Physics Cup 2018 - Problem 2. February 18, 2018

A spaceship travels with a constant acceleration g (as perceived by the passengers) along a straight line. At a certain moment, it launches two missiles in the direction of its motion, one with speed v (comparable to the speed of light c), and another with speed $2v$ (these are speeds in the spaceship's frame). Find the proper time interval in the space ship between catching the first missile and catching the second missile.

Hints of 4th and 11th February 2018: This problem appeared to be relatively easy for the contestants, so I shall not give you hints for a brute force approach. Instead, I'll let you know that this problem has a very simple geometric solution — simpler than any of the submitted solutions, if you use $x - ct$i - diagram; for more information, see **http://mathworld.wolfram. com/MinkowskiSpace.html**. The curve in $x - ct$i — diagram appears to be a circle! Be careful to treat the imaginary unit correctly!

Third hint, February 18, 2018. As a first step, show that its curvature radius is constant. Then, apply the inscribed angle theorem.

Correct solutions submitted during the first two weeks:

name	school	country	pr2 solved
Tóbiás Marozsák	Óbudai Árpád Gimnázium	Hungary	28 Jan 17:06
Eftime Andrei	International Computer Highschool Bucharest	Romania	28 Jan 17:15
Thomas Bergamaschi	Colegio Etapa Valinhos-Brazil	Brazil	28 Jan 17:51
Navneel Singhal	ALLEN Kota	India	28 Jan 18:12
Gabriel Golfetti	Colégio Etapa	Brazil	28 Jan 18:14
Victor Hugo O Bastos	Ari de Sá Cavalcante	Brazil	28 Jan 21:11
Luciano Rodriges	Christus	Brazil	28 Jan 22:14
Rafael Timbó	Colégio Antares S/S LTDA	Brazil	28 Jan 23:04
Carlos Henricco Queiroz	Farias Brito Colegio	Brazil	29 Jan 02:53
Soma Nagahama	Osaka Seiko High School	Japan	29 Jan 10:26
Artur Soares Rodrigues	Colégio Farias Brito	Brazil	29 Jan 10:53
Takamasa Ando	Okayama Asahi High School	Japan	29 Jan 11:38
Dylan Toh	NUS High School	Singapore	29 Jan 14:51
Balázs Németh	Budapesti Fazekas Gimnázium	Hungary	29 Jan 18:44
Paulo Kitayama	Farias Brito Colegio	Brazil	29 Jan 20:30
Peter Elek	DRK Dóczy Gimnázium	Hungary	29 Jan 21:26
Bulcsu Fajszi	Fazekas Secondary School, Budapest	Hungary	30 Jan 14:05
Satoshi Yoshida	The University of Tokyo	Japan	30 Jan 16:57
Levy Batista	Farias Brito	Brazil	31 Jan 02:05
Muhammad Farhan Husain	Kharisma Bangsa High School	Indonesia	01 Feb 12:57
Juan Sheikh Mohammad	Al Bassel school	Syria	01 Feb 21:07
Vinicius Alcântara Névoa	Colégio Visão	Brazil	03 Feb 17:00
Sabina Dragoi	International Computer Highschool Bucharest	Romania	04 Feb 09:49
Elvinas Ribinskas	University of Cambridge	Lithuania	04 Feb 11:16
Radosław Grabarczyk	Marynarki Wojennej RP w Gdyni	Poland	04 Feb 14:56
Flavio Salvati	I.I.S. Leonardo da Vinci	Italy	05 Feb 22:23
Leonardo Martins Pires	Colégio Objetivo Integrado	Brazil	07 Feb 00:36
Otá vio Bittencourt	Colégio Objetivo Integrado	Brazil	07 Feb 20:08
Prathyush Poduval	Canara PU College	India	08 Feb 07:08
Gabriel Capelo	Colégio Ari de Sá Cavalcante	Brazil	09 Feb 01:27
Uwuwewewe Osas	Tashak Yalama High School	Uganda	09 Feb 21:17
Dolteanu Stefan	International Computer Highschool Bucharest	Romania	11 Feb 09:11
Davit Mdinaradze	Komarovi Tbilisi N199	Georgia	11 Feb 15:47
Kosuke Yoshimi	Nada High School	Japan	12 Feb 07:35
Abrar Al Shadid	Chittagong College	Bangladesh	14 Feb 05:45
Gabriel Trigo	Colegio Etapa	Brazil	15 Feb 01:49
Gabriel Domingues	Colégio Etapa	Brazil	15 Feb 20:34