Rational Equations Word Problems

1. Anne and Maria play tennis almost every weekend. So far, Anne has won 12 out of 20 matches.

a) How many matches will Anne have to win in a row to improve her winning percentage to 75%?

b) How many matches will Anne have to win in a row to improve her winning percentage to 90%?

Rational Equations Word Problems

c) Can Anne reach a winning percentage of 100%?

d) After Anne has reached a winning percentage of 90% by winning consecutive matches as in part (b), how many matches can she now lose in a row to have a winning percentage of 50%?

Rational Equations Word Problems

1. Anne and Maria play tennis almost every weekend. So far, Anne has won 12 out of 20 matches.

a) How many matches will Anne have to win in a row to improve her winning percentage to 75%?

Suppose that Anne has already won 12 of 20 matches, and let m represent the number of additional matches she must win to raise her winning percentage to 75%. After playing and winning all of those additional m matches, she has won $12 + m$ matches out of a total of $20 + m$ matches played. Her winning percentage is then $\frac{12+m}{20+m}$, and we want to find the value of m that solves the equation

$$\frac{12 + m}{20 + m} = 0.75.$$

Multiply both sides by $20 + m$.

$$12 + m = 0.75(20 + m)$$
$$12 + m = 15 + 0.75m$$

Solve for m:

$$0.25m = 3$$
$$m = 12$$

So, Anne would need to win 12 matches in a row in order to improve her winning percentage to 75%.

b) How many matches will Anne have to win in a row to improve her winning percentage to 90%?

This situation is similar to that for part (a), except that we want a winning percentage of 0.90, instead of 0.75. Again, we let m represent the number of matches Anne must win consecutively to bring her winning percentage up to 90%.

$$\frac{12 + m}{20 + m} = 0.90$$

Solve for m:

$$12 + m = 0.90(20 + m)$$
$$12 + m = 18 + 0.90m$$
$$0.10m = 6$$
$$m = 60$$

In order for Anne to bring her winning percentage up to 90%, she would need to win the next 60 consecutive matches.

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c) Can Anne reach a winning percentage of 100%?

Allow students to come to the conclusion that Anne will never reach a winning percentage of 100% because she has already lost 8 matches.

d) After Anne has reached a winning percentage of 90% by winning consecutive matches as in part (b), how many matches can she now lose in a row to have a winning percentage of 50%?

Recall from part (b) that she had won 72 matches out of 80 to reach a winning percentage of 90%. We will now assume that she loses the next k matches in a row. Then, she will have won 72 matches out of $80 + k$ matches, and we want to know the value of k that makes this a 50% win rate.

$$\frac{72}{80 + k} = 0.50$$

Solving the equation:

$$72 = 0.50(80 + k)$$
$$72 = 40 + 0.50k$$
$$32 = 0.50k$$
$$64 = k$$

Thus, after reaching a 90% winning percentage in 80 matches, Anne can lose 64 matches in a row to drop to a 50% winning percentage.