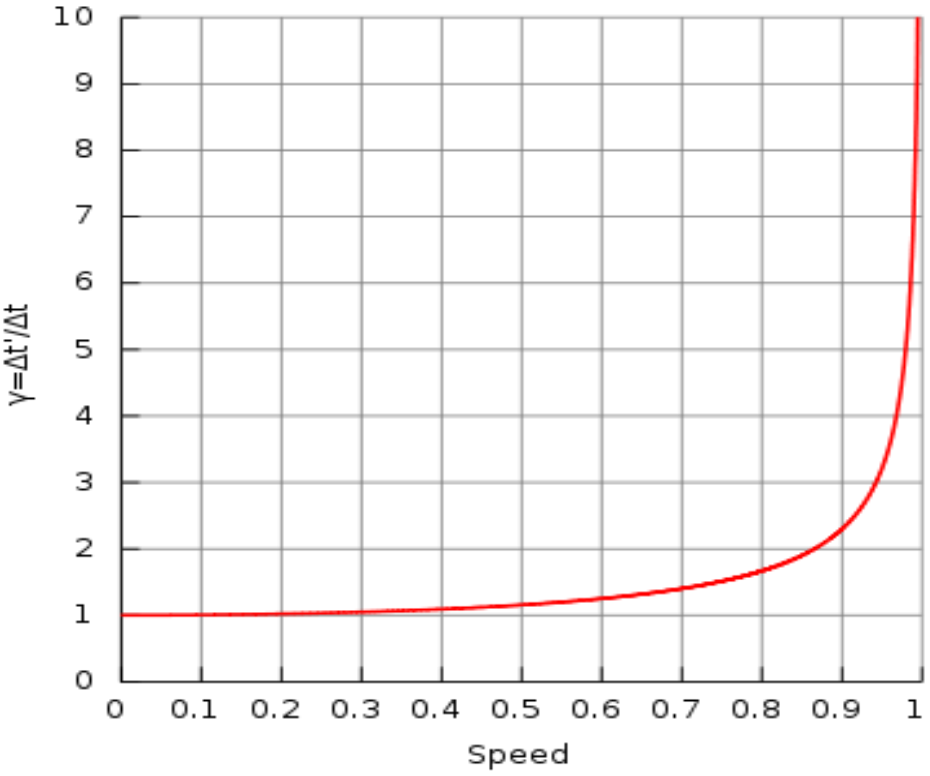
Time Dilation – Special Relativity

Name: _____ Date: _____

$$\Delta t_m = \gamma \Delta t_s = \frac{\Delta t_s}{\sqrt{1 - \frac{v^2}{c^2}}}$$

The "Gamma" - γ – Factor



Problems:

1. Two friends synchronize their watches. One friend then sets out on a miraculous journey. He sets out at 0.95 times the speed of light and returns back to his friend when his watch says he was gone for 10 years. How long would the friend that remained behind record the journey to have taken? Calculate the gamma (γ) factor as well.

2. A student who is 17 years old leaves on an advanced spaceship to test the theory of relativity at *2.8 x* 10^8 m/s, leaving her friends and family behind. One day she returns and is surprised with what she finds. She meets up with one of her friends. Her friend who was the same age when she left tells her that she is now 27 years old. How old would the person who left on the trip be ? [This would be her biological age as all physical and chemical processes are affected by time-dilation. Calculate the gamma (γ) factor as well.

3. Two atomic clocks are perfectly synchronized. One clock is placed on a spaceship and leaves Earth. Upon return the two clocks are compared. One clock reads that 80 minutes has passed. The other reads that only 50 minutes has passed. Which clock was moving and calculate the speed at which it was travelling. Calculate the gamma (γ) factor as well.

4. Julia calls Dana and tells her to come over to visit. Julia tells Dana she has exactly 8 seconds to get there or she'll be mad. Dana leaves in super car at 0.8c and it takes her exactly 8 seconds to get there. Why is Julia mad at her? Calculate the distance Dana travels in both reference frames. Is the answer suprising. Explain. Calculate the gamma (γ) factor as well.