

# Math 099 - Summer 2011 - Test 1

Instructor: Dr. Francesco Strazzullo

Name KEY

**Instructions.** Only calculators are allowed on this examination. Point values of each problem are indicated. Always use the appropriate wording and units of measure in your answers (when applicable). **SHOW YOUR WORK NEATLY, PLEASE** (no work, no credit).

1. Write each sentence with an equation. Let  $x$  be the input. Let  $y$  be the output. The output is:

(a) (6pts) four more than a third of the input;

$$y = \frac{1}{3}x + 4$$

(b) (6pts) 5.3% of the input less than twenty;

$$5.3\% = \frac{5.3}{100} = .053 \quad ; \quad y = 20 - .053x$$

(c) (6pts) the reciprocal of twice the input, increased by one.

$$y = \frac{1}{2x} + 1$$

2. (18pts) The following is an input-output table, where the input  $x$  is the amount in pounds of Roma tomatoes bought at a wholesale and the output  $y$  is the cost charged.

$x$	$y$	model
$0 \leq x \leq 15$	1.05 dollars per pound plus a fixed cost of 1.50 dollars	$y = 1.05x + 1.50$
$15 < x \leq 50$	.95 dollars per pound plus a fixed cost of 1.65 dollars	$y = .95x + 1.65$
$x > 50$	.75 dollars per pound plus a fixed cost of 1.75 dollars	$y = .75x + 1.75$

Fill the third column, writing each rule with an equation in  $x$  and  $y$ , that is  $y =$  "algebraic expression in  $x$ ".

3. (16pts) In the setting of Exercise 2, use the following chart

$x$	$y$
$0 \leq x \leq 15$	$1.65x + 2.10$
$15 < x \leq 50$	$1.35x + 1.80$
$x > 50$	$1.15x + 1.50$

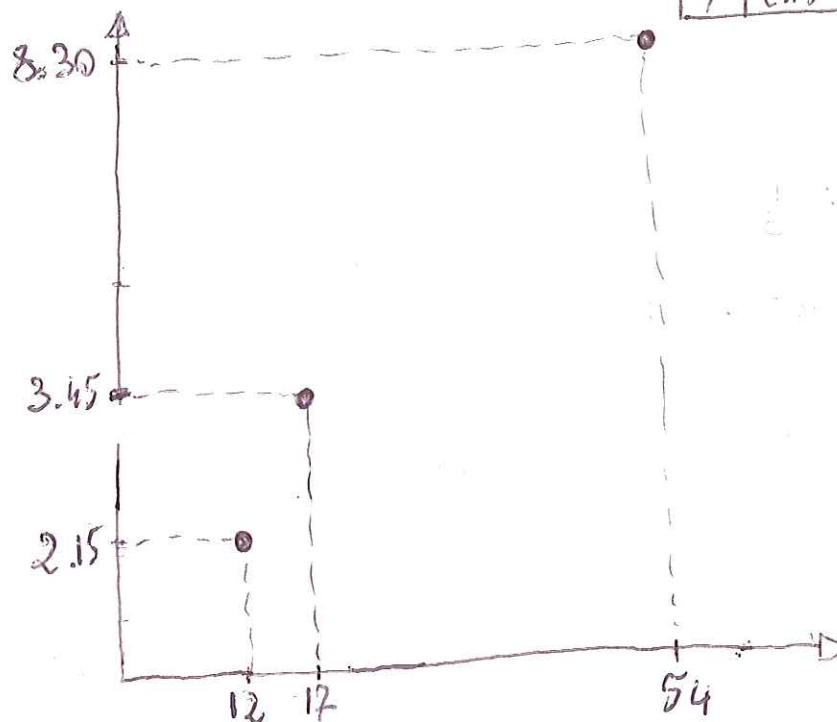
to calculate the costs for the following consumptions.

Weight	Cost
$0 \leq 15 \leq 15$ 15 lb	$1.65(15) + 2.10 = \$26.85$
$0 \leq 10 \leq 15$ 10 lb	$1.65(10) + 2.10 = \$18.60$
$60 > 50$ 60 lb	$1.15(60) + 1.50 = \$70.50$
$15 < 30 \leq 50$ 30 lb	$1.35(30) + 1.80 = \$42.30$

4. (18pts) At Groix chocolate rice cereals of your preferred brand come in three different packages as follows: 12 oz for \$2.15, 17 oz for \$3.45, and 54 oz for \$8.30. Graph the weight and cost for these packages as individual ordered pairs.

$X = \text{WEIGHT IN OZ}$  ;  $Y = \text{COST IN \$}$

X	12	17	54
Y	2.15	3.45	8.30



5. (16pts) Combine like terms in the following expressions:

(a)  $6 + 2x^3 - 5y - 9x^3 - 15 + y$

$$2x^3 - 9x^3 - 5y + y + 6 - 15$$

$$-7x^3 - 4y - 9$$

(b)  $x^2(2x - 3) - 4x^3 - 5x^2 + 3$

$$= x^2(2x) + x^2(-3) - 4x^3 - 5x^2 + 3$$

$$= 2x^3 - 3x^2 - 4x^3 - 5x^2 + 3$$

$$= -2x^3 - 8x^2 + 3$$

6. (14pts) Combine like terms in the expression  $a + 3.14c - 4.00c - 4\frac{1}{15} + \frac{5}{12}$ .

$$a + (3.14 - 4.00)c - \left(4 + \frac{1}{15}\right) + \frac{5}{12} = a - .86c + \frac{-61(4) + 5(5)}{60}$$

A CALC. CAN BE USED HERE

$$= a - .86c - \frac{4 \cdot 15 + 1}{15} + \frac{5}{12}$$

$$= a - .86c - \frac{61}{15} + \frac{5}{12}$$

LCD OF 15 = 5 · 3 AND 12 = 2 · 2 · 3

18 5 · 3 · 2 = 30

2

$$= a - .86c + \frac{-244 + 25}{60}$$

$$= a - .86c - \frac{219}{60} \text{ OR}$$

$$= a - .86c - 3.65 \text{ OR}$$

$$= a - .86c - 3\frac{13}{20}$$

# Math 099 - Summer 2011 - Test 2

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Name

Key

**Instructions.** Only calculators are allowed on this examination. Point values of each problem are indicated. Always use the appropriate wording and units of measure in your answers (when applicable). **SHOW YOUR WORK NEATLY, PLEASE** (no work, no credit).

1. Solve the following linear equations

(a) (15pts)  $4x + 6 = 2(1 + 3x) + 1$ .

$$\begin{aligned} 4x + 6 &= 2(1) + 2(3x) + 1 \\ 4x + 6 &= 2 + 6x + 1 \\ 4x + 6 &= 3 + 6x \\ -4x - 3 &\quad -3 - 4x \\ \hline 3 &= 2x \\ \frac{3}{2} &\quad \frac{2}{2} \\ x &= \frac{3}{2} \end{aligned}$$

CHECK:

$$\begin{aligned} 4\left(\frac{3}{2}\right) + 6 &\stackrel{?}{=} 2\left(1 + 3\left(\frac{3}{2}\right)\right) + 1 \\ 6 + 6 &\stackrel{?}{=} 2 + 2\left(\frac{9}{2}\right) + 1 \\ 12 &\stackrel{?}{=} 2 + 9 + 1 \quad \checkmark \end{aligned}$$

(b) (15pts)  $\frac{2}{3}(x - 1) = \frac{4}{15}x + 3$ .

LCD  $\left(\frac{2}{3}, \frac{4}{15}\right)$  is  $3 \cdot 5 = 15$

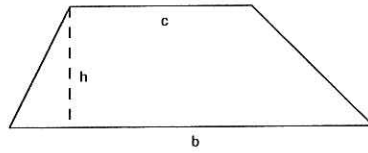
$$\begin{aligned} 15\left(\frac{2}{3}\right)(x - 1) &= 15\left(\frac{4}{15}x + 3\right) \\ 10(x - 1) &= 15\left(\frac{4}{15}x\right) + 15(3) \\ 10x - 10 &= 4x + 45 \\ -4x + 10 &\quad -4x + 10 \\ \hline 6x &= 55 \rightarrow x = 9\frac{1}{2} \\ &\quad \quad \quad = 9.5 \end{aligned}$$

CHECK:

$$\begin{aligned} \frac{2}{3}\left(\frac{55}{2} - 1\right) &\stackrel{?}{=} \frac{4}{15}\left(\frac{55}{2}\right) + 3 \\ \frac{2}{3}\left(\frac{55 - 2}{2}\right) &\stackrel{?}{=} \frac{2 \cdot 11}{3 \cdot 3} + 3 \\ \frac{1 \cdot 49}{3 \cdot 3} &\stackrel{?}{=} \frac{22}{9} + 3 \\ \frac{49}{9} &\stackrel{?}{=} \frac{22 + 27}{9} \quad \checkmark \end{aligned}$$

2. The formula for the area of a trapezoid is

$$A = \frac{1}{2}(b+c)h$$



(a) (15pts) Solve the above formula for c.

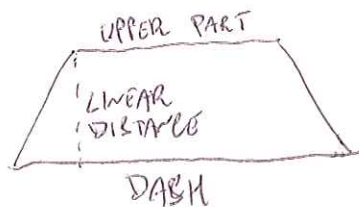
$$\begin{aligned} A &= \left(\frac{1}{2}b + \frac{1}{2}c\right)h \\ A &= \frac{1}{2}bh + \frac{1}{2}ch \\ -\frac{1}{2}bh & \quad -\frac{1}{2}bh \\ \hline A - \frac{1}{2}bh &= \frac{1}{2}ch \\ \left(\frac{2}{h}\right) \frac{1}{2}ch &= \frac{2}{h} \left(A - \frac{1}{2}bh\right) \\ c &= \frac{2A}{h} - b \end{aligned}$$

(b) (10pts) You can approximate the shape of your vehicle's windshield with a trapezoid whose area is  $13.5 \text{ ft}^2$ . Knowing that the dash of your vehicle is  $7 \text{ ft}$  and the linear distance between the dash and the roof is  $5 \text{ ft}$ , find the length of the upper part of your windshield.

WE CAN USE THE GIVEN FORMULA  $A = \frac{1}{2}(b+c)h$

OR THE ONE OBTAINED AT (a).

DATA:



$$\begin{aligned} c &= ? & h &= 5 \\ b &= 7 & A &= 13.5 \end{aligned}$$

$$\begin{aligned} \text{PLUG: } 13.5 &= \frac{1}{2}(7+c)(5) \\ 13.5 &= \left(\frac{7}{2} + \frac{1}{2}c\right)(5) \\ 13.5 &= \frac{35}{2} + \frac{5}{2}c \\ -12.5 & \quad -12.5 \\ \hline -4 &= \frac{5}{2}c \end{aligned}$$

$$-4 = \frac{5}{2}c \rightarrow c = -\frac{8}{5} = -1.6 \text{ FT}$$

THE UPPER PART OF THE WINDSHIELD SHOULD HAVE A NEGATIVE LENGTH, WHICH IS ABSURD. THE MODEL IS WRONG

ALGEBRAIC CHECK

$$13.5 \stackrel{?}{=} \frac{1}{2}(7-1.6)(5)$$

$$13.5 \stackrel{?}{=} \frac{1}{2}(5.4)(5)$$

$$13.5 = (2.7)(5) \quad \checkmark$$



3. (15pts) The total cost of an air-compressor rental is \$45 for the first day plus \$30 for each additional day. Write two equations with inputs for each described with an inequality. Define your variables so  $y$  depends on  $x$ .

INPUT:  $x$  DAYS OF RENTAL ; OUTPUT:  $y$  COST IN DOLLARS FOR RENTAL

$$y = \begin{cases} 45 & , 0 < x \leq 1 \\ 45 + 30(x-1) & , x > 1 \end{cases}$$

$x$  TOTAL DAYS,  $(x-1)$  DAYS AFTER THE FIRST DAY.

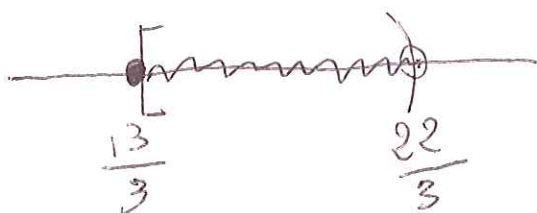
4. (15pts) Solve the inequality

$$-11 \geq -5x + 2(x+1) > -20$$

and graph its solution set, then write it in interval notation.

$$\begin{array}{r} -11 \geq -5x + 2x + 2 > -20 \\ -11 \geq -3x + 2 > -20 \\ \underline{-2} \quad \quad \quad \underline{-2} \quad \quad \underline{-2} \\ -13 \geq -3x > -22 \\ \underline{-3} \quad \quad \quad \underline{-3} \quad \quad \underline{-3} \end{array}$$

$$\frac{13}{3} \leq x < \frac{22}{3}$$



CHECK:  $x = 5$

$$\begin{array}{l} ? \\ -11 \geq -5(5) + 2(5+1) > -20 \\ ? \\ -11 \geq -25 + 2(6) > -20 \\ ? \\ -11 \geq -13 > -20 \quad \checkmark \end{array}$$

SOLUTION SET:

$$\left[ \frac{13}{3}, \frac{22}{3} \right)$$

or

$$[4.\bar{3}, 7.\bar{3})$$

5. (15pts) The conversion formula from Fahrenheit to Celsius degrees is

$$C = \frac{5}{9}(F - 32).$$

To melt iron, the temperature of a furnace must be at least  $1540^{\circ}\text{C}$  but at most  $1650^{\circ}\text{C}$ . What range of Fahrenheit temperatures must be maintained?

RANGE IN CELSIUS

$$1540 \leq C \leq 1650$$

↑                      ↓  
AT LEAST              AT MOST

PLUG FORMULA:

$$1540 \leq \frac{5}{9}(F - 32) \leq 1650$$

$$\left(\frac{9}{5}\right) 1540 \leq \left(\frac{9}{5}\right) \frac{5}{9}(F - 32) \leq \left(\frac{9}{5}\right) 1650$$

$$2772 \leq F - 32 \leq 2970$$

+32              +32              +32

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$$2804 \leq F \leq 3002$$

TO MELT IRON, THE TEMPERATURES OF A FURNACE MUST BE BETWEEN  
 $2804^{\circ}\text{F}$  AND  $3002^{\circ}\text{F}$ .