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MATH 100
Fall 2022
HW 10: Due 10/26

"Getting arrested, that makes people look guilty, even the innocent ones and innocent people get arrested every day."
　　　　　　　　　　　–James (Jimmy) McGill, Better Call Saul

Problem 1. (10pt) Jeffrey is writing a term paper. Currently, he has only written 8 pages. He returns from a writing break and then goes back to the paper. After an additional 5 hours of writing, he has written 20 pages.

(a) Assuming Jeffrey writes at a constant rate, find the linear function representing the number of pages that he has written after t hours of writing.

(b) How long after this break will it take him in total to write this 50 page term paper?

Solution.

(a) Assuming that Jeffrey writes at a constant rate, we know that the number of pages he has written, P, after t hours is a linear function. But then we know that $P(t) = mt + b$ for some m, b. We know that after 5 hours, he has written 20 pages. But then we have...

$$m = \frac{\Delta P}{\Delta t} = \frac{20}{5} = 4$$

But then $P(t) = 4t + b$. At the start, he has written 8 pages. Therefore, $(0, 8)$ is a point on the line $P(t)$. So we know...

$$P(t) = 4t + b$$

$$P(0) = 4(0) + b$$

$$8 = 0 + b$$

$$b = 8$$

Therefore, $P(t) = 4t + 8$.

(b) If he needs to write 50 pages, then we have $P(t) = 50$. But then we have...

$$P(t) = 50$$

$$4t + 8 = 50$$

$$4t = 42$$

$$t = 10.5$$

Therefore, it will take Jeffrey 10.5 hours after his break to write the term paper.

Problem 2. (10pt) Richard is a tailor. He uses an automated sewing machine can create custom labels on jackets. Every 4 hours, it is able to stitch 26 jackets. Richard sets the machine going during the night and when he comes in the next morning it has stitched 80 jackets.

(a) Assuming the machine works at a constant rate, find the number of jackets, J, that the machine has stitched t hours from now.

(b) How many total jackets has the machine stitched 8 hours after opening?

Solution.

(a) Because the machine works at a constant rate, the number of jackets, J, it has produced after t hours is linear, i.e. $J(t)$ can be written in the form $J(t) = mt + b$ for some m, b. Because the machine produces 26 additional jackets every 4 hours, we know that the machine produces at a rate of $m = \frac{26}{4} = \frac{13}{2}$ jackets per hour. But then $J(t) = \frac{13}{2} t + b$. Using the fact that it currently has 80 jackets produced in the morning, i.e. $t = 0$, we know that $80 = J(0) = \frac{13}{2} \cdot 0 + b$ so that $b = 80$. But then $J(t) = \frac{13}{2} t + 80$.

(b) We have...
$$J(8) = \frac{13}{2} \cdot 8 + 80 = 52 + 80 = 132$$

Therefore, 8 hours after opening, the machine will have stitched a total of 132 jackets.