Rotational and Circular motion

Lady bug activity directions:

In this activity, you must include values that you measure **and** show sample calculations to support your answers to the questions. Include examples that use both bugs in different locations.

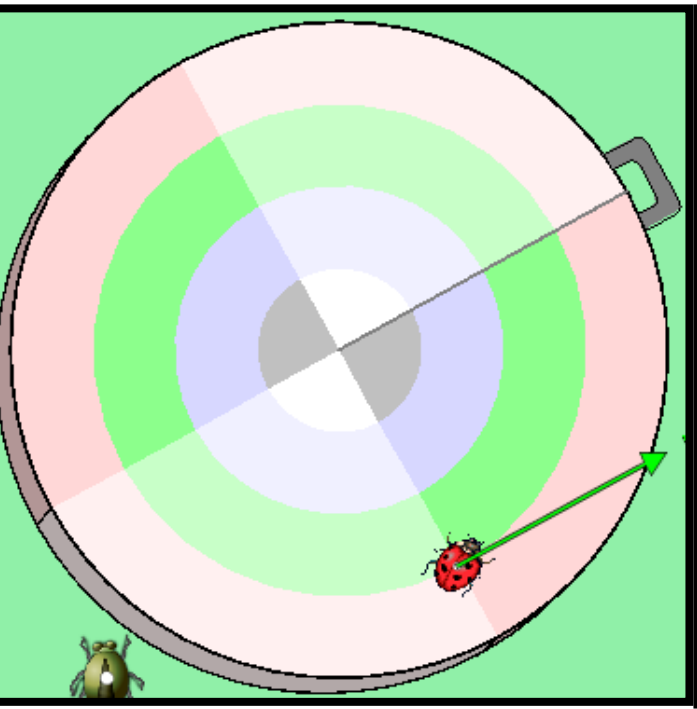
Sample calculations include:

Equation: PE=mgh

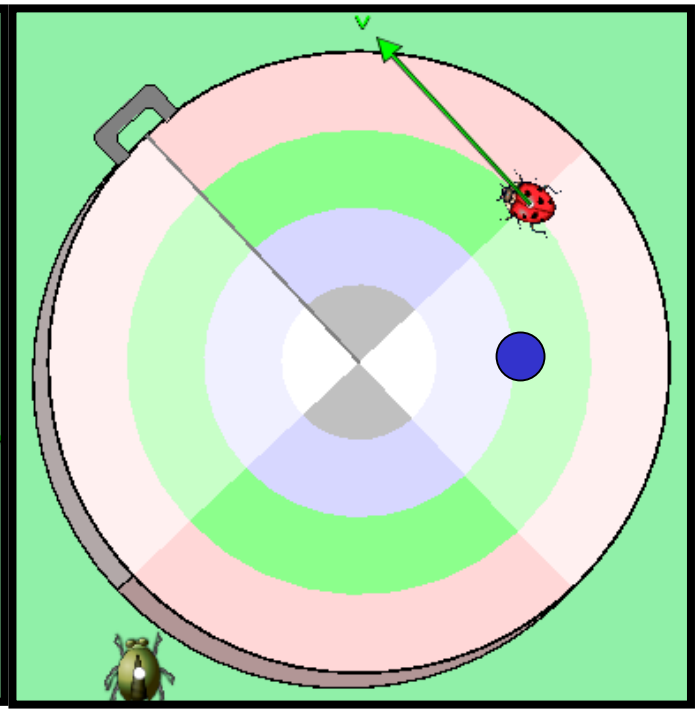
Substitution: PE = .50*9.81* 2

Answer with units: 9.81 J

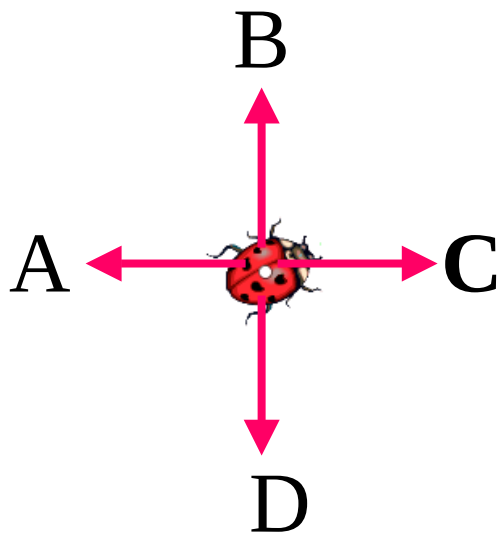
1. A bug is spinning on a platform with constant speed, what was the direction of acceleration at the blue point?



Beginning of test



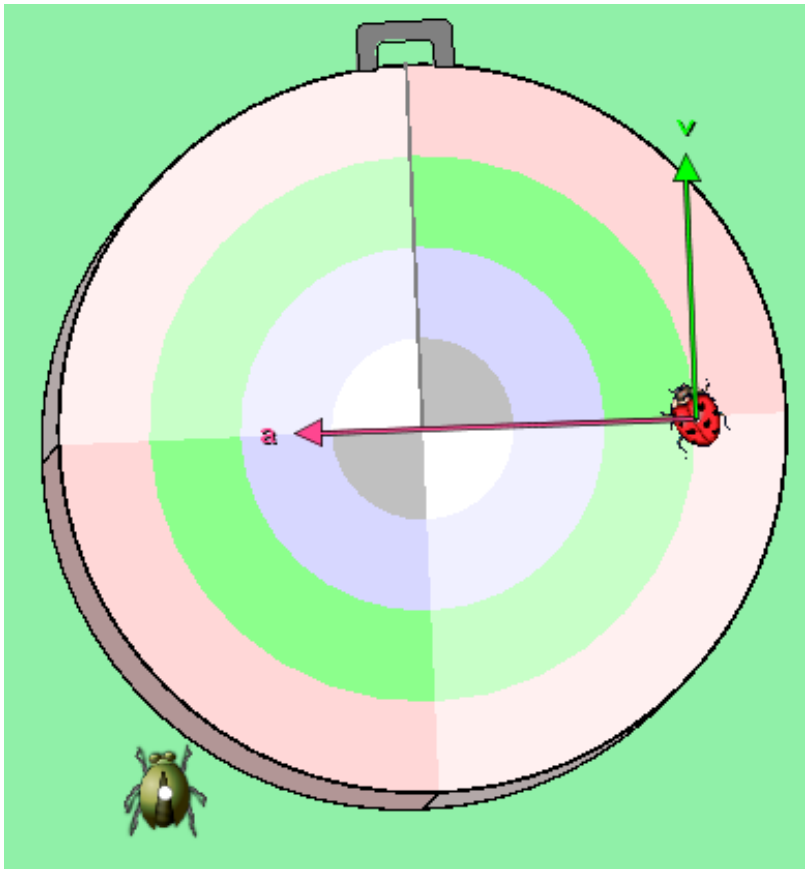
End of test



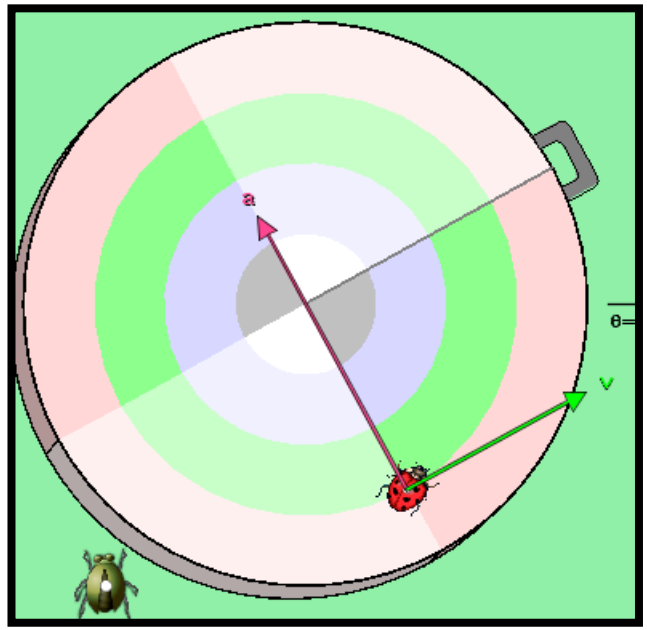
E none of these

Velocity is the green vector

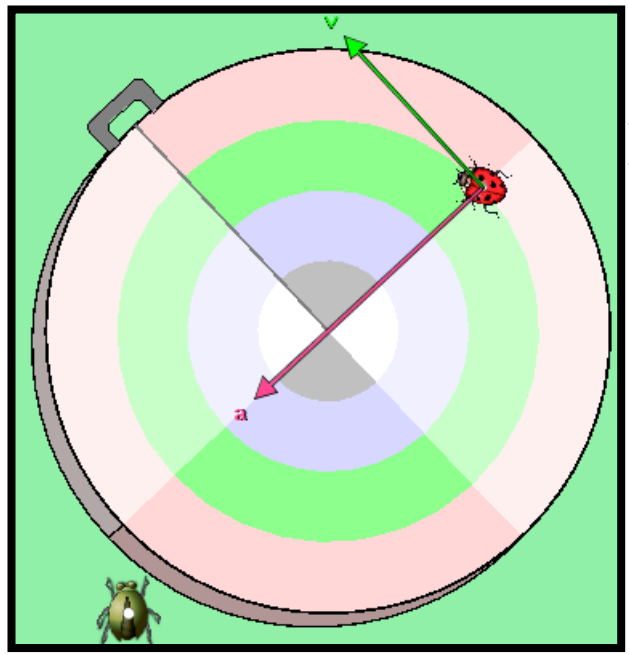
Answer to previous slide



A: acceleration vector always points radially for constant speed

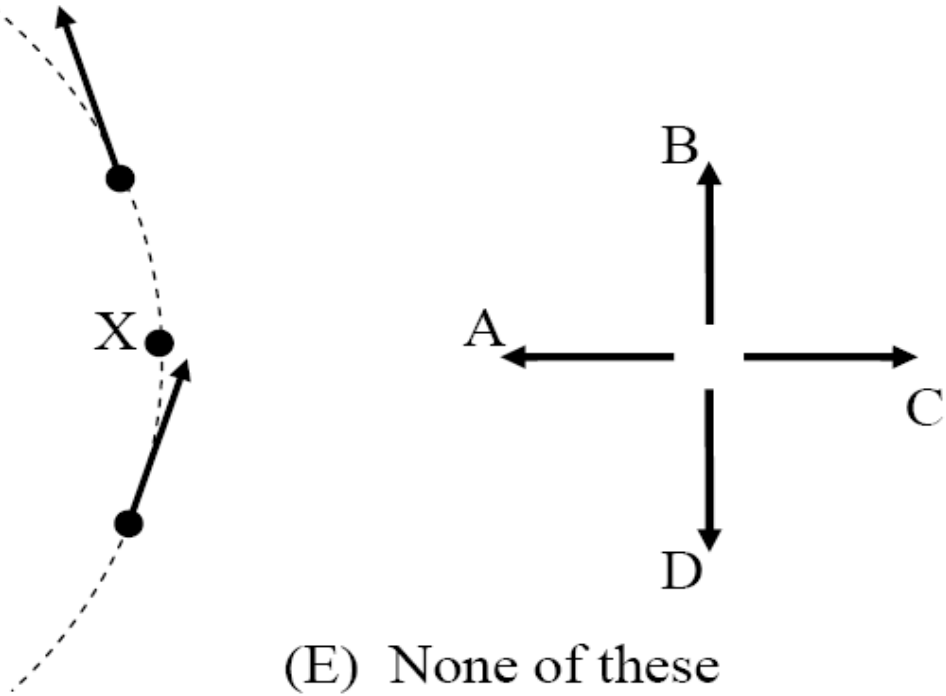


Beginning of test



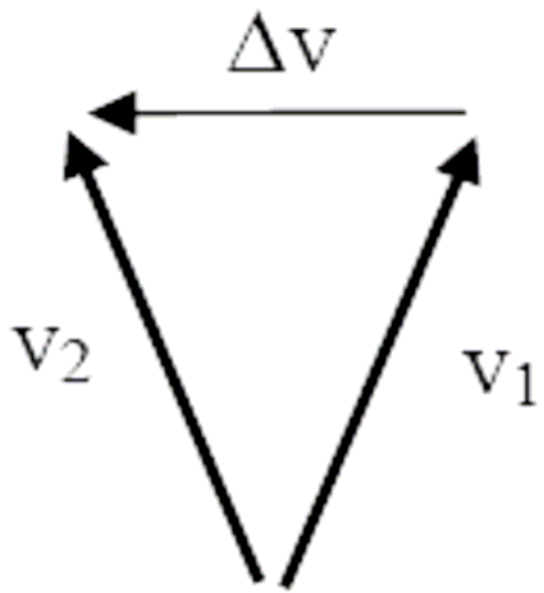
End of test

CTCirc-1. A particle is moving along the path shown, with constant speed. Its velocity vector at two different times is shown. What is the direction of the acceleration when the particle is at point X?

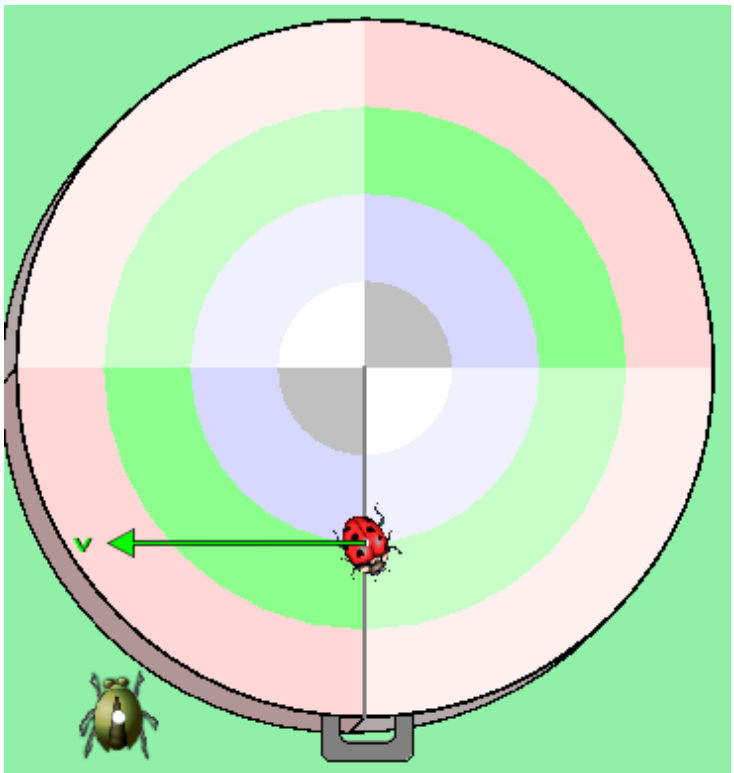


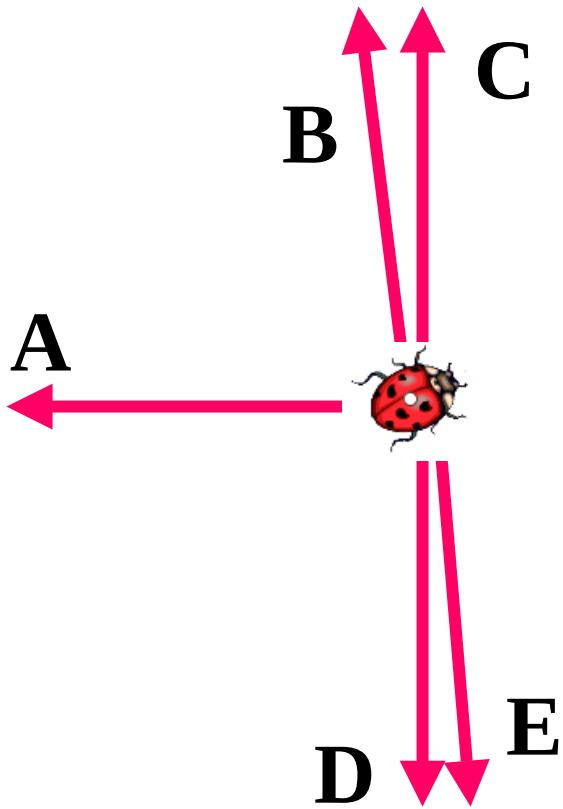
(E) None of these

Answer: to the left (A)

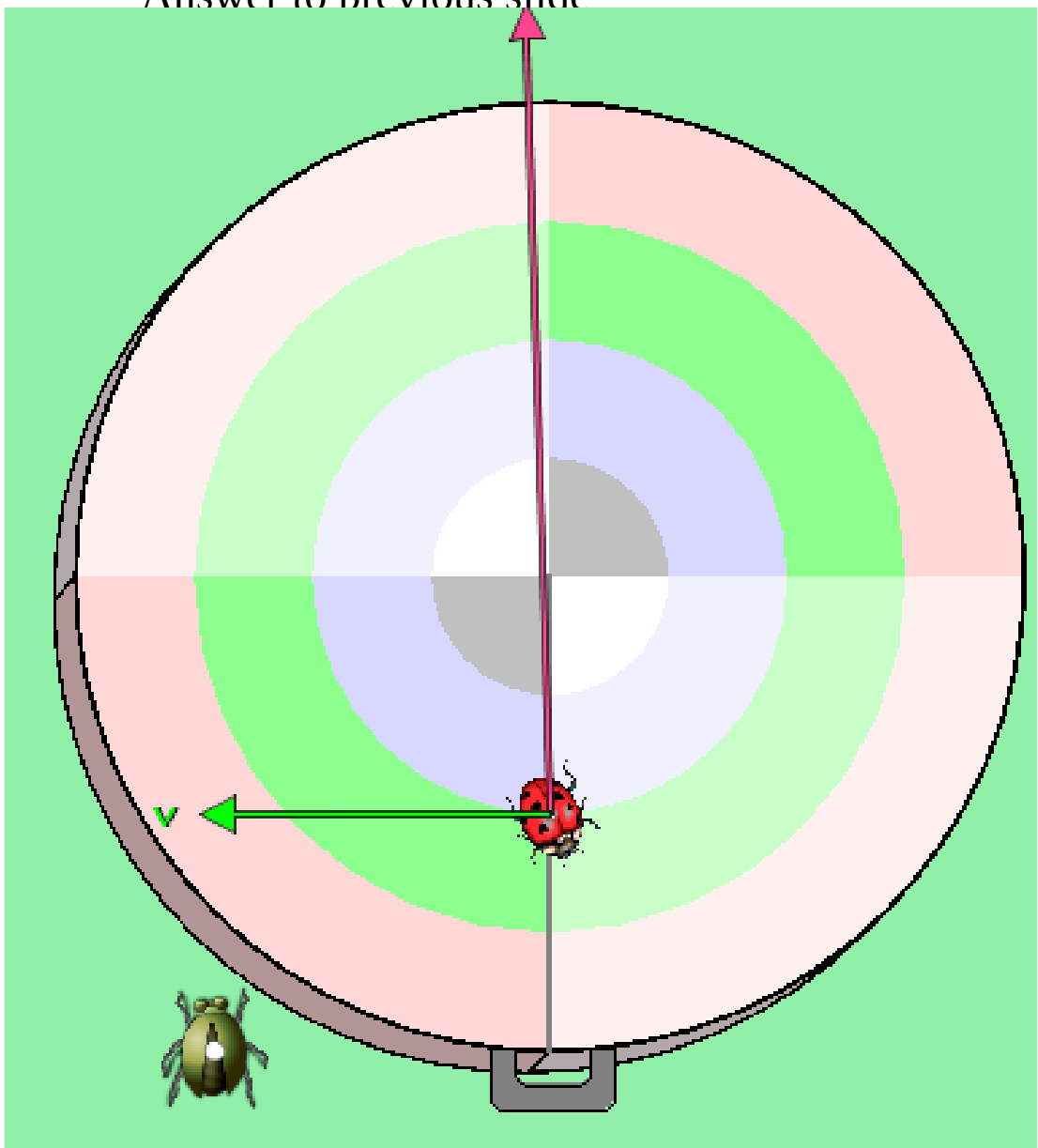


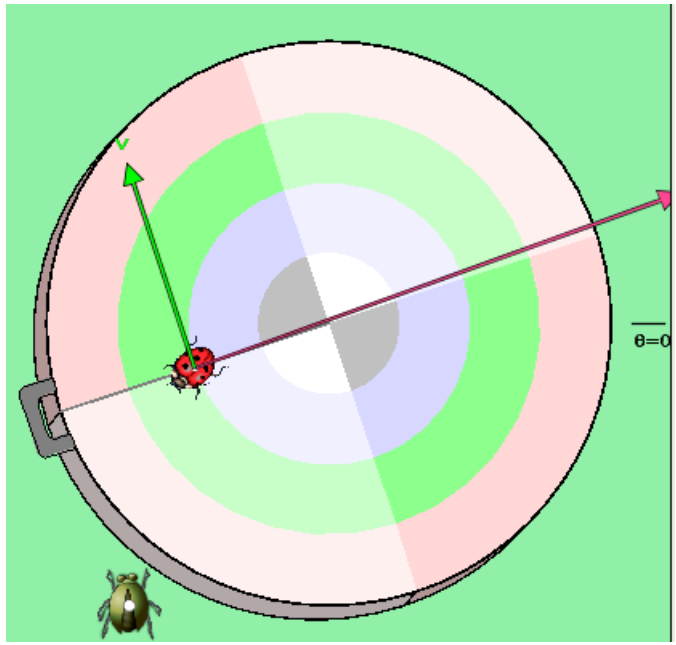
2. A bug is on a platform spinning clockwise & speeding up. Which best shows the bug's acceleration direction at this spot?





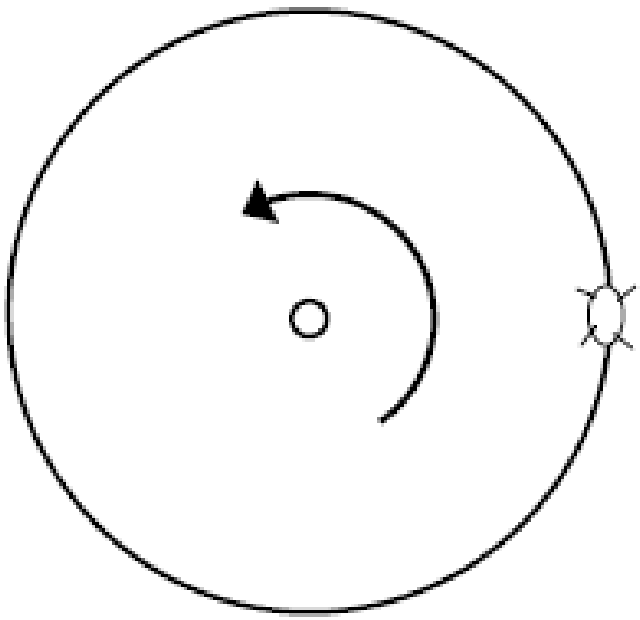
Answer to previous slide





B: If the acceleration is constant and increasing, the vector will be not radial, but off to the same side of the radius as the velocity vector.

CTRot-3. A ladybug is clinging to the rim of a spinning wheel which is spinning CCW and is speeding up. At the moment shown, when the bug is at the far right, what is the approximate direction of the ladybug's acceleration?



A) ↙

B) ↑

C) →

D) ←

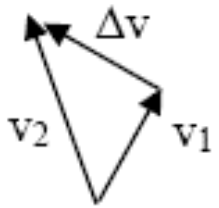
E) ↖

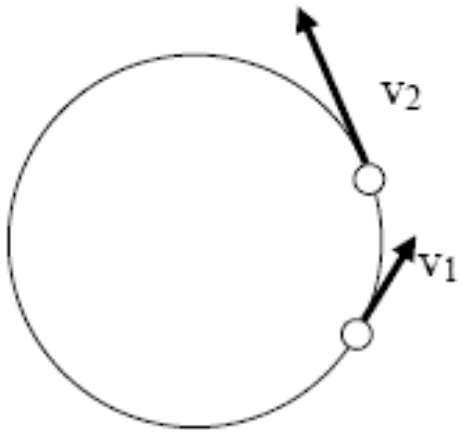
ctrot3

Ctr rot 3 ans E

Answer:

The direction of the acceleration **a** is the same as the direction of $\Delta \mathbf{v}$. The v1-v2-Δv diagram looks like:





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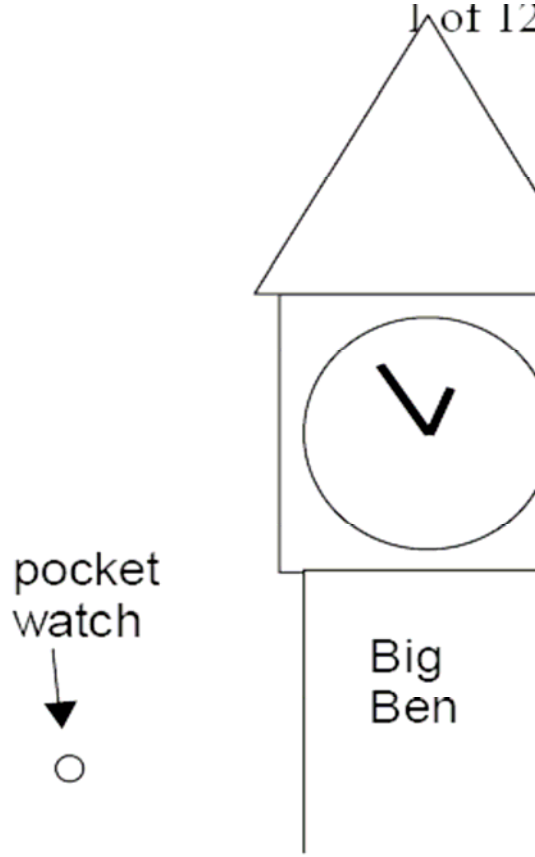
CTRot-1. A pocket watch and Big Ben are both keeping perfect time. Which minute hand has the larger angular velocity ω?

A) Pocket watch's
B) Big Ben's
C) Same ω on both.

Which minute hand's tip has the larger tangential velocity?

A) Pocket watch's B) Big Ben's C) Same ω on both.

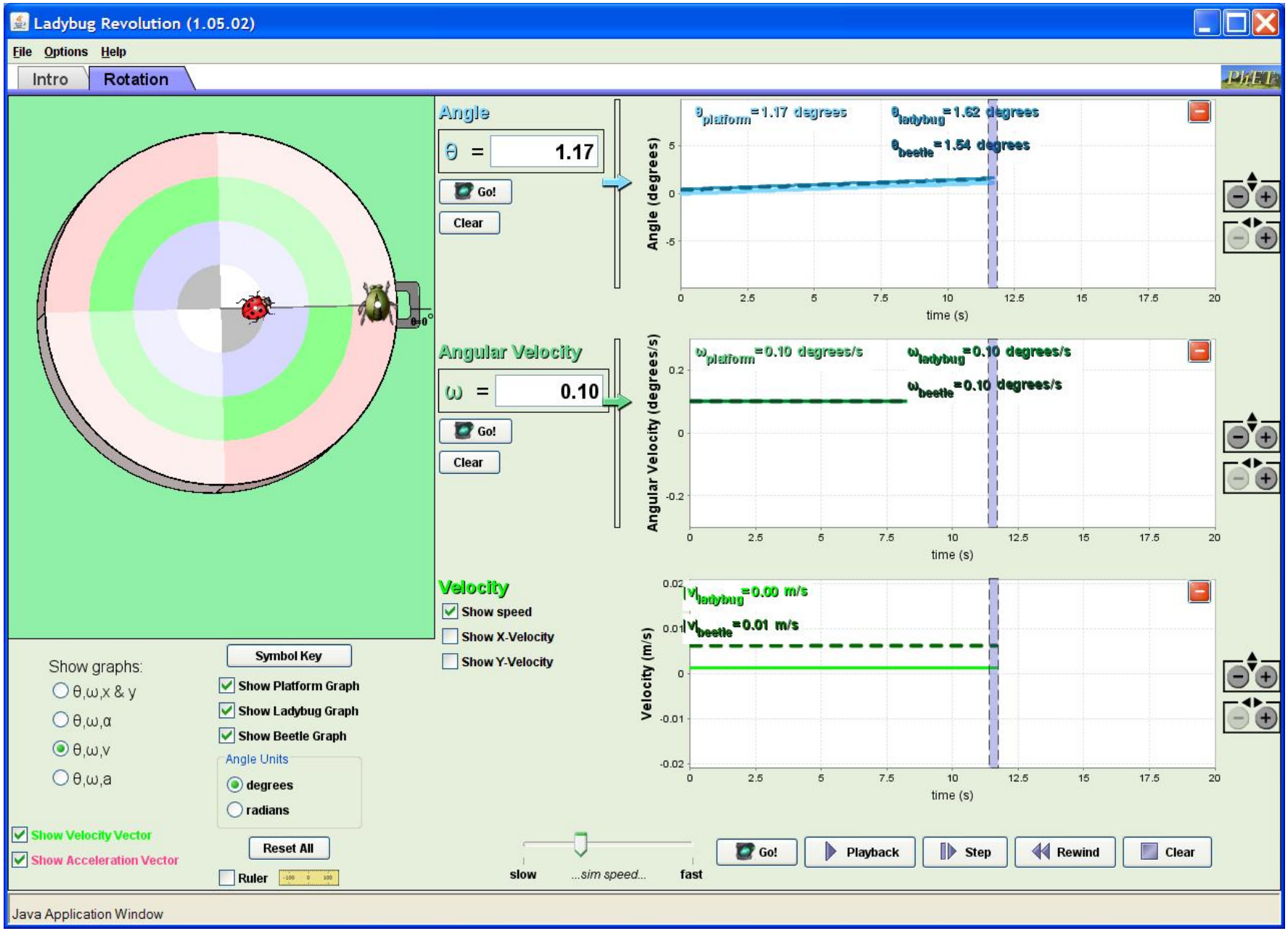


CRT rot 1 ans C, B

Answers: Both Big Ben and the pocket watch have the same magnitude angular velocity

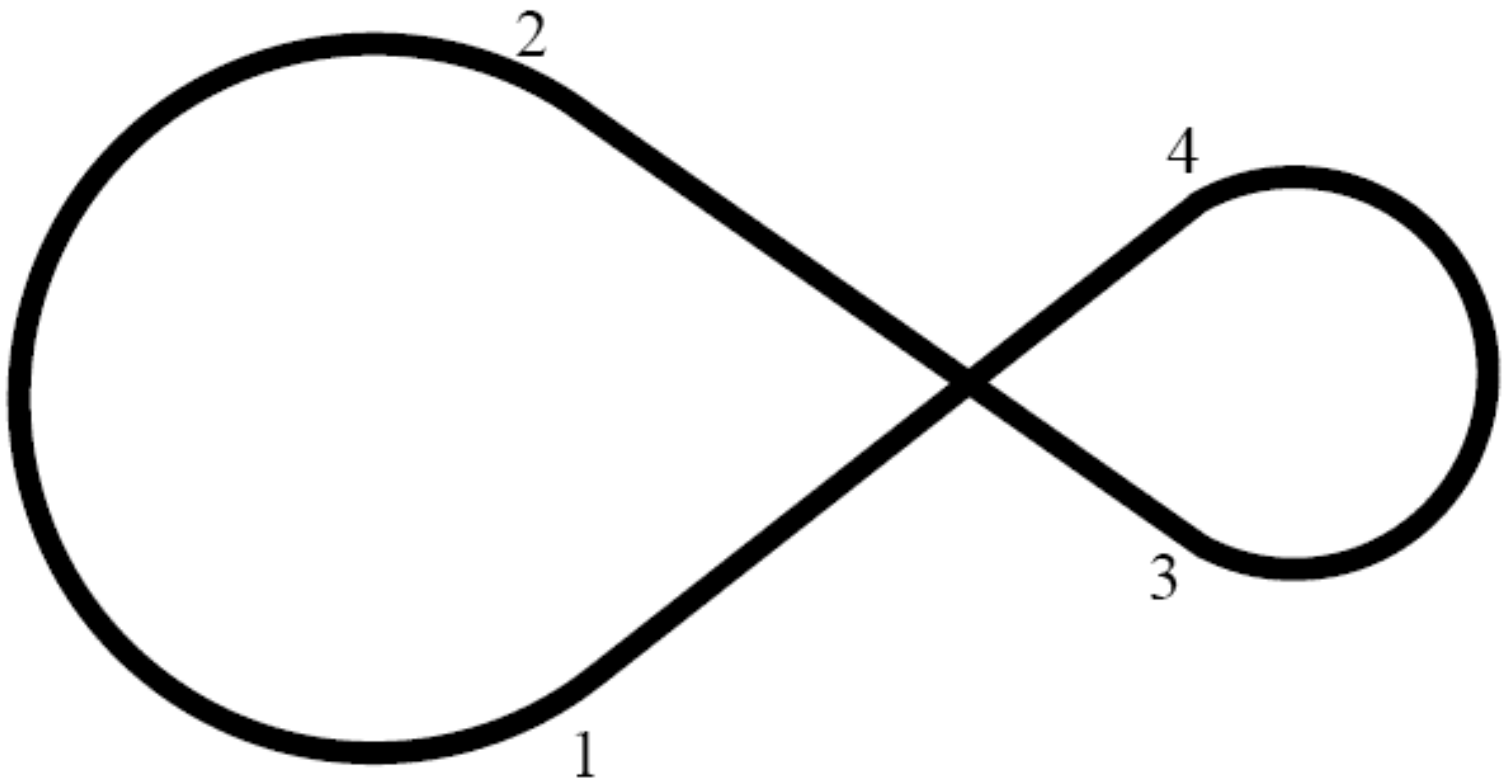
$$|\omega| = \frac{2\pi \text{ rad}}{3600 \text{ s}}$$

Big Ben has the larger tangential velocity $v = \omega r$.


Ladybug Revolution (1.05.02)
File Options Help
Intro Rotation
PhET
Angle
θ = 1.17
Go!
Clear
θplatform = 1.17 degrees
θladybug = 1.62 degrees
θbeetle = 1.54 degrees
Angle (degrees)
time (s)
Angular Velocity
ω = 0.10
Go!
Clear
ωplatform = 0.10 degrees/s
ωladybug = 0.10 degrees/s
ωbeetle = 0.10 degrees/s
Angular Velocity (degrees/s)
time (s)
Velocity
Show speed
Show X-Velocity
Show Y-Velocity
vladybug = 0.00 m/s
vbeetle = 0.01 m/s
Velocity (m/s)
time (s)
Show graphs:
θ,ω,x & y
θ,ω,α
θ,ω,v
θ,ω,a
Symbol Key
Show Platform Graph
Show Ladybug Graph
Show Beetle Graph
Angle Units
degrees
radians
Show Velocity Vector
Show Acceleration Vector
Reset All
Ruler
slow
...sim speed...
fast
Go!
Playback
Step
Rewind
Clear
Java Application Window

4

CTCirc-3. A race car travels around the track shown at constant speed. Over which portion of the track is the magnitude of the acceleration the smallest? (Hint: it's a trick question!!)



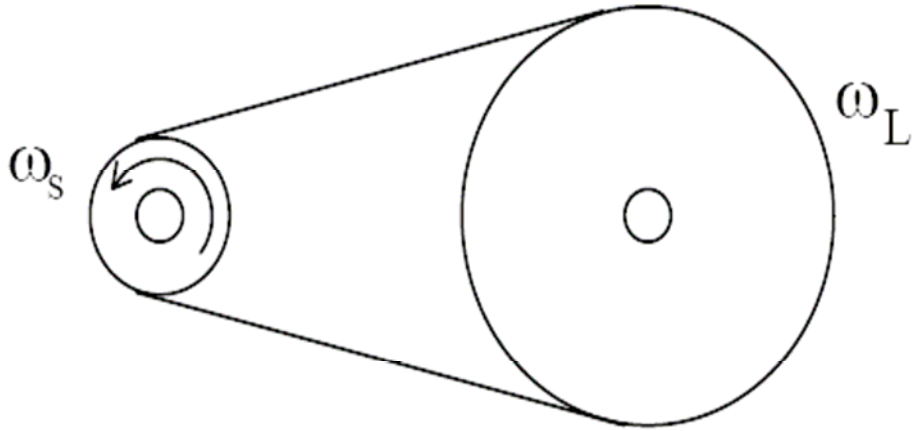
A) From 1 to 2
B) From 3 to 4
C) Neither of these
D) Both of these

Ct circ 3 ans c

Answer: Neither of these. The acceleration is zero along the straight line portions of the track.

5

CTRot-2. A small wheel and a large wheel are connected by a belt. The small wheel is turned at a constant angular velocity ω_s. How does the magnitude of the angular velocity of the large wheel ω_L compare to that of the small wheel?



A) $\omega_s = \omega_L$ B) $\omega_s > \omega_L$ C) $\omega_s < \omega_L$

There is a bug S on the rim of the small wheel and another bug L on the rim of the large wheel. How do their speeds compare?

A) S = L B) S > L C) S < L

Ctr rot 2 ans

Answers: $\omega_S > \omega_L$ Every time the big wheel turns once, the little wheel turns several times. So the small wheel turns thru more radians per sec.

S = L. Because the wheels are connected by a belt which does not slip, when one bug moves an inch along the rim, so does the other bug, so they have the same speed.