

## Physics Cup 2018 - Problem 2. February 11, 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.

*Hint of 4th 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  $x - cti$  - diagram; for more information, see <http://mathworld.wolfram.com/MinkowskiSpace.html>

*Second hint, February 11, 2018.* The curve in  $x - cti$  - diagram appears to be a circle! Be careful to treat the imaginary unit correctly!

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 Highsch	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 Rodrigues	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 Fajsi	Fazekas Secondary School, Buda	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 F Husain	Kharisma Bangsa High School	Indonesia	01 Feb 12:57
Juan S Mohammad	Al Bassel school	Syria	01 Feb 21:07
Vinicius A Névoa	Colégio Visão	Brazil	03 Feb 17:00
Sabina Dragoi	International Computer Highsch	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
Otávio 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 Highsch	Romania	11 Feb 09:11