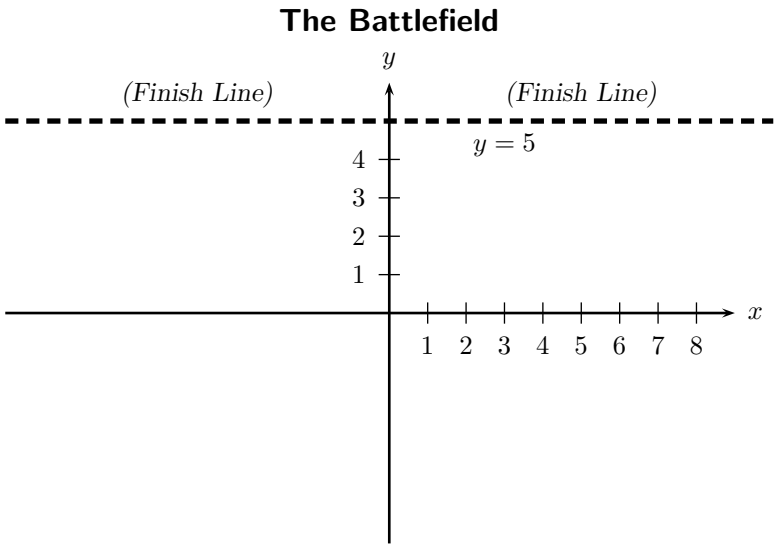
10. The newest FOX reality show, "BattleBugs: Clash of the Beetles" begins (at $t = 0$) with eight assorted insects placed randomly on a large mat (the "battlefield", pictured here), on which is marked a "finish line". The producers hoped that the bugs would battle to be first to cross the finish line, but instead they wander around, each according to its nature. The motion of each bug is described by the equations below. Both x and y are measured in inches.



Hercules Beetle $x(t) = \cos(t/2)$ $y(t) = \sin(t/2)$	**Ladybug** $x(t) = e^{-t}$ $y(t) = e^{-2t}$	**Tiger Beetle** $x(t) = 1 + t$ $y(t) = -1 + 8t$	**Longhorned Beetle** $x(t) = 3 + t$ $y(t) = 4 - t$
Dung Beetle $x(t) = t$ $y(t) = -2$	**Scarab** $x(t) = 2 - 7t$ $y(t) = -1 - 7t$	**June Beetle** $x(t) = 0$ $y(t) = -1$	**African Ground Beetle** $x(t) = \sin(t)$ $y(t) = \cos(t)$

Which bug (or bugs)...

(a) move repetitively?

The Hercules Beetle and African Ground Beetle move in circles. The others all move along lines, except for the ladybug.

(b) move fastest?

The Scarab Beetle moves fastest. Its velocity is $\sqrt{7^2 + 7^2} \approx 9.9$. This is faster than the Tiger Beetle, whose velocity is $\sqrt{1^2 + 8^2} \approx 8.1$.

(c) begin closest to the finish line?

$y(0)$ determines how close to the finish line a beetle starts. The Longhorned Beetle begins at $y = 4$, only one unit from victory. Unfortunately, it moves the wrong way.

(d) will reach the finish line first?

Most of the beetles either wander around or go in the wrong direction. The only one who actually moves consistently in the positive y direction (i.e., has $dy/dt > 0$) is the Tiger Beetle.

(e) will move very slowly (or not at all), in the long run?

The June Beetle doesn't move at all. The Ladybug gets slower and slower as she approaches the origin.