

VectorJockey 2.0

An Educational, Game Experience in Vector Addition of Velocity and Acceleration in a Frictionless, 2-D Space.

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YOUR MISSION:

Pilot your ship to break all **seven** of the green, laser beams (in any order) in the shortest possible time.

NOTE: The first screen contains only **five** of the beams - you need to FIND the other two!

THE CONTROLS:

- **10 m/s²** button - advances the game one second with your ship's engines ON.
Keycode: a
- **Coast** button - advances the game one second with your ship's engines OFF. Keycode: s
- **Left arrow** button - click to rotate your ship COUNTER-CLOCKWISE. Keycode: k
- **Right arrow** button - click to rotate your ship CLOCKWISE. Keycode: L

Time only passes in the simulation when YOU make a move - that is when you press either the **10 m/s²** button or the **Coast** button. Each move advances the game time by one second.

Since your ship is in deep space where both gravitational and frictional forces are negligible, once your ship is in motion, it remains in motion unless acted on by your engines (or, more abruptly, by an asteroid). In-other-words, if you, for example, rotate your ship so that the front points downward on the display screen (90°), and press the **10 m/s²** acceleration button for five consecutive turns, then you will be moving 50 m/s at 90°. Then, if you press the **Coast** button, then one second of simulation time will pass with your ship's engines turned off. Your ship will continue to move 50 m/s at 90°- without using any fuel, nor without slowing down.

CHANGING DIRECTION:

Directions in this game are measured in degrees - 0° being directly to the right on the screen, 90° being directly up on the screen, 180° being directly to the left, and 270° being directly down on the screen.

There are two buttons for changing the direction your ship is facing: one turns the ship clockwise, and the other counter-clockwise. Note that turning the direction that your ship is facing has ABSOLUTELY NO EFFECT ON THE DIRECTION IT IS MOVING. The direction that your ship is facing determines the direction of your ship's ACCELERATION when you press the **10 m/s²** button. The only way to stop, is to rotate your ship to face the opposite direction of its velocity, and to start accelerating. For example, if you ship's velocity is 50 m/s at 90°, then to stop you should rotate your ship to face 270°, and press the **10 m/s²** acceleration button. Even though you are accelerating opposite your velocity, YOU WOULD STILL MOVE at 90° - although you move a little less quickly (40 m/s instead of 50 m/s). It would take 5 turns (seconds) of accelerating at 0° while moving at 180° before your ship came to a stop. Changing the direction that your ship is facing takes zero simulation time, and does not use any fuel.

HINT: it is easy to complete the game if you always keep your velocity less than 25 m/s. The drawback to this strategy is, of course, that your race time will be very large - but at least you will finish. It is dangerous to move at high velocity. Since it takes just as much time to lose velocity as it does to gain it, you need to turn your ship opposite to its motion and start slowing down when you are half-way to your destination.

IMPORTANT NOTE ABOUT TURNING:

Consider the following example: Your ship is moving 20 m/s at 180°. You rotate to face 90°, and press the '**10 m/s²**' button. The result of this will be that your ship will be moving 10 m/s at 90° AND 20 m/s at 180° AT THE SAME TIME! your actual velocity will be the vector sum of 10 m/s at 90° and 20 m/s at 180° or 22 m/s at 153°. If you continue to accelerate while facing 90°, then you will go faster and faster in the 90° direction, however YOU WILL ALWAYS ALSO BE GOING 20 m/s at 180°. The only way to get rid of your leftward velocity is to face your ship so that it is pointed somewhat to the right when you accelerate. If your ship is facing directly to the right (0°) then it will take two seconds of acceleration to get rid of the 20 m/s of leftward velocity.

Special Thanks to the Albuquerque Academy class of 2000 for great ideas, and excellent bug hounding.

May the FORCE be with you.

Information for The Teacher

VectorJockey is NOT an ARCADE type game! In VectorJockey, time only advances when the user tells it to advance. This has a number of desirable effects:

- 1) Students who are gifted with superior hand-eye coordination do not, on average, perform better in VectorJockey than do students who are not so gifted. Likewise, having extensive arcade-type video game experience does not correlate with superior performance in VectorJockey.
- 2) There are a number of arcade-type video games that simulate the physical world with a fair degree of accuracy; however, developing proficiency at these games, like developing proficiency at basket ball, soccer or some other sport, does not require that the player develop a sophisticated, cerebral understanding of the physics involved. The staccato flow of time in VectorJockey seems to effectively foil the body's ability to do physics by reflex and without reasoning. Since the user controls each stroke of game-time in VectorJockey, there is always sufficient think-time for complex reasoning. Performing well in VectorJockey requires an understanding of the underlining physics.

I use this software in my physics class about half way through covering kinematics in 2-dimensions. I usually take the class down to the computer lab for one day. I demo a few principals, and then let them go at it. By the end of one 50 minute period, three-quarters of the class has completed the 7 beams at least once. I then give the students a week or two to use the software outside of class, and grade each student's best score.

Whenever a user breaks all 7 beams, a code is displayed that encrypts the student's name and score. An instructor who knows how to decipher this code can quickly verify the authenticity of a student's score. The Key to this code will be released to teachers only.

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