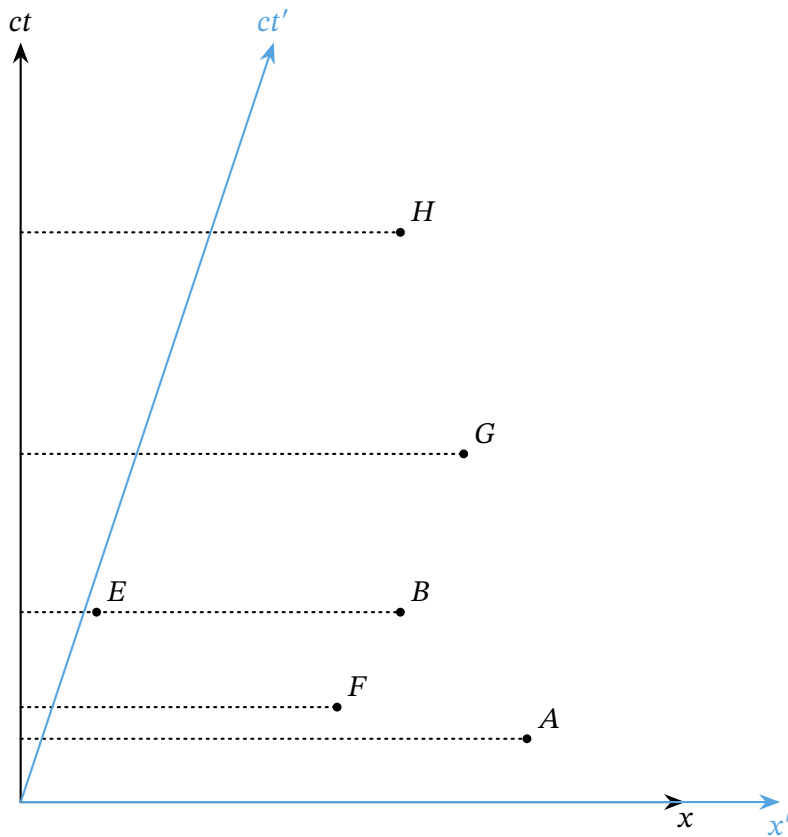


The above diagram shows what a Minkowski diagram would look like for two reference frames that obey Galilean relativity. Frame S is shown by the axes x and ct , and frame S' is shown by the axes x' and ct' . Frame S' moves at a speed u relative to frame S . Which of the following does the red line show?

- i. An object that is moving at the speed of light in both S and S'
- ii. An object that is moving at the speed of light in frame S'
- iii. An object that is moving at a constant, nonzero speed in both S and S'
- iv. The world line of an object that is at rest in frame S
- v. The world line of an object that is moving at speed $-u$ in frame S
- vi. An object that is moving at the speed of light in frame S
- vii. The world line of an object that is at rest in frame S'

- A iii
- B vii and vi
- C ii
- D iii and i
- 2 E v and iv

Q2:



The above diagram shows what a Minkowski diagram would look like for two reference frames that obey Galilean relativity. Frame S is shown by the axes x and ct , and frame S' is shown by the axes x' and ct' . Frame S' moves at a speed u relative to frame S . Six events are shown on the diagram: A , B , E , F , G , and H .

► Which two events are simultaneous in frame S' ?

- A E and A
- B B and E
- C B and G
- D F and A
- E H and G

► Which two events are simultaneous in frame S' ?

A E and A

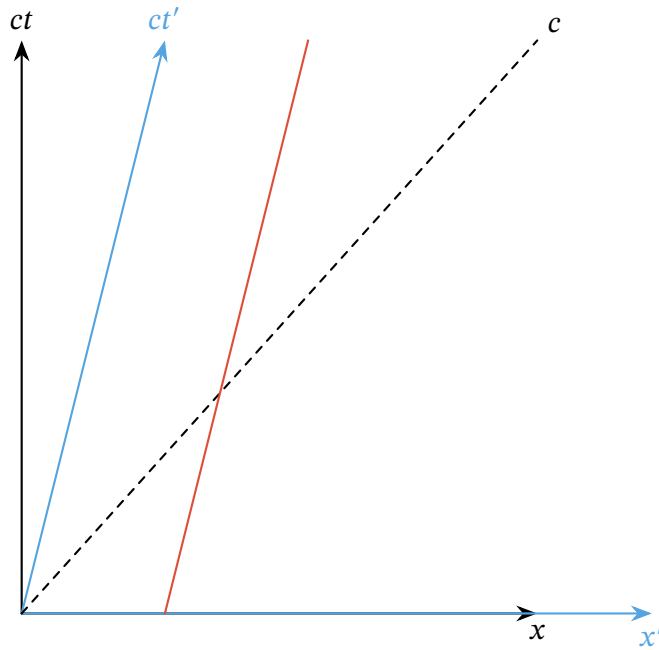
B B and E

C B and G

D F and A

E H and G

Q3:

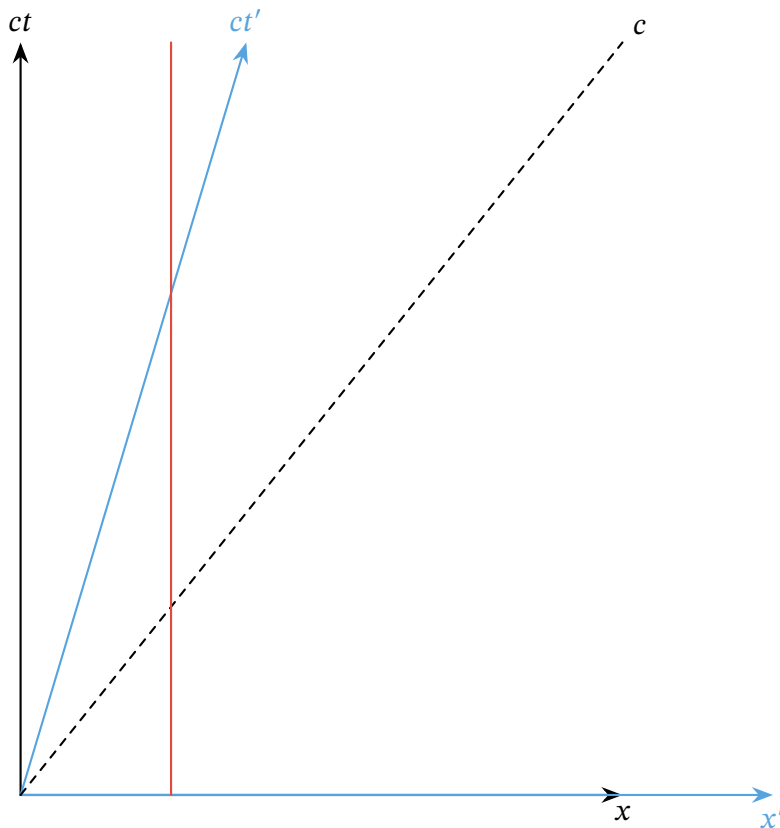


The above diagram shows what a Minkowski diagram would look like for two reference frames that obey Galilean relativity. Frame S is shown by the axes x and ct , and frame S' is shown by the axes x' and ct' . Frame S' moves at a speed u relative to frame S . Which of the following does the red line show?

- i. An object that is moving at the speed of light in both S and S'
- ii. An object that is moving at the speed of light in frame S'
- iii. An object that is moving at a constant, nonzero speed in both S and S'
- iv. The world line of an object that is at rest in frame S
- v. The world line of an object that is moving at speed $-u$ in frame S
- vi. An object that is moving at the speed of light in frame S
- vii. The world line of an object that is at rest in frame S'

- A v and vi
- B i and ii
- C iii and iv
- D vii
- 5 E i and vii

Q4:



The diagram shows what a Minkowski diagram would look like for two reference frames that obey Galilean relativity. Frame S is shown by the axes x and ct , and frame S' is shown by the axes x' and ct' . Frame S' moves at a speed u relative to frame S . Which of the following does the red line show?

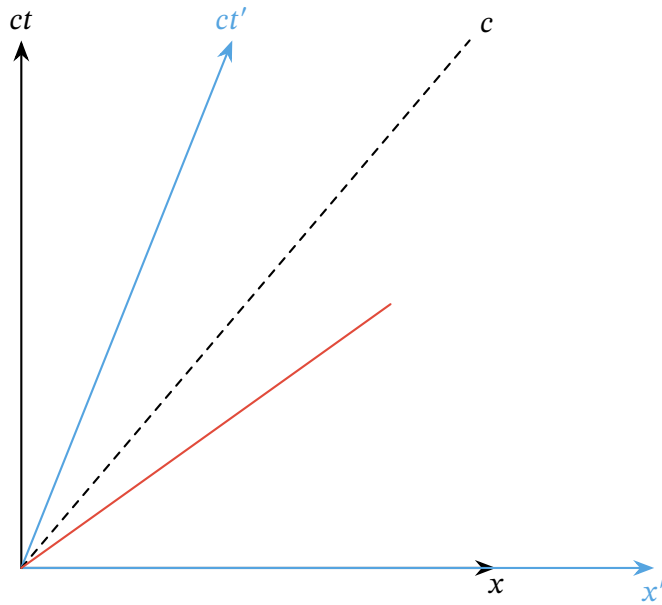
- i. The world line of an object that is moving at speed $-u$ in frame S'
- ii. An object that is moving at the speed of light in both S and S'
- iii. An object that is moving at the speed of light in frame S'
- iv. An object that is moving at a constant, nonzero speed in both S and S'
- v. The world line of an object that is at rest in frame S
- vi. The world line of an object that is moving at speed $-u$ in frame S
- vii. An object that is moving at the speed of light in frame S
- viii. The world line of an object that is at rest in frame S'

A iii and vi

6 B vi and iv

C iii and viii

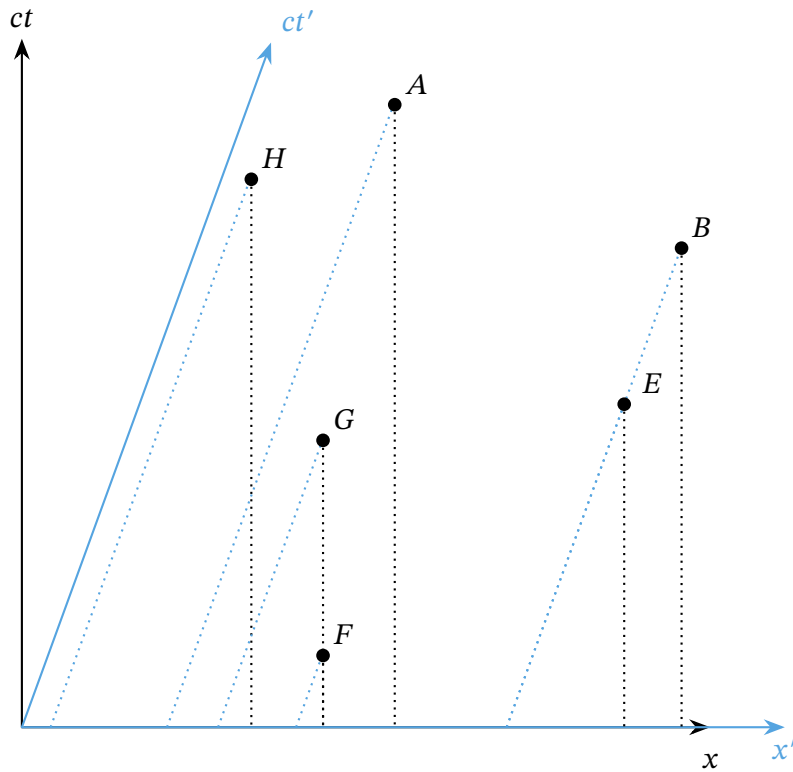
Q5:



The above diagram shows what a Minkowski diagram would look like for two reference frames that obey Galilean relativity. Frame S is shown by the axes x and ct , and frame S' is shown by the axes x' and ct' . Frame S' moves at a speed u relative to frame S . The red line is the world line of a particle that is moving at the speed of light in frame S' . Which of the following expressions gives the speed of the particle in frame S ?

- A u
- B $c + 2u$
- C c
- D $c - u$
- E $c + u$

Q6: The diagram shows what a Minkowski diagram would look like for two reference frames that obey Galilean relativity. Frame S is shown by the axes x and ct and frame S' is shown by the axes x' and ct' . Frame S' moves at a speed u relative to frame S . Six events are shown on the diagram: A , B , E , F , G , and H .



► Which two events occur at the same position in S ?

- A G and F
- B B and F
- C A and B
- D E and F
- E G and H

► Which two events occur at the same position in S' ?

A B and E

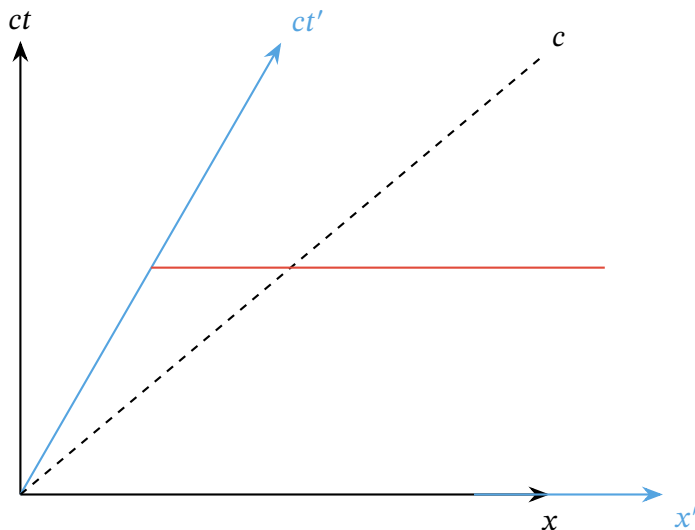
B E and F

C G and F

D B and F

E A and B

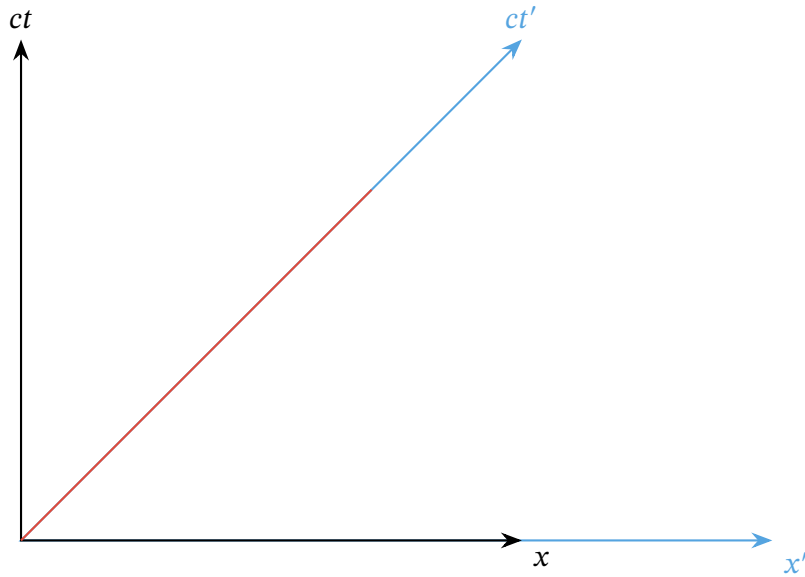
Q7: The diagram shows what a Minkowski diagram would look like for two reference frames that obey Galilean relativity. Frame S is shown by the axes x and ct , and frame S' is shown by the axes x' and ct' . Frame S' moves at a speed u relative to frame S . Which of the following does the red line show?



- i. An object that is moving at the speed of light in both S and S'
- ii. An object that is moving at the speed of light in frame S'
- iii. An object that is moving at a constant, nonzero speed in both S and S'
- iv. The world line of an object that is at rest in frame S
- v. The world line of an object that is moving at speed $-u$ in frame S
- vi. A line of constant time in both S and S'
- vii. An object that is moving at the speed of light in frame S
- viii. The world line of an object that is at rest in frame S'

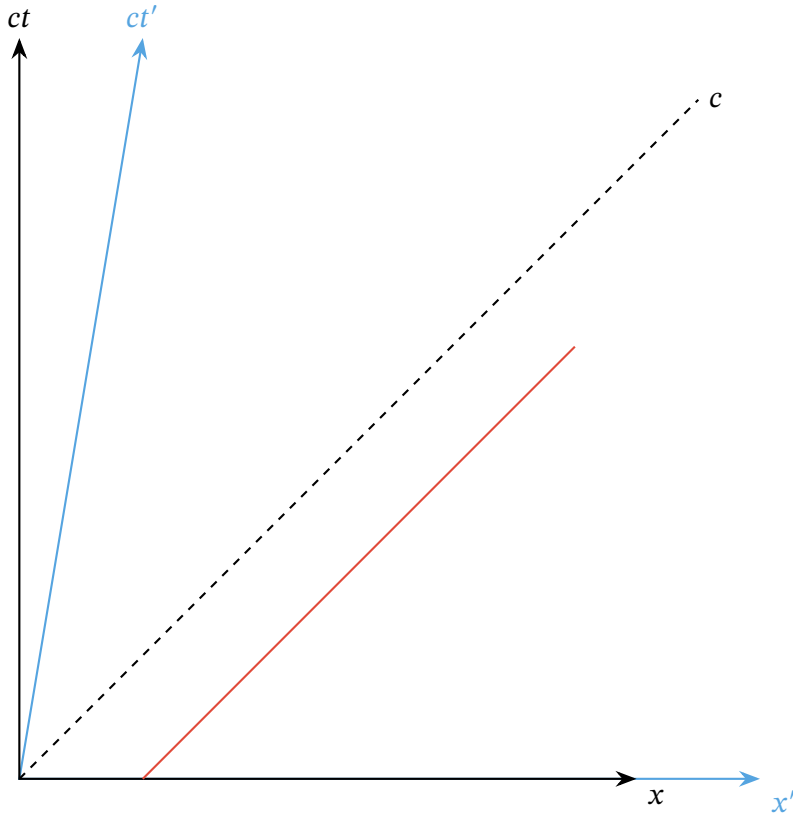
- A ii and iii
- B v and vii
- C vi
- D viii
- E iv and i

Q8: The above diagram shows what a Minkowski diagram would look like for two reference frames that obey Galilean relativity. Frame S is shown by the axes x and ct , and frame S' is shown by the axes x' and ct' . Frame S' moves at the speed of light, c , relative to S . The red line is the world line of a particle that is moving at the speed of light in frame S . What is the speed of the particle in frame S' ?



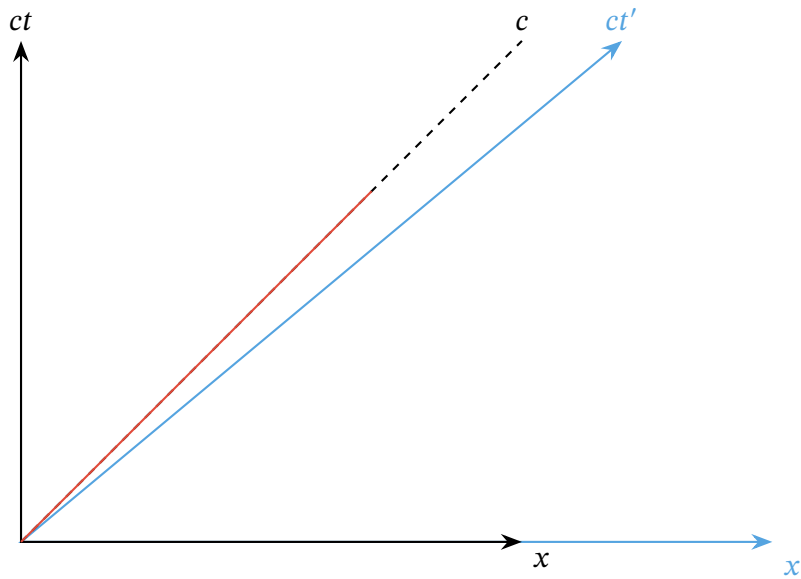
- A 0
- B c
- C $-c$
- D $\frac{c}{2}$
- E $2c$

Q9: The above diagram shows what a Minkowski diagram would look like for two reference frames that obey Galilean relativity. Frame S is shown by the axes x and ct , and frame S' is shown by the axes x' and ct' . Frame S' moves at a speed u relative to frame S . The red line is the world line of a particle moving at the speed of light, c , in frame S . Which of the following expressions gives the speed of the particle in frame S' ?



- A $c + u$
- B $c - u$
- C c
- D $c - 2u$
- E u

Q10: The above diagram shows what a Minkowski diagram would look like for two reference frames that obey Galilean relativity. Frame S is shown by the axes x and ct , and frame S' is shown by the axes x' and ct' . Frame S' moves at a speed u relative to frame S , where u is faster than the speed of light. The red line is the world line of a particle moving at the speed of light, c , in frame S . Which of the following statements is true for an observer at rest in frame S' ?



- A The particle is moving away from the observer at a speed $c - 2u$.
- B The particle is moving away from the observer at a speed $-c$.
- C The particle is not moving relative to the observer.
- D The particle is moving away from the observer at a speed $c - u$.
- E The particle is moving away from the observer at a speed $-u$.