# Three Ways to Accelerate:

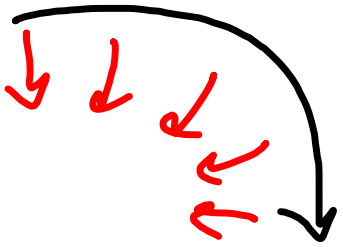
1) Speed up

2) Slow down

3) ??

# Centripetal Acceleration

Acceleration toward the center of the turn



**What does it depend on?**

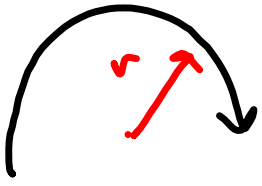
**Which situation creates a more violent turn?**
(more centrip accel)

**Go into a turn fast**

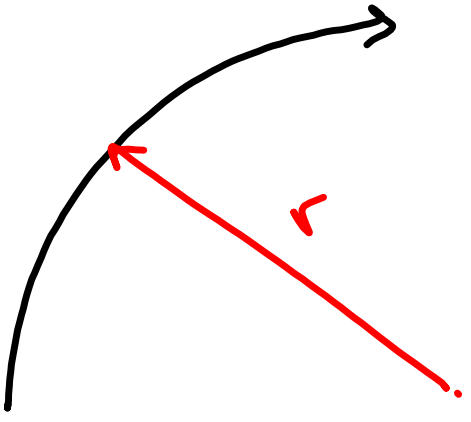
**Go into a turn slow**

**Which situation creates a more violent turn?**
(more centrip accel)

**Go into a tight turn**

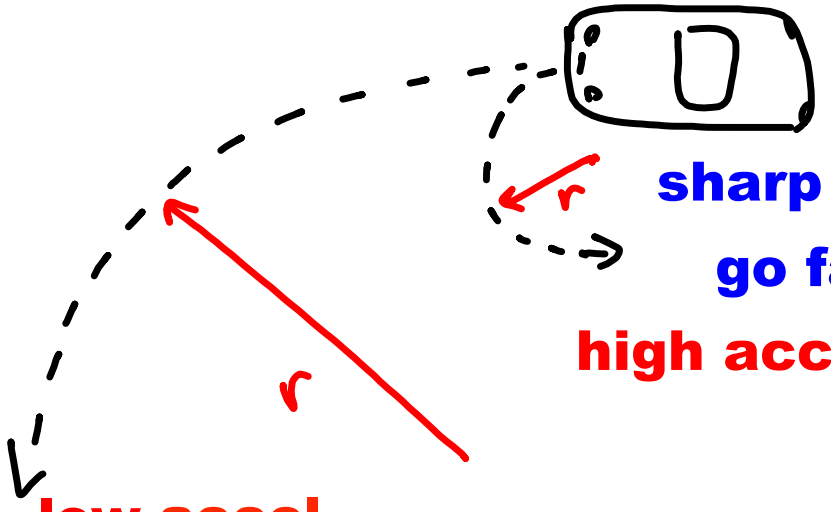



**Go into a wide turn**



# Centripetal Acceleration

(accel due to turning)




sharp turn

go fast

high $accel_{centrip}$

$low\ accel_{centrip}$

wide turn

go slow

# Coaster Loops & Pilots

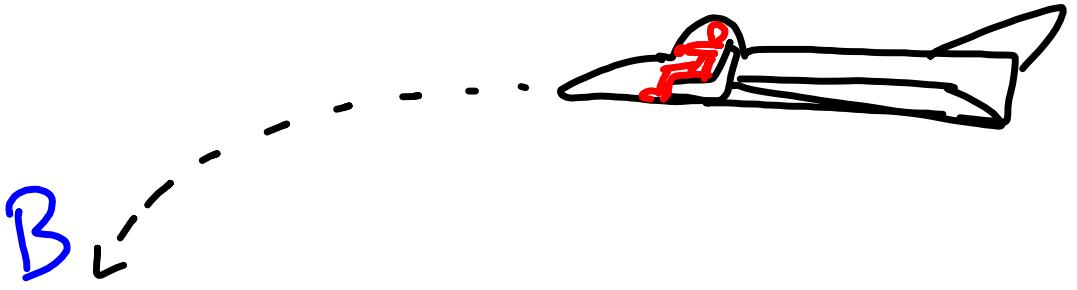
g's

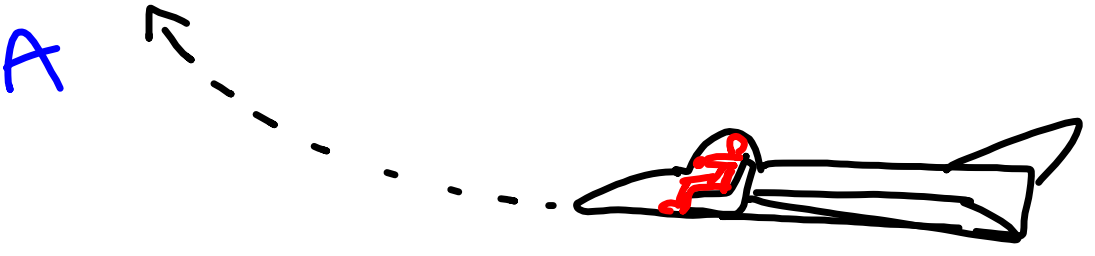
**g's measure acceleration**

**not force!**

**1 g = 10 meters/sec every sec**

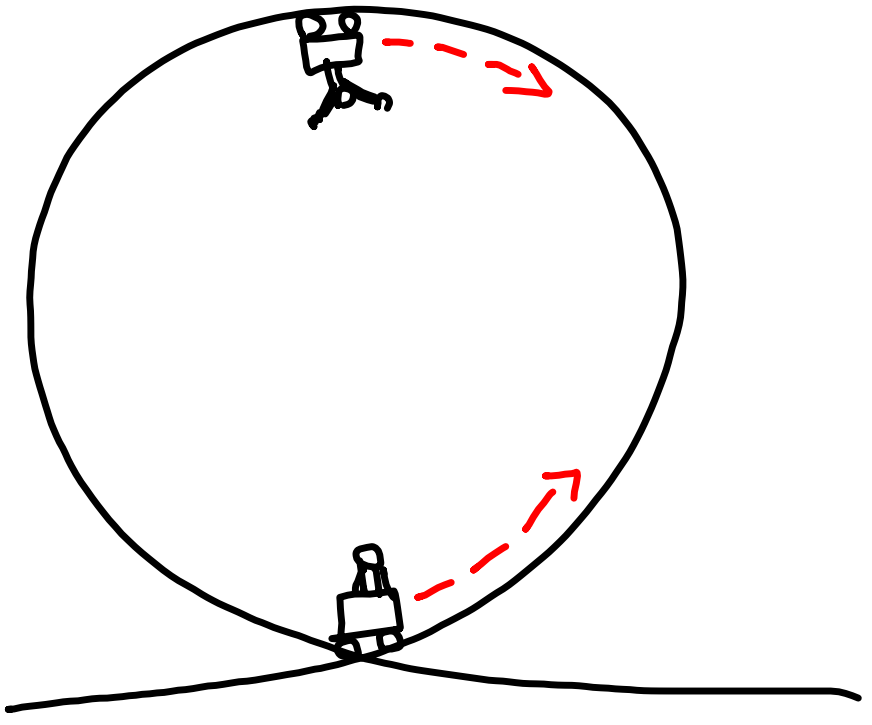
**Which one is more likely to make the pilot black out?**




**answer: A**

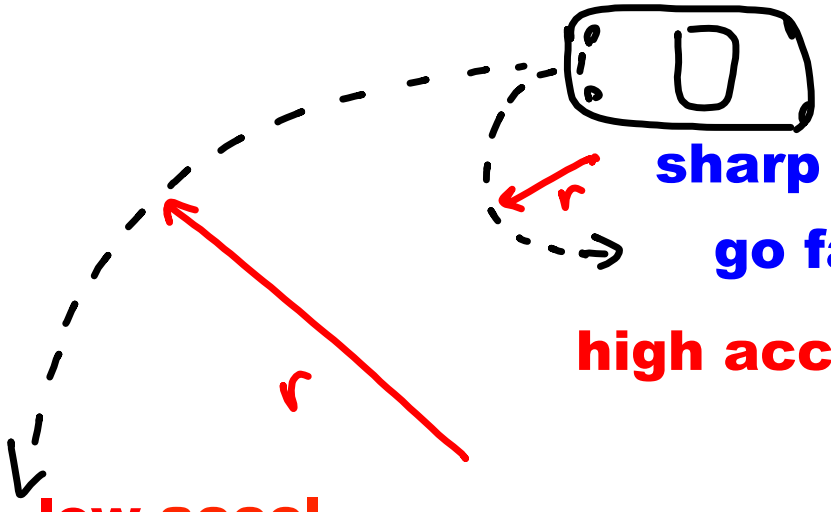
**Top of loop: danger of falling in**



**Bottom of loop: Danger of ???**

## Centripetal Acceleration

(accel due to turning)




sharp turn

go fast

high accel$_{centrip}$

low accel$_{centrip}$

wide turn

go slow

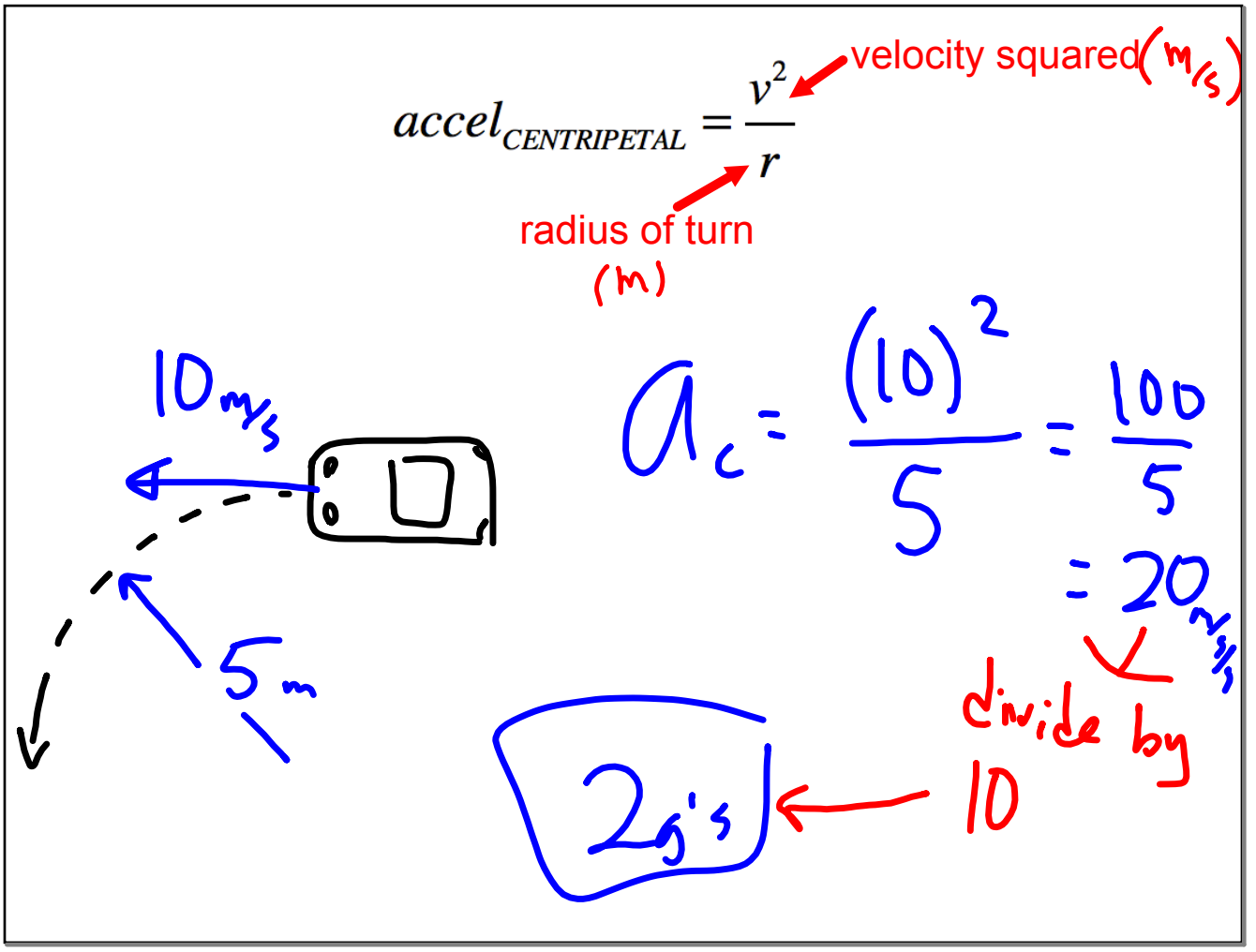

LOOPING THE LOOP-YOUNG'S PIER
ATLANTIC CITY, U.S.A.

$$accel_{CENTRIPETAL} = \frac{v^2}{r}$$

velocity squared (m/s)

radius of turn (m)

Then divide by 10 to convert to g's


$accel_{CENTRIPETAL} = \frac{v^2}{r}$
velocity squared (m/s)
radius of turn (m)
10 m/s
5 m
$a_c = \frac{(10)^2}{5} = \frac{100}{5}$
$= 20 \text{ m/s}^2$
divide by 10
2 g's

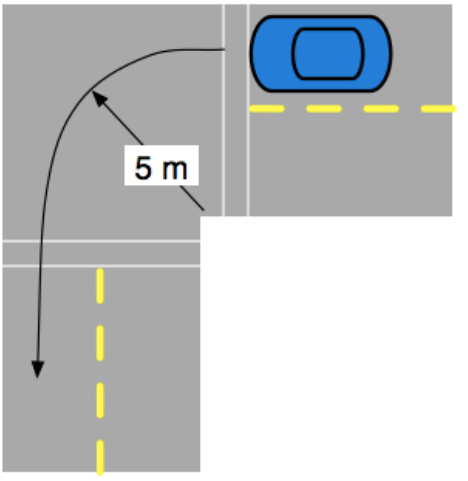
The car takes a turn at 9 m/s.

a) What is the car's centripetal acceleration?

b) How many g's is that?

$$accel_{CENTRIPETAL} = \frac{v^2}{r}$$

then divide by 10 to convert to g's



The car takes a turn at 9 m/s.

a) What is the car's centripetal acceleration?

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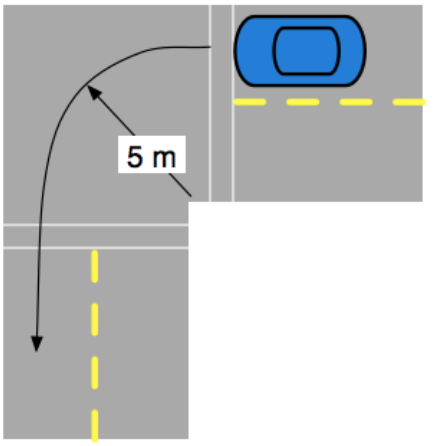
$$accel_{CENTRIPETAL} = \frac{v^2}{r}$$

then divide by 10 to convert to g's




*a) The v in the formula is the velocity in m/s. The r in the formula is the radius, which is on the diagram.*

$$accel = \frac{v^2}{r}$$

$$= \frac{(9)^2}{(5)}$$

$$= \frac{(81)}{(5)}$$

$$= 16.2\ m/s^2$$

*b) To get g's, divide by 1g, which Earth's gravity: 10 $m/s^2$*

$$\frac{16.2}{10} = 1.62\ g's$$

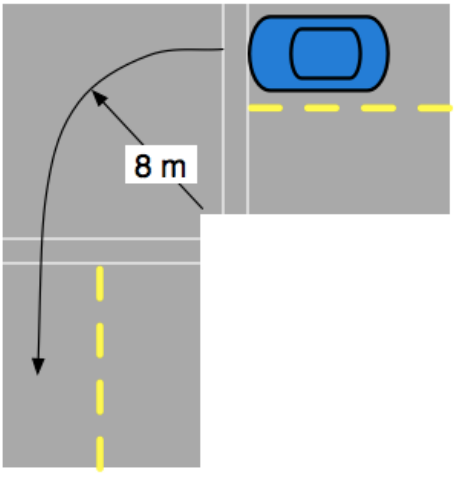
The car takes a turn at 10 m/s.

a) What is the car's centripetal acceleration?

b) How many g's is that?

$$accel_{CENTRIPETAL} = \frac{v^2}{r}$$

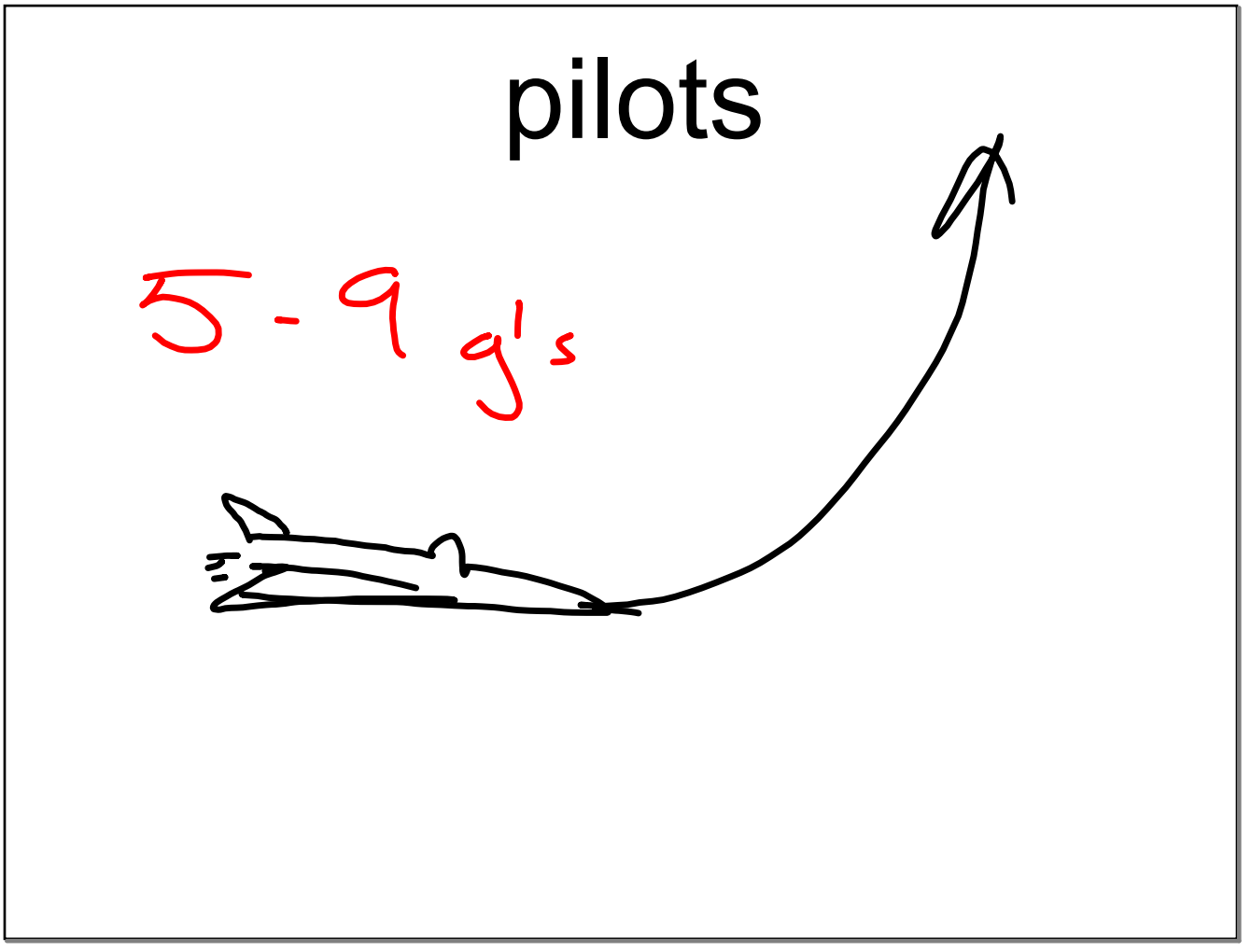
then divide by 10 to convert to g's

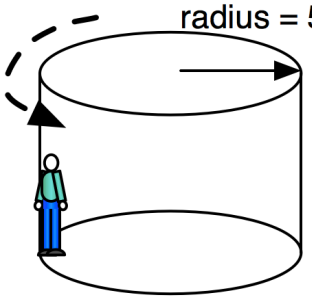



**You should get:**

**a) 18.5 m/s/s**

**b) 1.85 g's**


pilots
5 - 9 g's




$$accel_{CENTRIPETAL} = \frac{v^2}{r}$$

then divide by 10 to convert to g's

SHOW WORK!

1. The Gravitron ride takes 20 seconds to spin around 5 times.

a) Calculate the time it takes to spin around once.

$\frac{20\text{ sec}}{5} = 4\text{ sec}$

b) Calculate the distance the person goes around each spin. (circumference!)

**c = 2πr**

$2\pi r = 2\pi(5) = 31.4\text{ m}$

c) Calculate the person's velocity. (velocity = distance / time)

$v = \frac{d}{t} = \frac{31.4\text{ m}}{4\text{ sec}} = 7.85\text{ m/s}$

d) Use the formula to calculate the centripetal acceleration of the person.

$a_c = \frac{v^2}{r} = \frac{(7.85)^2}{5} = 12.3\text{ m/s}^2$

e) How many g's is that? 1.23 g's