7.RP Gym Membership Plans

Alignments to Content Standards: 7.RP.A.2.a  7.RP.A.2.c

Task

In January, Georgia signed up for a membership at Anytime Fitness. The plan she chose cost $95 in start-up fees and then $20 per month starting in February. Edwin also signed up at Anytime Fitness in January. His plan cost $35 per month starting in February, and his start-up fees were waived.

a. Create tables for both Georgia and Edwin that compare the number of months since January to the total cost of their gym memberships. Continue this table for one year.

b. Plot the points from the two tables in part (a) on a coordinate plane.

c. Decide if either or both gym memberships are described by a proportional relationship, and write an equation representing any such relationship. Explain how parts (a) and (b) could be used to support your answer.

IM Commentary

In this task, students are presented with two situations in a single context and asked which one represents a proportional relationship. Students are asked to understand this proportional relationship from a variety of perspectives -- a table, a graph, a verbal context, and an equation. As such, this task might be used as a synthesis of these various perspectives that one learns about when studying proportional relationships. Alternatively, it could be used as an introduction to the various ways one might be presented with a proportional relationship. In this case, instructors should be prepared for students who may not be familiar with using one of the perspectives (in particular, tables of values).
Solution

a. The table for Georgia's gym membership cost for 12 months is below:

<table>
<thead>
<tr>
<th>number of months since January</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>total cost of Georgia's gym membership</td>
<td>95</td>
<td>115</td>
<td>135</td>
<td>155</td>
<td>175</td>
<td>195</td>
<td>215</td>
<td>235</td>
<td>255</td>
<td>275</td>
<td>295</td>
<td>315</td>
</tr>
</tbody>
</table>

The table for Edwin's gym membership cost for 12 months is below:

<table>
<thead>
<tr>
<th>number of months since January</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>total cost of Edwin's gym membership</td>
<td>0</td>
<td>35</td>
<td>70</td>
<td>105</td>
<td>140</td>
<td>175</td>
<td>210</td>
<td>245</td>
<td>280</td>
<td>315</td>
<td>350</td>
<td>385</td>
</tr>
</tbody>
</table>

b. We plot the points from the two tables in part (a) on the coordinate axes below, where number of months since January is on the horizontal axis and the total cost is on the vertical axis. The red dashed line contains Edwin's table of values and the blue dashed line contains the values from Georgia's table.

Note that we are connecting the plotted points with a dashed line only to better see the general trend. Since this is actually discrete data a solid line would not be a suitable representation.
c. Georgia's plan does not represent a proportional relationship, and Edwin's plan does represent a proportional relationship. That Edwin's plan is proportional can be seen from the table by observing that whenever we multiply the number of months by a constant, the total cost multiplies by that same constant -- for example, doubling the number of months from 3 to 6 has the effect of doubling the cost from $105 to $210. This does not hold true for Georgia's plan, as can be seen by similarly doubling.

We could also see this from our response to part (b). Proportional relationships can be visualized graphically as being described by lines that go through the origin. Since Edwin's line (in red above) does go through the origin, it describes a proportional relationship, and likewise, Georgia's does not.

Finally, we find an equation to describe Edwin's plan. Since his relationship is proportional, every one month that passes will cost him $35. So after $n$ months, he will have paid $35 dollars $n$ times, for a total cost of $35n$ dollars. Thus the total cost $c$ of Edwin's plan is related to the number of months passed by the equation $c = 35n$. 