College Algebra w.B.A. — Joysheet 3
MAT 120, Spring 2014 — D. Ivanšić

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Show all your work!

1. (10pts) Last month Jane was paid $413.07. If her hourly pay is $8.43 and she gets time-and-a-half for working overtime (that is, her hourly wage is 50% higher for hours worked beyond 40), how many hours did Jane work? Write the meaning of your variable.

x = hours Jane worked

$8.43 \cdot 40 + \underbrace{8.43 \cdot 1.5}_{\text{hourly wage 50\% higher}} \cdot (x - 40) = 413.07$

$337.20 + 12.645x - 505.80 = 413.07$

$12.645x = 413.07 + 505.80 - 337.20$

$12.645x = 581.67 \mid \div 12.645$

$x = 46$

Jane worked 46 hours

2. (10pts) The revenue of a company (in thousands) can be approximated by the formula $R = -.13t^2 + 7.4t + 15.68$, where $3 < t < 15$ and $t = 3$ corresponds to year 2003.
a) What is the revenue in 2010?
b) When will revenue be $89,500?

a) $t = 10$

$R = -.13 \cdot 100 + 7.4 \cdot 10 + 15.68$

$= -13 + 74 + 15.68 = 76.68$ thousand

$R = 76,680$

b) $89.5 = -0.13t^2 + 7.4t + 15.68 \mid -89.5$

$0 = -0.13t^2 + 7.4t - 73.82 \mid \cdot(-1)$

$0.13t^2 - 7.4t + 73.82 = 0$

$t = \dfrac{-(-7.4) \pm \sqrt{(-7.4)^2 - 4 \cdot 0.13 \cdot 73.82}}{2 \cdot 0.13}$

$= \dfrac{7.4 \pm \sqrt{16.3736}}{0.26} = \begin{matrix} 44.024\ldots \\ 12.898\ldots \end{matrix}$ ← not in $(3, 15)$ so not a solution

$t = 12.898344 \approx 13$

Around 2013

3. (12pts) How many liters of pure antifreeze must be mixed with 4 liters of a 12% solution of antifreeze in order to get an 20% solution? Write the meaning of your variable.

x	+	4	=	$x+4$
100%		12%		20%

x = liters of pure antifreeze

$x + 0.12 \cdot 4 = 0.2(x + 4)$

$x + 0.48 = 0.2x + 0.8 \mid -0.2x - 0.48$

$0.8x = 0.32$

$x = \dfrac{0.32}{0.8} = 0.4$ liters

4. (14pts) Runners Fernando and Maria live 5 miles apart. One day, they decide to exercise by running toward each other. Maria runs 1mph faster than Fernando, and they meet in 18 minutes. Write the meaning of your variables as you solve:
a) How fast does each of them run?
b) How far from Maria's house do they meet?

r = Fernando's rate (mph)
$r+1$ = Maria's rate (mph)
$18\text{min} = \frac{18}{60}\text{hours} = \frac{3}{10} = 0.3$

a) $5 = \underbrace{0.3 \cdot r}_{\text{how far F runs}} + \underbrace{0.3(r+1)}_{\text{how far M runs}}$

$5 = 0.3r + 0.3r + 0.3$

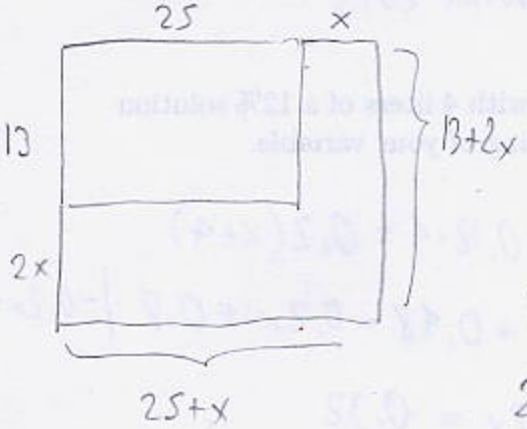
$4.7 = 0.6r$

$r = \frac{4.7}{0.6} = 7.833333$

Fernando runs 7.833333 mph
Maria runs 8.833333 mph

b) $0.3 \cdot 8.833333 = 2.65$ miles

5. (14pts) Harry has a plot of land 13 meters wide and 25 meters long. He wants to extend it to get a plot of area 500 square meters by increasing the width and length. If the increase in width has to be twice the increase in length, by how much is he increasing each to achieve the desired area? Write the meaning of your variable.



x = amount (meters) by which length is increased

$2x$ = width

$(25+x)(13+2x) = 500$

$325 + 63x + 2x^2 = 500$

$2x^2 + 63x - 175 = 0$

$x = \frac{-63 \pm \sqrt{63^2 - 4 \cdot 2 \cdot (-175)}}{2 \cdot 2}$

$= \frac{-63 \pm \sqrt{5369}}{4}$

$x = \frac{-63+\sqrt{5369}}{4} = 2.568365$

only sol. since $\frac{-63-\sqrt{5369}}{4} < 0$

Increase length by 2.568365
width by 5.136730