

1. A company manufactures widgets and gadgets. To make a widget requires 3 oz of steel and 1 oz of plastic. A gadget requires 2oz of steel and 3 oz of plastic. Widgets earn the company a profit of \$1.50 while gadgets earn \$2.00. The company has 120 oz of steel and 75 oz of plastic available.

(a) Introduce variables to set this up as a linear programming problem.

Let x be the number of widgets and y be the number of gadgets made.

(b) Write down a mixture chart for this problem.

	steel	plastic	
widgets	3	1	1.50
gadgets	2	3	2.00
	120	75	

(c) Write down **all** the constraint inequalities. $3x + 2y \leq 120$, $x + 3y \leq 75$, $x \geq 0$, $y \geq 0$

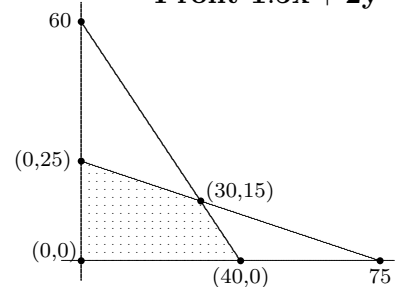
(d) Write down an expression for the profit.

Profit $1.5x + 2y$

(e) Sketch the feasible region on the graph shown:

$$\begin{array}{r} x + 3y = 75 \quad \times 3 \quad 3x + 9y = 225 \\ 3x + 2y = 120 \quad \times 1 \quad 3x + 2y = 120 \\ \hline \text{Subtract} \quad \quad \quad 7y = 105 \end{array}$$

Gives $y = 15$, so $x + 3(15) = 75$ and $x = 30$.

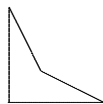


(f) Find the production policy that maximizes profit.

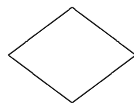
(0, 0)	$1.5(0) + 2(0)$	$= 0$
(0, 25)	$1.5(0) + 2(25)$	$= 50$
(40, 0)	$1.5(40) + 2(0)$	$= 60$
(30, 15)	$1.5(30) + 2(15)$	$= 75$

Answer: make 30 widgets and 15 gadgets

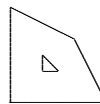
2. Which of the following regions could be feasible sets for a linear programming problem?



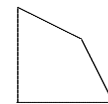
(A) Yes / No



(B) Yes / No



(C) Yes / No



(D) Yes / No

3. Opinion polls are usually conducted by asking questions of 1500 people.

a) Such opinion polls normally state that their ‘margin of error’ is $\pm 3\%$. Explain what this means.

95% of polls conducted in a similar manner would give a result that was within 3% of the correct value.

b) If an opinion poll is conducted by asking 4000 people, do you think the margin or error will be more, less, or the same as $\pm 3\%$?

Less. Larger samples generally give more accurate answers.

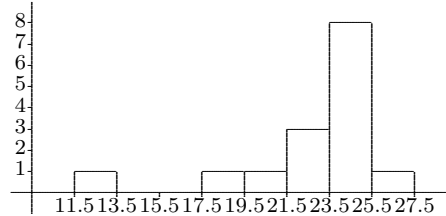
4. Find a simple random sample of 5 members out of a population of 60 using the following random digits:

36|94|8 0|07|83| 93|51|5 1|08|01| 00|62|6 5|48|98| 85|55|8 9|77|08

Answer: 36 07 51 08 01

5. Two students wish to study what proportion of the population drop litter.
- a) The first student sends out questionnaires to a simple random sample of 100 students from her university asking whether or not they drop litter. Give **three** reasons why this is not a good study.
- University students may not be typical of the general population.**
 - Many students may not answer, so there is voluntary response bias.**
 - Respondents may not tell the truth.**
- b) The second student instead decides to stand in a shopping mall one Monday morning and count the number of people dropping litter. Give **three** reasons why this is not a good study.
- People in shopping mall on Monday morning may not be typical (people who are at work are excluded).**
 - This only tells the student whether they drop litter in shopping malls, they may drop litter elsewhere.**
 - Difficult to estimate sample size**
6. The yield of corn grown in several test plots are: 24, 26, 25, 13, 25, 22, 25, 25, 23, 19, 25, 25, 21, 22, 25.

a) Draw a histogram representing this information. (Label your axes carefully. Use classes of size 2.)



b) Describe the distribution fully.
Distribution is skewed to the left with one outlier on the left.

c) Calculate the mean and median.


Mean = $(24 + 26 + \dots + 25)/15 = 345/15 = 23$.


13 19 21 22 22 23 24 25 25 25 25 25 25 26. Median = 25.

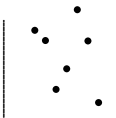
d) Are the mean and median close to each other or not? Explain why.

They are not very close. This is because the distribution is skewed to the left.

7. For each of the three scatterplots below, circle the most likely correlation coefficient (r), least squares regression line ($y = ax + b$), and whether you think x and y are strongly related.

(A)  1) $r = -.9$ 2) $r = -.3$ 3) $r = .3$ 4) $r = .9$
 1) $y = x + 1$ 2) $y = x - 1$ 3) $y = -x + 5$ 4) $y = -x - 5$
 Strongly related Yes / No

(B)  1) $r = -.9$ 2) $r = -.3$ 3) $r = .3$ 4) $r = .9$
 1) $y = x + 1$ 2) $y = x - 1$ 3) $y = -x + 5$ 4) $y = -x - 5$
 Strongly related Yes / No

(C)  1) $r = -.9$ 2) $r = -.3$ 3) $r = .3$ 4) $r = .9$
 1) $y = x + 1$ 2) $y = x - 1$ 3) $y = -x + 5$ 4) $y = -x - 5$
 Strongly related Yes / No