

Solving Systems--Substitution with Differing Increments

Example:

Sue is charging her phone and tablet at the same time. The phone has 10% of a charge left and charges at a rate of 5% every 12 minutes. The tablet has a 30% charge left and charges at a rate of 10% every 30 minutes.

$$\begin{aligned} \frac{5\%}{12m} &= \frac{25\%}{60m} = \frac{25\%}{1h} \\ \frac{10\%}{30m} &= \frac{20\%}{60m} = \frac{20\%}{1h} \end{aligned}$$

a. Write a system of equations to represent this situation:

Phone Charge: $y = 25x + 10$ Tablet Charge: $y = 20x + 30$

b. What do the variables represent? $y = \text{total charge}$ $x = \text{\# of hours}$

c. Solve this system of equations and show your work.

$$\begin{aligned} 25x + 10 &= 20x + 30 \\ -20x &\quad -20x \\ \hline 5x + 10 &= 30 \\ -10 &\quad -10 \\ \hline 5x &= 20 \\ x &= 4 \end{aligned}$$

$$\begin{aligned} 20(4) + 30 &= 110 \\ 80 + 30 &= 110 \end{aligned}$$

d. When will the phone and tablet have the same charge? 4 hrs

e. What will the charge be? 110% (not possible)

f. Sketch a graph of this situation.

g. How long will it take for the phone to be fully charged? 3 hrs 36 min

$$\begin{aligned} 100 &= 25x + 10 \\ -10 &\quad -10 \\ \hline 90 &= 25x \\ \frac{90}{25} &= \frac{25x}{25} \\ x &= 3\frac{3}{5} \end{aligned}$$

h. How long will it take for the tablet to be fully charged? 3 hrs 30 min

$$\begin{aligned} 100 &= 20x + 30 \\ -30 &\quad -30 \\ \hline 70 &= 20x \\ \frac{70}{20} &= \frac{20x}{20} \\ x &= 3\frac{1}{2} \end{aligned}$$

