Practice Problems
For Chapter 11

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 11 Practice Problems

1. What is the force exerted by a cyclist who goes from stop to 20mph in 10secs if the mass of the bike and rider is 75 kg?

John Stevenson '07

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2. Mr. Laba is cruising along in Physics World in his Porsche 911 Turbo at 35 m/sec. Suddenly, he sees a pretty flower on the side of the road 125 m ahead of him that he really wants. He slams on the brakes. His brakes can exert a force of 3800 N, and the Porsche has a mass of 1500 kg. Will the car stop in time so that he doesn't pass the pretty flower?

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3. Debby is driving along in her Toyota Prius (1000 kg) at 25 m/s when a squirrel runs out in front of her path. She has cars on either side of her, so she can't swerve to the side. She can safely exert 3000 N on her brakes. Will she be able to stop to save the squirrel which is 110 meters away? Or should she keep going since it's useless. (Note: the squirrel is too stupid to move.)

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4. Iana, dressed as Dobby the House Elf, and Fontaine, dressed as the woman in the painting that lets Gryffindor in their dorms with a password wait in the car as their little sister struggle to put costumes together. Finally Floy emerges as Hagrid with a beard and fur coat and Margaux emerges as Malfoy with a green robe and greased hair. They jump in the car and rush to get to the Harry Potter and the Goblet of Fire primer. The last light before the cinamark 17 turns yellow when they are moving 20 m/s and only 40 meters from the light. The car and the characters mass is 2300 kilograms.

a) if they decide that seeing the beginning of Harry Potter is more important then there lives and hit the gas to accelerate 5 m/sec squared, will they make it alive if the light lasts 2 seconds?

b) if they decide that Harry Potter can wait, what force do the brakes give to stop the car in time?

5. For the last day of 4th grade, the class celebrates with a game of tug of war. They decide to have the game at the Galleria on ice skates (what a dangerous idea! But there is no friction). The team of 8 girls can pull with a force of 240 newtons and the team of 7 boys are overconfident and choose not too pull. If the girls are 320 kg collectively and the boys are 300 and if the teams start out 6 meters apart, where will they meet?

6. Coach Stringer loves to do push-ups more than anyone on the face of the earth. If he has a mass of 90 kg and he lowers himself .2 m in 2 seconds what is his acceleration and what is the force exerted on his two hands?

7. Greg was driving an 80kg golf cart one day traveling north at a velocity of 22 m/s when he crashed into table full of elderly pedestrians. The golf cart stopped in .85 seconds. Calculate the force during the course of the wreck.

8. If Moritz and Roland are pushing the astro van (mass = 1000N) with a force of 200N what is the vans acceleration? What is its speed after 10 seconds?

9. If Seth pushes the ball with a force of 50N and Mikey pushes in the opposite direction with a force of 40N how much will the ball accelerate (mass of the ball= .5kg)? If Cody is fifty meters in from of Seth, how far will the ball be from him in 2 seconds?

10. If a Ferrari F430 Spider goes 60 mph to 0 mph in 107 ft. and weighs 3197 lbs, what is its:

A) acceleration
B) the force of this deceleration

11. If a Maybach 57 takes 4.9 sec to go 0-60 mph and weighs 6029.6 lbs, how much force is needed to accelerate it at that rate?

12. Which takes more force: a Hummer H1 (7847lbs) going to 60 mph in 13.5 seconds or a Bugatti Veyron (4200 lbs) going to 188 mph in 16.7?

13. If a Scion xB does the quarter mile in 18.4 secs @ 77.8 mph, what is its acceleration and the force used to attain this run? (starts at rest and weighs 2395 lbs)

14. If a Volvo C70 pulls itself with a force of 5996N, what will its velocity be after 10 seconds if its mass is 1565 kg? (from rest)

15. If a Dodge Ram 1500 (5141 lbs) has tires with 40 psi of pressure each, what total surface area does the tires (all together) have on the road surface?

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16. Mr. Laba is stopped at a red light and a large man in a truck next to him revs his engine. Mr. Laba nods with utter certainty and then the light turns green. If Mr. Laba's 55 Mustang has a force of 1000N and a mass of 200kg, while the truck has a force of 1500N and a mass of 400kg, which driver will reach a light 40m away first, and at what speed?

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17. Two navy commanders have a good deal of time on their hands while being based far away from the frontline, so they decide to have a little game of tug of war with two hovercraft that are sitting around (this creates no friction to the ground). One hovercraft (craft A) has a mass of $8x10^2$ kg and pulls with a force of 750 N. The second hovercraft (craft B) has a mass of $5x10^2$ kg. How far will craft A move if they start at 50 meters apart?

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18. Legendary tennis pro Phat Bui (pronounced "Fat boy") can miracuosly serve a ball with a force of 4.3 Newtons. If the a Penn tennis ball has a mass of 56.7 g (barely legal) and a Wilson tennis ball has a mass of 58.5 g (also barely legal), which ball ill have the higher acceleration and by how much?

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19. The average human weighs an estimated 53 kilograms and there are approximately 6.5 billion people on the planet. If theoretically every human on earth jumped at the same time, what would be the acceleration of the earth? (The earth has a mass of 5.9742×10^{24} kg)

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20. A new design car can accelerate from rest with a force of 1500 N until it tops out at 130 m/s. How far will the car go in this time period if the car has mass of only 1300 kg?

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21. The "strongest" jet in the world can break with a force of 1222500 N. If this jet usually touches down at a speed of 270 m/s and has a mass of 94000 kg, how long does the shortest runway in the world need to be?

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22. Two astronauts in space are separated by a 10 km deadline. If one of the astronauts pulls on the deadline with a force of 15 N, will Fred (55 kg) or George (75 kg) go further and how far will the winner have gone?

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23. Base jumping off the Eiffel Tower, you encounter a problem: your parachute won't open. Miraculously, a collision with a bird causes your parachute to open at .11 km

off the ground. If you have a mass of 71 kg and your parachute can operate under a force of 2720 N, will your 120 m/s traveling self be able to land at a velocity under 13 m/s so as to not break your legs?

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24. When Bob walks, he exerts a force of 8N on the ground. After 7 sec from when Bob Started to walk he has reached a velocity of 6 mph and is continually acceleration. Find:

a. Bob's Acceleration during the 7 sec.
b. Bob's mass
c. Bob's weight.

Hailey Arterburn (class of 2010)

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25. While speeding down Walnut Hill, Jim sees a squirrel crossing the road and slams on his breaks so he won't hit the fuzzy creature. Jim and his car have a combined mass of 1800 kg and he was speeding at 25 m/s. If his breaks can exert a force of 3000 N, will he be able to stop before he hits the squirrel that is 200 meters away?

Bethany Berg (class of 2011)

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26. Two boys in canoes are playing tug-a-war. Joe has a mass of 22 kg and pulls with 5 N of force. Jim has a mass of 20 kg and pulls with a force of 6 N. Whose canoe will have moved the farthest at the end of the game if they are 10 meters apart to start? An how far will it have moved?(frictionless canoes and water)

Bethany Berg (class of 2011)

Chapter 11 Solutions

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1. Vf=vi+at
8.94=0+a(10)
a=.894
F=ma
F=75*.894
F=67.05N

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2. $\Sigma F = ma$
$-3800 = 1500a$
$a = -2.53\ m/s^2$
$V_f^2 = V_i^2 + 2a\Delta x$
$0 = 35^2 + 2(-2.53)\Delta x$
$\Delta x = 242.1\ m$
No, by the time he stops his car he will have driven way past the pretty flower

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3. F=ma
3000=1000a
a=3
$V_f^2 = V_i^2 + 2ax$
$0 = 25^2 + 2(-3)x$
x=104.1 m
yes! She saved the squirrel

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4. Vi=20m/s
t=2 sec
a= 5 m/s2
Δx=vi t + .5 a t^2
=20(2)+.5(5)(2^2) =50m
They will not make it--they died for Harry Potter!
Vf^2=vi^2+2a Δx
0= 400+2a(40)
-400=80a
a=- 5m/s^2
F=ma
F=(2300)(-5)
F= -11500 N

5.

Girls vs. Boys

320 kg 300 kg

According to Newton's 3rd law both sides pull with 240 N

240=320a 240=300a

.75=a . 8=a

Distance=6meters

x=vi t + .5 a t^2 6-x= .4t ^2

x=.375t^2

x/.375 =t^2 (6-x)/.4=t^2

set them equal to each other

x/.375=(6-x) /.4

.4x= 2.25-.375x

.775x=2.25

X= 2.9 m

They will meet 2.9 meters from where the girls originally started

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6. $\Delta x = \frac{1}{2} a t^2$

$.2 = \frac{1}{2} a 2^2$

$.2 = 2a$

$a = .1 \text{ m/sec}^2$

$90{,}000g(.1) = F$

$9000N = F$

$9{,}000N (2) = 18{,}000 N$

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7. $F = (800)(0) - (800)(-22) / (.85)$

$17600 / .85$

$20705.88235 N = \text{Force of the crash}$

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8. $F=ma$

$200= 1000*a$

$a= .2$

$V = at$

$V = .2*10$

$V = 2 m/s$

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9. Net force = ma

50-40=ma

10 = ma
10= .5a
a = 20m/s
Distance = ½ a t²
.5*20*4
Distance 40 from Seth
50-40= 10 meters from Cody

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10. A. $Vf^2=vi^2+2a\Delta x$
$0=(26.8224m/sec^2)^2+2a(32.6136)$
$a=-11.02977196\ m/sec^2$
B. F=1450.134806kg*(-11.02977196)
F=-15994.65623N

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11. $A=\Delta V/\Delta T$
$A=26.8224/4.9$
$A=5.473959184m/sec^2$
F=ma
F=2734*5.47
F=14971.16889N

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12. $A=\Delta V/\Delta T$
$A(hummer)=26.8224/13.5=1.9868m/sec^2$
$A(veyron)=84.04352/16.7=5.156m/sec^2$
F=ma
F(hummer)=3559*1.9868=7071.97N
F(veyron)=1905.087*5.156=9822.717723N
The Veyron
Work:
$K=(1/2)mv^2$
$K(hummer)=(1/2)(3559)*(26.8224)^2=1280389.364$ J
$K(veyron)=(1/2)(1905.087)*(84.04352)^2=6728113.129$ J
The Veyron

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13. $A=\Delta V/\Delta T$
$A=34.779/18.4$
$A=1.89\ m/sec^2$
F=ma
F=(1086.353kg)*(1.89)

F=2053.20717N

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14. F=ma
5996=1565a
a=3.83 m/sec^2
vf=vi+at
vf=0+(3.83*10)
vf=-38.3m/sec

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15. P=F/A
275790.291*4=(2331.918*9.8)/A
A=.0207157369 m^2

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16. Force of the mustang= ma
1000 = 200a
a = 5m/s²
Force of the truck=ma
1500 = 400a
a = 3.75²
v² = 2*a* Δx
v² = 2*5*40
v² = 400
v = 20m/s
Mr. Laba will reach the light first at a speed of 20m/s.

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17. F=ma
750 N= (800 kg)a
Acceleration of A= .9375 m/sec^2
x=(1/2)(.9375)t^2
750 N= (500 kg)a
Acceleration of B= 1.5 m/sec^2
(50-x)=(1/2)(1.5)t^2
23.4375-.46875x=.75x
x=19.23076923m
Craft A moves 19.23076923 meters

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18. F= ma
4.3= (.0585)(a)

A= 73.50
F= ma
4.3= (.0567)(a)
A_2 = 75.84
The Penn tennis ball could be served with acceleration 2.34 m/s^2 faster.

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19. F= ma
F= (53)(6500000000)(9.8)
F= 3.376 x 10^{12}
F= ma
3.376 x 10^{12} = (5.9742 x 10^{24})(a)
A= 5.65 x 10^{-13}

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20. F= ma
9500= 1300(a)
A= 7.308 m/s^2
$V_f^2 = V_i^2 + 2a\triangle x$
130^2 = 2(7.308)(x)
X = 1156.267 m

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21. F= ma
1222500= (94000)(a)
A= 13.005 m/s^2
$V_f^2 = V_i^2 + 2a\triangle x$
0 = (270)(270) + 2(13.005)x
X = 2802.77 m

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22. F= ma
15= (a)(55)
a (George)= .273
F= ma
15= (a)(75)
a (Fred)= .200
$x = V_it + (1/2)at^2$ $x = Vit + (1/2)at^2$
$x = (1/2)(.273)t^2$ $20-x = (1/2)(.2)t^2$
$x / .1365 = t^2 = (20-x) / .1$
.1x = (20-x)(.1365)
.2365x = 2.73

x = 11.54
George travels 11.54 km and therefore travels the farthest.

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23. F= ma
2720= (71)(a)
a= 38.31
$V_f^2 = V_i^2 + 2a\triangle x$
V_f^2 = 120^2 + 2(38.31)(-110)
V_f = 77.277 m/s
Splat! Not even close.

24.
a. 1069m=1mile
(6mph x1069)/3600=1.78m/s
$V_f = V_i + at$
1.78m/s = 0 + a(7)
0.255m/s^2= a
b. F=ma
8N=m(0.255m/s)
31.37kg=m

C. weight= mass x gravity
Weight= 31.37kg x 9.8 m/s^2
Weight= 307.45 N

25.
F = ma
-3000 = 1800a
a = -1.67 m/s^2
$V_f^2 = V_i^2 + 2a\Delta x$
$0 = 25^2 + 2(-1.67)\Delta x$
Δx = 187.13 meters
Yes, the squirrel survived.

26.

Joe:
F=ma
11=22a
a = .5 m/s^2
$\Delta x = \frac{1}{2} at^2$
$\Delta x = \frac{1}{2} (.5)t^2$
$\Delta x = .25t^2$

Jim:
F=ma
11=20a
a = .55 m/s^2
$10-x = \frac{1}{2} at^2$
$10-x = \frac{1}{2} .55t^2$
$10-(.25t^2) = .275t^2$

t=4.36 seconds

Δx= 4.76 meters Δx= 5.23 meters

Jim's will have moved the farthest, making him the loser and it will have moved 5.23 meters.
