

ASSIGNMENT No. 1**Q. 1****(a)**

	Product 1	Product 2	Product 3	Total
Acceptable	156	350	204	710
Unacceptable	24	40	26	90
Total	180	390	230	800

A sample of 800 parts has been selected from three product lines and inspected by the quality control department. The given table summarizes the results of the inspection. If a part is selected at random from this sample, what is the probability that:

i) **The part is of the product 1 type**

$$180 / 800 = 0.225$$

ii) **The part is unacceptable**

If unacceptable so the calculation not possible.

iii) **The part is an acceptable unit of product 3**

$$230 / 800 = 0.2875$$

iv) **The part is an unacceptable unit of product 1**

$$800 / 180 = 4.44$$

v) **The part is acceptable, given that the selected part is a unit of product 2**

$$390 / 800 = 0.4875$$

vi) **The part is product 1, given that the selected part is acceptable**

$$570 / 800 = 0.7125$$

vii) **The part is product 3, given that the selected part is unacceptable**

$$800 / 390 = 2.051$$

(b) What is the difference between the states of statistical independence and statistical dependence?

When two events are dependent events, one event influences the probability of another event. A dependent event is an event that relies on another event to happen first. Dependent events in probability are no different from dependent events in real life: If you want to attend a concert, it might depend on whether you get overtime at work; if you want to visit family out of the country next month, it depends on whether or not you can get a passport in time. More formally, we say that when two events are dependent, the occurrence of one event influences the probability of another event.

Simple examples of dependent events:

- Robbing a bank and going to jail.
- Not paying your power bill on time and having your power cut off.

- Boarding a plane first and finding a good seat.
- Parking illegally and getting a parking ticket. Parking illegally increases your odds of getting a ticket.
- Buying ten lottery tickets and winning the lottery. The more tickets you buy, the greater your odds of winning.
- Driving a car and getting in a traffic accident.

An independent event is an event that has no connection to another event's chances of happening (or not happening). In other words, the event has no effect on the probability of another event occurring. Independent events in probability are no different from independent events in real life. Where you work has no effect on what color car you drive. Buying a lottery ticket has no effect on having a child with blue eyes.

- When two events are independent, one event does not influence the probability of another event.
- Owning a dog and growing your own herb garden.
- Paying off your mortgage early and owning a Chevy Cavalier.
- Winning the lottery and running out of milk.
- Buying a lottery ticket and finding a penny on the floor (your odds of finding a penny does not depend on you buying a lottery ticket).
- Taking a cab home and finding your favorite movie on cable.
- Getting a parking ticket and playing craps at the casino.
- Here are more formal ways to quantify dependent or independent events. You'll come across these formulas in basic probability.
- $P(A|B) = P(A)$.
- $P(B|A) = P(B)$

The probability of A, given that B has happened, is the same as the probability of A. Likewise, the probability of B, given that A has happened, is the same as the probability of B. This shouldn't be a surprise, as one event doesn't affect the other. You can use the following equation to figure out probability for independent events:

$$P(A \cap B) = P(A) \cdot P(B).$$

Q. 2

(a) Unemployment statistics within a western state indicate that 6 percent of those eligible to work are unemployed. Suppose that an experiment is conducted where three persons are selected at random and their employment status is noted. If the random variable for this experiment is defined as the number of persons unemployed.

i) Construct the probability distribution for this experiment and determine the probability that

$$C(n, r) = ?$$

$$C(n, r) = C(3, 3)$$

$$= \frac{3!}{(3!(3-3)!)} = 1$$

$$= \frac{3!}{3! \times 0!}$$

$$= 1$$

ii) None of three is unemployed

$$C(n, r) = ?$$

$$C(n, r) = C(3, 0)$$

$$= \frac{3!}{(0!(3-0)!)} = 1$$

$$= \frac{3!}{0! \times 3!}$$

$$= 1$$

iii) Or two or more are employed

$$C(n, r) = ?$$

$$C(n, r) = C(3, 2)$$

$$= \frac{3!}{(2!(3-2)!)} = 3$$

$$= \frac{3!}{2! \times 1!}$$

$$= 3$$

(b) Find a formula for the probability distribution of the number of boys in families with three children assuming equal probabilities for boys and girls.

A. All girls - $0.5 \times 0.5 \times 0.5 = 0.125$ (12.5%)

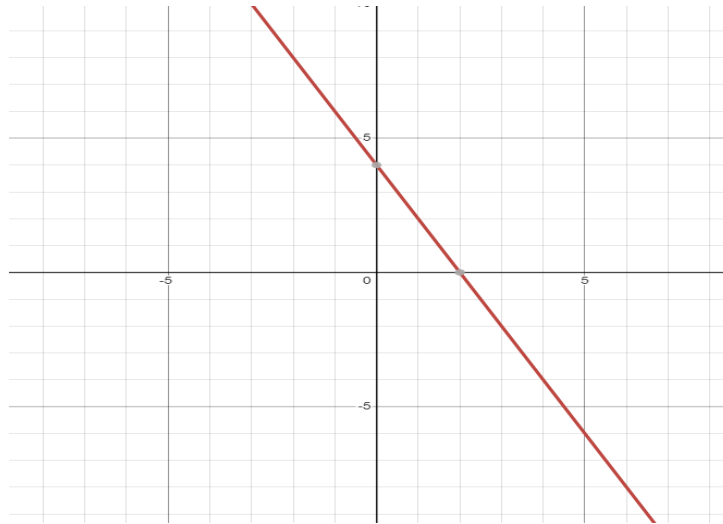
B. 2 Boys 1 Girl — $3C_2 \times 0.125 = 37.5\%$

C. At least 2 girls — 2 Girls 1 boy + all girls = $37.5\% + 12.5\% = 50\%$

D. 2 Boys at most — All possibilities — $P(\text{all boys}) = 100\% - 12.5\% = 87.5\%$

Q. 3

(a) Sketch the plane representing $2x + y + 0z = 4$



(b) The average size of farms in the United State increased from 100 acres in 1920 to 700 acres in 1980.

Let y be the average size x years after 1900. In what year was the average size 400 acres?

Number of years = $1980 - 1920 = 60$

Total growth in farm size between (1920-1980) = 700 acres

Average yearly growth in farm size (x) = $(700 \text{ acres} - 100 \text{ acres}) / 60 = 600 / 60 = 10 \text{ acres}$

Therefore:

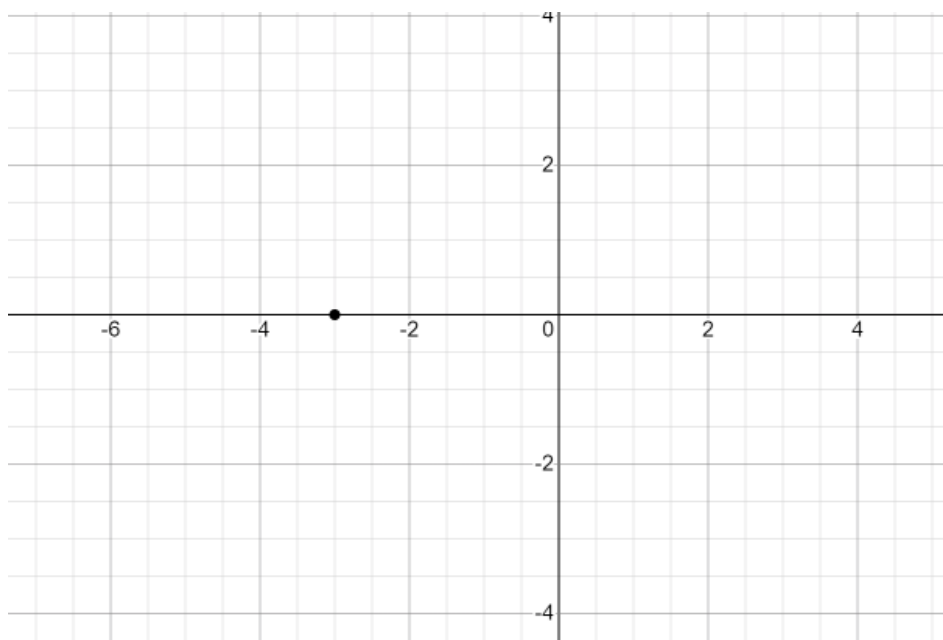
10 acres X 30 years = 300 acres

$1920 + 30 \text{ years} = 1950$

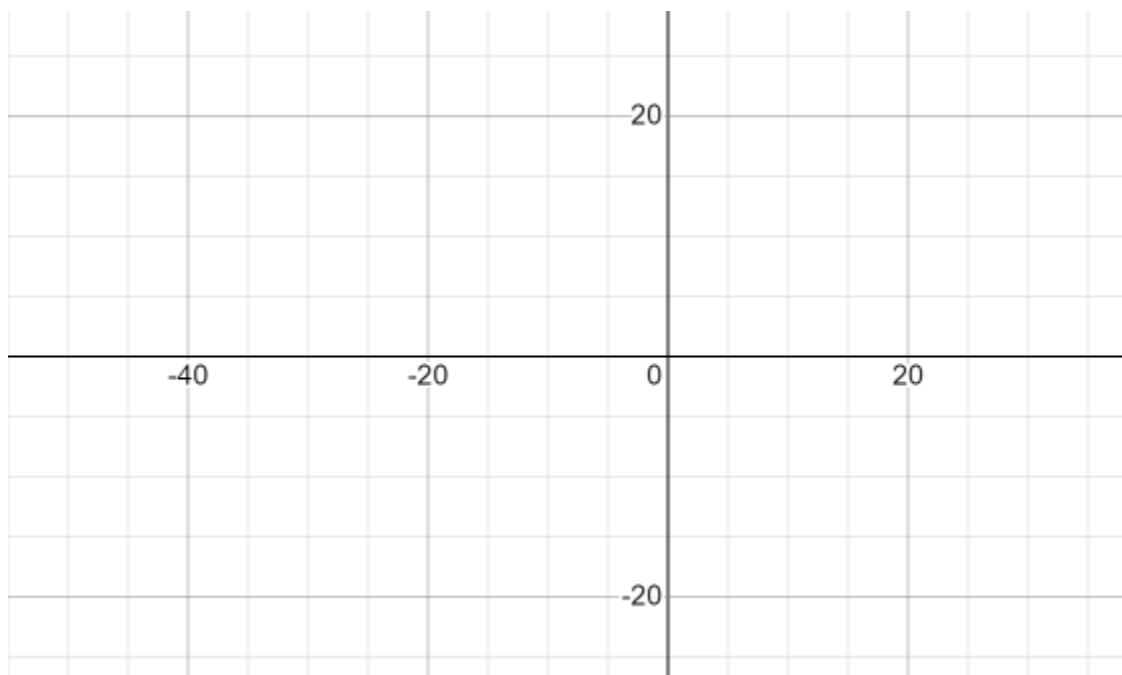
Q. 4

(a) Sketch the following intervals.

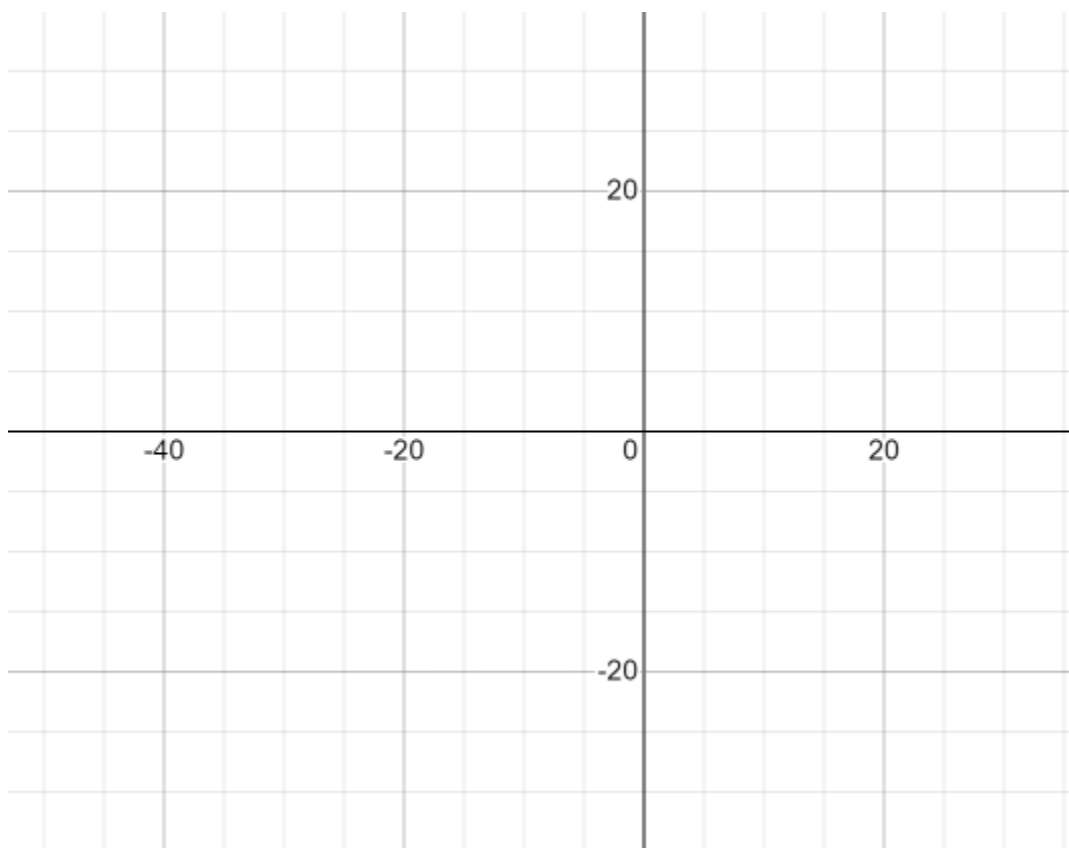
i) $(-3, 0)$



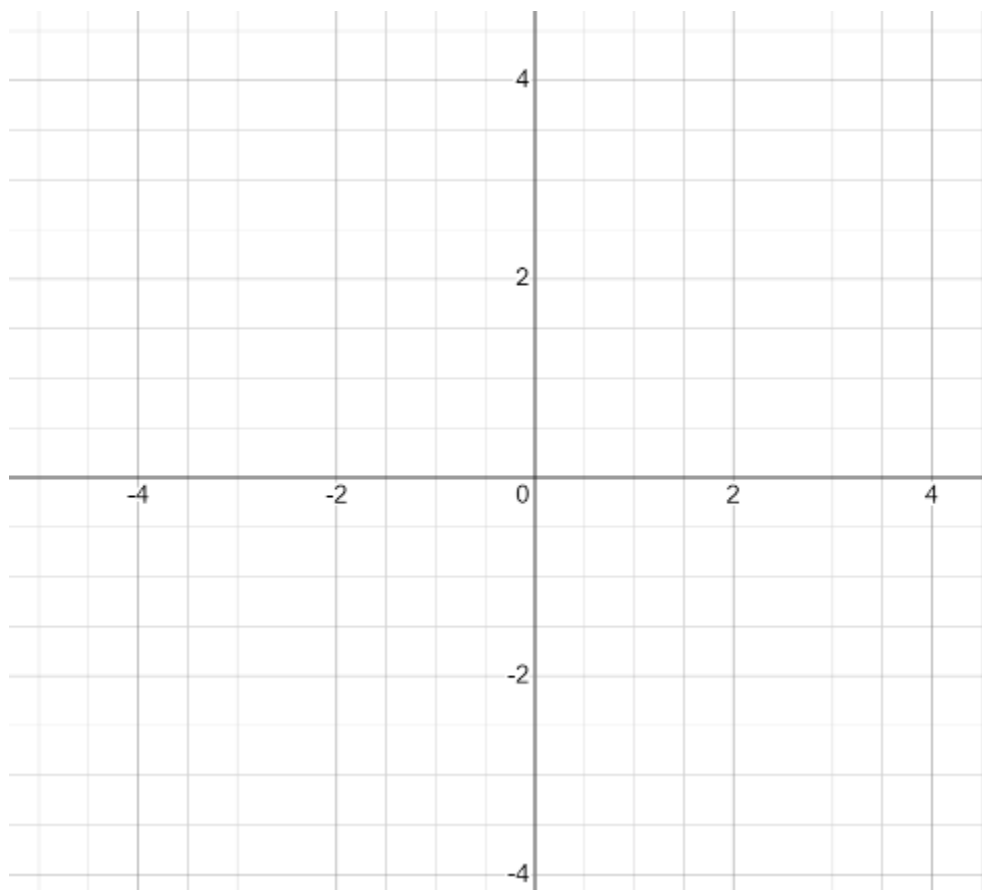
ii) $[-5, -3]$



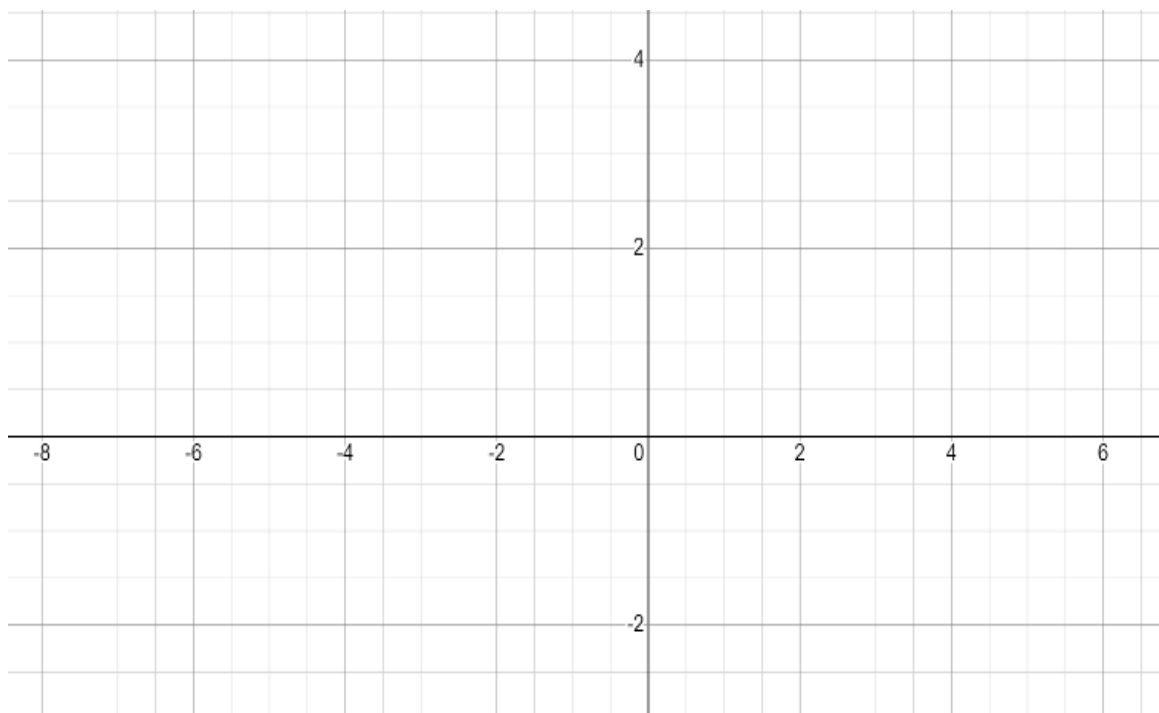
iii) $[-5, -1)$



iv) $(5, 10]$



v) $[-2, 3]$



(b) Solve:

i) $|7x - 12| = |4 - 3x|$

$$|7x - 12| = |4 - 3x|$$

$$|7x - 12| = |-3x + 4|$$

Solve Absolute Value.

$$|7x - 12| = |-3x + 4|$$

We know either $7x - 12 = -3x + 4$ or $7x - 12 = -(-3x + 4)$

$$7x - 12 = -3x + 4 \text{ (Possibility 1)}$$

$$7x - 12 + 3x = -3x + 4 + 3x \text{ (Add } 3x \text{ to both sides)}$$

$$10x - 12 = 4$$

$$10x - 12 + 12 = 4 + 12 \text{ (Add 12 to both sides)}$$

$$10x = 16$$

$$\frac{10x}{10} = \frac{16}{10} \text{ (Divide both sides by 10)}$$

$$x = \frac{8}{5}$$

$$7x - 12 = -(-3x + 4) \text{ (Possibility 2)}$$

$$7x - 12 = 3x - 4 \text{ (Simplify both sides of the equation)}$$

$$7x - 12 - 3x = 3x - 4 - 3x \text{ (Subtract } 3x \text{ from both sides)}$$

$$4x - 12 = -4$$

$$4x - 12 + 12 = -4 + 12 \text{ (Add 12 to both sides)}$$

$$4x = 8$$

$$\frac{4x}{4} = \frac{8}{4} \text{ (Divide both sides by 4)}$$

$$x = 2$$

ii) $|5x - 4| \leq -10$

$$|5x - 4| \leq -10$$

No solutions. (Absolute value cannot be less than 0.)

Q. 5

(a) The value of machine is expected to decrease at a liner rate over the time. Two data points indicate that the value of the machine at $t=0$ (time of purchase) is \$18,000 and its value in 1 year will equal \$14,500.

i) Determine the slope intercept equation ($V = mt + k$) which relates the value V of the machine to its age t .

The two ordered pairs are (0, 18000) and (1, 14500).

So, the equation will be

$$\frac{V-18000}{18000-14500} = \frac{t-0}{0-1}$$

$$\Rightarrow V - 18000 = -3500t$$

$$\Rightarrow V = -3500t + 18000 \text{ (Answer)}$$

ii) Interpret the meaning of the slope and V intercept.

Now, the slope in the above equation i.e. - 3500 is the rate of decrease of machine value in \$ per year.

And the V -intercept 18000 gives the initial value of the machine.

iii) Solve for the t intercept and interpret its meaning.

The t -intercept will give

$$0 = -3500t + 18000$$

$$\Rightarrow t = 5.14 \text{ years.}$$

This means the value of the machine will become zero after 5.14 years.

(b) Solve graphically and check your answer algebraically.

$$-x + 3y = 2$$

$$4x - 12 = -8$$

Step: Solve $4x - 12 = -8$ for x :

$$4x - 12 = -8$$

$$4x - 12 + 12 = -8 + 12 \quad (\text{Add 12 to both sides})$$

$$4x = 4$$

$$\frac{4x}{4} = \frac{4}{4} \quad (\text{Divide both sides by 4})$$

$$x = 1$$

Step: Substitute **1** for x in $-x + 3y = 2$:

$$-x + 3y = 2$$

$$-1 + 3y = 2$$

$$3y - 1 = 2 \quad (\text{Simplify both sides of the equation})$$

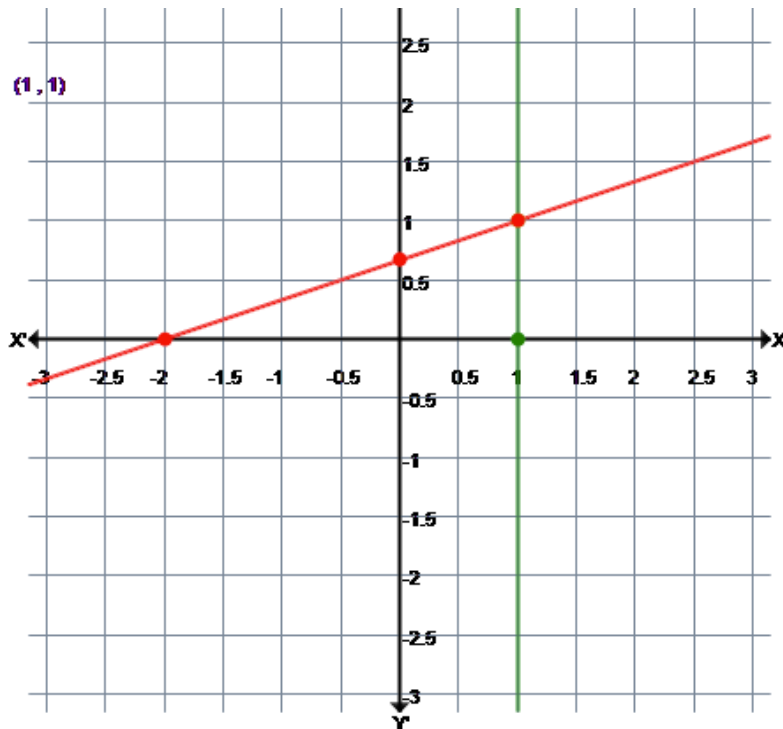
$$3y - 1 + 1 = 2 + 1 \quad (\text{Add 1 to both sides})$$

$$3y = 3$$

$$\frac{3y}{3} = \frac{3}{3} \quad (\text{Divide both sides by 3})$$

$$y = 1$$

$x=1$ and $y=1$



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