Practice Problems
For Chapter 09

The problems and solutions that follow were designed by students. Although I have checked them, there are very possibly a few errors here and there. If you notice a mistake and turn in a typed correction, you will receive two extra homework points. You may also write new homework problems to add to any chapter and receive between 2 and 5 homework points per problem (see syllabus for details.) Please note: since these problems were written by students, the teacher takes no responsibility for errors – in other words, if there is a mistake and you make the same mistake on a test, you will not get credit for that mistake.

In the problems below, I have highlighted what I feel are the best problems to study prior to tests. The other problems are all ok, but they tend to be very easy problems or repeats of homework problems with slight variations. You may want to start with a few of the regular problems as warm up and then move on to the highlighted problems.

Chapter 9 – Problems

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1. If a car's engine's rpm goes from 2000 rpm to 6000 rpm in 3 seconds, what is the engine's angular acceleration (the angular acceleration of the crankshaft)?

John Stevenson '07

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2. A video gamer is playing Battlefield 2 on his PC when his mom comes upstairs to check and see how far he has gotten in his Physics assignment. He quickly closes the game causing the CD in the drive to stop spinning in 5 sec. What is the disc's angular acceleration if the CD-ROM drive is spinning the disc at 7500 RPM?

John Stevenson '07

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3. Lilly likes carousals. She gets on, and Arnold Schwarzenegger starts pushing her. The Terminator pushes very fast. After 4 seconds, she has already gone around 25 times. The radius of the carousal is 2 m.
A. What was her angular acceleration?
B. If she loses hold and gets flung off the carousal after 4 seconds, how fast will she be flying through the air?
(Don't worry, Schwarzenegger, the loving caretaker that he is, has set up pillows where she'll land.)

Moritz Sudhof '07

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4. Mr. Laba, who is a giant in Labaland, picks up a random inhabitant, twirls him around with his hand, and then releases him so that the inhabitant goes flying. When the inhabitant is twirled, he has an angular acceleration of 3.6 rad/sec^2 for 5.4 sec, which is when Mr. Laba releases him. The inhabitant goes flying from 7 m up at a 0 degree angle. A big sea of jello (strawberry jello) is 15 m away. Will the inhabitant land safely in the jello, or will he crash to his death on the hard earth?
(The radius of the circle around which the inhabitant is spun is .76 m)

Moritz Sudhof '07

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5. A tiger is on a Ferris wheel that he does not want to be on. The diameter of the Ferris wheel is 15 meters and it is accelerating from rest with a tangential acceleration of 3 m/s^2. If the tiger's point on the wheel travels 50 radians, what is the final tangential velocity of the Ferris wheel? If the tiger will only throw up if he is traveling faster then 30 m/s, will the tiger throw up his lunch of assorted chicken parts?

Colt Power (class of 2008)

6. A DVD is revolving at 35 revolutions per second when you hit the eject button. When the case opens two seconds later, the DVD has stopped rotating. What was the average acceleration of the DVD?(Angular)

John Wheeler (class of 2008)

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7. It's an intense game of Ultimate Frisbee and jack throws a deep pass to Jill in the end zone. Due to a serious mental disorder, Jill can only catch the Frisbee if it is spinning at less than 20 revolutions per second (it's called T.O.icitis). If the Frisbee leaves Jack's hand spinning at 50 revolutions per second but decelerates at five revolutions per second until Jill catches it, how long does the pass have to be in the air?

John Wheeler (class of 2008)

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8. When the wheel was first invented a few years back, it was very unfortunately dropped down a hill (it took them a while to catch onto the whole "rolling" thing). The hill was of such a steep grade that it accelerated at 10 revolutions per second the entire trip down the hill. If it took 5 seconds for the wheel to make it to the bottom of the hill, and if the wheel was made such that it would be destroyed when making contact at speeds over 100 revolutions per second, will these clumsy cavemen have set back society millenniums?

John Wheeler (class of 2008)

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9. A disk with a radius of .2 m begins to revolve. It eventually reaches a speed of 3.6 rad/sec. If it takes 7 seconds to reach this speed, what is its angular acceleration? How many degrees has the disk revolved through?

Franci Rooney ('08)

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10. A bowling ball is rolled down an alleyway without slipping. From the start, it has an angular velocity of 11 radians per second and after accelerating for 7sec, it has a angular velocity of 5 meters per second. Find:

a. Acceleration in rad/sec in the 7 sec
b. angular displacement?
c. If the radius is 50cm, then what is position or distance?

Hailey Arterburn (class of 2010)

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11. A kid pushes a merry-go-round by running around with it right at the edge and it

was pushed from rest in a constant acceleration. If after the kid runs for 8sec, the kid is running at 5m/s.

a. How far did the kid run?
b. If the radius of the merry-go-round is 250cm, what is the angular velocity at the 8sec? (assume the radius for the child and the merry-go-round are the same)
c. if there was a bug 200m from the edge of the merry-go-round, then what is the tangential velocity of the bug at the 8 sec?

Hailey Arterburn (class of 2010)

Chapter 9 Solutions

1.
Vf=vi+at
100revpersec=33.333revpersec+3a
Answer: A=22.22 rps^2

2.
7500 RPM= 785.3985 rad/sec
Vf=vi+at
0=785.3985+a(5sec)
a=157.0797

Answer: the angular acceleration is 157.0797 rad/sec^2

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3. A.
25 revolutions(2π radians) = 157.1 rad
$\Delta\vartheta = \acute{\omega}_i t + (1/2)\,\alpha\, t^2$
157.1 = (1/2) α (16)
α = 19.6 rad/sec^2

B.
$\acute{\omega}_f = \acute{\omega}_i + \alpha\, t$
$\acute{\omega}_f$ = 19.6(4)
$\acute{\omega}_f$ = 78.4 rad/sec
$\acute{\omega}\, r = v_t$
78.4(2) = v_t
v_t = 156.8 m/s

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$v_t = 156.8$ m/s

5.
r= 7.5 meters

$a_t=\alpha r$
$3= \alpha (7.5)$
$\alpha=.4$ rad/sec^2

$\omega_f^2= \omega_i^2+2\alpha\Delta\Theta$
$\omega_f^2=2(.4)(50)$
$\omega_f^2=40$
$\omega_f=6.32$ rad/sec

$v_t=\omega r$
$v_t=6.32(7.5)$
$v_t=47.4$ m/s final velocity

Yes, since he is traveling faster than 30 m/s, the tiger will throw up his chicken pieces.

6.

$\omega_f = \omega_i + \alpha t$

$0 = 35\text{rps} + (\alpha)(2)$

$\alpha = -17.5\text{r/s}^2$

7.

$\omega_f = \omega_i + \alpha t$

$20 = 50 - 5$ (x sec.)

x = 6 seconds

8.

$\omega_f = 0 + (10)(5)$

$\omega_f = 50$

Even cavemen can get lucky.

9.

Wi = 0
Wf = 3.6
T=7
a=?
Wf/t = a= .514
$\Delta ø = 1/2at^2$
$\Delta ø = 9.8(49)/2$
240 radians, 13750º total

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10. a. $\omega_f = \omega_i + \alpha t$
$5 = 11 + a(7)$
$-0.857 = a$

b. $\Delta\theta = \omega_i t + (1/2)\alpha t^2$
$\Delta\theta = 11(7) + (1/2)a(7)^2$

$\Delta\theta = 77 + 30.1(-0.857)$
$\Delta\theta = 102.8$ rad

c. 5cm=0.05m
$\Delta\theta\ r = d$
$102.8(0.05) = d$
$5.14m = d$

11.

a. $V_f = V_i + at$
$5 = 0 + a(8)$
$0.625 = a$

$\Delta x = V_i t + (1/2)at^2$
$\Delta x = 0 + (1/2)(0.625)(8)^2$
$\Delta x = 20m$

b. 250cm = 2.5 m
$\omega r = v_t$
$w(2.5) = 5$

w=2 rad/sec

c. 200cm=2m

radius of circle that the bug makes is 2.5m-2m = 0.5m

$\omega r = v_t$

$w(2.5)=5m/s$

$w= 2$ rad/sec

$\omega r = v_t$

$2rad/sec(.5m) = v_t$

$1m/s= v_t$ the tangential velocity of the bug