

## Relativistic Correction on GPS Satellite (13 points)

### Part A. Single accelerated particle (2.8 points)

Question	Answer	Marks
1. 0.5 pts	$a =$	
2. 0.5 pts	$\beta(t) =$	
3. 0.3 pts	$x(t) =$	
4. 0.7 pts		
5. 0.4 pts	$\beta(\tau) =$	
6. 0.4 pts	$t(\tau) =$	

### Part B. Flight Time (2.0 points)

Question	Answer	Marks
1. 1.2 pts	$t_0(\tau) =$ Will it freeze ? Yes or No If yes, $t_0(\tau \rightarrow \infty) =$	
2. 0.8 pts	$\tau_0(t) =$ Will it freeze ? Yes or No If yes, $\tau_0(t \rightarrow \infty) =$	

**Part C. Minkowski Diagram (1.0 points)**

Question	Answer	Marks
1. 0.5 pts	Plot of the Minkowski diagram:          $L' =$	
2. 0.5 pts		

**Part D. Two Accelerated Particles (2.3 points)**

Question	Answer	Marks
1. 0.3 pts	$\tau_2 =$	
2. 1.0 pts	$C_1 =$	
3. 1.0 pts	$C_2 =$	

**Part E. Uniformly Accelerated Frame (2.7 points)**

Question	Answer	Marks
1. 0.8 pts	$x_p =$	
2. 1.3 pts	$g_2 =$	
3. 0.6 pts	$\frac{d\tau_2}{d\tau_1} =$	

**Part F. Correction for GPS (2.2 pts)**

Question	Answer	Marks
1. 0.6 pts	$r =$ $=$ (numerical value) $v =$ $=$ (numerical value)	
2. 1.2 pts	$\Delta\tau_g =$ $=$ (numerical value) $\Delta\tau_s =$ $=$ (numerical value) $\Delta\tau =$ (numerical value) Which clock is faster? earth's clock or satellite's clock.	
3. 0.4 pts	$\Delta L =$ (numerical value)	