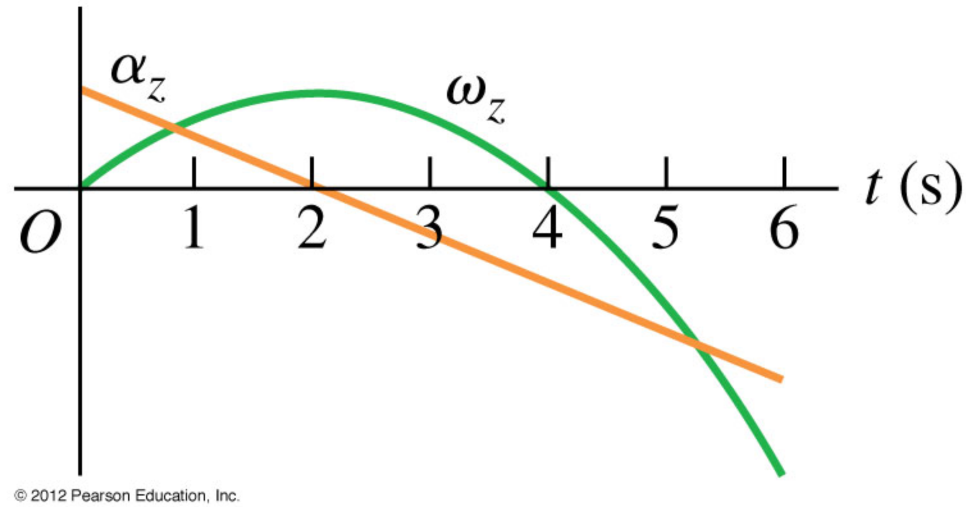
Q9.1

The graph shows the angular velocity and angular acceleration versus time for a rotating body. At which of the following times is the rotation speeding up at the greatest rate?



A. $t = 1$ s

B. $t = 2$ s

C. $t = 3$ s

D. $t = 4$ s

E. $t = 5$ s

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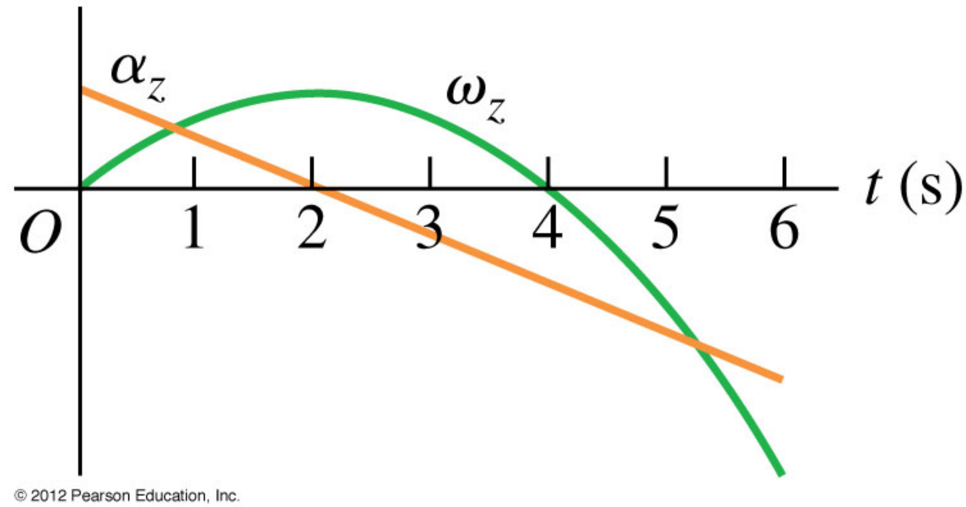


A. $t = 1$ s

B. $t = 2$ s

C. $t = 3$ s

D. $t = 4$ s

E. $t = 5$ s ✔

Q9.2

A DVD is initially at rest so that the line *PQ* on the disc's surface is along the +*x*-axis. The disc begins to turn with a constant $\alpha_z = 5.0\ \text{rad/s}^2$.

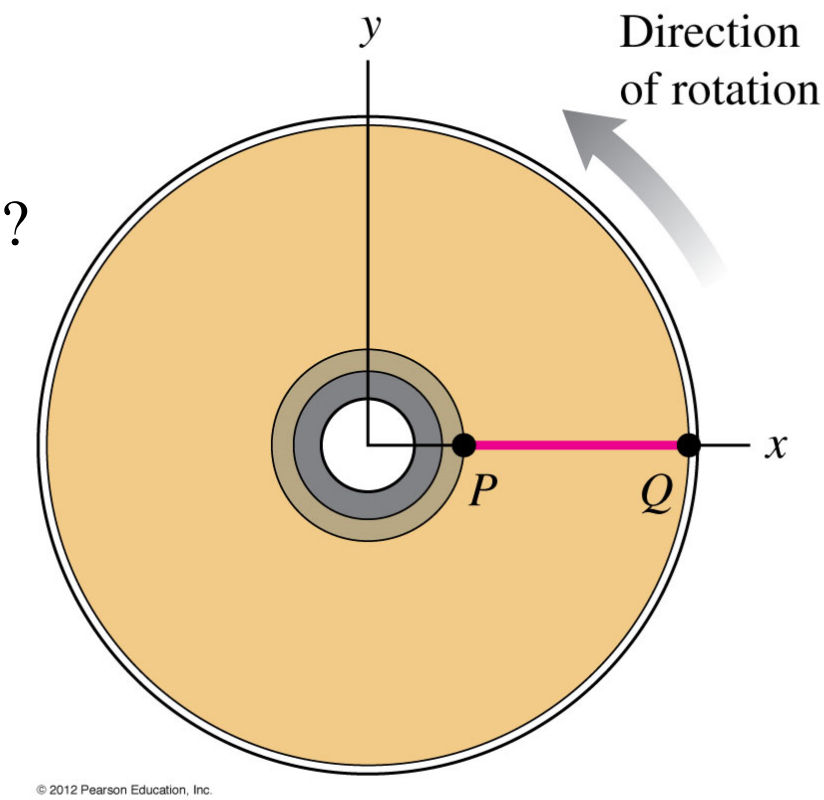
At $t = 0.40$ s, what is the angle between the line *PQ* and the +*x*-axis?

A. 0.40 rad

B. 0.80 rad

C. 1.0 rad

D. 2.0 rad



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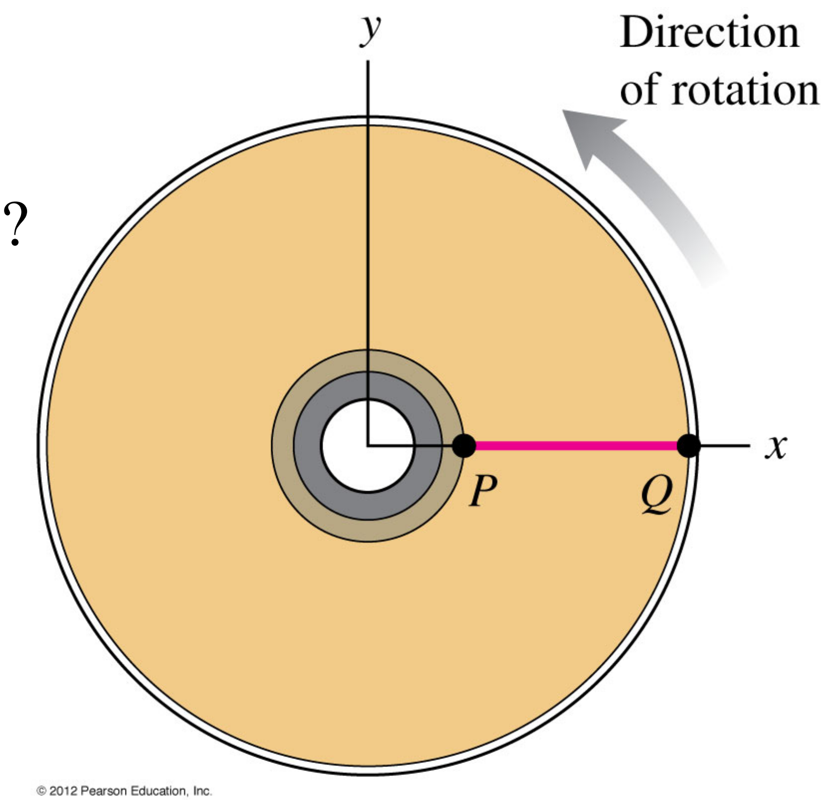
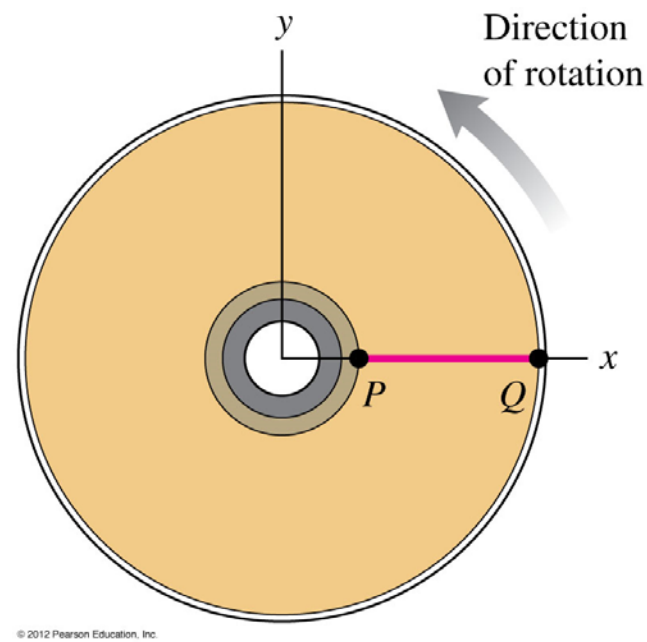


Q9.3

A DVD is rotating with an ever-increasing speed. How do the centripetal acceleration a_{rad} and tangential acceleration a_{tan} compare at points *P* and *Q*?



A. *P* and *Q* have the same a_{rad} and a_{tan}.

B. *Q* has a greater a_{rad} and a greater a_{tan} than *P*.

C. *Q* has a smaller a_{rad} and a greater a_{tan} than *P*.

D. *P* and *Q* have the same a_{rad}, but *Q* has a greater a_{tan} than *P*.

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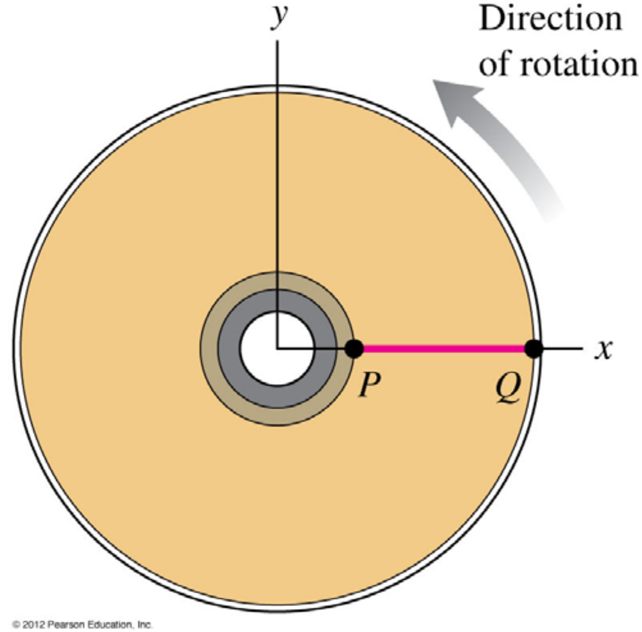


A. *P* and *Q* have the same a_{rad} and a_{tan}.

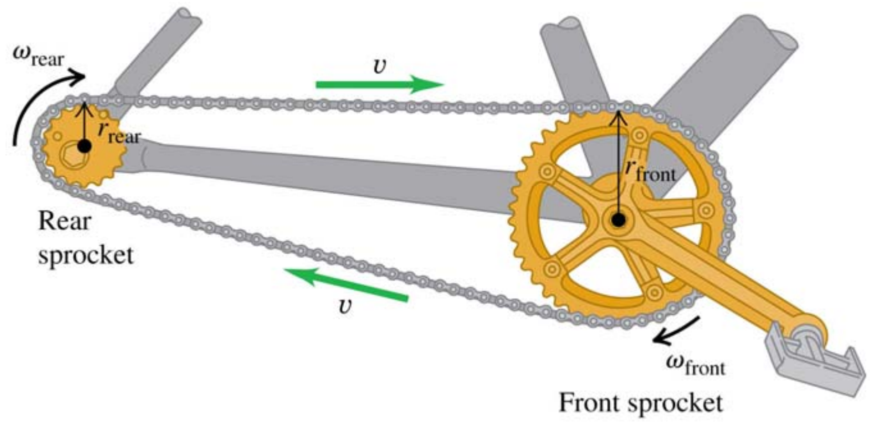
✔ B. *Q* has a greater a_{rad} and a greater a_{tan} than *P*.

C. *Q* has a smaller a_{rad} and a greater a_{tan} than *P*.

D. *P* and *Q* have the same a_{rad}, but *Q* has a greater a_{tan} than *P*.

Q9.4

Compared to a gear tooth on the rear sprocket (on the left, of small radius) of a bicycle, a gear tooth on the *front* sprocket (on the right, of large radius) has



A. a faster linear speed and a faster angular speed.

B. the same linear speed and a faster angular speed.

C. a slower linear speed and the same angular speed.

D. the same linear speed and a slower angular speed.

E. none of the above

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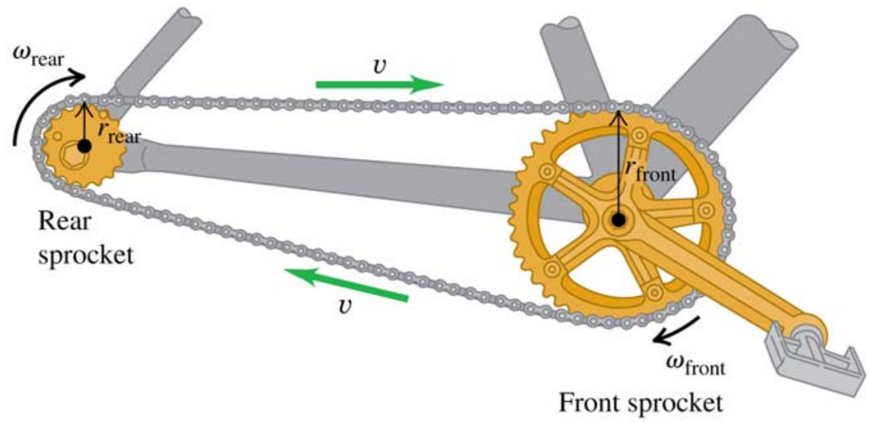

A. a faster linear speed and a faster angular speed.

B. the same linear speed and a faster angular speed.

C. a slower linear speed and the same angular speed.

✓ D. the same linear speed and a slower angular speed.

E. none of the above

Q9.5

You want to double the radius of a rotating solid sphere while keeping its kinetic energy constant. (The mass does not change.) To do this, the final angular velocity of the sphere must be

A. 4 times its initial value.

B. twice its initial value.

C. the same as its initial value.

D. 1/2 of its initial value.

E. 1/4 of its initial value.

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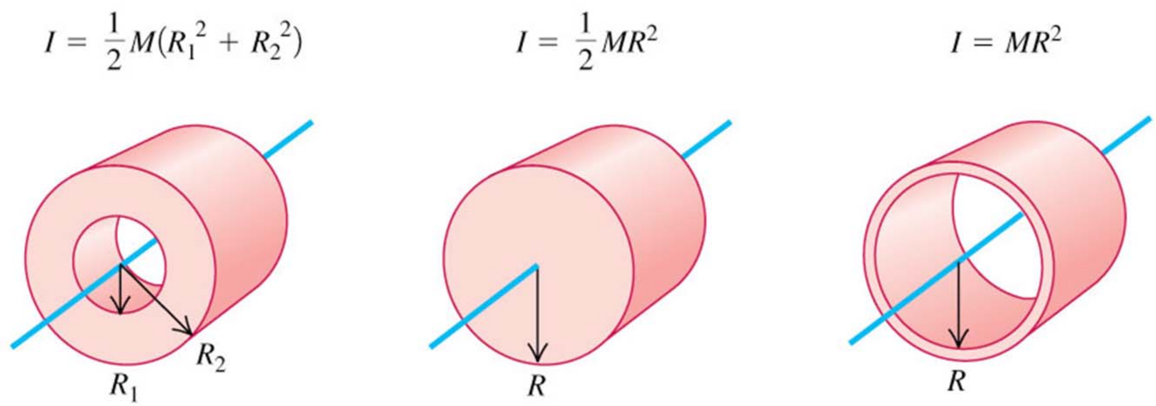
Q9.6

The three objects shown here all have the same mass *M* and radius *R*. Each object is rotating about its axis of symmetry (shown in blue). All three objects have the *same* rotational kinetic energy. Which one is rotating *fastest*?



A. thin-walled hollow cylinder

B. solid sphere

C. thin-walled hollow sphere

D. two or more of these are tied for fastest

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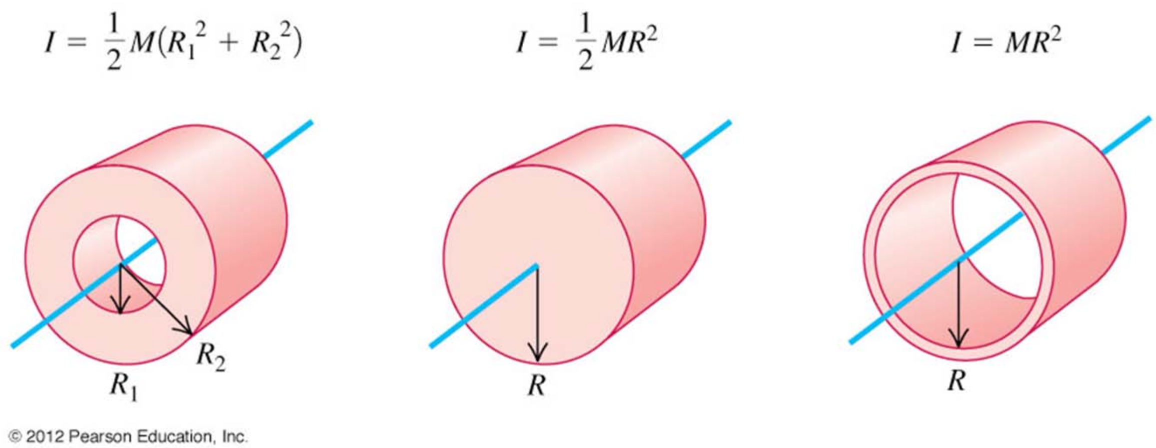


A. thin-walled hollow cylinder

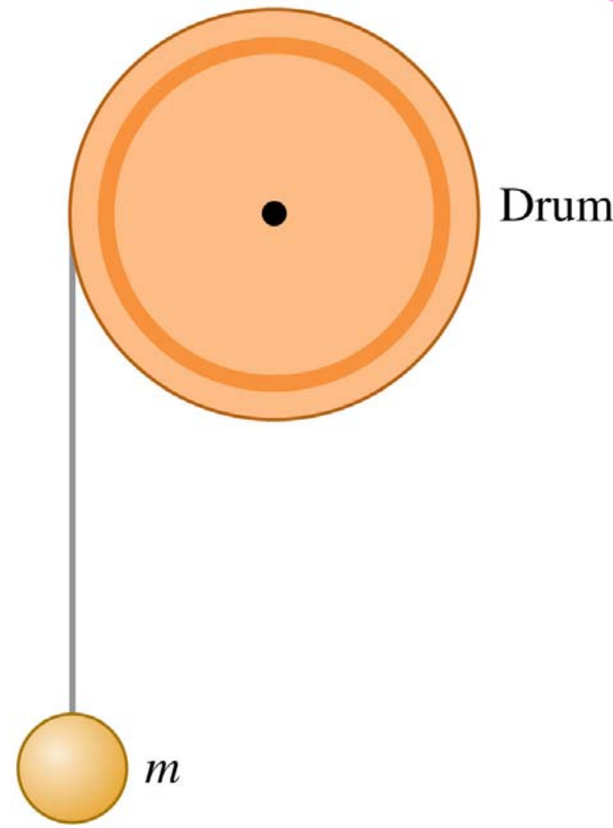
B. solid sphere

C. thin-walled hollow sphere

D. two or more of these are tied for fastest

Q9.7

A thin, very light wire is wrapped around a drum that is free to rotate. The free end of the wire is attached to a ball of mass *m*. The drum has the same mass *m*. Its radius is *R* and its moment of inertia is $I = (1/2)mR^2$. As the ball falls, the drum spins.



At an instant that the ball has translational kinetic energy *K*, the drum has rotational kinetic energy

A. *K*.

B. 2*K*.

C. *K*/2.

D. none of these

A9.7

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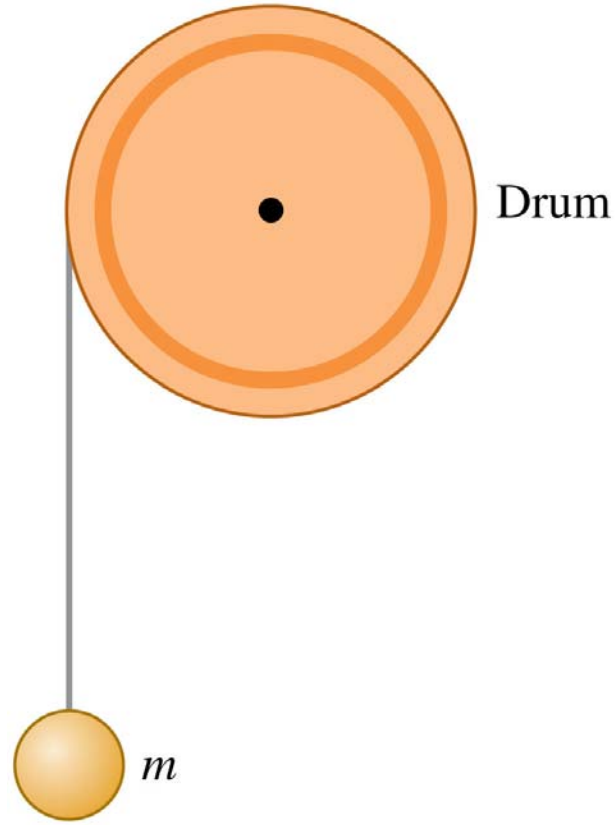

At an instant that the ball has translational kinetic energy K, the drum has rotational kinetic energy

A. K.   B. $2K$.   C. $K/2$.   D. none of these