— Simulations using Parametric Equations —

A skier travels at $30 \frac{ft}{sec}$ down a 10° slope (17.6%) starting at location $(0, 50)$ feet.

At the same starting time, a friend throws a snowball from the same starting location $(0, 50)$ ft. at an angle of elevation (AOE) of 45° and initial velocity of $40 \frac{ft}{sec}$.

QUESTION: How close does the snowball come to the skier?

Snowball's position:

$$X_{1T} = 40\cos(45^\circ)\,t$$

$$Y_{1T} = -16.1\,t^2 + 40\sin(45^\circ)\,t + 50$$

Skier's position:

$$X_{2T} = 30\cos(10^\circ)\,t$$

$$Y_{2T} = -30\sin(10^\circ)\,t + 50$$

Distance between snowball & skier:

$$X_{3T} = 25t \leftarrow \text{dummy variable}$$

$$Y_{3T} = \sqrt{(X_{2T} - X_{1T})^2 + (Y_{2T} - Y_{1T})^2}$$

Window:

start time TMIN = 0

end time TMAX = 3

time step TSTEP = 0.1

Xmin = −50

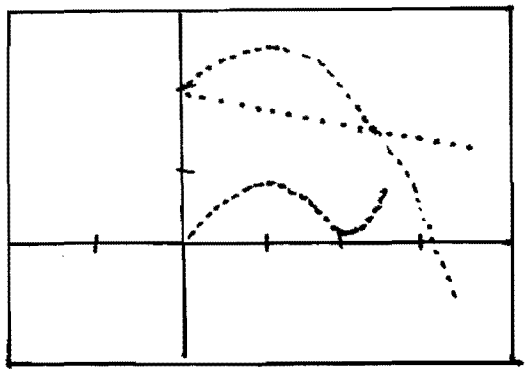
Xmax = 100

Xscl = 25

Ymin = −25

Ymax = 75

Yscl = 25



Answer to the question:

about 2.7' is the closest the snowball gets to the skier.

Math 112 (Sec 9.7)

Sailboat/Freighter Simulation Using Parametric Mode

Problem:

A sailboat traveling at 9 $\frac{mi.}{hr.}$ N 70° E starting at coordinates (25, 5) miles passes "near" a freighter. The ship moves at 11 $\frac{mi.}{hr.}$ S 20° W starting from coordinates (80 mi., 60 mi.).

How close do they come to each other? At what time does this occur?

Solution: Recall, distance = (rate)(time)

We separate x movement from y movement and use time, t, in hours as our independent parameter.

Sailboat: $X_1 = 25 + 9(\cos 20°)t$

$Y_1 = 5 + 9(\sin 20°)t$

Freighter: $X_2 = 80 + 11(\cos 250°)t$

$Y_2 = 60 + 11(\sin 250°)t$

$t_{min} = 0$

$t_{max} = 5.5$ hours,

$t_{step} = 0.1$ hour

$X_{min} = 0$

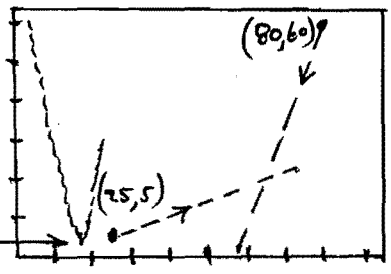
$X_{max} = 94$

$X_{scl} = 10$

$Y_{min} = 0$

$Y_{max} = 62$

$Y_{scl} = 10$



Distance between the boats can be displayed using the distance formula:

$X_3 = 4t$ ("spreads" out the sketch)

$Y_3 = \sqrt{((X_{2T} - X_{1T})^2 + (Y_{2T} - Y_{1T})^2)}$

Using Trace @ 4.3 hr. the boats are ≈ 3.64 mi. apart