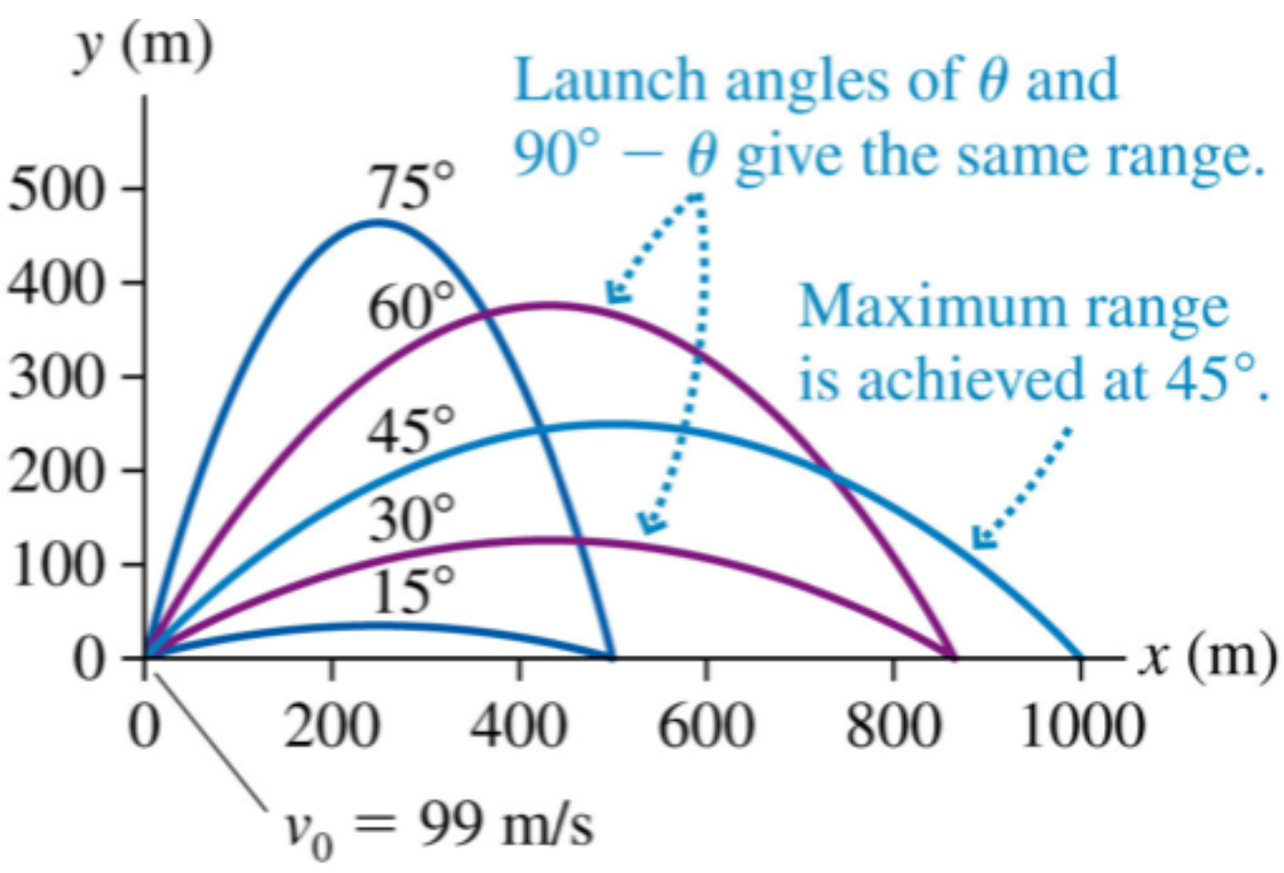
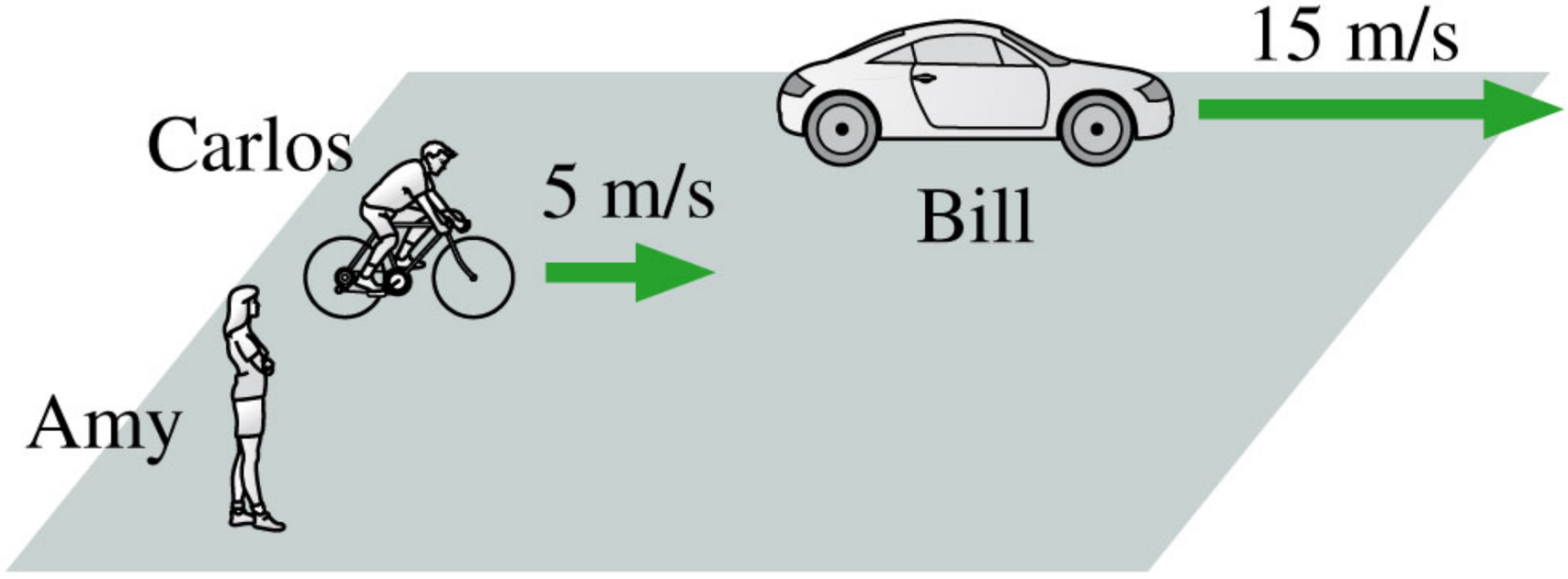
Range of projectile

$$R = \frac{v_0^2 \sin(2\theta)}{g}$$

When the initial height is the same as the final height.



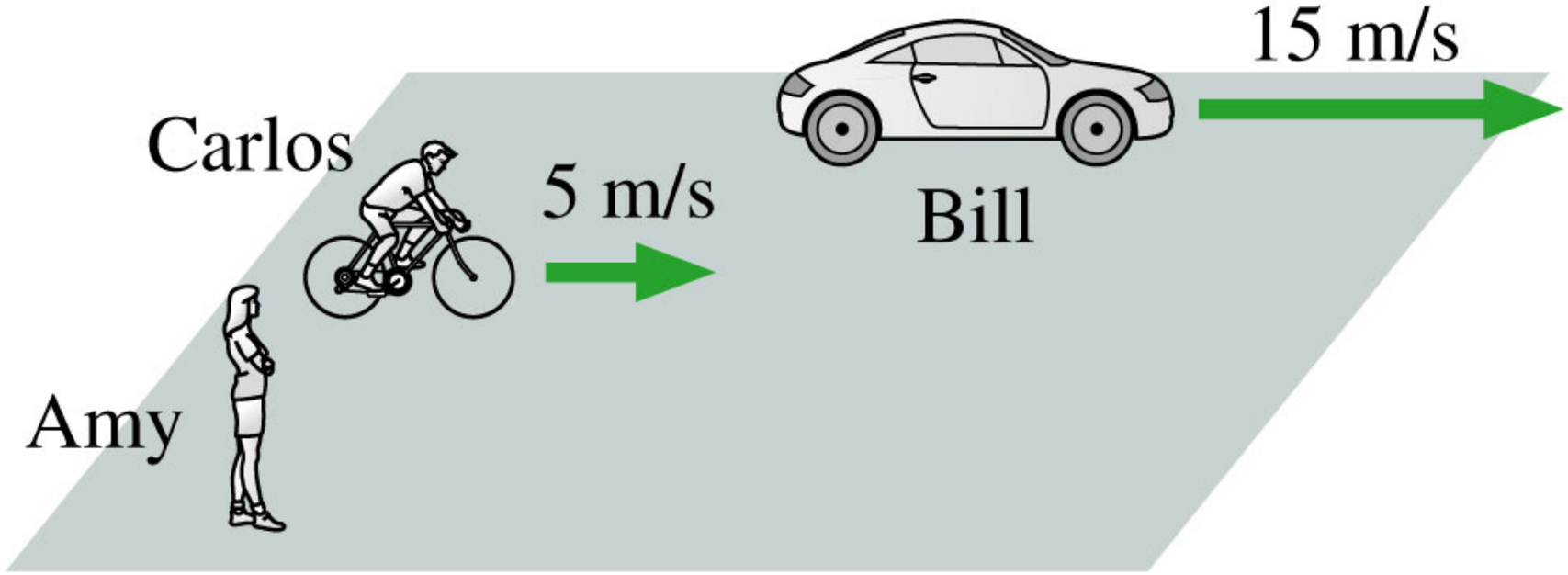
Relative Motion **Question #1**



What is Carlos's speed as measured by Bill (v_{CB})?

a)+15 m/s
b) - 15 m/s
c) +10 m/s
d) -10 m/s
e) +5 m/s

Relative Motion **Question #2**



What is Amy's speed as measured by Bill (v_{AB})?

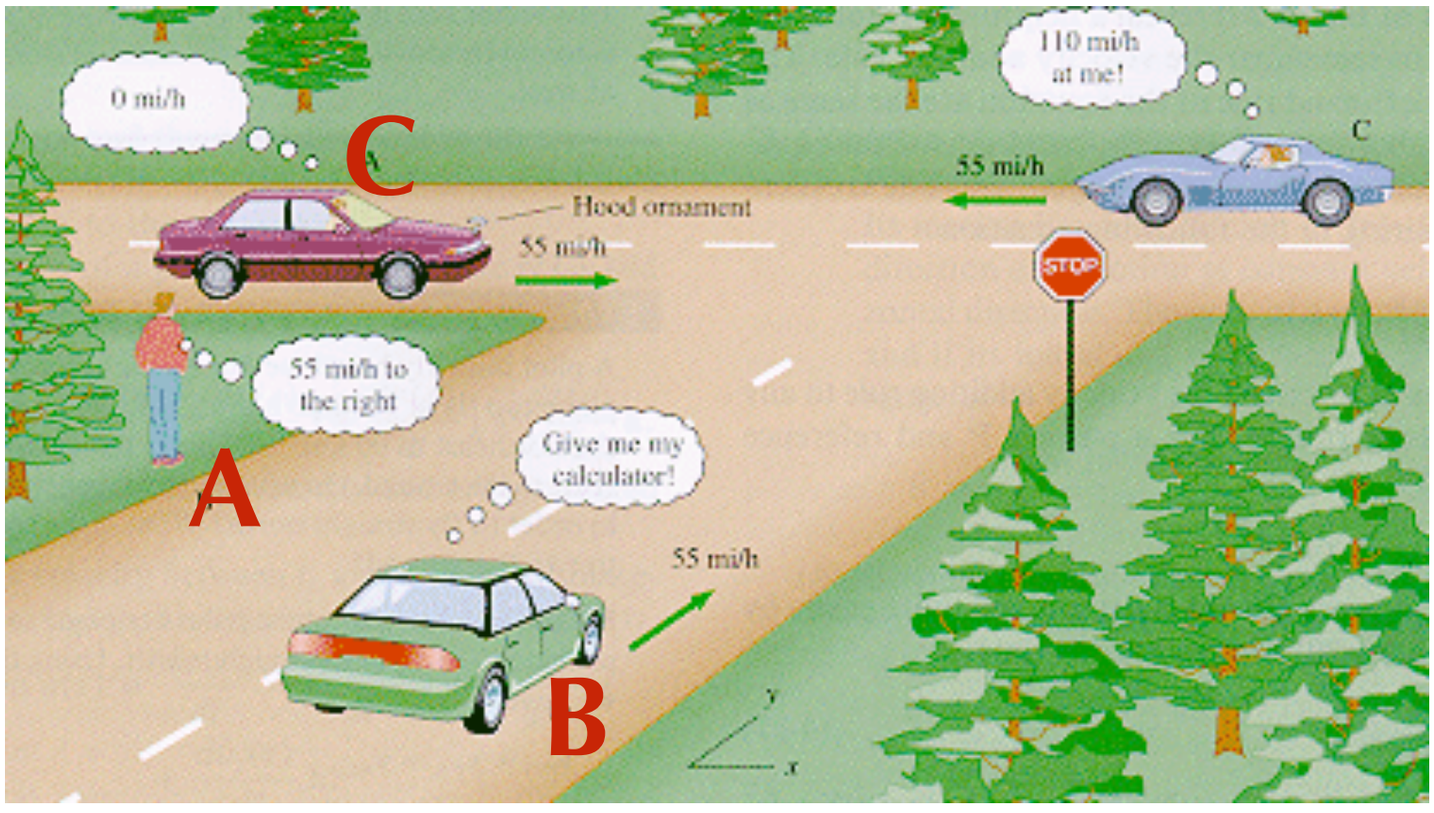
a)+15 m/s
b) - 15 m/s
c) +10 m/s
d) -10 m/s
e) +5 m/s

Reference Frames **Question #3**

$$\vec{v}_{CB} = \vec{v}_{CA} + \vec{v}_{AB}$$

What is C's velocity (red car) as measured by B (green car)?

a) $(-55\ \hat{i} - 55\ \hat{j})$ mph
b) $(-55\ \hat{i} + 55\ \hat{j})$ mph
c) $(55\ \hat{i} - 55\ \hat{j})$ mph
d) $(55\ \hat{i} + 55\ \hat{j})$ mph



Relative motion applet

Circular Motion **Question #4**

What is the meaning of the word period (T)?

a) The time it takes for an object to turn through **<u>one full radian</u>**.
b) The distance a particle travels during one full revolution.
c) .
d) The time it takes to travel through 90 degrees.
e) The time it takes for an object to make **<u>one full revolution</u>**.

Angular Velocity ω Question #5

b)

$$\omega = \frac{1}{T} \text{ revs/min}$$

$$\omega = \frac{2\pi}{T} \text{ rads/min}$$

a)

c)

$$\omega = \frac{T}{2\pi} \text{ revs/min}$$

d) a) and b) are both correct

e) a) and c) are both correct.

Angular Velocity ω Question #5

If the ferris wheel makes one full revolution in T minutes, which expression below is a correct?

b)

$$\omega = \frac{1}{T} \text{ revs/min}$$

$$\omega = \frac{2\pi}{T} \text{ rads/min}$$

a)

c)

$$\omega = \frac{T}{2\pi} \text{ revs/min}$$

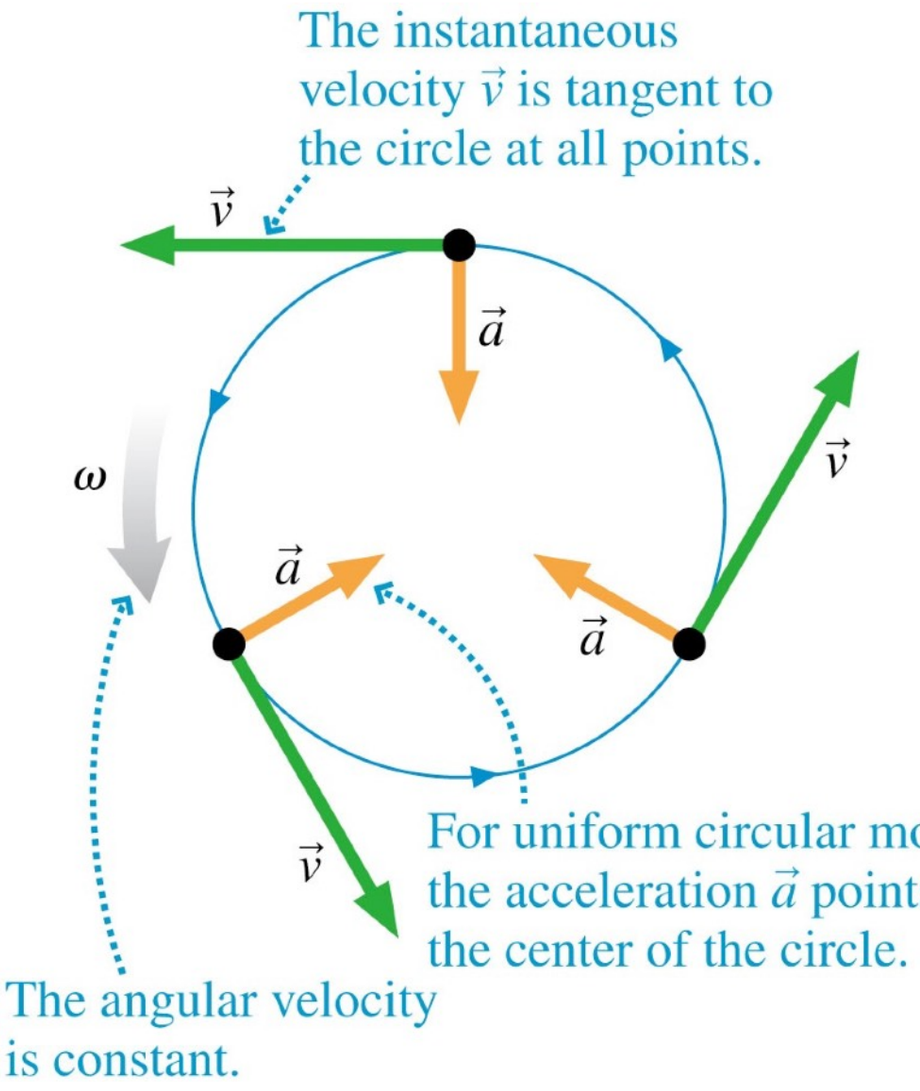
d) a) and b) are both correct

e) a) and c) are both correct.

Tangential Velocity

Question #6

a) d) and e) are both correct.
b) 314 meters/min
c) 50 meters/min
d) 0.524 meters/ s
e) 3.14 meters/min

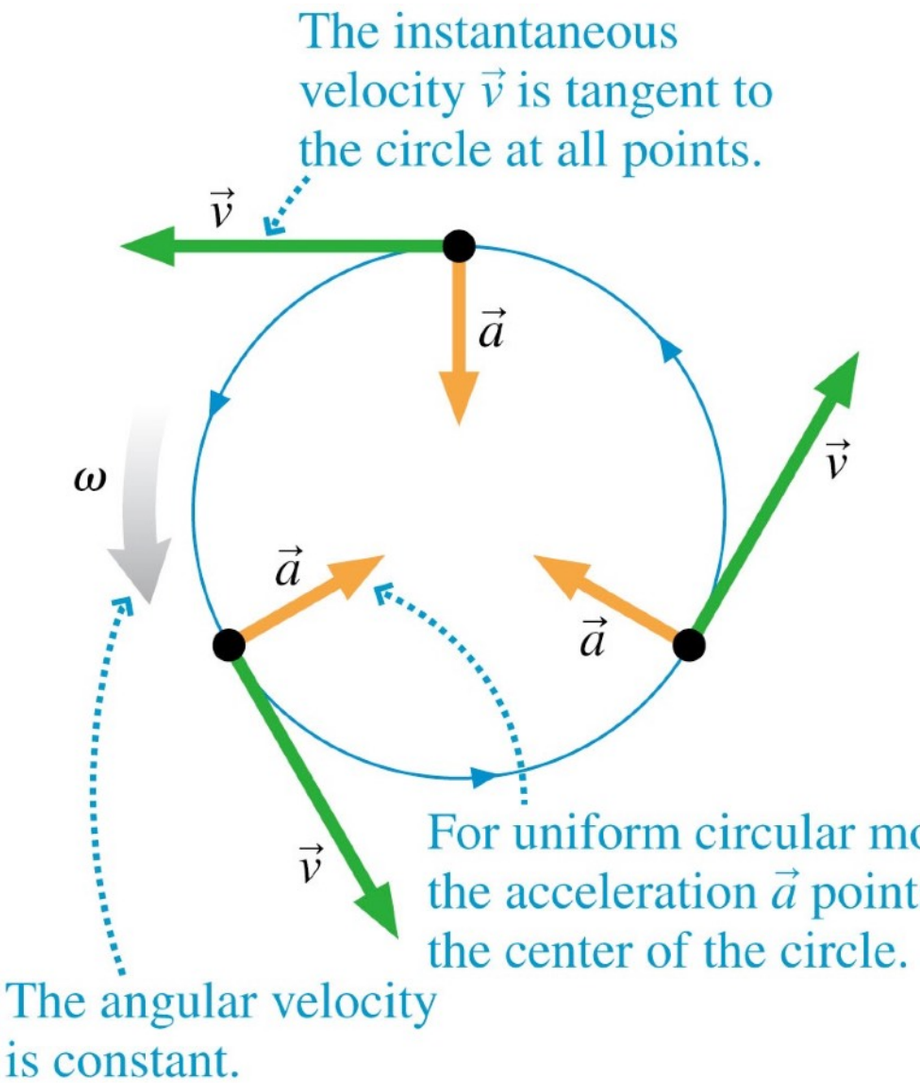


Tangential Velocity

Question #6

A wheel is spinning at a rate of 5 rpm. What is the speed of point on the wheel, 10 cm away?

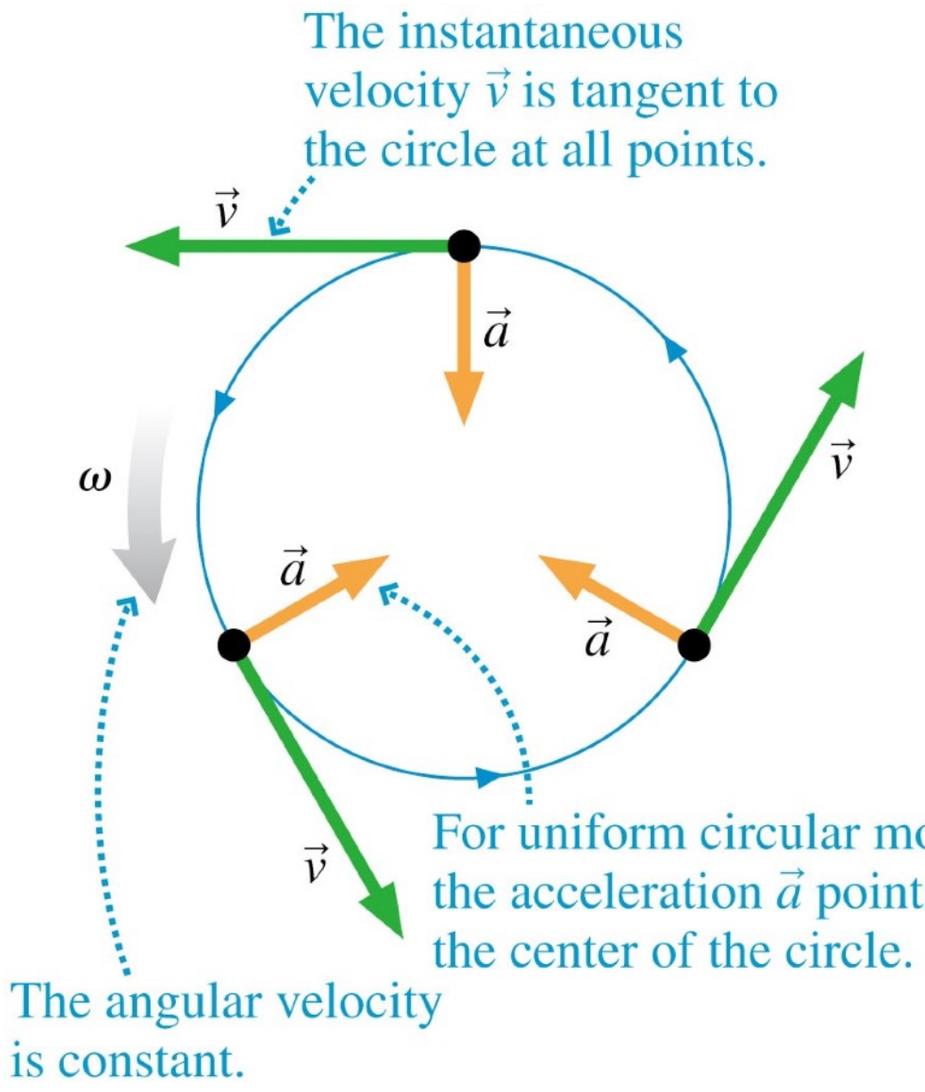
a) d) and e) are both correct.
b) 314 meters/min
c) 50 meters/min
d) 0.524 meters/ s
e) 3.14 meters/min



Tangential Velocity

Question #7

a) 0.0628 meters/min
b) 6.28 meters/sec
c) 0.0628 meters/sec
d) 62.8 meters/ sec
e) a) and b) are both correct.

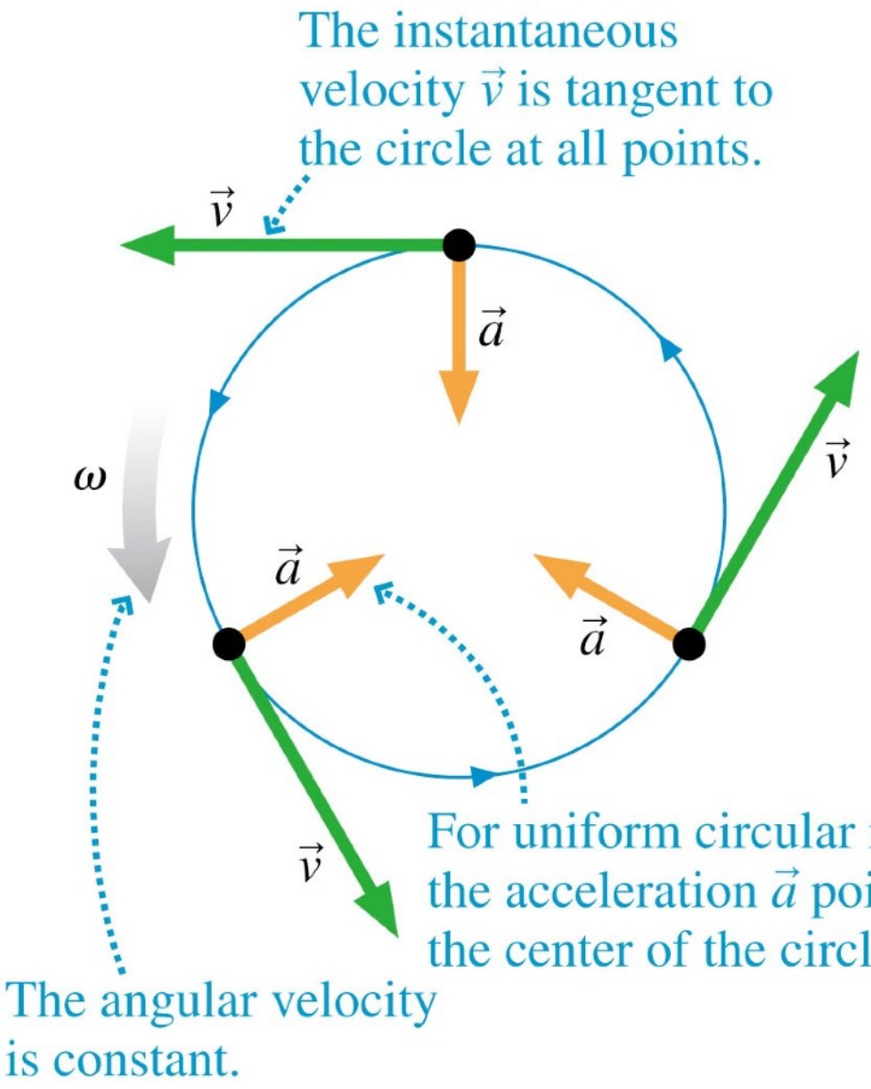


Tangential Velocity

Question #7

A wheel is spinning with a period of 10 sec. What is the speed of point on the wheel, 10 cm away?

a) 0.0628 meters/min
b) 6.28 meters/sec
c) 0.0628 meters/sec
d) 62.8 meters/ sec
e) a) and b) are both correct.



After setting this wheel in motion you measure that it takes 10 s to make 15 revolutions. Find the tangential velocity v_t of a point on the rim, the angular velocity ω and the period T.

Question #8

v_t

a) 0.13 meters/min
b) 1.89 meters/sec
c) 1.89 meters/min
d) 0.13 meters/ sec
e) b) and c) are both correct.

Question #9

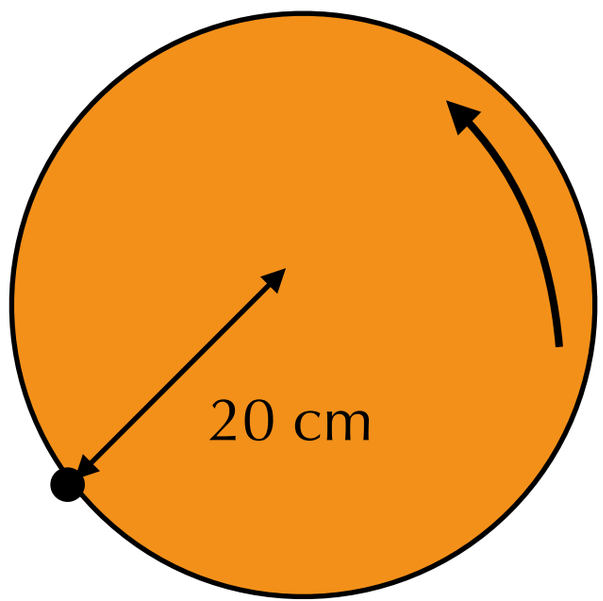
ω

a) 0.63 rads/min
b) 0.63 rads/sec
c) 9.42 rads/min
d) 9.42 rads/ sec
e) c) and d) are both correct.

Question #10

T

a) 0.667 s
b) 0.667 min
c) 1.5 s
d) 1.5 min
e) a) and b) are both correc



Angular	Tangential
θ	s
ω	v_t
α	a_t

Angular		Tangential
θ	rads revs degrees	s
ω		v_t
α		a_t

Angular		Tangential
θ	rads revs degrees	s
ω	$\frac{\text{rads}}{\text{s}}$ $\frac{\text{revs}}{\text{s}}$ $\frac{\text{degrees}}{\text{s}}$	v_t
α		a_t

Angular			Tangential
θ	rads	revs degrees	s
ω	$\frac{\text{rads}}{\text{s}}$	$\frac{\text{revs}}{\text{s}}$ $\frac{\text{degrees}}{\text{s}}$	v_t
α	$\frac{\text{rads}}{\text{s}^2}$	$\frac{\text{revs}}{\text{s}^2}$ $\frac{\text{degrees}}{\text{s}^2}$	a_t

Angular			Tangential		
θ	rads	revs	degrees	s	m	cm	km
ω	$\frac{\text{rads}}{\text{s}}$	$\frac{\text{revs}}{\text{s}}$	$\frac{\text{degrees}}{\text{s}}$	v_t			
α	$\frac{\text{rads}}{\text{s}^2}$	$\frac{\text{revs}}{\text{s}^2}$	$\frac{\text{degrees}}{\text{s}^2}$	a_t			

Angular			Tangential		
θ	rads	revs degrees	s	m	cm km
ω	$\frac{\text{rads}}{\text{s}}$	$\frac{\text{revs}}{\text{s}}$ $\frac{\text{degrees}}{\text{s}}$	v_t	m/s	cm/s km/s
α	$\frac{\text{rads}}{\text{s}^2}$	$\frac{\text{revs}}{\text{s}^2}$ $\frac{\text{degrees}}{\text{s}^2}$	a_t		

Angular			Tangential		
θ	rads	revs	degrees	s	m	cm	km
ω	$\frac{\text{rads}}{\text{s}}$	$\frac{\text{revs}}{\text{s}}$	$\frac{\text{degrees}}{\text{s}}$	v_t	m/s	cm/s	km/s
α	$\frac{\text{rads}}{\text{s}^2}$	$\frac{\text{revs}}{\text{s}^2}$	$\frac{\text{degrees}}{\text{s}^2}$	a_t	m/s^2	km/s^2	cm/s^2

Angular			Tangential		
θ	rads	revs	degrees	s	m	cm	km
ω	$\frac{\text{rads}}{\text{s}}$	$\frac{\text{revs}}{\text{s}}$	$\frac{\text{degrees}}{\text{s}}$	v_t	m/s	cm/s	km/s
α	$\frac{\text{rads}}{\text{s}^2}$	$\frac{\text{revs}}{\text{s}^2}$	$\frac{\text{degrees}}{\text{s}^2}$	a_t	m/s^2	km/s^2	cm/s^2

How would you convert degrees/s^2 to m/s^2?

Angular			Tangential		
θ	rads	revs	degrees	s	m	cm	km
ω	$\frac{\text{rads}}{\text{s}}$	$\frac{\text{revs}}{\text{s}}$	$\frac{\text{degrees}}{\text{s}}$	v_t	m/s	cm/s	km/s
α	$\frac{\text{rads}}{\text{s}^2}$	$\frac{\text{revs}}{\text{s}^2}$	$\frac{\text{degrees}}{\text{s}^2}$	a_t	m/s^2	km/s^2	cm/s^2

How would you convert degrees/s^2 to m/s^2?

How would you convert revs/s to m/s?

Angular			Tangential		
θ	rads	revs	degrees	s	m	cm	km
ω	$\frac{\text{rads}}{\text{s}}$	$\frac{\text{revs}}{\text{s}}$	$\frac{\text{degrees}}{\text{s}}$	v_t	m/s	cm/s	km/s
α	$\frac{\text{rads}}{\text{s}^2}$	$\frac{\text{revs}}{\text{s}^2}$	$\frac{\text{degrees}}{\text{s}^2}$	a_t	m/s^2	km/s^2	cm/s^2

How would you convert degrees/s^2 to m/s^2?

How would you convert revs/s to m/s?

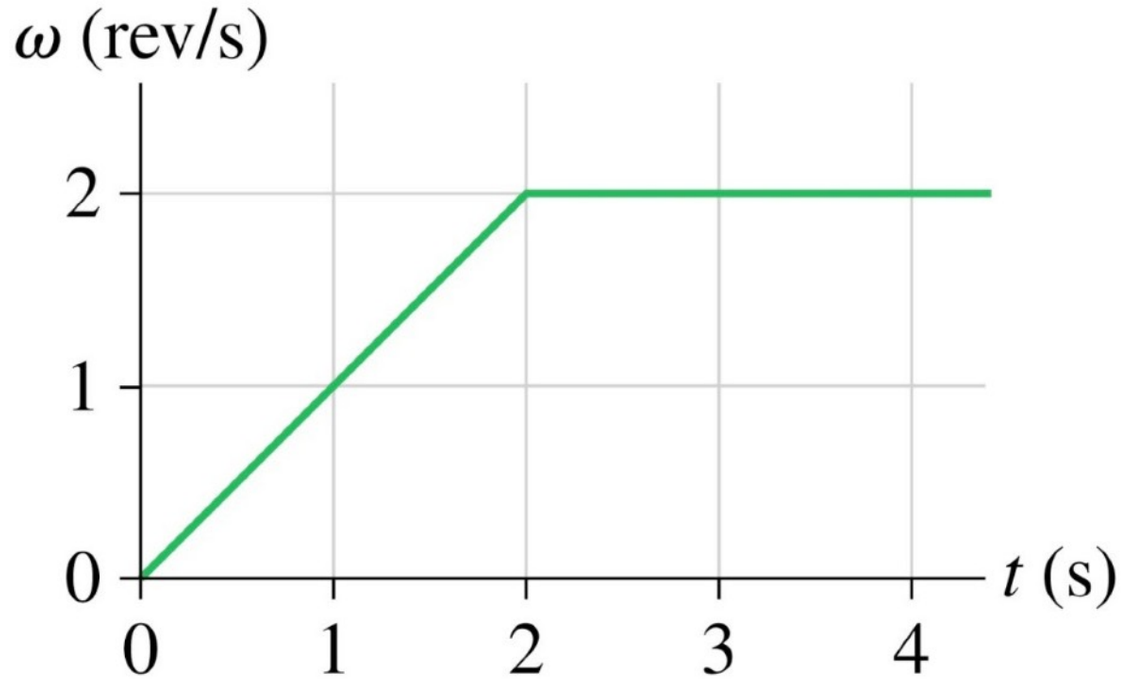
$$s = \theta r$$

$$v_t = \omega r$$

$$a_t = \alpha r$$

Question #11

This is the angular velocity graph of a wheel. How many revolutions does the wheel make in 4s?



a) 1

b) 2

c) 4

d) 6

e) 8

Question #12

A ball rolls around a circular track with an angular velocity of 4π rad/s. What is the period of the motion?

a) 1 s

b) $\frac{1}{2}$ s

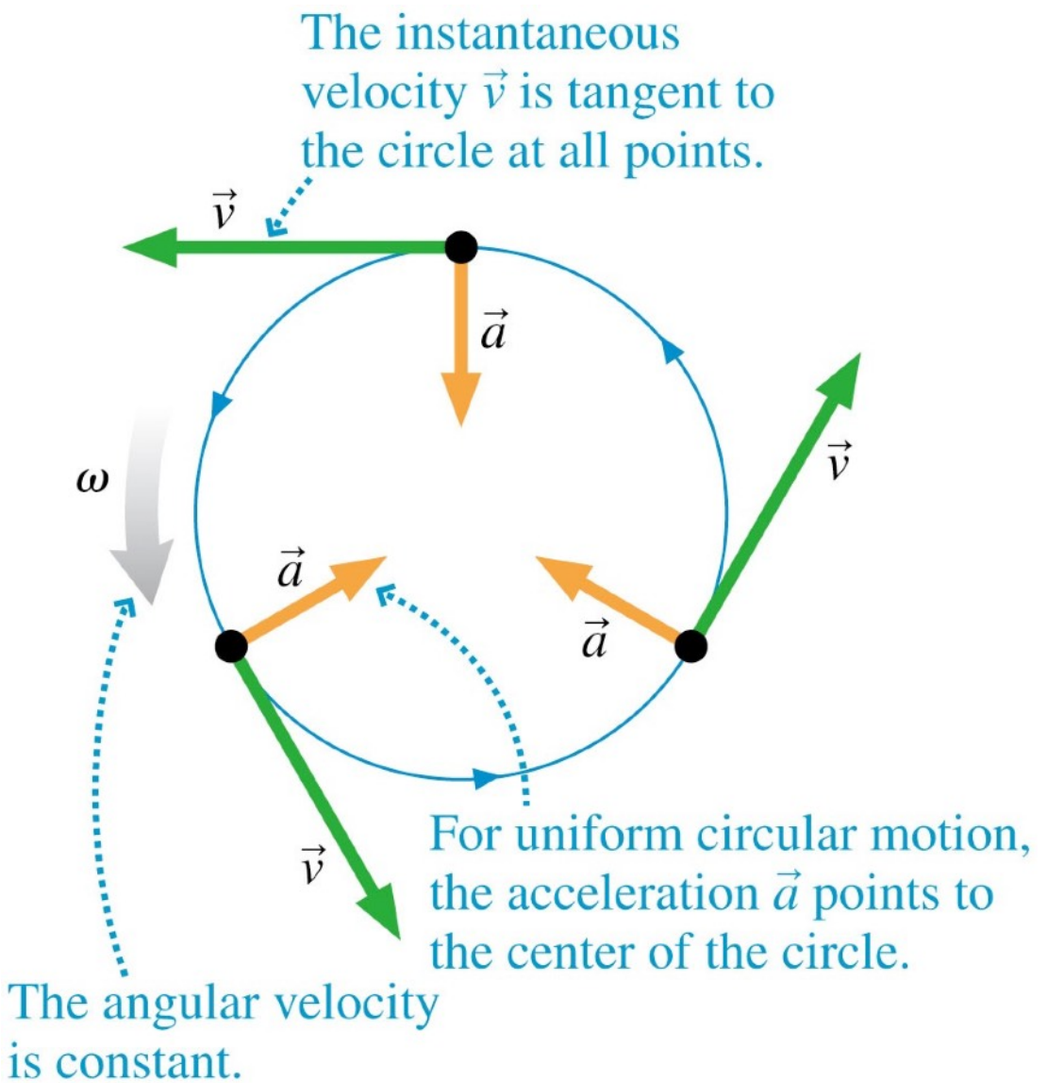
c) 2 s

d) $\frac{1}{2\pi}$ s

e) $\frac{1}{4\pi}$ s

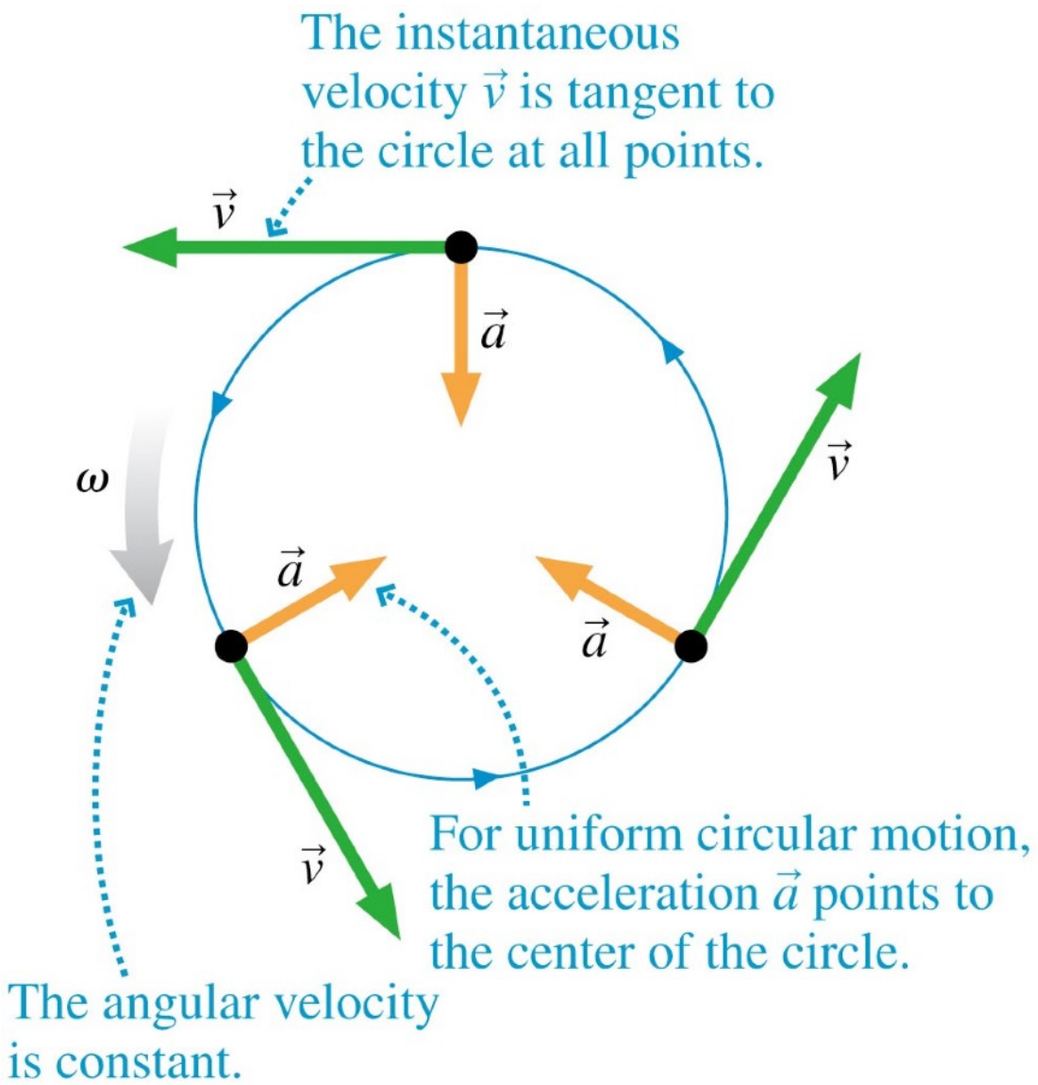
Centripetal Acceleration

Human centrifuge



Centripetal Acceleration

Human centrifuge



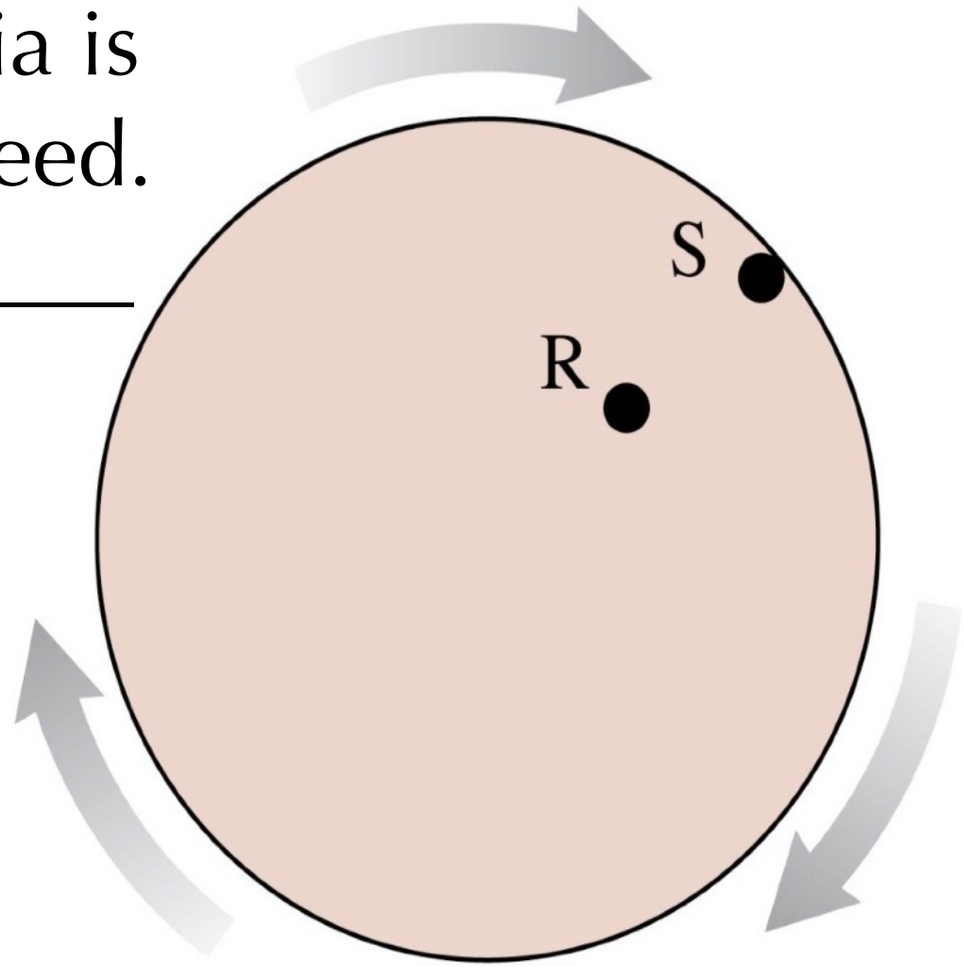
$$\vec{a} = \frac{v^2}{r} \text{ toward center of circle}$$

Human Centrifuge

To withstand "g-forces" of up to 10 g's, caused by suddenly pulling out of a steep dive, fighter jet pilots train on a "human centrifuge." 10 g's is an acceleration of 98 m/s^2. If the length of the centrifuge arm is 12 m, at what speed is the rider moving when she experiences 10 g's? What angular velocity does this correspond to?

Question #13

Rasheed and Sofia are riding a merry-go-round that is spinning steadily. Sofia is twice as far from the axis as is Rasheed. Sofia's angular velocity is _____ that of Rasheed.



a) half

b) four times

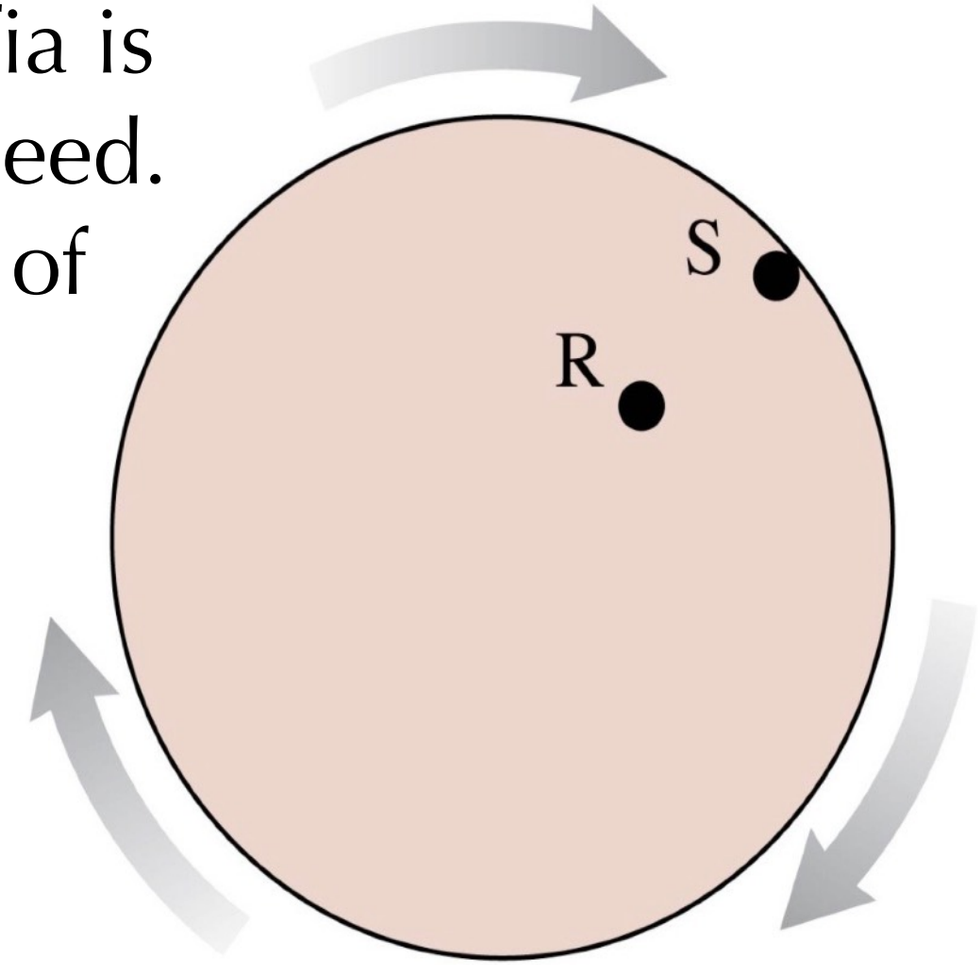
c) twice

d) the same as

e) We can't say

Question #14

Rasheed and Sofia are riding a merry-go-round that is spinning steadily. Sofia is twice as far from the axis as is Rasheed. Sofia's speed is _____ that of Rasheed.



a) half

b) the same as

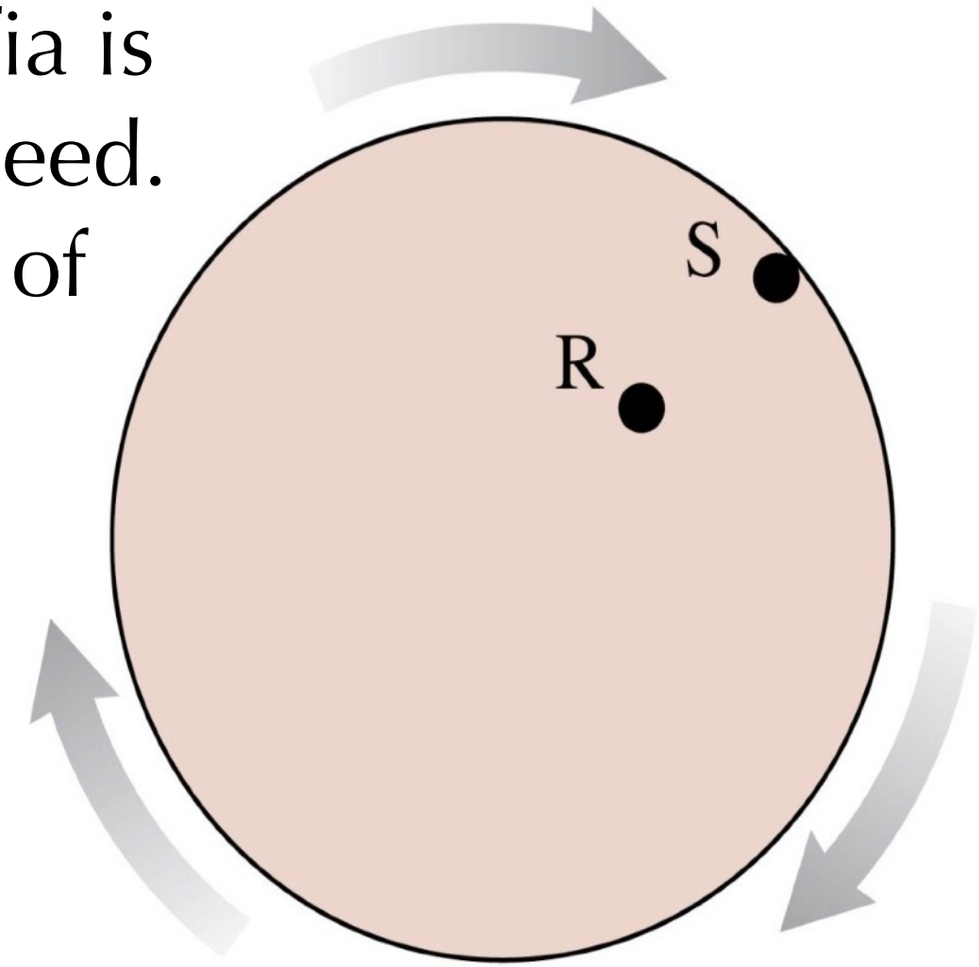
c) We can't say

d) four times

e) twice

Quiz

Rasheed and Sofia are riding a merry-go-round that is spinning steadily. Sofia is twice as far from the axis as is Rasheed. Sofia's speed is _____ that of Rasheed.



a) half

b) the same as

c) We can't say

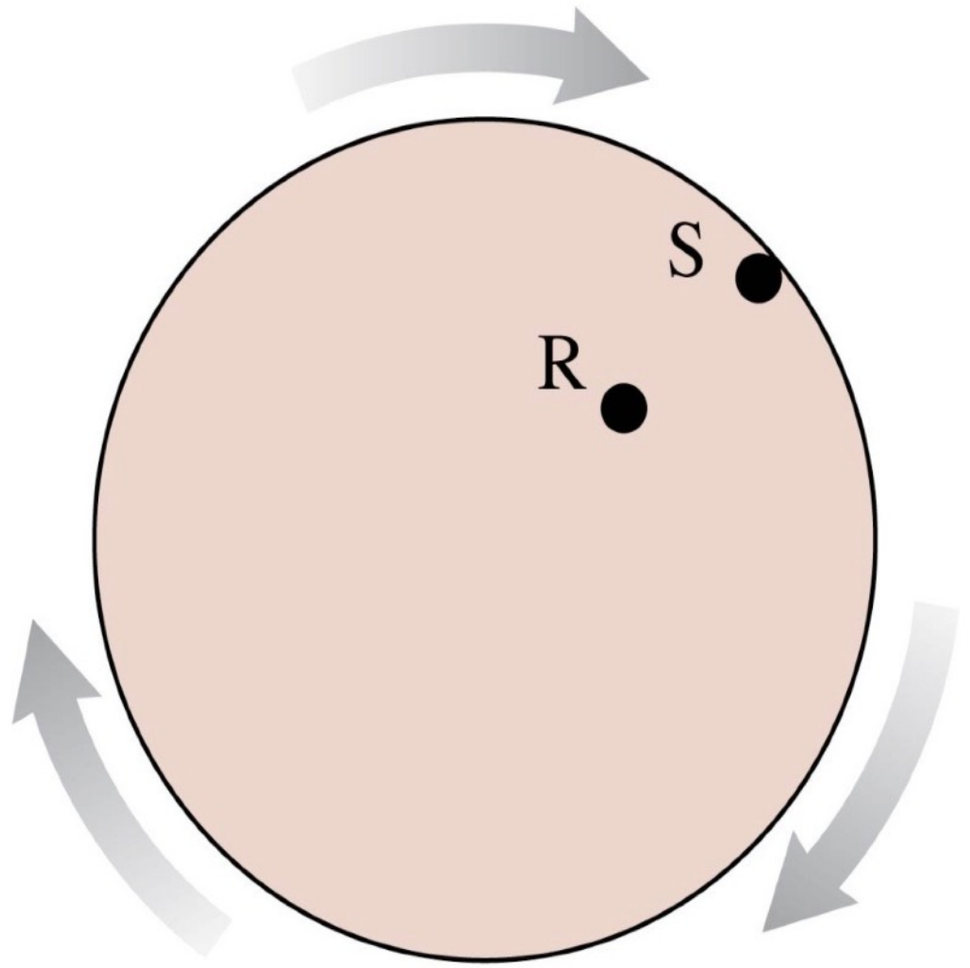
d) four times

e) twice

$v = \omega r$

Question #15

Rasheed and Sofia are riding a merry-go-round that is spinning steadily. Sofia is twice as far from the axis as is Rasheed. Sofia's acceleration is _____ that of Rasheed.



a) half

b) the same as

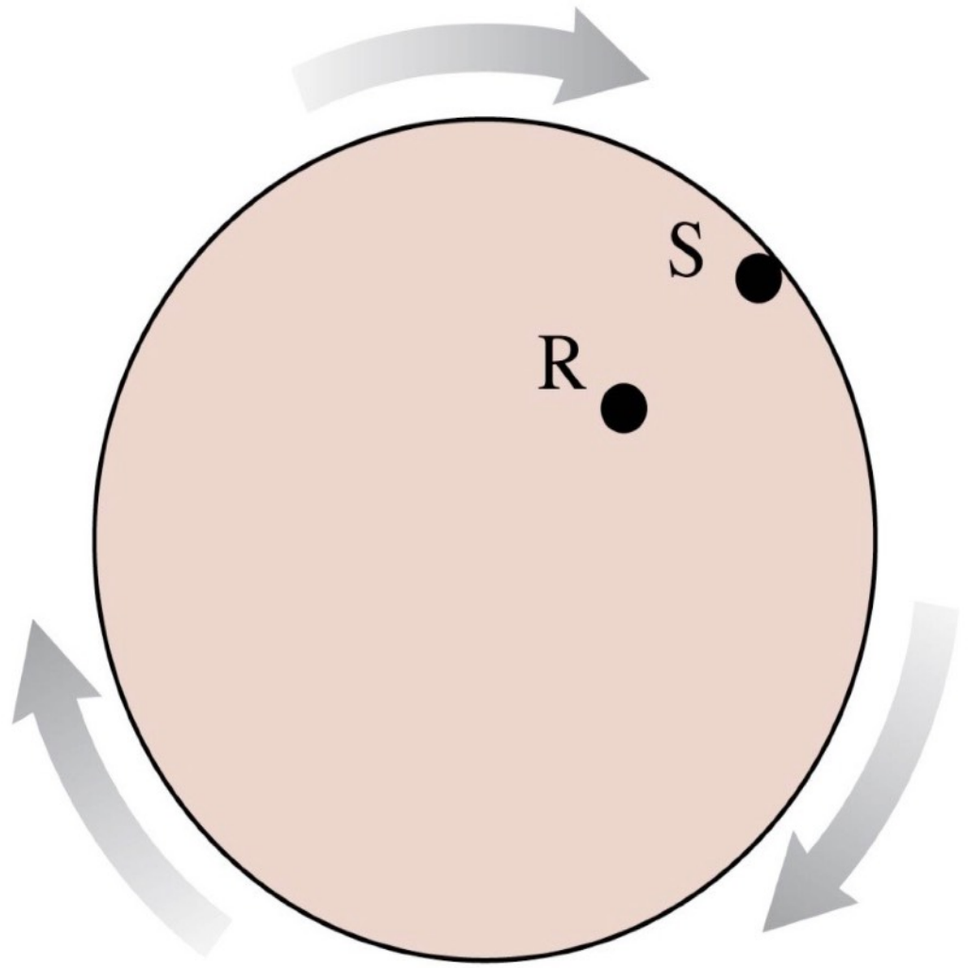
c) We can't say

d) four times

e) twice

Quiz

Rasheed and Sofia are riding a merry-go-round that is spinning steadily. Sofia is twice as far from the axis as is Rasheed. Sofia's acceleration is _____ that of Rasheed.



a) half

b) the same as

c) We can't say

d) four times

e) twice

Centripetal acceleration $a = \frac{v^2}{r} = \omega^2 r$