Practice Problems
For Chapter 05

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 5 Practice Problems

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1. If an airplane is traveling at 200m/sec (to the ground) at 30deg north of east and a crew shell is going 5 m/sec at 270deg (to ground, no current), what is the velocity of the plane relative to the boat?

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2. One day, Ronnie was sitting in the passenger seat traveling at 13.5m/s. On whim, Ronnie decides to chuck a water balloon out the window perpendicular to the car at a velocity of 10 m/s. Mr. Laba is standing at a 45 degree angle facing the car with a distance of 14.1 m from Ronnie. If Ronnie's water balloon affects a radius of 4m, will Mr. Laba get splashed? (the car is one meter high)

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3. After seeing his beloved Labamobile destroyed, Mr. Laba decided to get a new car, the Labamobile^2. While trying out his new "whip," Mr. Laba found himself flying down Northwest Highway next to Bachman Lake at 70 m/sec (speed limits are for chemists, not physicists). While doing this, he sees a shell (crew boat) moving at 5 m/sec (in relation to the water/ground, no current) at 62 deg north of east. He wonders, "What is my velocity in relation to that vessel?"

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4. Mr. Laba is driving down Midway (speeding of course) at 30 m/sec headed south in the Labamobile, and looks up and sees a plane flying at 400 m/sec at 30 degrees north of east. What is the velocity of the Labamobile relative to the plane?

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5. If a boat's speed relative to the water is 10 m/s and it is aimed directly east across a river and there is a water current headed south at a speed of 3 m/s relative to the shore, what is the velocity of the boat relative to the shore?
(Round to the hundredths place)

6.

a. Bob Saget is riding one of the moving walkways in an airport. He is standing still (relative to himself) and the walk way moves at a constant 1.3 m/s. He glances over to the other side of the room and sees someone else walking on a similar walkway that travels the opposite direction. If the other walk way moves at 1.4 m/s and the person walking on it has a walking speed of 1.22m/s on solid un-moving ground, what is that person's velocity relative to Bob.

b. Bob then realizes he left his bag in the baggage claim behind him. He turns around on the walkway and begins to run at 3.12 m/s. how long will it take him to get off the walkway if he is 20 m from the end he needs to be at, and now what is the person from part A's velocity relative to B. Saget.

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7. A small child and his family are taking the train to downtown when the boy hears a plane overhead. The boy has just been schooled in the arts of physics by his older brother and wonders how fast the plane is flying relative to the train. He knows the following:
Train to Ground=245km/h@180^{o}
Plane to ground=530km/h@110^{o}

   *find the velocity of the plane relative to the train.

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8. Jeremiah wants to swim west across the 40 m wide river, which has a current of 3 m/s going south. If he can swim 9 m/s, what angle should he point himself to swim straight across? How long will it take him?

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9. An airplane is flying 80^{o} north of east. Is engines are propelling it at 223 m/s. There is also a wind blowing at 30 m/s at 160^{o}. How fast and in what direction is the airplane going if you were watching it from the control tower?

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10. Mr. Lutken and Brother Lutken are canoeing across the Trinity (it's 1963). They are moving at 12m/s and the width of the river is 30 meters wide. The Trinity has a current of 8m/s. At what angle should the Lutken brothers point their canoe and how long will it take for them to reach the other side?

Chapter 5 Solutions

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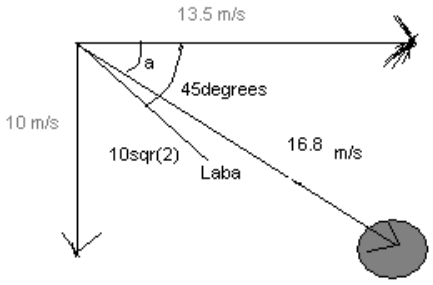
1. Work:
   Vbg=5@270
   Vpg=200@30→ Vgp= 200@-30
   Ax=5cos270=0
   Ay=5sin270=-5
   Bx=200cos330=173.205
   By=200sin330=-100
   Rx=173.205
   Ry=-105
   R=sqroot(173^2+105^2)
   R=202.37
   Arctan(-105/172)=-31.225deg
   Answer: 202.37 m/sec@ -31.225 deg North of East

2.



Y= 1/2gt^2
2/9.8=t^2
t = .45s

<a = arctan 10/13.5
<a = 36.5

10sqr(2) = 14.14

X = 16.8 * (.45)
X = 7.56m

the circle spans from 3.56 to 11.56, and because Laba is standing about 14.14m away, he will not be affected.

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3. Work:
   Vsg=5@62 deg
   Vlg=70@0deg→ -70@0 deg
   Ax=5cos62=2.347357814
   Ay=5sin62=4.414737964
   Bx=-70cos0=-70
   By=-70sin0= 0
   Rx=-67.65264219
   Ry=4.414737964
   $\sqrt{(Rx)^2+(Ry)^2}=R$
   R= 67.79653314 m/sec
   Arctan(4.41/-67.6)=-3.7 deg +180 deg= 176.26 deg
   Answer: 67.79653314 m/sec @ 176.26 deg north of east

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4. Work/ Answer:

   V_{CG}= 30 @ 270
   V_{PG}= 400 @ 30→ V_{GP}= 400 @ 210

   Ax: 30cos270=0
   Ay: 30sin270=30
   Bx: 400cos210=-346.4104615
   By: 400sin210=-200

   Rx: -346.4104615
   Ry: -170

   $|R|=\sqrt{(-346.4104615)^2+(-170)^2}$
   |R|=385.8758969 m/sec
   arctan=(-170/-346.4104615)=206.1393712 degrees

   Answer: 385.8758969 m/sec @ 206.1393712 degrees

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5. A_x: 10cos(0)= 10
   A_y:10sin(0)= 0

   B_x:3cos(270)= 0
   B_y: 3sin(270)= -3

   R_x: 10
   R_y: -3

$\sqrt{(Rx)^2+(Ry)^2}= R$
R=10.44
Arctan(-3/10)= -16.69 degrees = 16.69 degrees south of east

The boat's velocity is 10.44 m/s @ 16.69 degrees south of east.

6.
a. 3.92 m/s
b. 10.989 seconds, the persons relative speed is now .8m/s

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7. Vpt=Vtg + Vgp
Train=245km/h@180^o
Plane=530km/h@110^o

Ax=-245
Bx=-181.3
Ay=0
By=498.04
Rx=-426.3
Ry=498.04
|R|=257.5
R Θ=-49.44

R=257.5km/h@-49.44^o

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8. 9@x + 3@270 = y@0
y: 9sinx -3 = 0
9 sinx = 3
sinx = .33
x = 19.471º
x: 9cosx= y
y = 9 (.9428) = 8.485
40/8.485= 4.714 seconds

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9. 223@80 + 30@160
y: 223sin80 + 30sin160 = 229.8727
x: 223cos80 + 30cos160 = 10.5327
$(229.87^2 + 10.53^2)^{1/2} = 230.11$
230.11 @87.37

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10. $12m/s@\Theta + 8m/s@270^o = y@0^o$

    Y: $12\sin\Theta - 8 = 0$

    $12\sin\Theta = 8$

    $\sin\Theta = .66$

    $\Theta = 41.29^o$

    x: $12\cos\Theta = y$

    $y = 12(.7514) = 9.017$

    $30/9.017 = 3.32$seconds