Pre-Calculus Notes

Parametrics - DAY TWO (Application)

We will now work some problems involving the APPLICATION of Parametric Equations.

Example 1: Chris can sprint at 28 feet per second. Jason sprints at 22 feet per second. Chris gives Jason a 30-foot head start.

a. Write a pair of parametric equations to represent EACH runner. Remember, \( d = rt \).

\[
egin{align*}
\text{CHRIS:} & \quad x_1 = 28t \\
& \quad y_1 = 3 \quad \uparrow \\
\text{JASON:} & \quad x_2 = 22t + 30 \\
& \quad y_2 = 5 \\
\end{align*}
\]

b. Find a viewing window to simulate a 100-yard dash. WATCH YOUR UNITS.

\[
\begin{align*}
\text{MIN} & : t_{\text{min}} = 0, t_{\text{max}} = 20, t_{\text{step}} = 0.5 \\
\text{MIN} & : x_{\text{min}} = 0, x_{\text{max}} = 300, x_{\text{step}} = 1 \\
\text{MIN} & : y_{\text{min}} = 0, y_{\text{max}} = 6, y_{\text{step}} = 1 \\
\end{align*}
\]

c. Who is ahead after 3 seconds? Who is ahead after 5 seconds? Who wins the race? What was the winner's time?

<table>
<thead>
<tr>
<th></th>
<th>3 seconds</th>
<th>5 seconds</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chris</td>
<td>84</td>
<td>140</td>
<td>Winner</td>
</tr>
<tr>
<td>Jason</td>
<td>96</td>
<td>140</td>
<td>Loser</td>
</tr>
</tbody>
</table>

Example 2: Anytown High School is planning a play. The script calls for two characters to meet on stage. Lauren starts at the point (0 feet, 7 feet) and travels 2 feet horizontally and 1 foot vertically every second. Alex starts at the point (4 feet, 0 feet) and travels vertically at the rate of 2 feet per second. If Alex and Lauren start walking at the same time, will they meet?

a. Use the GRID to graph each walk.

Lauren - orange
Alex - green

b. From the graph in part (a), can you determine if Alex and Lauren meet? EXPLAIN YOUR ANSWER.

\[ \text{Not precisely, unless I look} @ \text{points} \text{ plotted for each second} \]

\[ \text{Not accurate method} \]

\[ \text{What if meet @ fraction of second?} \]
c. Complete the table of values for Lauren and Alex.

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>Lauren</th>
<th>Alex</th>
</tr>
</thead>
<tbody>
<tr>
<td>x (horizontal)</td>
<td>y (vertical)</td>
<td>x (horizontal)</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>t</td>
<td>7-t</td>
<td>2t</td>
</tr>
</tbody>
</table>

d. Can you tell from the table if Lauren and Alex meet? Explain your answer.

Not accurately → table only account for time in exact seconds. Again, they could meet at fraction of a second.

e. Write a pair of equations for Lauren's horizontal and vertical position in terms of the third variable, or parameter, time.

\[ x_1 = 2t \quad \text{and} \quad y_1 = 7-t \]

f. Write a pair of parametric equations for Alex's horizontal and vertical position in terms of the third variable, or parameter, time.

\[ x_2 = 4 \quad \text{and} \quad y_2 = 2t \]

g. The script is incorrect since Alex and Lauren do not meet on stage at the same time. The director of the play decided that Lauren and Alex should meet after 4 seconds. Write a new pair of parametric equations that will produce this result.

\[ \text{LAUREN:} \quad x_1 = 2t \quad \text{and} \quad y_1 = 8-t \]
\[ \text{ALEX:} \quad x_2 = 8 \quad \text{and} \quad y_2 = t \]

⇒ now meet up @ (8, 4) and 4 seconds

*Can also change starting positions