**LO1**

**Part (1)**

According to law of sine’s

Take any two sides

**Part (b)**

Where

= perpendicular

B = Base

H = Hypotenuse

**Task (2)**

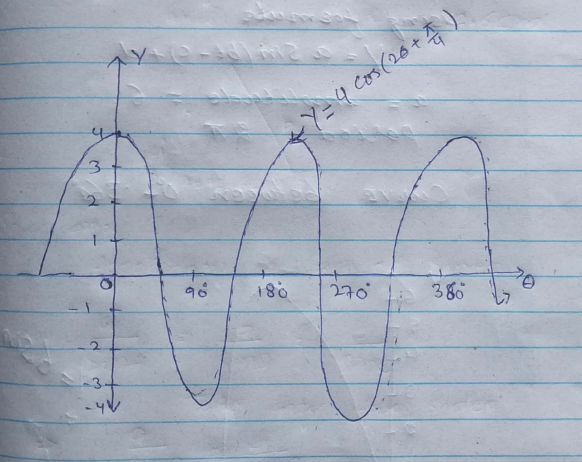
**Part (a)**

1). Amplitude (A) = 4

2). Period (P) =

Amplitude = 4

Period =

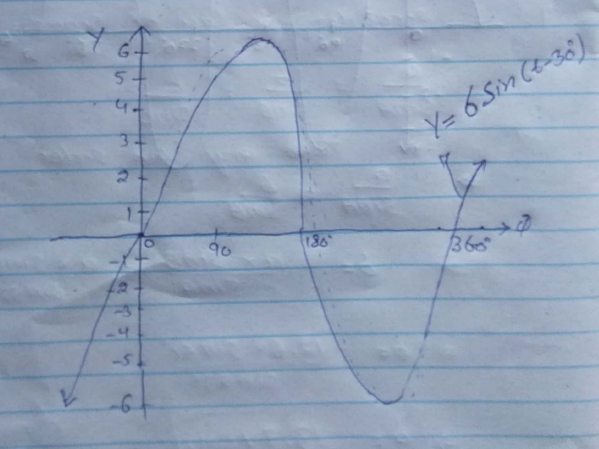
****

**Part (b)**

Using formula

a = amplitude = 6

Period =

****

**Part (c)**

Taking LHS

**LO2**

Part (1)

a).

Trapezium Rule A/C to the formula

Area = d/2[(o1+o7)+2(o2+o3+o4+o5+o6)]

Area= 25/2[(3.6+4)+2(5+6.5+7.5+7.3+6)]

Area= 25/2[7.6+64.6]

Area902.5 sqm

b).

Simpson’s Rule

According to the formula

Area= d/3[(o1+o7)+4(o2+o4+o6)+2(o3+o5)]

Area= 25/3[(3.6+4)+4(5+7.5+6)+2(6.5+7.3)]

Area= 25/3[(7.6)+4(18.5)+2(13.8)]

Area= 25/3[7.6+74+27.6]

Area=910 sqm

c).

Mid ordinate Rule

Accourding to the formula

Area= (sum of all ordinates\*L) / n

Where L= n\*d (L= length of base line)

Area= [(o1+o2+o3+o4+o5+o6+o7)\*L]/ 7

L= n\*d

L=7\*25

=175m

Area = [(3.6+5+6.5+7.5+7.3+6+4)\*175]/7

Area=999.5 sqm

Compare and Comment

|  |  |  |
| --- | --- | --- |
| Rule | Area | Comment |
| Trapezium | 902.5 | Less accuracy |
| Simpson’s | 910 | High Accuracy |
| Mid Ordinate | 997.5 | accuracy |

Part (2)

Simplify by moving 2 inside the logarithm

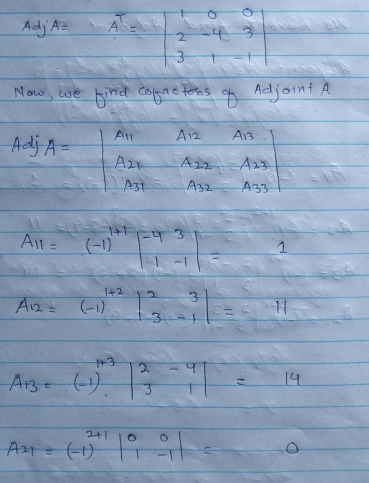
For the equation to be equal, the argument of log must be equal

Therefore

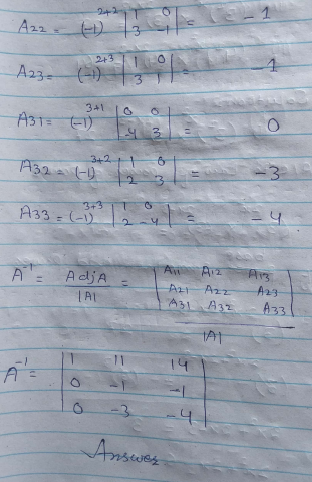
X= 0.2 Answer

Part (3)

Find the invers of the above matrix



Part (4)

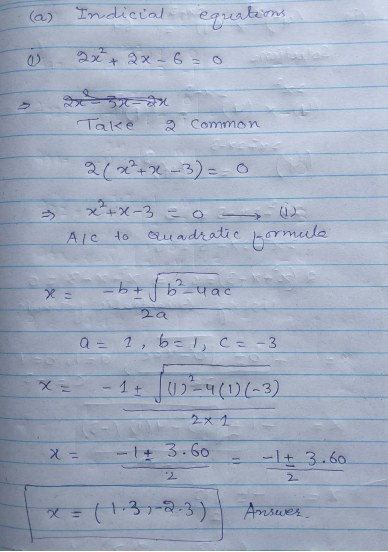


Task (2)

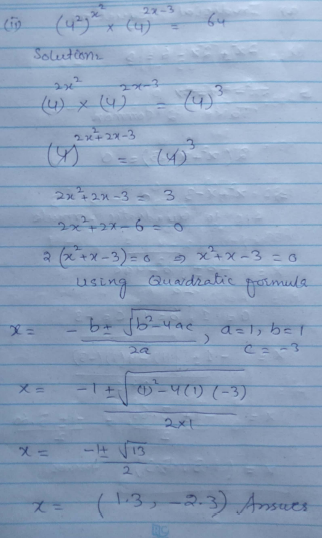


A/C to Law of power of power

If base same then add power



b).



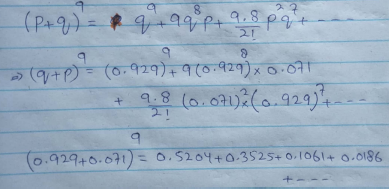
LO3

Task (1)

Let Probability of failure

p = 0.071 and Probability of success q = 0.929

By using binomial expansion, we get



Probability of failure to meet specification up to three blocks

The three blocks **P = 0.0186** because Probability corresponds to 0,1,2,3

b).

Probability that less than four blocks =0.5204+ 0.3525+0.3525+0.1061+0.0188

**P= 0.9976**

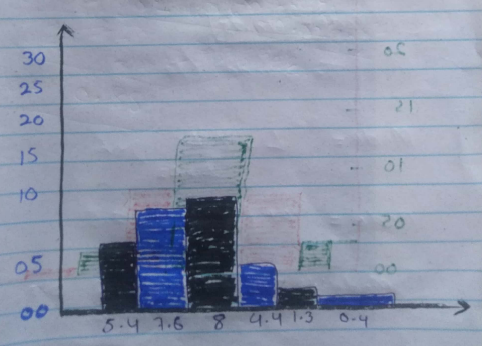
Task (2)

**(a).**

**Histogram (January)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Class Boundries** | **Width** | **Frequency** | **Proportional Height** |
| **0-5** | **5** | **27** | **5.4** |
| **5- 10** | **5** | **38** | **7.6** |
| **10-15** | **5** | **40** | **8** |
| **15-20** | **5** | **22** | **4.4** |
| **20-30** | **10** | **13** | **1.3** |
| **30-40** | **10** | **4** | **0.4** |

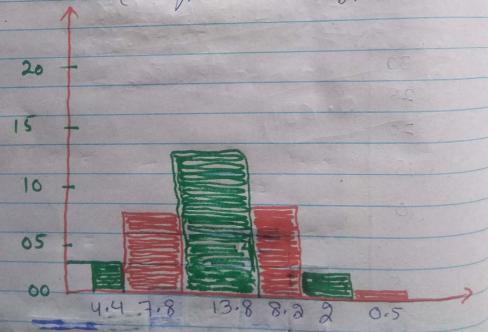
The histogram is shown as under of (January)



**Histogram (July)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Class Boundaries** | **Width** | **Frequency** | **Proportional Height** |
| **0-5** | **5** | **22** | **4.4** |
| **5- 10** | **5** | **39** | **7.8** |
| **10-15** | **5** | **69** | **13.8** |
| **15-20** | **5** | **41** | **8.2** |
| **20-30** | **10** | **20** | **2** |
| **30-40** | **10** | **5** | **0.5** |

The histogram is shown as under of (January)



1. Frequency density and the mode

**Frequency density (January)**

Fd1 = Frequency / width = 27/5= 5.4

Fd2 = Frequency / width = 38/5= 7.6

Fd3 = Frequency / width = 40/5= 8

Fd4 = Frequency / width = 22/5= 4.4

Fd5 = Frequency / width = 13/10= 1.3

Fd6 = Frequency / width = 4/10= 0.4

**Frequency density (July)**

Fd1 = Frequency / width = 4.4

Fd2 = Frequency / width = 7.8

Fd3 = Frequency / width = 13.8

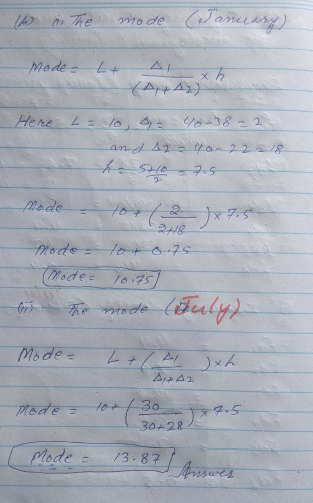
Fd4 = Frequency / width = 8.2

Fd5 = Frequency / width = 2

Fd6 = Frequency / width = 0.5

**b).**

**the mode January**

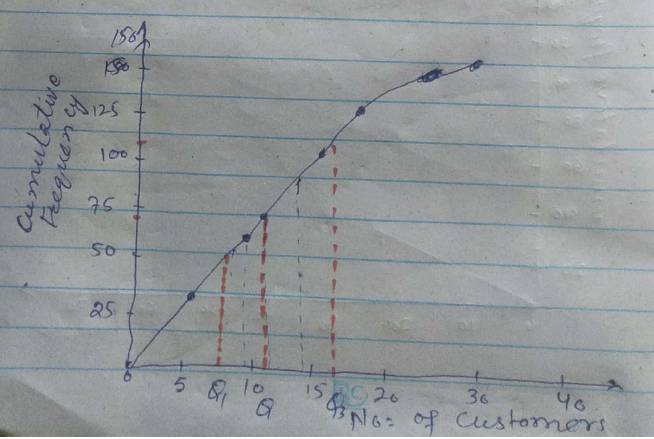
****

**Cumulate frequency curve and find interquartile range**

**For January (distribution)**

|  |  |  |
| --- | --- | --- |
| **Class Interval** | **Frequency** | **Cumulative frequency** |
| **0-5** | **27** | **27** |
| **5- 10** | **38** | **65** |
| **10-15** | **40** | **105** |
| **15-20** | **22** | **127** |
| **20-30** | **13** | **140** |
| **30-40** | **4** | **144** |

**Cumulate frequency curve can plotted from above table as (5,27), (10,65), (15,105), (20, 127), (30,140), (40,144)**

****

**There are 144 values, so median will be 144+1/2 =72.5**

Interquartile = q3 –q1

Interquartile = 116 – 8.5

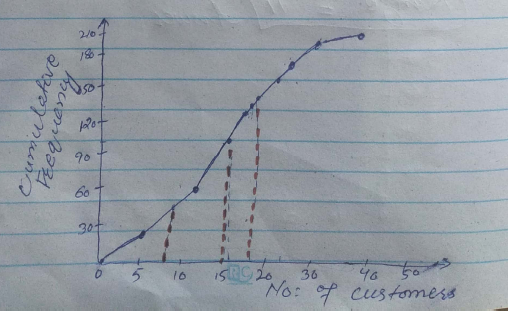
Interquartile Range = 8

**Cumulate frequency curve and median interquartile range**

**For July (distribution)**

|  |  |  |
| --- | --- | --- |
| **Class Interval** | **Frequency** | **Cumulative frequency** |
| **0-5** | **22** | **22** |
| **5- 10** | **39** | **61** |
| **10-15** | **69** | **130** |
| **15-20** | **41** | **171** |
| **20-30** | **20** | **191** |
| **30-40** | **5** | **196** |

**Cumulate frequency curve can plotted from above table as (5,22), (10,61), (15,130), (20, 171), (30,191), (40,196)**

****

**There are 196 values, so median will be 196+1/2 = 98.5**

Interquartile = q3 –q1

Interquartile = 19 – 8

Range = 11

**c).**

For the January Distribution first draw frequency distribution table

|  |  |  |  |
| --- | --- | --- | --- |
| Class interval | Frequency | Mid-point | xifi |
| 0-5 | 27 | 2.5 | 67.5 |
| 5-10 | 38 | 7.5 | 285 |
| 10-15 | 40 | 12.5 | 500 |
| 15-20 | 22 | 17.5 | 385 |
| 20-30 | 13 | 25 | 325 |
| 30-40 | 4 | 35 | 140 |
|  | Sum =144 |  | Sum= 1702.5 |

1. The mean

= 1702.5/ 144

= 11.82 Answer

(2)

The range

Range upper class boundary of the richest interval – lower class of the lowest interval

Range = 40-0 = 40

**(3)**

The standard derivation CB = class boundary

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Class Boundary | Fi | xi | (Xi-u)^2 \* fi | u |
| 0-5 | 27 | 2.5 | 2345.28 | 11.82 |
| 5-10 | 38 | 7.5 | 709.17 | 11.82 |
| 10-15 | 40 | 12.5 | 18.49 | 11.82 |
| 15-20 | 22 | 17.5 | 709.77 | 11.82 |
| 20-30 | 13 | 25 | 2258.26 | 11.82 |
| 30-40 | 4 | 35 | 2149.24 | 11.82 |
| sum | 144 |  | 8190.21 |  |

**c).**

Mean Range and Standard derivation

For July Distribution

CI= Class Interval

|  |  |  |  |
| --- | --- | --- | --- |
| Class interval | Frequency | Mid-point | xifi |
| 0-5 | 27 | 2.5 | 55 |
| 5-10 | 38 | 7.5 | 292.5 |
| 10-15 | 40 | 12.5 | 862.5 |
| 15-20 | 22 | 17.5 | 717.5 |
| 20-30 | 13 | 25 | 500 |
| 30-40 | 4 | 35 | 175 |
| sum | 196 |  | 2602.5 |

1. The mean

= 2602.5 / 196

= 13.27 Answer

(2)

The range

Range upper class boundary of the richest interval – lower class of the lowest interval

Range = 40-0 = 40

(3)

The standard derivation CB = class boundary

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Class Boundary | Fi | xi | (Xi-u)^2 \* fi | u |
| 0-5 | 22 | 2.5 | 2551.8 | 13.27 |
| 5-10 | 39 | 7.5 | 1298.4 | 13.27 |
| 10-15 | 69 | 12.5 | 40.91 | 13.27 |
| 15-20 | 41 | 17.5 | 733.60 | 13.27 |
| 20-30 | 20 | 25 | 2751.8 | 13.27 |
| 30-40 | 5 | 35 | 2360.9 | 13.27 |
| sum | 196 |  | 9737.41 |  |

**Task 3**

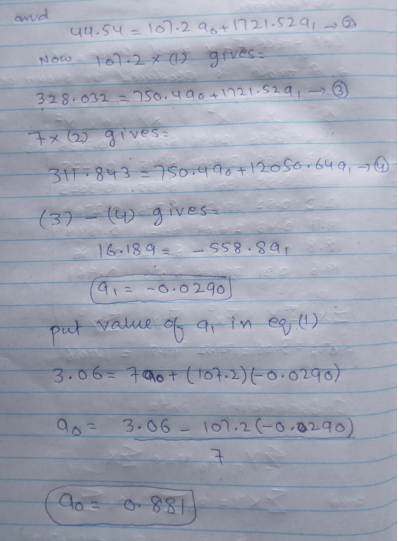
Let force F=x and time Y

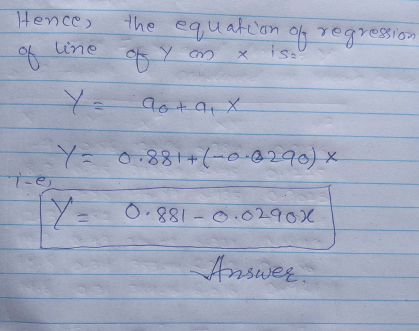
A table is produced as shown below

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **x** | **y** | **X^2** | **xy** | **Y^2** |
| 11.4 | 0.56 | 129.96 | 6.384 | 0.3136 |
| 18.7 | 0.35 | 349.69 | 6.545 | 0.1225 |
| 11.7 | 0.55 | 136.98 | 6.545 | 0.3025 |
| 12.3 | 0.52 | 151.29 | 6.396 | 0.2704 |
| 14.7 | 0.43 | 216.09 | 6.321 | 0.1849 |
| 18.8 | 0.34 | 353.44 | 6.392 | 0.1156 |
| 19.6 | 0.31 | 384.16 | 6.076 | 0.961 |
| **= 107.2** | **= 3.06** | **=1721.52** | **=44.54** | **= 1.4056** |

**Substituting in to**

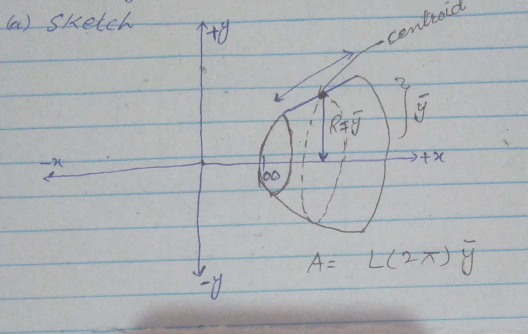
**Gives = 3.06 + 90\*7 + 91 (107.2)-----(1)**

****

****

LO4

Task (1)

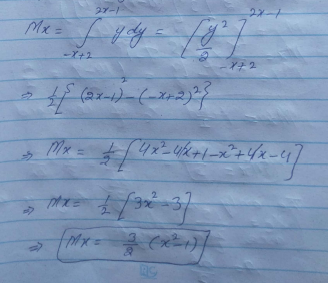


Task 3

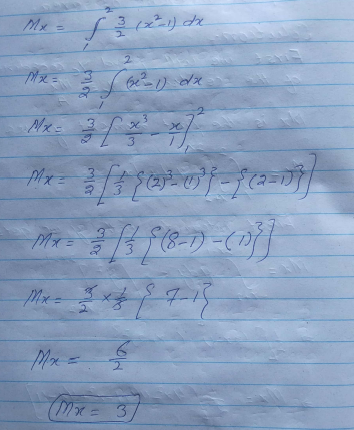
First we eill find yc coordinate of the centroid ,yc = Mx/A

Mx is the First movement of area

First integrate with y, we get

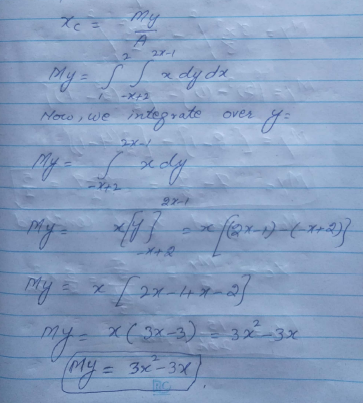


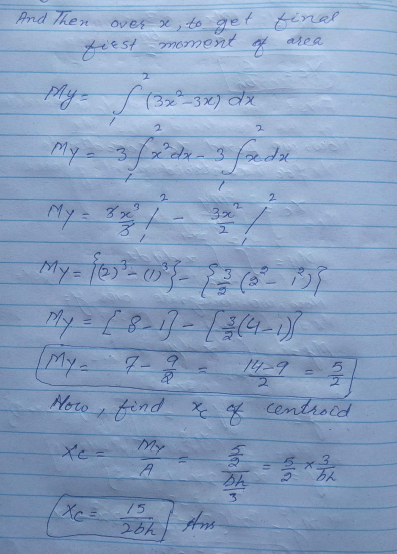
**Now integrate with x, we get**

****

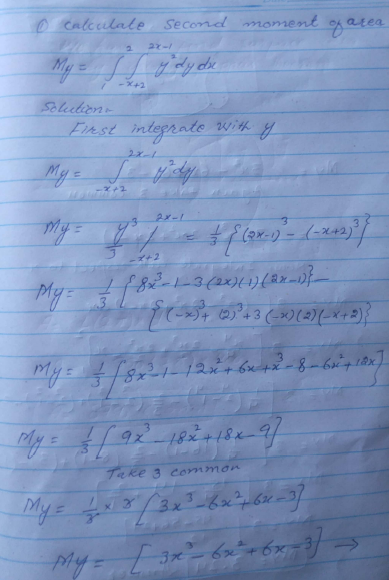
**The only remaining thing is the area of triangle**

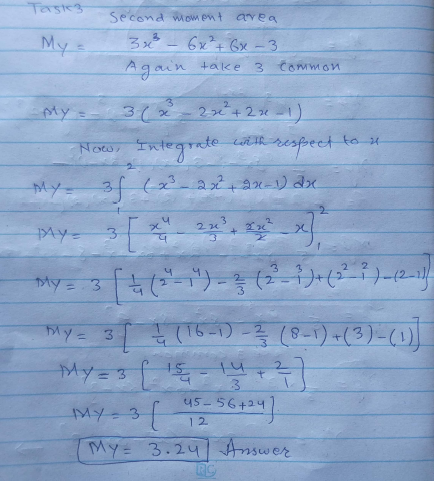
Now we find the coordinate for centroid





Now the calculate the second moment of area





**Task 4**

