



U2.3 A drive that goes sideways

Kinematics and frames · University · about 25 min

Name _____

Class _____

Date _____

What this lesson is about

Three degrees of freedom on the floor, and what holonomic buys you.

- What that buys you
- The three commands are not the same size

Questions

6 marks in all

- Why is a car non-holonomic while the BugBot is holonomic? [1 mark]
☐ **A** A car has three degrees of freedom on the floor but only two controls, and cannot move sideways directly
☐ **B** A car has fewer degrees of freedom on the floor than the BugBot
☐ **C** A car cannot change its heading while it is moving
☐ **D** A car's controls are blocking and the BugBot's are not
- This robot's sideways full scale is 15 cm/s. At what speed does `drive(0, 70, 0)` move it, in cm/s? [1 mark]

- With $V_MAX = 20$ cm/s and $V_LAT = 15$ cm/s, `drive(70, 70, 0)` is sent expecting a 45 degree diagonal. At what angle to the right of straight ahead does the robot actually travel, to the nearest degree? [1 mark]

- Which of these does a holonomic drive buy you? [1 mark]
Tick every answer that is true.
☐ **A** The robot can point its camera at one thing while travelling towards another
☐ **B** Errors in x and y can be corrected by separate terms at the same time
☐ **C** Any curve on the floor is a path the robot can follow
☐ **D** Better efficiency than a wheeled car
☐ **E** Fewer actuators to control
- Code that treats a command as a velocity asks for a straight diagonal. What happens? [1 mark]
☐ **A** The robot drifts to one side of the line, because each axis has its own full scale
☐ **B** The robot follows the line exactly, just more slowly
☐ **C** The robot spins, because the diagonal couples into rotation
☐ **D** Nothing goes wrong, because commands on every axis are percentages of the same speed
- The green zone is to the robot's right. Which command gets it there without turning? [1 mark]
☐ **A** `drive(0, 70, 0)`
☐ **B** `drive(70, 0, 0)`
☐ **C** `drive(0, 0, 70)`
☐ **D** `drive(0, -70, 0)`

The task: crab into the zone

The green zone is to the robot's right. Get into it without turning: the robot has to arrive facing the same way it started.

```
from bugbot import *  
connect()  
  
# drive(forward, sideways, rotation)
```

Plan your program here, then type it in and press Run.



Do it on the robot

www.bugbotlab.com/learn/u2-3-holonomic/

The simulator checks it and tells you when it passes. Nothing to install, no account.

Challenges

1. Drive a diagonal by using forward and sideways together. Is the path straight?
2. Drive in a circle without changing the heading at all, using only the two translation terms.
3. Measure the sideways top speed and the forward top speed, and work out the ratio. Keep the number.