

Math 102 - Fall 2011 - Test 1

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Name

Key

**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 supermarket charges a flat rate of \$5, plus \$3 per hour for rental of a carpet cleaner. If it cost Ron \$26 to rent the machine, how many hours did he keep it?

$X = \text{HOURS OF RENTAL}$   
 $Y = \text{RENTAL COST IN \$}$

FLAT RATE =  $Y$ -INTERCEPT = 5

HOURLY RATE = SLOPE = 3

IT IS ASKED FOR  $X$  SUCH  
 THAT  $Y = f(X) = 26$ .

MODEL:  $Y = 3X + 5$

SOLVE  $\begin{cases} Y = 3X + 5 \\ Y = 26 \end{cases}$

OR  $3X + 5 = 26 \rightarrow 3X = 26 - 5$

$\rightarrow \frac{3X}{3} = \frac{21}{3} \rightarrow X = 7$  HOURS OF RENTAL.

2. Write the equation of the line passing through the points  $(-1, 3)$  and  $(2, 5)$ .

$$\text{SLOPE} = \frac{Y_2 - Y_1}{X_2 - X_1} = \frac{5 - 3}{2 - (-1)} = \frac{2}{3}$$

$$Y = mx + b \rightarrow Y = \frac{2}{3}x + b \quad \rightarrow 5 = \frac{2}{3}(2) + b$$

PLUG A POINT:  $X = 2, Y = 5$

$$b = 5 - \frac{4}{3} = \frac{11}{3} \rightarrow Y = \frac{2}{3}X + \frac{11}{3}$$

3. Write the equation of the line passing through  $(4, 0)$  and perpendicular to the line  $4x + 3y = 5$ .

$$\text{SLOPE OF } 4x + 3y = 5 \rightarrow 3y = -4x + 5 \rightarrow y = -\frac{4}{3}x + \frac{5}{3}$$

$$\text{SLOPE REQUIRED} = -\frac{1}{m} = -\left(-\frac{3}{4}\right) = \frac{3}{4}$$

$$(4, 0) \text{ PLUGGED IN } y = \frac{3}{4}x + b \rightarrow 0 = \frac{3}{4}(4) + b \rightarrow$$

$$\rightarrow b = -3 \rightarrow y = \frac{3}{4}x - 3$$

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.

$x$  = NUMBERS OF YEARS AFTER PURCHASE

$y$  = VALUE IN 1000'S DOLLARS

DATA: I) AT PURCHASE:  $x = 0$ ,  $y = 250$

II) AFTER 5 YEARS VALUE IS \$500,000:  $x = 5$ ,  $y = 500$

$$\text{APPRECIATION RATE} = \text{SLOPE} = \frac{500 - 250}{5 - 0} = \frac{250}{5} = 50 \text{ (THOUSAND DOLLARS PER YEAR)}$$

$$\text{MODEL: } y = 50x + 250 \text{ (IN THOUSAND DOLLARS)}$$

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

SOLVE FOR Y: 
$$\frac{-4Y}{-4} = \frac{-3X + 12}{-4}$$

$$Y = \frac{3}{4}X - 3$$

6. Write the equation of the vertical line passing through  $(-4, 6)$ .

VERTICAL LINE:  $X = C$   
 PWB POINT:  $-4 = C \rightarrow X = -4$

7. Solve the system of linear equations  $\begin{cases} 2x + y = 3 \\ 3x - 3y = 12 \end{cases}$

BY GRAPHING (SOLVE FOR Y BOTH) OR SUBSTITUTION (SOLVE EQ. 1 FOR Y)

HERE ELIMINATION:

$$\begin{array}{r} 3 \text{ EQ. 1: } 6X + 3Y = 9 \\ 3X - 3Y = 12 \\ \hline 9X = 21 \\ \hline \frac{9X}{9} = \frac{21}{9} \end{array}$$

$$X = \frac{7}{3}$$

PWB  
w/ EQ. 2

$$\begin{array}{r} 3\left(\frac{7}{3}\right) - 3Y = 12 \\ \downarrow \\ -3Y = \frac{12-7}{-3} \\ \hline Y = -\frac{5}{3} \end{array}$$

CHECK IN EQ. 1:  $2\left(\frac{7}{3}\right) + \left(-\frac{5}{3}\right) = \frac{14}{3} - \frac{5}{3} = \frac{9}{3} = 3 \quad \checkmark$

APPROX:  $X = 2.\overline{3}$   
 $Y = -1.\overline{6}$

8. (12 points) A pharmacist wants to mix two solutions to obtain 450 cc 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?

ITEM	QUANT CC	RATE %	Q · R VALUES
SOL 1	X	.10	.10X
SOL 2	Y	.25	.25Y
TOT	450	.18	450 · (.18)

$$\begin{array}{l} \downarrow \qquad \qquad \downarrow \\ \boxed{X + Y = 450} \quad \boxed{.10X + .25Y = 81} \\ \text{EQ 1} \qquad \qquad \text{EQ 2} \end{array}$$

$$\begin{array}{rcl} - .10 \text{ EQ 1:} & -.10X - .10Y & = -45 \\ \text{EQ 2:} & .10X + .25Y & = 81 \\ \hline \end{array}$$

$$\frac{.15Y}{.15} = \frac{36}{.15} \rightarrow Y = 240 \text{ CC}$$

$$\text{PLUG IN EQ 1: } \begin{array}{rcl} X + 240 & = & 450 \\ -240 & -240 & \\ \hline X & = & 210 \text{ CC} \end{array}$$

$$\text{CHECK EQ 2: } .10(210) + .25(240) = 21 + 60 = 81 \quad \checkmark$$

SHE NEEDS 210 SOLUTION AT 10% AND 240 CC SOLUTION AT 25%

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?

$$\begin{cases} p = 50.5 + .8q \\ p = 400 - .7q \end{cases}$$

BY GRAPHING, HERE BY SUBSTITUTION  
 $\boxed{QND} + \boxed{GRAPH} + \boxed{5} + 3 \text{ TIMES } \boxed{ENTER}$

$$\begin{array}{r} 50.5 + .8q = 400 - .7q \\ -50.5 + .7q \quad -50.5 + .7q \\ \hline \end{array}$$

$$\frac{1.5q}{1.5} = \frac{349.5}{1.5} \rightarrow q = 233 \quad \text{EQUILIBRIUM QUANTITY}$$

PLUG IN EQ 1:  $p = 50.5 + .8(233) = 236.9$

EQUILIBRIUM PRICE:  $p = \$236.90$

CHECK, EQ 2:  $400 - .7(233) = 236.9$  ✓