Practice Problems
For Chapter 03

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 3 Questions

1.) Add these vectors mathematically:
A: 240 units @ 64 deg
B: 27 units @ 101 deg

John Stevenson '07

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2. If Ben started out from his house traveling along vector of 20 m @ 37°, then Ben turns (in order to avoid a gang of blood sucking goats) and travels 30 m @ 123°. How far away would he be from his home? Figure by adding vectors mathematically.

Zach Dearing (class of 2008)

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3. If Vector A= -43N @ 531 degrees and Vector B= 69N @ 31 degrees, what is A-B and A+b

Reed Duncan (class of 2008)

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4. Add these vectors mathematically:
A: 100 units @ 67 deg
B: 35 units @ 315 deg

Colt Power (class of 2008)

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5. Mr. Laba is lost in the woods trying to find his way back to his cabin. He wanders 4.5 miles southwest in a straight line then turns and wanders 2.7 miles east-north-east in a straight line when he happens to stumble upon his cabin.

What direction should he have started wandering in to get to the cabin in the shortest distance and what is that distance?

Colt Power (class of 2008)

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6. Calculate A + B and A – B.
A= 15 units @ 35°
B= 9 units @ 35°
Stephen Tonti

7. Calculate A + B and A – B.
A= 23 units @ 60°
B= 18 units @ 83°
Stephen Tonti

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8. Calculate A – B then B – A.
A= 1500m @ 160°
B= 800m @ 30°

Stephen Tonti

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9. Mr. Lones (Bonez) leaves his house on an adventure to GameStop in search of Super Smash Bros Brawl. He walks 3 miles at 35° N of E. He realizes, quite suddenly, that he has walked too far and must double back. He decides to walk 1.5 miles at 15° W of S. After finally arriving, Lones is shocked to find Mr. Laba—he is buying Lord of the Rings, the game. After hearing Lones's story, Mr. Laba explains that Luke should have spent more time and vectors for if he had found the straight-line path to GameStop, he would have arrived faster. Find the path he should have taken to arrive at GameStop in a straight line.
Stephen Tonti

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10. Use R and A to find B.
R= 14units @ 135°
A= 9units @ 200°
Stephen Tonti

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11. Vector N has a magnitude of 3 at 135º. Vector O has a magnitude of 19 at 14º. What is the magnitude and angle of Vector N+O?

Franci Rooney '08

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12. Vector ☺ is 5@25. It is also equal to Vector H, 10.86@unknown angle, plus Vector A, 6@ 170º. What is the unknown angle?

Franci Rooney ('08)

13.

Add two vectors

10 units at 30°
25 units at -15°

Anne Duncan ‘09

Here begins the story of the space ship Nickellogan.

14. Five score and 121 years from now in a galaxy rather close, a wondrous ship named the Nickellogan conquered men and gypsies alike. You see children, this was not just any ship, no it was a pirate ship, the greatest one to sail the Milky Way. Our story begins in the Laba System where the Nickellogan is plotting a course to the Witkinik System, but it must navigate around an asteroid field. If Captain Steve must go north for 500 meters (in this system everyone becomes really small and meters are like thousands of miles) and then east for 350 meters, how far will the Nickellogan be from her original location?
15. Bad NEWS!!! The evil Tralfamadorians have spotted the Nickellogan on their radar (they police this area of the Milky Way). Now, the Nickellogan must navigate around Tralfamadorian Capital Ships by traveling west 400 meters and then 30 degrees north of east for 230 meters. Because of your success on the last problem you have promoted to the ships navigator. Captain Steve must know how far your ship will be from its original location after these evasive maneuvers.
16. Congratulations! Your dutiful navigating skills have allowed you to escape the Tralfamadorians! Now you need to navigate a course at 35 degrees north of east for 350 meters. But there is a sun in the direct path to this location so you to travel to this location you must navigate first east then north. How far east and then north would you need travel?
17. Now you are have come across a gelatinous blob—nicknamed the Teratator. To avoid it you must travel 50 degrees north of east for 450 meters and then 110 degrees north of east for 200 meters. Captain Steve needs to know where this course puts you. So, how far are you from your original location?
18. Phew, that was close. You avoided the Teratator, and now the Witkinik System is only 525 meters at 25 degrees south of east from your location. Because of strange asteroid belts that favor only eastern entrance, you must enter the system by traveling first south then east. How far south, then east must you travel?
19. Now for your last navigating job, for now, you must navigate the ship into Port Sisson. The gate is 250 meters at 35 degrees north of east from your location.

You must enter the port in the eastern direction so you must travel first north then east. How far north then east must you travel?

Continued in chapter 6.
Logan Nickell (class of 2010)

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20. Winston is drives his car 45 miles due east, then he decides he needs to visit Maddy back in Dallas, so he turns around and heads 25 miles due west. But unfortunately the mythical road in north Texas that runs East to West disappeared while he was driving and he was forced to drive 10 miles north and then 17 miles south west. At this time he is somewhere in the Dallas vicinity. Find his location by adding the vectors and if Maddy's house is only two miles away from his house (where he started) is he there yet?

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21. A boy was driving a remote control car and the car started by facing 54º South of West. It moved 98 meters then stopped. It then turned and went 146 meters at 21º North of West until it ran out of gas. If they boy wants to walk straight to the car, how far and in which direction should he walk?

Bethany Berg – Class of 2011

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22. Mr. Laba is walking at 2 m/s at 30 degrees across the Swann Courtyard. A group of rowdy, incensed AP Physics students wish to intersect his path and keep him from getting back to the Cook Building to grade their tests. They are 14 m directly west of Mr. Laba's starting point. If the group of students can sneak up on Mr. Laba at a rate of 3 m/s, at what angle should they walk if they want to intercept Mr. Laba after he has walked for 10s? Assume Mr. Laba and the students begin walking at the same time.

Lindsey Osimiri (class of 2010)

23.
Add the following vectors:
A: 187 m@ 44 degrees
B: 113 m @ 56 degrees

24.
Add these two vectors:
A: 34.67 m @ 67 degrees
B: 56.78 m @ 132 degrees

25.
Donkey Kong challenges Luigi to a fight. Bowser tells Luigi he can get to Donkey Kong's hut by traveling 45 steps at 35 degrees, then traveling 155 steps at 165 degrees. Add these vectors and answer in unit vector notation. Did Browser give good directions?
Philip Wagley – Class of 2011

26.

A) Add these vectors, and keep in unit vector notation:

A= 75i - 30j
B= 37i + 10j

B) Convert to standard form.

Philip Wagley – Class of 2011

27.

Mario is riding Yoshi and travels 50 yards at 25 degrees; suddenly Mario catches a glimpse of Peach doing Yoga so he turns to her and travels 75 yards at 95 degrees. Add these vectors and answer in unit vector notation.

Philip Wagley – Class of 2011

28.

Vector X is 35.4 meters @ 14.5º North of West. Vector C is 28 centimeters @ 321.2º. What is vector X + C? (mathematically).

Bethany Berg – Class of 2011

29.

While trying to find my car in a parking lot I walked a little ways at an unknown degree. I then turned and walked 32 steps at 110º and found my car. I then realized that I could have just walked 78 steps at 97º to end up at the same place. What angle did I first begin walking at?

Bethany Berg – Class of 2011

30.

Add the vectors 40 units @ 20 degrees and 71 units @ 80 degrees

William Meier - Class of 2011

31.

Vector B is 41 meters @ 146º. Vector R is .4 km @ 355º. What is vector B + R? (mathematically).

Bethany Berg (class of 2011)

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32. Yoshi travels 45m at 35 degrees, he then sees Peach selling lemonade and travels 70m and 60 degrees. What would have been the shortest distance he could have traveled? At what angle would that have been?
Philip Wagley (class of 2011)

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33. Bowser is looking for Bowser Jr.. Bowser Jr. is 80m away at 60 degrees. Bowser travels 40m at 30 degrees and then 60m at 80 degrees; will Bowser find Bowser Jr.?
Philip Wagley (class of 2011)

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34. Toad finds Luigi after traveling 90m at 45 degrees and then 120m at 75 degrees. How far in a straight line was Luigi from Toad in the beginning? At what angle?
Philip Wagley (class of 2011)

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35. Add the vectors mathematically:
50 units at 160 degrees, and 90 units at 45 degrees.
Philip Wagley (class of 2011)

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36. Add the vectors mathematically:
120 units at 70 degrees, and 150 units at 80 degrees.
Philip Wagley (class of 2011)

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37. Add the vectors mathematically:
30 units at 30 degrees, and 75 units at 75 degrees.

Philip Wagley (class of 2011)

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38. Peace, Daisy, and Bowser go for a skip. They skip 85 meters at 40 degrees, and then 50m at 65 degrees to reach their final destination. What is the shortest distance they could have taken? At what angle?
Philip Wagley (class of 2011)

Solutions Chapter 3

1.Work:
Ax: 240cos64=105.2090752
Ay: 240sin64=215.7105711
Bx: 27cos101=-5.151842875
By: 27sin101=26.50393395
Rx: 100.0572323
Ry: 242.145051
$\sqrt{(Rx)^2+(Ry)^2}= R$
R=262.0673887 units
Arctan(242/100)=67.55 deg
Answer: 262.0673887 units @ 67.55 deg

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2. A_x: 20m cos37=15.9727m @ 0°
A_y: 20m sin37=12.036m @ 90°
B_x: 30m cos123=-16.333m @ 0°
B_y: 30m sin123=25.16 @ 90°
$R_x = A_x + B_x$
R_x: -.3664m @ 0°
$R_y = A_y + B_y$
R_y: 37.19 @ 90°
$R = \sqrt{(R_x)^2+(R_y)^2}$
R = 37.19 m
$\text{Arctan}(R_y/R_x) = \text{Arctan}(-) = -89.44° + 180° = 90.55°$
R = 37.19 m @ 90.55°

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3. Cos531*-43 – cos31*69=-16.6739451
Sin 531*-43 – Sin31*69= -42.26430917
$45.43= X^2+Y^2=Z^2$

Tan^{-1}(-42.26430917/-16.6739451)= 68degrees+180=248 degrees
45.43@248 degrees

Cos531*-43 + cos31*69= 101.6151424
Sin 531*-43 + Sin31*69= 28.8109
$105.62=X^2+Y^2=Z^2$

Tan $^{-1}$(28.8109/101.6151424)=15.8296 degrees

105.62@15.8296 degrees

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4. *Solution:*

A_x: 100cos(67)= 39.07
A_y: 100sin(67)= 92.05

B_x: 35cos(315)= 24.75
B_y: 35sin(315)= -24.75

R_x: 63.82
R_y: 67.30

$\sqrt{(Rx)^2+(Ry)^2}= R$
R=92.75

Arctan(67.30/63.82)= 46.52 deg

Answer: R= 92.75 units @ 46.52 deg

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5. *Solution:*

A_x: 4.5cos(225)= -3.18
A_y: 4.5sin(225)= -3.18

B_x: 2.7cos(22.5)= 2.49
B_y: 2.7sin(22.5)= 1.03

R_x: -.69
R_y: -2.15

$\sqrt{(Rx)^2+(Ry)^2}= R$
R=2.26

Arctan(-2.15/-.69)= 72.20 degrees

72.20+180= 252.20 degrees

He should have wandered 17.8 degrees west of south, and this would have made his hike

only 2.26 miles.

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6. A + B=15 + 9 @35°
R=24 units@35°

7.

(A+B)
Ax=23cos60=11.5
Bx=18cos83=2.2
Ay=18sin83=19.92
By=18sin83=17.87
Rx=11.5 + 2.2=13.7
Ry=19.92 + 17.87=37.79
|R|=√(13.7²) + (37.79²)
|R|=40.2
RΘ=arctan(37.79/13.7)
RΘ= 70.1°

R=40.2 units@70.1

(A-B)
Ax=23cos60=11.5
Bx=18cos83=2.2
Ay=18sin83=19.92
By=18sin83=17.87
Rx=11.5 - 2.2=9.3
Ry=19.92 - 17.87=2.05
|R|=√(9.3²) + (2.05²)
|R|=9.52
RΘ=arctan(2.05/9.3)
RΘ= 12.43°

R=9.52units@12.43°

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8. (A-B)
Ax=1500cos160=-1409.54
Bx=800cos30=692.82
Ay=1500sin160=513.03
By=800sin30=400
Rx=-2102.36
Ry=113.03
|R|=√(-2102.36²) + (113.03²)
|R|=2105.49
RΘ=arctan(113.03/-2102.36)
RΘ= -3.14°

R=2105.4ms@-3.14°

(B-A)
Ax=-1409.54
Bx=692.02
Ay=513.03
By=400
Rx=2101.56
Ry=-113.03
|R|=2104.6
R∅=-3.08°

R=2104.6m@-3.08°

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9. A=3m@35°
B=1.5m@255°

Ax=2.46
Bx=-.39
Ay=1.72
By=-1.45
Rx=2.07
Ry=.27
|R|=2.1
R∅=7.43°

R=2.1miles@7.43°

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10. Rx=-9.9
Ax=-8.46
Ry=9.9
Ay=-3.08
Bx=-1.44
By=12.98
|B|=13.06
B∅=-83.67°

B=13.06units@-83.67°

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11. **3@135 + 19@14 = NO**

NOy = 3sin135 + 19sin14
NOx = 3cos125 + 19cos14
Square root of NOy^2 +NOx^2 = magnitude = 18.014
18.014 at 68.1º

12.
5@25 = 10.86@x + 6@170
x = arcsin((5cos25-6cos170)/10.86)
x = 16.7 degrees

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13. 1. X_1 Y_1
Cos(30)=x/10 Sin(30)=y/10
X=10cos(30) Y=10sin(30)
8.66 5
2. X_2 Y_2
Cos(-15)=x/25 Sin(-15)=y/25
X=25cos(-15) Y=25sin(-15)
24.15 -6.47
X_r=8.66+24.15
X_r=32.81
Y_r=5-6.47
Y_r= -1.47

h=32.8
tanΘ=(-1.47/32.81)
Θ=$\tan^{-1}$(-1.47/32.81)
Θ= -2.6
32.8 @-2.6°

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14. Vf=$\sqrt{Vx^2 + Vy^2}$
Vf=$\sqrt{122500 + 250000}$
Vf=610.328 meters (aprox.)
Vf angle=$\tan^{-1}$(Vy/Vx)
Angle=$\tan^{-1}$(500/350)
Vf angle=55.008˚

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15. Vy= 500 + 230sin30
Vy= 615 meters
Vx= 250 + (-400) + 230cos30
Vy= 149.2 meters

V = root(Vy^2 x Vx^2)
V = 632.8 meters
Angle = arctan(149.2/615)
Angle = 76 degrees

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16. Vy=350sin35
Vy=200.75 meters
Vx=350cos35
Vx=286.7 meters
You travel 286.7 meters east, then 200.75 meters north.

17.

Vy= 632.8sin76 +200.8 + 450sin50 + 200sin110
Vy= 1347.5 meters
Vx= 632.8cos76 + 286.7 +450cos50 + 200cos110
Vy= 660.6 meters
V = root(Vy^2 x Vx^2)
V = 1500 meters
Angle = arctan(1347.5/660.6)
Angle = 63.9 degrees

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18. Vy=525sin-25
Vy= -221.8746 meters
Vx=525cos-25
Vx=475.812 meters
You travel 221.875 meters south, then 475.812 meters east.

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19. Vy=250sin35
Vy= 143.4 meters
Vx=250cos35
Vx=204.79 meters
You travel 143.4 meters north, then 204.79 meters east.

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20. (45i +0j) + (-25i + 0j) + (0i + 10) + ((17cos225)i + (17sin225)j) = ?
(45i +0j) + (-25i + 0j) + (0i + 100j) + (-12i – 9.9j) = ?
8i - 2j
8^2 + 2^2 = 68
root68=8.25
arctan (2/8)= x

X= 14 degres

Winston is 8 miles away from his house, .14 degrees above east.
He has clearly not reached Maddy's house.

21.

A + B = C
A = 98 meters at 54º South of West
A_X = 98cos(54) = 57.6
A_Y = 98sin(54) = 79.28

B = 146 meters at 21º North of West
B_X = 146cos(21) = 136.3
B_Y = 146sin(21) = 52.3

$A_X + B_X = C_X$
57.6 + 136.6 = 194.2

$A_Y + B_Y = C_Y$
79.28 + 52.3 = 131.58

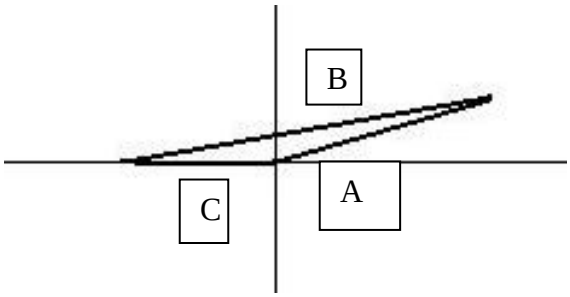
$(C_X)^2 + (C_Y)^2 = C^2$
$194.2^2 + 131.58^2 = C^2$
$55026.9364 = C^2$
234.58 meters = C

Θ = arctan(131.58/194.2)
Θ = 34º South of West

The boy needs to walk 234.58 meters at 34º South of West to reach his toy car on a straight path.

22.

Solution:
Mr. Laba's vector will be named vector A; The students' vector, vector B; the distance between the students and Mr. Laba, vector C.



So, **A** – **B** = **C**
X =vt
Mr. Laba: x = (2 m/s)(10s), x = 20m
Students: x = (3 m/s)(10s), x = 30m
Ax = 20cos30 Ay= 20sin30
Bx= 30cosA By= 30sinA
Cx= 14 Cy= 0
0 = 20sin30 – 30sinA
30sinA = 20sin30
sinA = 2/3(sin30)
sinA = 1/3
A = $\sin^{-1}$ 1/3
A = 19.47 degrees

23.

Solution:
Ax = 187cos44 Ay = 187sin44
Bx = 113cos56 By = 113sin56
Rx = 197.71 m Ry = 223.58 m
$|R|^2 = Rx^2 + Ry^2$
$|R|^2$ = 39089.244 + 49988.0164 = 89077.261
|R| = 298.46 m
<R = $\tan^{-1}$ (223.58/197.71) = 48.51 degrees

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24. Ax = 34.67cos67
Bx = 56.78cos132
Rx = 13.54 - 37.99 = -24.45 m
Ay = 34.67sin67
By = 56.78sin132
Ry = 31.91 + 42.20 = 74.11 m
|R| = sqrt (597.8 m2 + 5492 m2)
|R| = 78 m
<R = tan-1 (74.11 m/-24.45 m)
<R = -71.74 degrees + 180 degrees = 108.26 degrees

25.
A= 45 steps at 35 degrees

A= 36.86i + 25.81j
B= 155 steps at 105 degrees
B= -40.12i + 149.72j
A+B= -3.3i steps + 175.53j steps
No; Luigi had to travel much farther than needed.

26.

A)
75i + 37i = 112i
-30j + 10j = -20j
A+B = 112i - 20j
B)
A+B= Square root(112^2 + 20^2)
inverse tan(-20/112)
A+B = 113.8 at -10.1 degrees

27.

A= 50 yards at 25 degrees
A= 45.32i + 21.13j
B=75 yards at 95 degrees
B= 38.78i + 95.84j
A+B= 38.78i yards + 95.84j yards

28.

$X_x = 35.4 \cos 14.5 = 34.27$
$X_Y = 35.4 \sin 14.5 = 8.86$

$C_X = .28 \cos 321.2 = .218$
$C_Y = .28 \sin 32.1.2 = -.175$

$R_X = X_x + C_X = 34.27 + .218$
$R_X = 34.488$

$R_Y = X_Y + C_Y = 8.86 + (-.175)$
$R_Y = 8.685$

$R^2 = (34.488)^2 + (8.685)^2$
$R^2 = 1189.4 + 75.43$
$R^2 = 1264.85$
$R = 35.56$

Θ = arctan (34.488/8.685)
Θ = 75.87º

X + C = 35.56 @ 75.87º

29.

X + Y = Z
X steps @ xº + 32 @ 110º = 78 @ 97º
78 @ 97º - 32 @ 110º = X steps @ xº

Z_X = 78cos97 = -9.5
Z_Y = 78sin97 = 77.4

Y_X = -32cos110 = 10.94
Y_Y = -32sin110 = -30.07

$Z_X + Y_X = X_X$
-9.5 + 10.94 = 1.44

$Z_Y + Y_Y = X_Y$
77.4 + (-30.07) = 47.33

$X^2 = 47.33^2 + 1.44^2$
X^2 = 2242.2
X = 47.35

Θ = arctan(1.44/47.33)
Θ = 1.74º
90+1.74 = 91.74

47.35 steps @ 91.74º

30.

X_1 = 40cos(20) = 37.59

Y_1 = 40sin(20) = 13.68

X_2 = 71cos(80) = 12.33

Y_2 = 71sin(80) = 69.92

37.59 + 12.33 = 49.92

13.68 + 69.92 = 83.6

Sqrt($49.92^2 + 83.6^2$) = 97.37

Arctan(83.6/49.92) = 59.16

97.37 units @ 59.16 degrees

31.

$B_x = 41 \cos 146 = -33.99$
$B_Y = 41 \sin 146 = 22.93$

$R_X = 400 \cos 355 = 398.48$
$R_Y = 400 \sin 355 = -34.86$

$C_X = B_x + R_X = -33.99 + .398.48$
$C_X = 364.49$

$C_Y = B_Y + R_Y = 22.93 + (-34.86)$
$C_Y = -11.9$

$C^2 = (364.49)^2 + (-11.9)^2$
$C^2 = 132852 + 141.61$
$C^2 = 132993$
$C = 364.68$

$\Theta = \arctan (-11.9/364.49)$
$\Theta = -1.87 + 360 = 358.13$

$B + R = 364.68 @ 358.13^o$

32.

x1:45cos35=36.9
x2:70cos60=35
x1+2=71.9

y1:4sin35=25.8
y2:70sin60=60.62
Y1+2=86.42
Square add root
-tan86.42/71.9=50.2
112.4 at 50.2 degrees

33.

Bowser=
x1:40cos30=34.64
x2:60cos80=10.42
x1+2=45
y1:40sin30=20
y2:60sin80=59
y1+2=79
Square add root
-tan79/45=60.3
91 at 60.3 degrees
no he will go too far

34.

x1: 90cos45=63.64
x2: 120cos75=31.1
x1+2=94.74
y1: 90sin45=63.64
y2:120sin75=115.9
Y1+2= 179.6
Square add root= 203m
-tan94.7/179.6=79.3
203m at 79.3 degrees

35.

x1:50cos160=-47
x2:90cos45=63.6
x1+2=16.6
y1:50sin160=17.1
y2:90sin45=63.6
Y1+2=80.7
Square add root
-tan80.7/16.6= 78.8

82.4 at 78.8 degrees

36.

x1:120cos70=41.04
X2:150cos80=26.04
x1+2=67.08
y1:120sin70=112.8
y2:150sin80=147.7
y1+2=260.5
Square add root
-tan260.5/67.08= 75.6
268 at 75.6 degrees

37.

x1:30cos30=26
x2:75cos75=19.4
x1+2=45.4
y1=30sin30=15
y2:75sin75=72.4
y1+2=87.44
Square add root
-tan87.44/45.4=62.6 degrees
98.5 at 62.6 degrees

38.

x1:85cos40=65.1
x2:50cos65=21.1
x1+2=86.2
y1:85sin40=54.6
y2:50sin65=45.3
y1+2=100
Square add root
-tan100/86.2=40.76
132 at 40.76 degrees