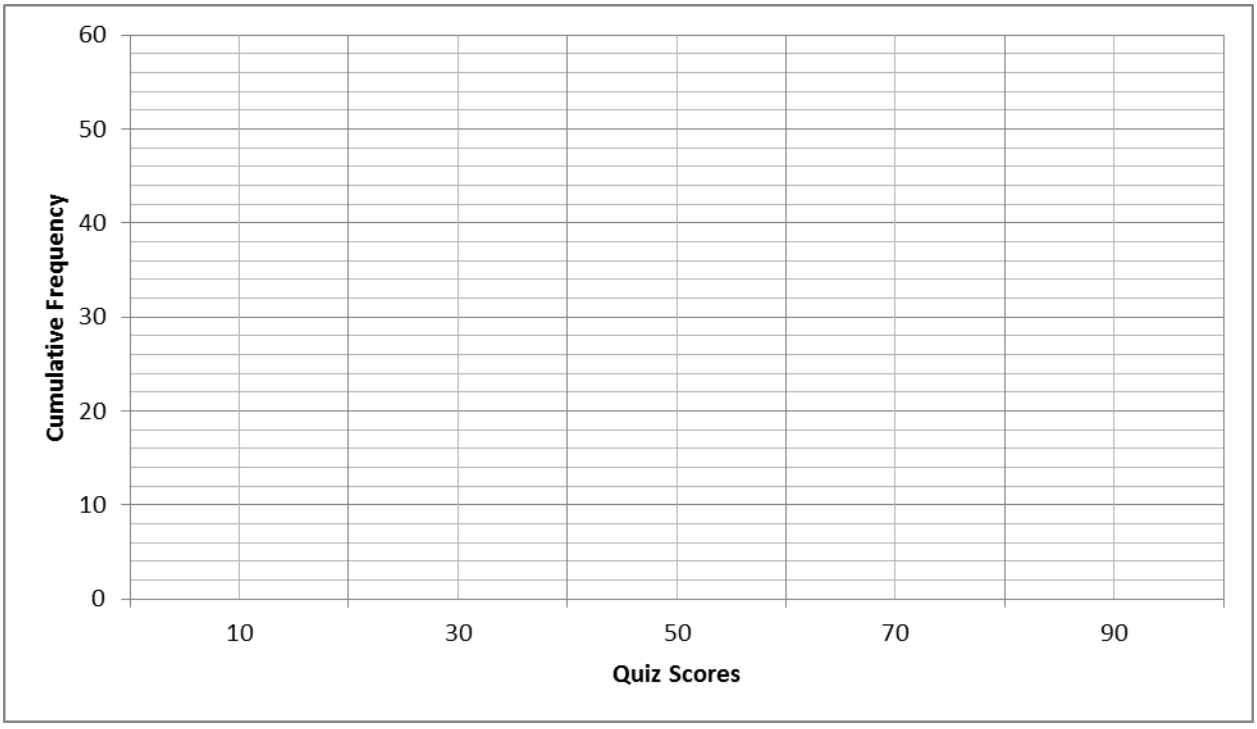
(A) Lesson Objectives

a. Prepare visual representations of statistical data using grouped data
b. Analyze the grouped data algebraically and graphically using the measures of central tendency and dispersion

(B) Detailed Example #1 – Here is the grouped data arising from the QUIZ scores from the IB Studies 2 REQUIZ from our last quiz (quizzes were scored out of 100 percent):

Grouped scores	frequency		Cumulative frequency	
1-20	7			
21-40	12			
41-60	15			
61-80	10			
81-100	11			

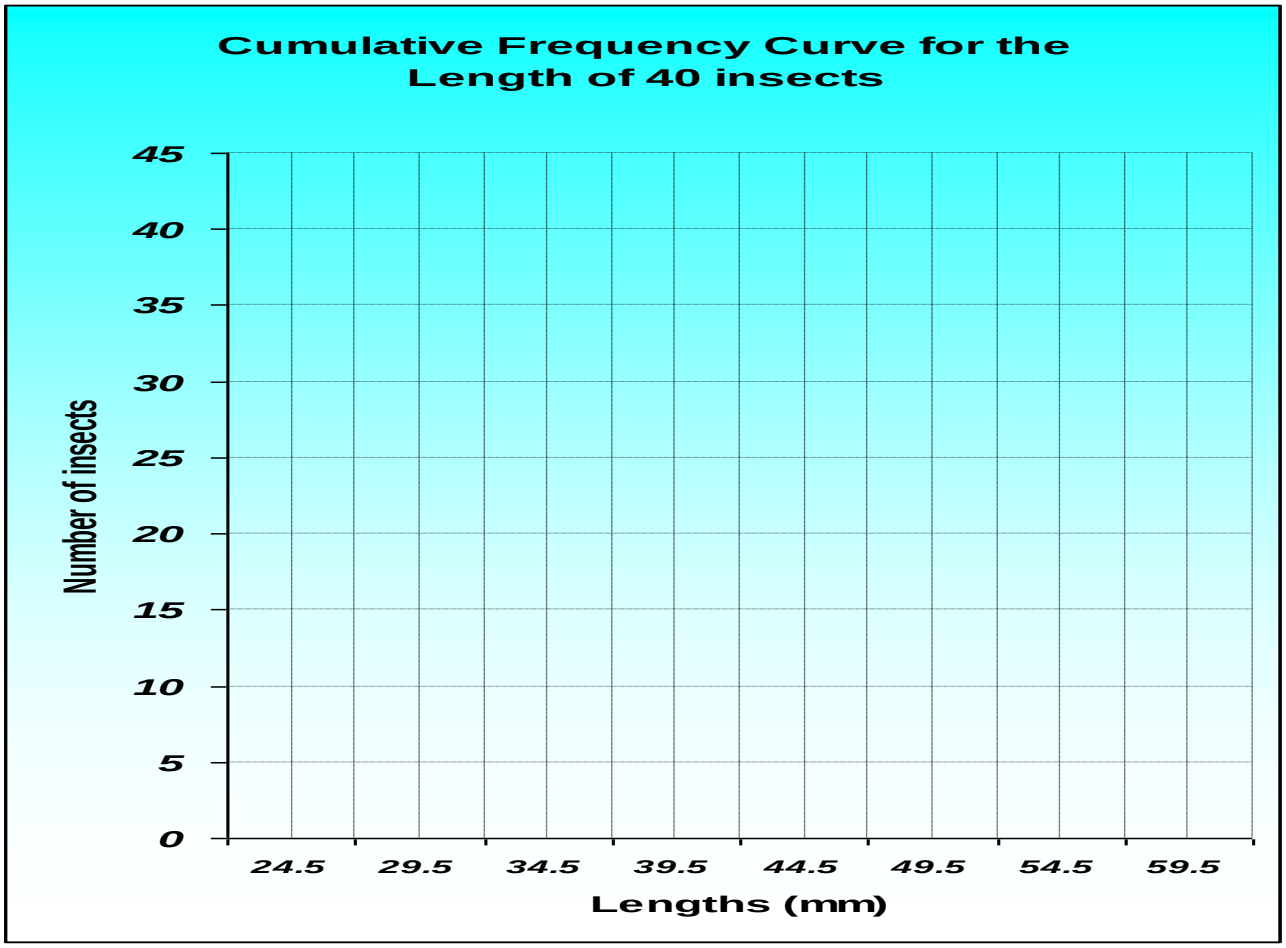
a. Prepare a "less than" ogive
b. USE THE OGIVE to determine ESTIMATES of min, Q_1,Q_2,Q_3, and max
c. USE ALGEBRA to calculate ESTIMATES of Q_1, Q_2, Q_3 and mean
d. An IB grade of 7 is awarded to students in the 90^{th} percentile or above. What ESTIMATED raw quiz score would be required to be awarded an IB score of 7?
e. Hiro scored a 72%. What is his ESTIMATED "class ranking" as a percentile?



(C) Example #2 - The length of 40 insects of a certain species were measured correct to the nearest millimeter. The frequency distribution is given below:

a. Construct a cumulative frequency table for the given data.
b. Draw the cumulative frequency curve for the data (ogive).
c. ESTIMATE from the curve AND use algebra to ESTIMATE:
   i. Q_1, Q_2, Q_3 and mean (algebra only)
   ii. The number of insects that were less than 43.5 mm long
   iii. The number of insects that were at least 37.5 mm long.
   iv. The value of ***k***, if 81% of the insects were less than ***k*** mm long.

Lengths (mm)	Frequency (f_i)		
25 – 29	2		
30 – 34	4		
35 – 39	7		
40 – 44	10		
45 – 49	8		
50 – 54	6		
55 – 59	3		



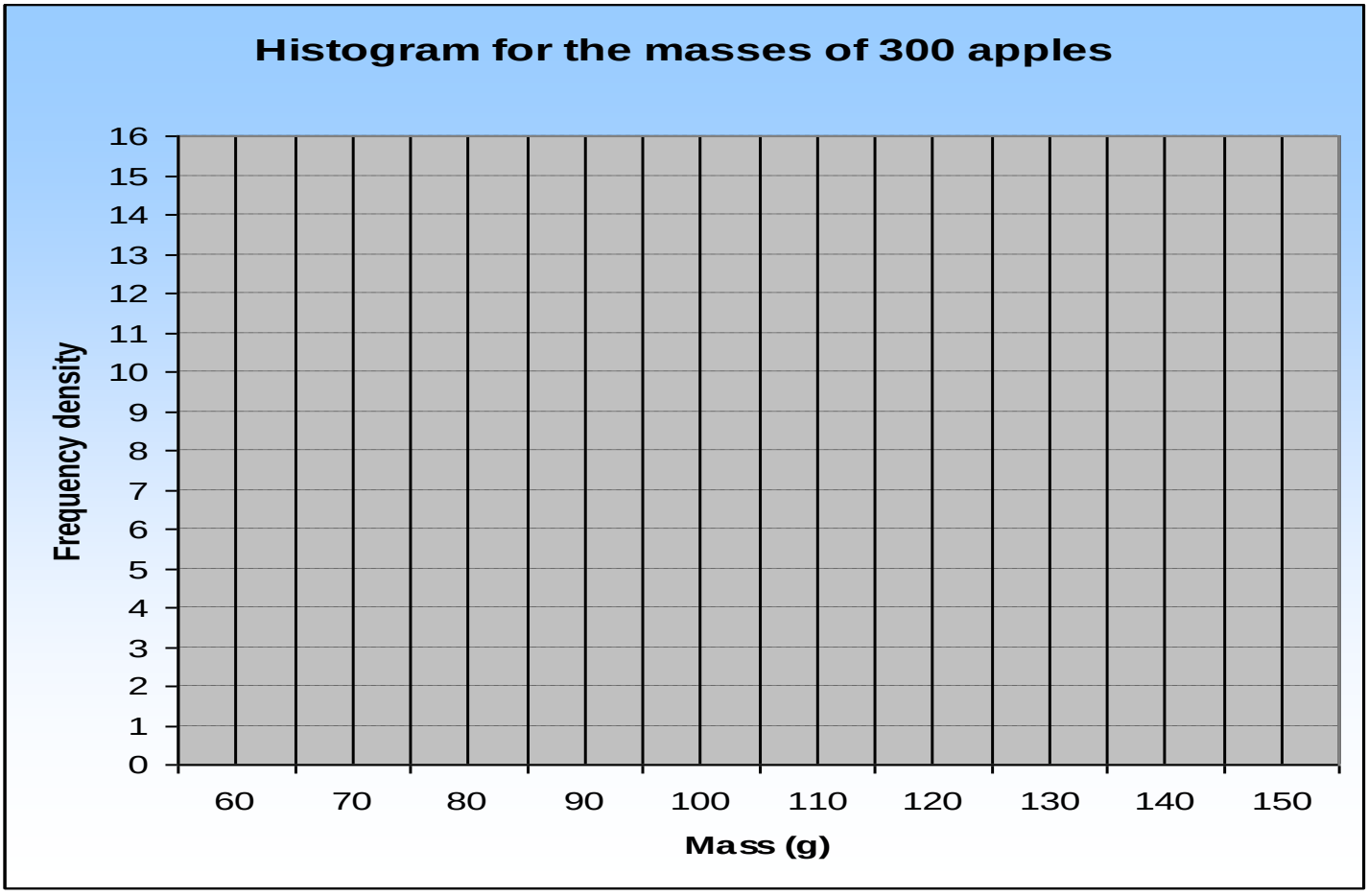
(D) Example #3 - The mass of 300 apples were measured. The table gives the cumulative frequency distribution of the masses.

a. Draw a cumulative frequency curve.
b. Estimate from the curve

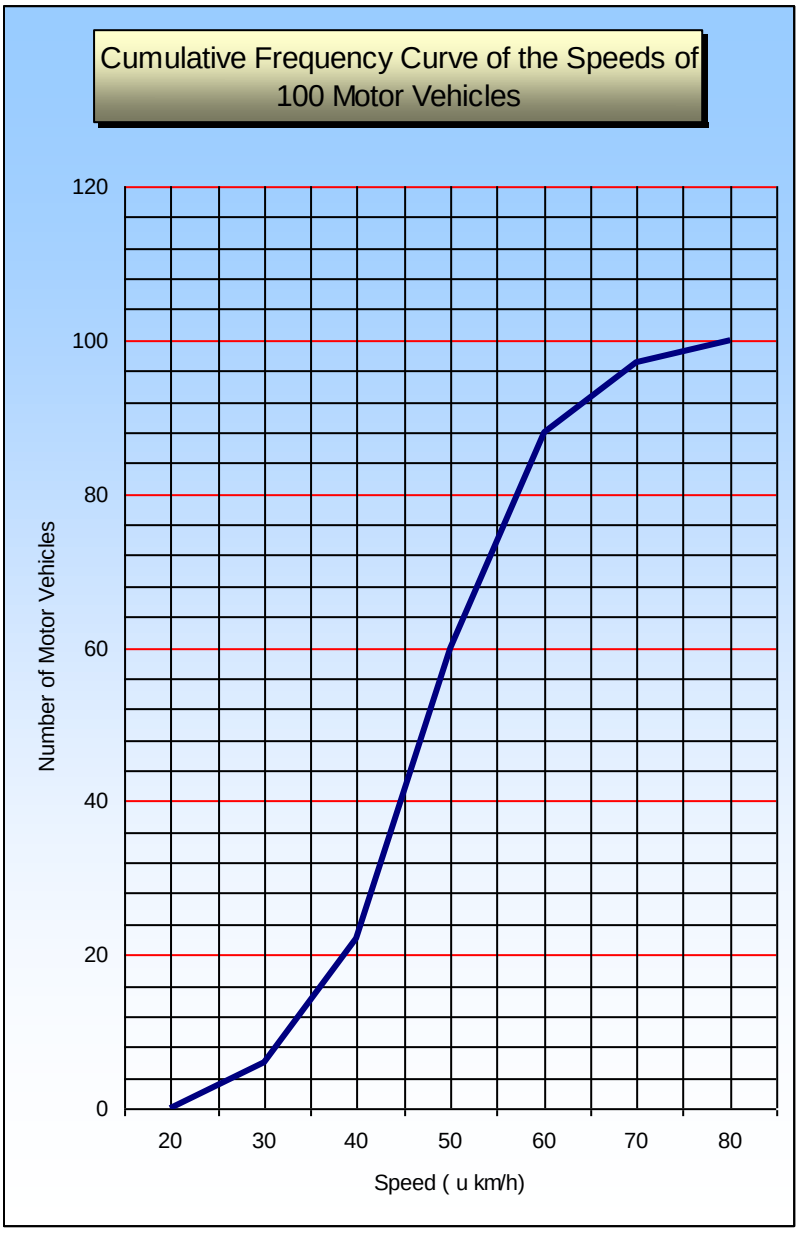
i. Q_1, Q_2, Q_3 and mean (algebra only)
ii. the number of apples having masses 98 g or less,
iii. the value of m given that 20% of the apples had masses more than mg.

Taking class interval $60 < x \leq 70$, $70 < x \leq 80$, $80 < x \leq 90$, … , construct a frequency distribution and draw a histogram

Mass (x g)	Cumulative frequency	Mass (x g)	Frequency
$x \leq 70$	*8*	$60 < x \leq 70$	*8*
$x \leq 80$	*19*		
$x \leq 90$	*57*		
$x \leq 100$	*89*		
$x \leq 110$	*141*		
$x \leq 120$	*216*		
$x \leq 130$	*266*		
$x \leq 140$	*290*		
$x \leq 150$	*300*		



1. The speeds of 100 motor vehicles passing a certain point in a busy street are recorded. The cumulative are frequency curve shows the speed, *u* km/h and the number of vehicles, whose speeds are less than *u* km/h. (As an example, 74 vehicles have speeds less than 53 km/h). Use the curve to estimate
   a. the number of vehicles whose speeds are less than 34 km/h,
   b. the fraction of the total number of vehicles whose speeds are greater than or equal to 59 km/h,
   c. the value of *v*, if 40% of the vehicles have a speed less than *v* km/h.



2. The results of a music examination taken by 160 pupils are shown in the cumulative frequency table below:

Mark	< 10	< 20	< 30	< 40	< 50	< 60	< 70	< 80
Number of pupils	0	8	21	55	103	135	150	160

a. Using a horizontal scale of 2 cm to represent 10 marks and a vertical scale of 1 cm to represent 10 pupils, draw a cumulative frequency curve for the results.

b. Use your graph to estimate

(i) the number of pupils who scored less than 45 marks,

(ii) the fraction of the total number of pupils who failed the music examination given that 34 is the lowest mark to pass the examination,

(iii) the value of x if 22.5% of the pupils obtained at least x marks in the music examination.

3. The table below shows the amount of milk (in kg) obtained from each of the 70 cows of a dairy farm on a particular day:

Amount of milk (x kg)	Number of cows
$0 \le x < 4$	7
$4 \le x < 6$	11
$6 \le x < 8$	17
$8 \le x < 10$	20
$10 \le x < 12$	10
$12 \le x < 14$	5

a. Construct a cumulative frequency table and draw a cumulative frequency curve.

b. Use your curve to estimate

(ii) the number of cows that give less than 9.4 kg of milk,

(iii) the fraction of the 70 cows that give at least 7.4 kg of milk,

(iv) the value of x if 70% of the cows give at least x kg of milk.

4. 500 earthworms were collected from a sample of soil. Their lengths were recorded and the results are given in the following table:

Length (mm)	Number of worms	Lengths (mm)	Number of worms
		≤ 10	0
$10 < x \leq 20$	10	≤ 20	10
$20 < x \leq 30$	20	≤ 30	
$30 < x \leq 40$	50	≤ 40	
$40 < x \leq 50$	90	≤ 50	
$50 < x \leq 60$	150	≤ 60	
$60 < x \leq 70$	100	≤ 70	
$70 < x \leq 80$	50	≤ 80	
$80 < x \leq 90$	20	≤ 90	
$90 < x \leq 100$	10	≤ 100	500

a. Copy and complete the following cumulative frequency table:

b. Draw a cumulative frequency curve to represent the results by using 2 cm to represent 100 worms on the vertical axis and taking values of the cumulative frequency from 0 to 500. On the horizontal axis, take values of the length from 10 mm to 100 mm and use a scale if 1 cm to represent 10 mm.

c. Use your graph to estimate

(i) the number of earthworms whose lengths are less than or equal to 58 mm,
(ii) the percentage of earthworms whose lengths are greater than 76 mm,
(iii) the value of x if 18% of the earthworms are of length x mm or less.

5. The lengths of 600 leaves from a tree are measured. The following table gives the cumulative frequency distribution of these lengths:

Length (x mm)	$x \leq 20$	$x \leq 25$	$x \leq 30$	$x \leq 35$	$x \leq 40$	$x \leq 45$	$x \leq 50$
Number of leaves	0	20	80	260	500	580	600

a. Draw a cumulative frequency to represent these results using the following scales:
On the horizontal axis, take values of the length from 20 mm to 50 mm and use a scale of 2 cm to represent 5 mm.

On the vertical axis, take values of the cumulative frequency from 0 to 600 and use a scale of 2 cm to represent 100 leaves.

b. Use your graph to estimate
(i) the number of leaves whose lengths are less than or equal to 41.5 mm,
(ii) the percentage of leaves whose lengths are greater than 33 mm.

c. Copy and complete the following frequency distribution table:

Length (x mm)	Number of worms
$20 < x \leq 25$	20
$25 < x \leq 30$	60
$30 < x \leq 35$	
$35 < x \leq 40$	
$40 < x \leq 45$	
$45 < x \leq 50$	

d. Draw a histogram to represent the frequency distribution in ©.