

Math 102 - Spring 2013 - Test 1

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Name: Ker

Instructions. Only calculators are allowed on this examination. Each problem is worth 11 points, unless otherwise specified. Always use the appropriate wording and units of measure in your answers (when applicable).

SHOW YOUR WORK NEATLY, PLEASE (no work, no credit).

1. A local hardware store charges a flat fee of \$25, plus \$10 per hour for the rental of a pickup. If it costs Ron \$55 to rent the pickup, how many hours did he keep it?

$$Y = \text{"\$ cost of renting X hours"} \quad Y = mx + b$$

$$\left. \begin{array}{l} \text{"Flat Fee"} = \text{"initial cost"} = \text{"Y-intercept"} = 25 \$ \\ \text{"Rate"} = \text{"cost per hour"} = 10 \$/\text{hr} = \text{"slope"} \end{array} \right\} \rightarrow Y = 10X + 25$$

$$\text{Cost} = 55 \rightarrow Y = 55 \rightarrow 55 = 10X + 25 \rightarrow \frac{10X}{10} = \frac{30}{10}$$

GRAPH

$\rightarrow X = 3 \text{ HOURS}$

2. Write the equation of the line passing through the points (2, -1) and (3, 4).

$$\text{SLOPE} = \frac{\text{CHANGE OF } Y}{\text{CHANGE OF } X} = \frac{-1 - 4}{2 - 3} = \frac{-5}{-1} = 5 \rightarrow m = 5$$

$$\rightarrow Y = 5X + b$$

plug point: $X = 2, Y = -1$

$$\rightarrow -1 = 5(2) + b \rightarrow b = -11$$

EQ. LINE: $Y = 5X - 11$

NOTE: 2-POINTS FORM $Y - Y_1 = \frac{Y_2 - Y_1}{X_2 - X_1} (X - X_1)$ MUST BE CHANGED TO SLOPE-INTERCEPT FORM, $Y = mx + b$, WHICH IS THE EQUATION OF A STRAIGHT LINE.

3. Write the equation of the line passing through $(-1, 2)$ and perpendicular to the line $4x - 2y = 3$.

$$\begin{aligned} \text{SLOPE OF } L_1: 4x - 2y &= 3 \rightarrow -2y = -4x + 3 \rightarrow y = \frac{-4x + 3}{-2} \\ \rightarrow y &= 2x - \frac{3}{2} \rightarrow \text{"SLOPE OF } L_1" = 2 \rightarrow \text{SLOPE OF OUR LINE IS} \\ m &= -\frac{1}{2} \rightarrow y = -\frac{1}{2}x + b \rightarrow 2 = -\frac{1}{2}(-1) + b \rightarrow \\ \text{PLUG POINT: } x &= -1, y = 2 \rightarrow -\frac{1}{2}(-1) = \frac{1}{2} \\ \rightarrow \frac{3}{2} &= b \rightarrow \text{EQ. LINE: } y = -\frac{1}{2}x + \frac{3}{2} \end{aligned}$$

4. A famous oil painting was purchased for \$250,000 and it is expected to double in value in 5 years. Compute the appreciation rate of this painting. Find the linear model giving the appreciation equation, so that x is the number of years after the purchase of the painting and y is the value of the painting in thousand dollars.

$$\begin{aligned} \text{"DOUBLES VALUE IN 5 YEARS"} &= 2(250000) = 500000 \\ \text{APPRECIATION RATE} &= \frac{\text{"EXTRA VALUE"}}{\text{TIME CHANGE}} = \frac{\text{CHANGE OF } Y}{\text{CHANGE OF } X} = \frac{250000}{5} = 50000 \text{ \$ / YEAR} \\ Y &= \text{VALUE OF PAINTING IN THOUSAND DOLLARS} \rightarrow \text{RATE IN THOUSAND \$ / YEAR} \rightarrow \\ \rightarrow m &= 50 \\ \text{"INITIAL VALUE"} &= b = 250 \rightarrow y = 50x + 250 \end{aligned}$$

5. Write the slope-intercept form of the line $3x - 4y = 12$.

Solve for y: $\frac{-4y}{-4} = \frac{-3x + 12}{-4} \rightarrow y = \frac{3}{4}x - 3$

6. Write the equation of the horizontal line passing through $(2, \frac{3}{2})$.

HORIZONTAL LINE $\rightarrow m=0 \rightarrow y=b \rightarrow y = \frac{3}{2}$

7. Solve the system of linear equations $\begin{cases} 10x - y = 2 \\ 5x + 2y = -1 \end{cases}$

BY ELIMINATION:

2EQ1: $20x - 2y = 4$

EQ2: $5x + 2y = -1$

SUM $\frac{25x}{25} = 3 \rightarrow x = \frac{3}{25}$

Solution: $(\frac{3}{25}, -\frac{4}{5})$

OR $\approx (.12, -.8)$

PLUG IN EQ1: $10(\frac{3}{25}) - y = 2 \rightarrow \frac{6}{5} - y = 2 \rightarrow y = -\frac{4}{5}$

CHECK IN EQ2: $5(\frac{3}{25}) + 2(-\frac{4}{5}) = \frac{3}{5} - \frac{8}{5} = -\frac{5}{5} = -1 \checkmark$

8. (12 points) A pharmacist wants to mix two solutions to obtain 450cc of a solution that has a 18% concentration of a certain medicine. If one solution has a 10% concentration of the medicine and the second has a 25% concentration, how much of each solution should she mix?

$X = \text{CC OF SOLUTION AT } 10\%$; $Y = \text{CC OF SOLUTION AT } 25\%$

"TOTALS EQUATION" : $X + Y = 450$

"STICK RATES" : $.1X + .25Y = .18(450)$ $\rightarrow \begin{cases} X + Y = 450 \\ .1X + .25Y = 81 \end{cases}$

BY SUBSTITUTION: EQ 1 $\rightarrow Y = 450 - X \rightarrow$ PLUG IN EQ 2:

$$.1X + .25(450 - X) = 81 \rightarrow .1X + 112.5 - .25X = 81 \quad \begin{array}{r} -112.5 \\ -112.5 \end{array} \rightarrow$$

$$\rightarrow \begin{array}{r} -.15X = -31.5 \\ \hline -.15 \quad \hline \end{array} \rightarrow X = 210 \text{ CC} \rightarrow \text{PLUG IN STEP 1:}$$

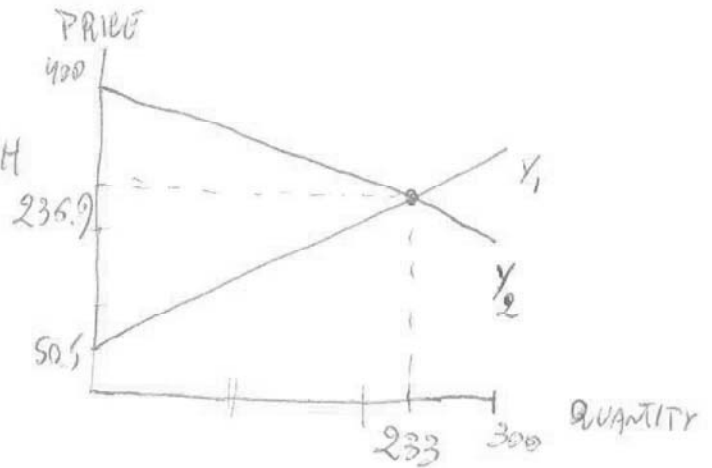
$$Y = 450 - 210 = 240 \text{ CC}$$

9. Wholesalers' willingness to sell laser printers is given by the supply function $p = 50.5 + .8q$, and retailers' willingness to buy the printers is given by the demand function $p = 400 - .7q$, where p is the price per printer in dollars and q is the number of printers. What price will give market equilibrium for these printers and what quantity will provide it?

MARKET EQUILIBRIUM = "DEMAND AND SUPPLY FUNCTIONS INTERSECT" →

$$\begin{array}{l} Y_1 \\ \rightarrow \\ Y_2 \end{array} \left\{ \begin{array}{l} p = 50.5 + .8q \\ p = 400 - .7q \end{array} \right.$$

BY GRAPH



$$\boxed{2ND} + \boxed{TRACE} + \boxed{5}$$

INTERSECTION: $(233, 236.9)$

EQUILIBRIUM PRICE = 236.9 \$/PRINTER

EQUILIBRIUM QUANTITY = 233 PRINTERS