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- 1) Trevor has a job shoveling snow from roofs and driveways for the Labrador Inuit Association in Postville. It takes him one hour to shovel a driveway and thirty-five minutes to shovel a roof. Trevor's mom does not permit him to shovel snow for any more than 20 hours per week. If x represents the number of driveways and y represents the number of roofs, which inequality below best represents this constraint on Trevor?

- a) $1x + 35y \leq 20$
 b) $1x + 35y \geq 20$
 c) $60x + 35y \leq 1200$
 d) $60x + 35y \geq 1200$

60 minutes = 1 hour
 1200 minutes = 20 hours

- 2) In trying to simplify an inequality to slope-intercept form, Gregory made a slight error. In which step did the error first occur?

$$3x - 9y - 18 > 0$$

$$3x - 9y - 18 + 18 > 0 + 18 \dots \text{Step 1}$$

$$3x - 9y > 18$$

$$3x - 3x - 9y > 18 - 3x \dots \text{Step 2}$$

$$-9y > 18 - 3x \dots \text{Step 3}$$

$$\frac{-9y}{-9} > \frac{18}{-9} - \frac{3x}{-9} \dots \text{Step 4}$$

$$y > -2 + \frac{1}{3}x$$

Did not switch sign.

- a) 1
 b) 2
 c) 3
 d) 4

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- 3) Jamie is trying to do the same type of problem as Gregory and also has made a slight error. In which step did the error first occur?

$$-5x + 4y - 12 < 0$$

$$-5x + 4y - 12 + 12 < 0 + 12 \dots \text{Step 1}$$

$$-5x + 4y < 12 \dots \text{Step 2}$$

$$-5x + (5x) + 4y < 12 - (5x) \dots \text{Step 3}$$

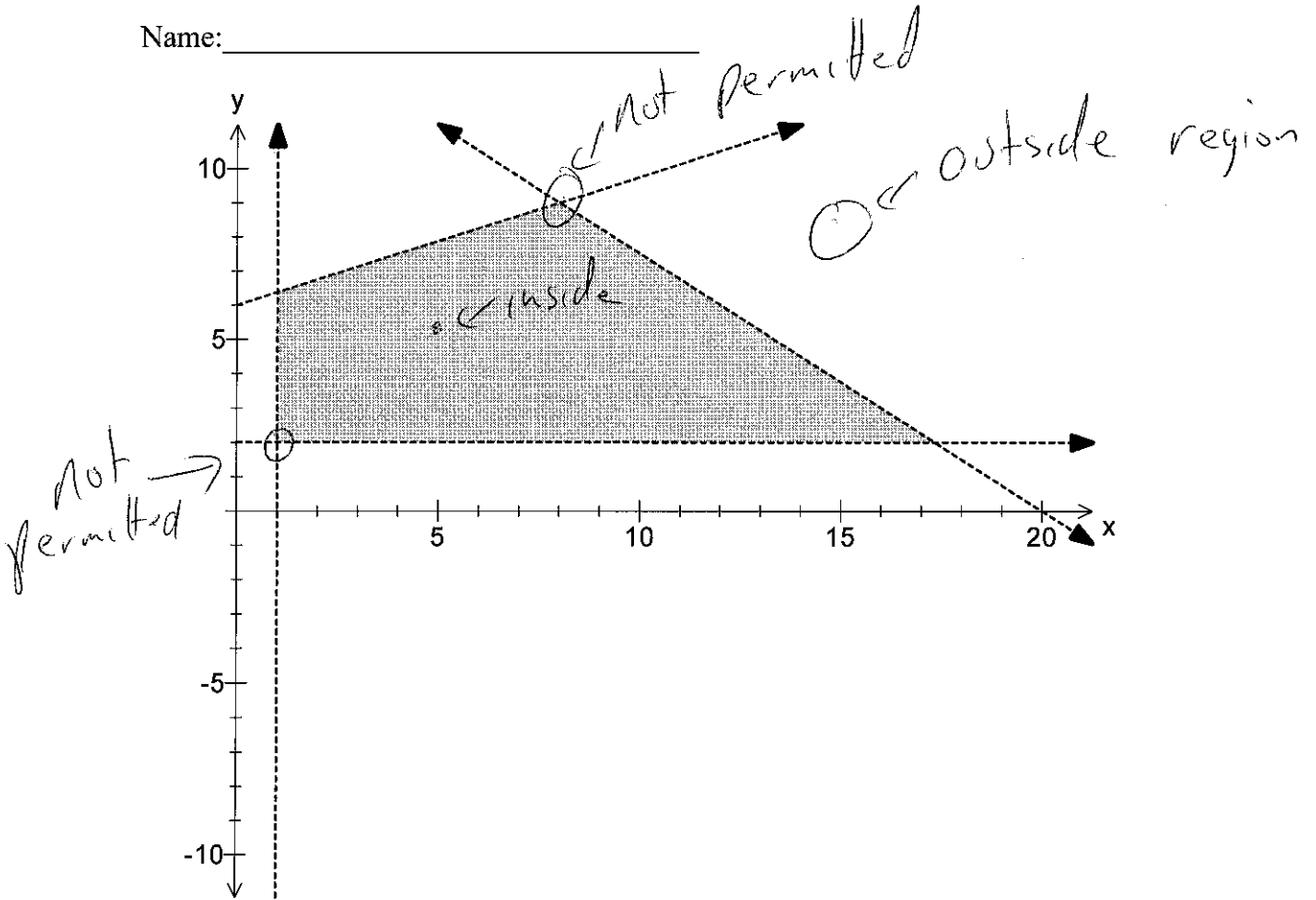
$$\frac{4y}{4} < \frac{12}{4} - \frac{5x}{4} \dots \text{Step 4}$$

$$y < 3 - \frac{5}{4}x$$

did not do
the opposite
on both
sides

- a) 1
- b) 2
- c) 3
- d) 4

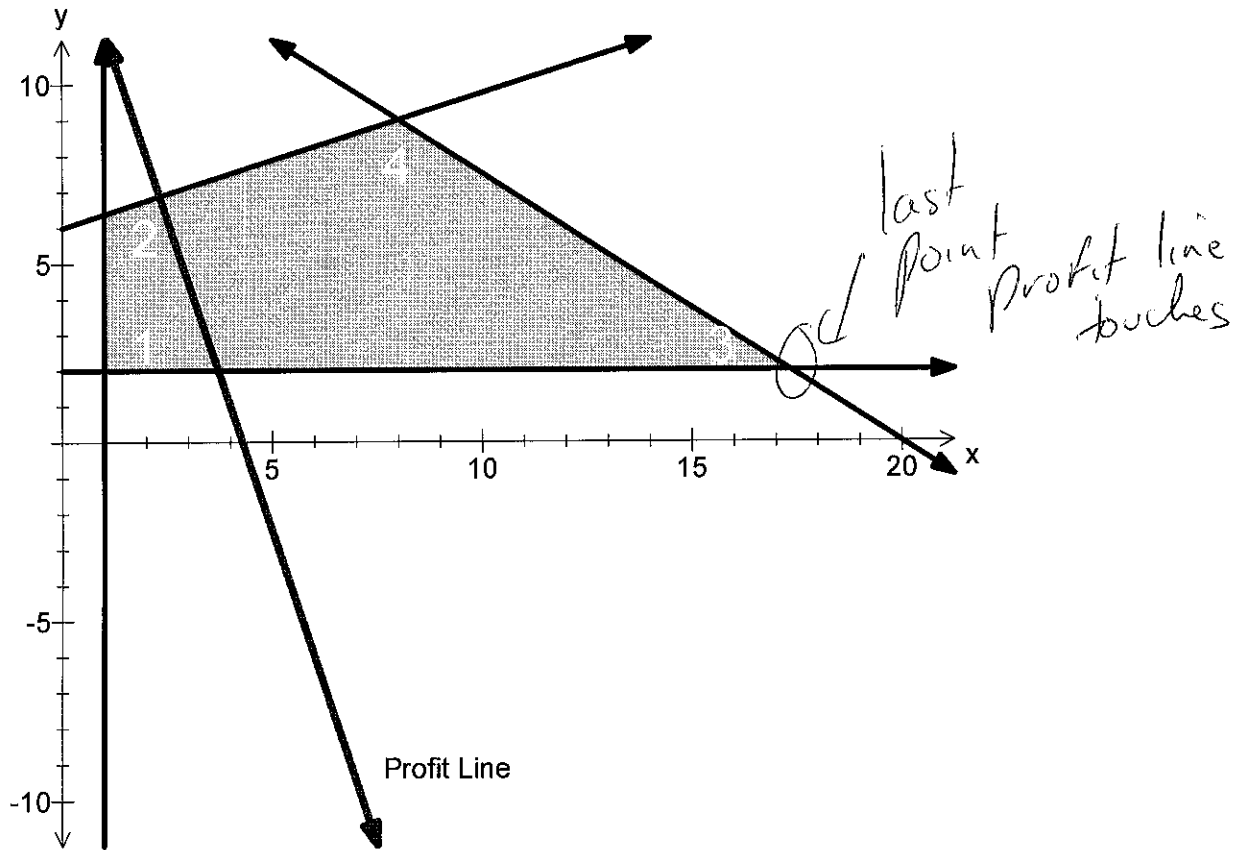
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4) Look at the above feasibility region. Which answer below indicates a point that lies outside the feasibility region?

- a) (1,2)
- b) (8,9)
- c) (15,8)
- d) (5,5)

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5) Given the above feasibility region and the profit function drawn as a line on the graph, which answer represents the optimal solution for the maximum profit?

- a) 1
- b) 2
- c) 3
- d) 4

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- 6) Solve the following using substitution. Where appropriate, leave answers in simplest fractional form and substitute your answer back into one of the equations to check your answer. No decimals numbers should appear anywhere throughout your solution.

$$x=3, y=-1$$

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

$$\textcircled{2} 2x+y=5$$

$$x=\frac{1}{2}, y=\frac{1}{3}$$

$$\textcircled{2} 4x+3y=3$$

$$\textcircled{1} \textcircled{b} -2x+6y=1$$

(12 marks)

$$\textcircled{c) } \frac{2}{3}w + \frac{1}{4}p = \frac{5}{12}$$

$$-\frac{1}{6}w + \frac{2}{5}p = -\frac{17}{30}$$

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

$$x+2y-2y=1-2y$$

$$x=1-2y$$

$$2(1-2y)+y=5$$

$$2-4y+y=5$$

$$2-3y=5$$

$$2-2-3y=5-2$$

$$-3y=3$$

$$\frac{-3y}{-3} = \frac{3}{-3}$$

$$y=-1$$

$$x=1-2(-1)$$

$$x=1+2$$

$$x=3$$

Check

$$3+2(-1)=1$$

$$3-2=1$$

$$\textcircled{1} -2x+6y=1$$

$$-2x+6y-6y=1-6y$$

$$-2x=1-6y$$

$$\frac{-2x}{-2} = \frac{1-6y}{-2}$$

$$x = -\frac{1}{2} + 3y$$

$$4\left(-\frac{1}{2} + 3y\right) + 3y = 3$$

$$-2 + 12y + 3y = 3$$

$$-2 + 15y = 3$$

$$-2+2+15y=3+2$$

$$\frac{15y}{15} = \frac{5}{15}$$

$$y = \frac{1}{3}$$

$$x = -\frac{1}{2} + 3\left(\frac{1}{3}\right)$$

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

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

→ Check

$$4\left(\frac{1}{2}\right) + 3\left(\frac{1}{3}\right) = 3$$

$$2 + 1 = 3$$

$$3 = 3 \checkmark$$

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$$w=1, p=-1$$

$$\textcircled{1} \quad \frac{2}{3}w + \frac{1}{4}p = \frac{5}{12}$$

$$\frac{3}{2} \times \frac{5}{12} = \frac{15}{24} = \frac{5}{8}$$

$$\textcircled{2} \quad -\frac{1}{6}w + \frac{2}{5}p = -\frac{17}{30}$$

$$\frac{3}{2} \times \frac{1}{4} = \frac{3}{8}$$

$$\textcircled{1} \quad \frac{2}{3}w + \frac{1}{4}p = \frac{5}{12}$$

$$\frac{2}{3}w + \frac{1}{4}p - \frac{1}{4}p = \frac{5}{12} - \frac{1}{4}p$$

$$\frac{2}{3}w = \frac{5}{12} - \frac{1}{4}p$$

$$\frac{3}{2} \left(\frac{2}{3}w \right) = \frac{3}{2} \left(\frac{5}{12} - \frac{1}{4}p \right)$$

$$w = \frac{5}{8} - \frac{3}{8}p$$

$$\frac{111}{240}p = \frac{-111}{240}$$

$$\frac{240}{111} \times \frac{111}{240}p = \frac{-111}{240} \times \frac{240}{111}$$

$$p = -1$$

$$w = \frac{5}{8} - \frac{3}{8}(-1)$$

$$w = \frac{5}{8} + \frac{3}{8} = \frac{8}{8} = 1$$

$$\textcircled{2} \quad -\frac{1}{6} \left(\frac{5}{8} - \frac{3}{8}p \right) + \frac{2}{5}p = -\frac{17}{30}$$

$$-\frac{5}{48} + \frac{3}{48}p + \frac{2}{5}p = -\frac{17}{30}$$

$$\frac{-25}{240} + \frac{15}{240}p + \frac{96}{240}p = \frac{-136}{240}$$

$$\frac{-25}{240} + \frac{111}{240}p = \frac{-136}{240}$$

$$\frac{-25}{240} + \frac{25}{240} + \frac{111}{240}p = \frac{-136}{240} + \frac{25}{240}$$

Check:

$$\frac{2}{3}(1) + \frac{1}{4}(-1) = \frac{5}{12}$$

$$\frac{8}{12} + \frac{-3}{12} = \frac{5}{12}$$

$$\frac{5}{12} = \frac{5}{12}$$

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- 7) Solve the following using the multiplication-addition method. Where appropriate, leave answers in simplest fractional form and substitute your answer back into one of the equations to check your answer. No decimals numbers should appear anywhere throughout your solution.

(12 marks)

$$\begin{array}{l} \textcircled{1} x + 2y = 1 \times 2 \\ \text{a) } \textcircled{2} 2x + y = 5 \times 1 \end{array}$$

$$\begin{array}{l} \textcircled{1} 4x + 3y = 3 \times 1 \\ \text{b) } \textcircled{2} -2x + 6y = 1 \times 2 \end{array}$$

$$\begin{array}{l} \frac{2}{3}w + \frac{1}{4}p = \frac{5}{12} \\ \text{c) } -\frac{1}{6}w + \frac{2}{5}p = -\frac{17}{30} \end{array}$$

$$\begin{array}{r} \textcircled{1} -2x + -4y = -2 \\ \textcircled{2} 2x + y = 5 \\ + \\ \hline \textcircled{1} + -3y = 3 \\ -3y = 3 \\ \frac{-3y}{-3} = \frac{3}{-3} \\ y = -1 \end{array}$$

$$\begin{array}{r} \textcircled{1} 4x + 3y = 3 \\ + -4x + 12y = 2 \\ \hline 0 + 15y = 5 \\ 15y = 5 \\ \frac{15y}{15} = \frac{5}{15} \\ y = \frac{1}{3} \end{array}$$

$$\begin{array}{r} x + 2(-1) = 1 \\ x + -2 = 1 \\ x + 2 + 2 = 1 + 2 \\ x = 3 \end{array}$$

$$\begin{array}{r} 4x + 3\left(\frac{1}{3}\right) = 3 \\ 4x + 1 = 3 \\ 4x + 1 - 1 = 3 - 1 \\ 4x = 2 \\ \frac{4x}{4} = \frac{2}{4} \\ x = \frac{1}{2} \end{array}$$

Check

$$\begin{array}{r} 2(3) + (-1) = 5 \\ 6 + -1 = 5 \\ 5 = 5 \end{array}$$

Check

$$\begin{array}{r} -2\left(\frac{1}{2}\right) + 6\left(\frac{1}{3}\right) = 1 \\ -1 + 2 = 1 \\ 1 = 1 \end{array}$$

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8 x 3 5 x 3

$$\textcircled{1} \quad \frac{2}{3}w + \frac{1}{4}P = \frac{5}{12} \quad \xrightarrow{\times \frac{1}{6}}$$

$$\textcircled{2} \quad -\frac{1}{6}w + \frac{2}{5}P = -\frac{17}{30} \quad \xrightarrow{\times \frac{2}{3}}$$

$$\textcircled{1} \quad \frac{2}{18}w + \frac{1}{24}P = \frac{5}{72}$$

$$\textcircled{2} \quad -\frac{2}{18}w + \frac{4}{15}P = \frac{-34}{90}$$

$$\frac{1}{24} + \frac{4}{15} = \frac{5}{120} + \frac{32}{120}$$

$$= \frac{37}{120}$$

$$\frac{5}{72} + \frac{-34}{90} = \frac{25}{360} + \frac{-136}{360}$$

$$=$$

$$\frac{37}{120}P = \frac{-111}{360}$$

$$\frac{120}{37} \times \frac{37}{120}P = \frac{-111}{360} \times \frac{120}{37} = \frac{-13320}{13320} = -1$$

$$P = -1$$

$$\frac{2}{3}w + \frac{1}{4}(-1) = \frac{5}{12}$$

$$\frac{2}{3}w + -\frac{1}{4} = \frac{5}{12}$$

$$\frac{2}{3}w + -\frac{1}{4} + \frac{1}{4} = \frac{5}{12} + \frac{1}{4}$$

$$\frac{2}{3}w = \frac{5}{12} + \frac{3}{12}$$

$$\frac{2}{3}w = \frac{8}{12}$$

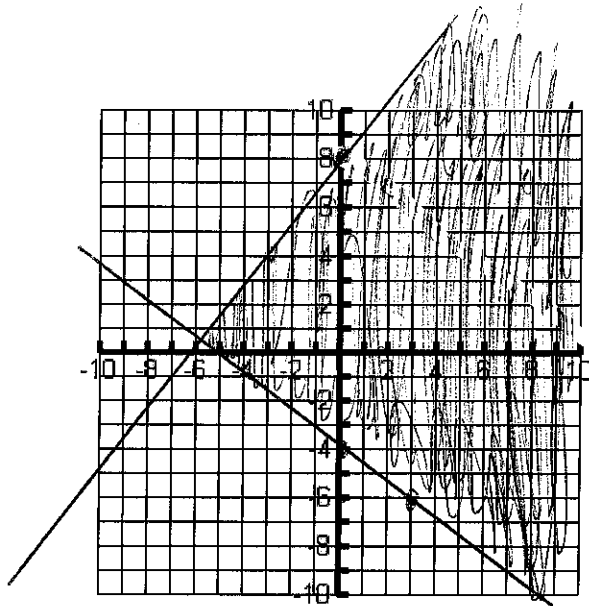
$$\frac{3}{2} \times \frac{2}{3}w = \frac{8}{12} \times \frac{3}{2}$$

$$w = \frac{24}{24} = 1$$

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8) Graph the following system of inequalities on the grids below. Outline the feasibility region. Use a ruler and be neat for full marks.

a) $4x - 3y + 24 > 0$
 $2x + 3y + 12 > 0$ (4 marks)



$$4x - 3y + 24 > 0$$

$$4x - 4x - 3y + 24 > 0 - 4x$$

$$-3y + 24 > -4x$$

$$-3y + 24 - 24 > -4x - 24$$

$$\frac{-3y}{-3} \frac{-4x - 24}{-3}$$

$$y < \frac{4}{3}x + 8$$

$$2x + 3y + 12 > 0$$

$$2x - 2x + 3y + 12 > 0 - 2x$$

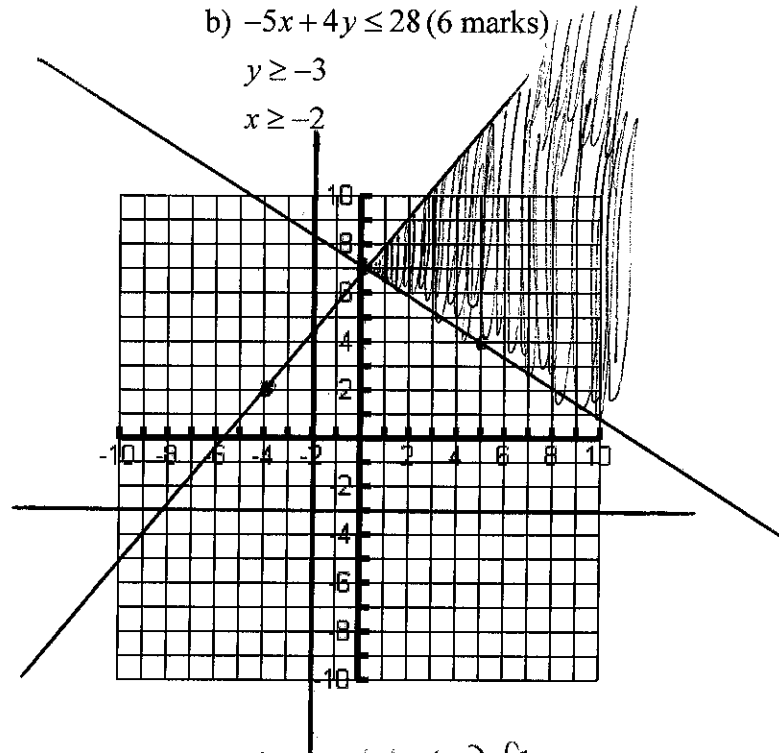
$$3y + 12 > -2x$$

$$3y + 12 - 12 > -2x - 12$$

$$\frac{3y}{3} > \frac{-2x - 12}{3}$$

$$y > \frac{-2}{3}x - 4$$

b) $y \geq -\frac{3}{5}x + 7$
 $-5x + 4y \leq 28$ (6 marks)



$$-5x + 4y \leq 28$$

$$-5x + 5x + 4y \leq 28 + 5x$$

$$\frac{4y}{4} \leq \frac{28 + 5x}{4}$$

$$y \leq \frac{5}{4}x + 7$$

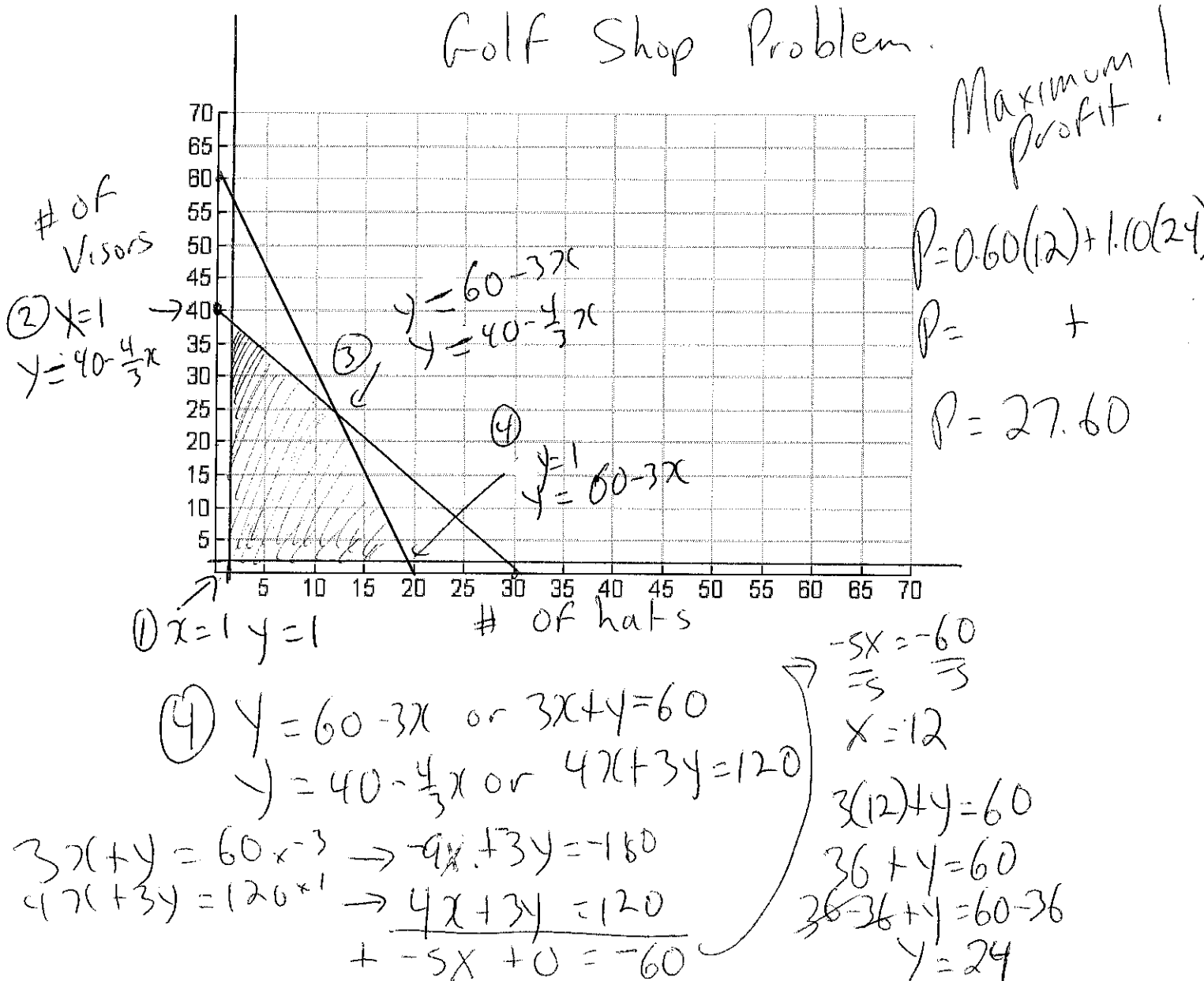
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9) A golf shop makes golf hats and visors. Each hat requires 4 minutes on the cutting machine and 3 minutes on the stitching machine. Each visor requires 3 minutes on the cutting machine and 1 minute on the stitching machine. The cutting machine is available for only 2 hours each day and the stitching machine is only available for 1 hour each day. At least one of each need to be made. If the profit on a visor is \$0.60 and the profit on a hat is \$1.10, how many of each should be produced each day to maximize profits. Assume x represents the number of hats and y represents the number of visors.

Include in your solution the following:

- Inequalities to represent all constraints. Please graph the feasibility region on the grid provided. (12 marks)
- Calculations to show how you obtained all the intersection points for the feasibility region. (6 marks)
- Calculations for minimum and maximum profit. (3 marks)

Golf Shop Problem



Name: _____

$$2 \text{ hours} = 120 \text{ minutes}$$

$$1 \text{ hour} = 60 \text{ minutes}$$

Cutting machine

$$4x + 3y \leq 120$$

time
needed
for hats

time
needed
for
visors

$$4x + 3y \leq 120$$

$$4x - 4x + 3y \leq 120 - 4x$$

$$\frac{3y}{3} \leq \frac{120 - 4x}{3}$$

$$y \leq 40 - \frac{4}{3}x$$

Stitching Machine

$$3x + y \leq 60$$

time
needed
for hats

time
needed
for visors

$$3x + y \leq 60$$

$$3x - 3x + y \leq 60 - 3x$$

$$y \leq 60 - 3x$$

$$x \geq 1$$

$$y \geq 1$$

Profit Calculations $P = 0.60y + 1.10x$

$$\textcircled{1} x = 1$$

$$y = 1$$

$$P = 0.60(1) + 1.10(1)$$

$$P = 0.60 + 1.10$$

$$P = 1.70$$

Minimum
Profit!

$$\textcircled{2} x = 1$$

$$y = 40 - \frac{4}{3}x$$

$$y = 40 - \frac{4}{3}(1)$$

$$y = 40 - \frac{4}{3}$$

$$y = \frac{120}{3} - \frac{4}{3} = \frac{116}{3}$$

$$P = 0.60\left(\frac{116}{3}\right) + 1.10(1)$$

$$P = 23.20 + 1.10$$

$$P = 24.30$$

$$\textcircled{3} y = 1$$

$$y = 60 - 3x$$

$$1 = 60 - 3x$$

$$1 - 60 = 60 - 60 - 3x$$

$$-59 = -3x$$

$$\frac{-59}{-3} = \frac{-3x}{-3}$$

$$P = 0.60(1) + 1.10\left(\frac{59}{3}\right)$$

$$P = 0.60 + 21.63$$

$$P = 22.23$$