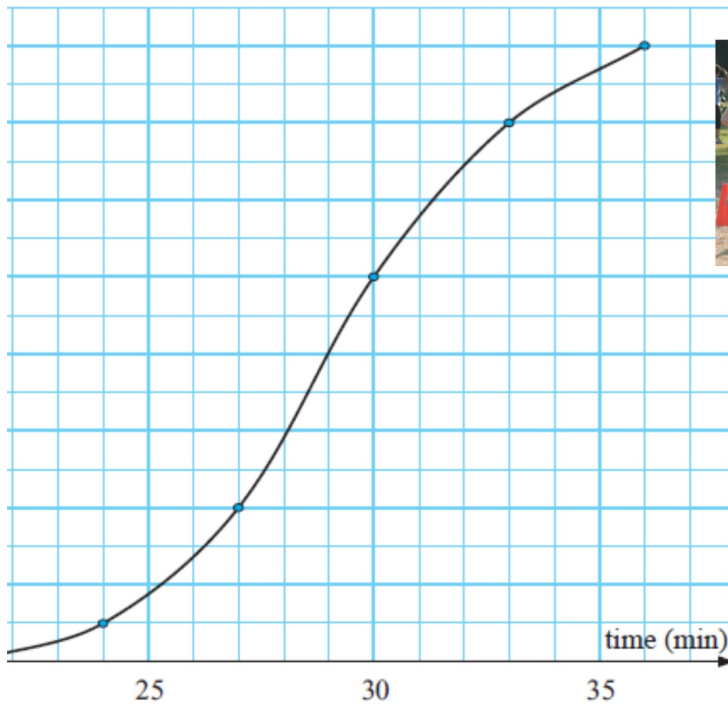


Welcome MYP 9 Mathematics!

	Assignment Effort Grade (Circle One)	Comments (What was interesting or challenging?)
Monday Date: <u>4/09</u> Topic: <u>No Homework over Spring Break</u>	0 1 2	
Tuesday Date: <u>4/10</u> Topic: <u>10B: Stem plots, discrete data</u>	0 1 2	
Wednesday Date: <u>4/11</u> Topic: <u>10C: Histograms, continuous data</u>	0 1 2	
Thursday Date: <u>4/12</u> Topic: <u>10D: Measures of center</u>	0 1 2	
Friday Date: _____ Topic: _____	0 1 2	

Cross-country race times



notice?



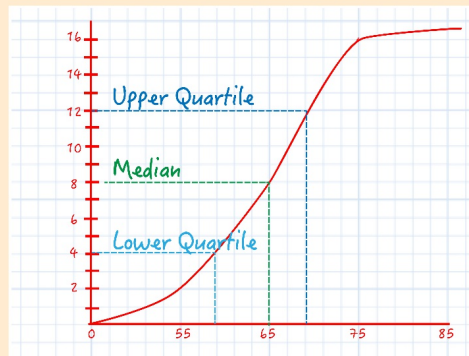
Class Plan:

1. Warm-up, homework ??
2. 10E: Cumulative Data, cumulative graph

E

CUMULATIVE DATA

3. Practice



E

CUMULATIVE DATA

Sometimes it is useful to know the number of scores that lie above or below a particular value. In such situations it is convenient to construct a **cumulative frequency distribution table** and a **cumulative frequency graph**.

The **cumulative frequency** gives a *running total* of the scores up to a particular value.

The cumulative frequency graph can be used to estimate the **median** of grouped data.

E**CUMULATIVE DATA**

Cumulative Frequency Table/Graph: To know the scores that lie about or below a particular value.

Cumulative Frequency: Gives a running total of the scores up to a particular value.

Example - A running total of the number of siblings.

<u>No. of Siblings</u>	<u>Frequency</u>	<u>Cumulative Frequency</u>
X	f	cf
0	3	3
1	7	10
2	10	20
3	3	23
4	4	27
5	0	27
6	1	28
Total	28	

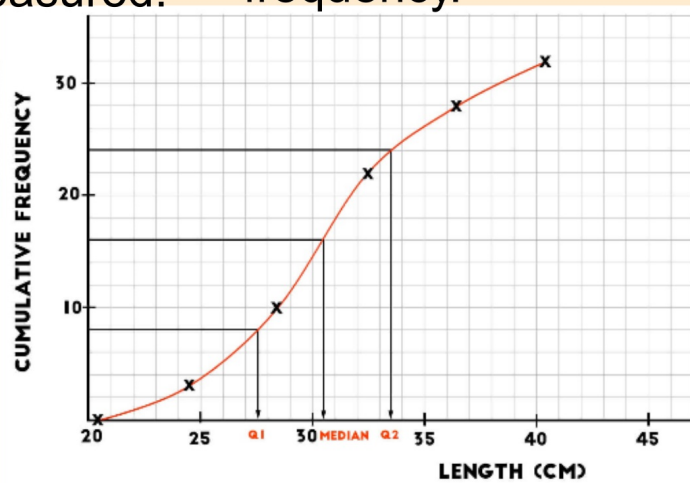
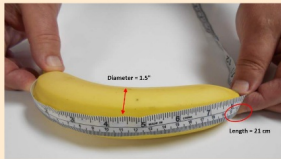
*Used to estimate the median

E

CUMULATIVE DATA

Cumulative Frequency Graph: Example - A display showing the lengths of a group of bananas.

x-axis: Values being compared, measured. **y-axis**: Cumulative frequency.



E Example: Exercise Bike CUMULATIVE DATA

Example 10

The table alongside shows the times 50 people spent on an exercise bike at a gym in one day.

- Construct a cumulative frequency table for the data.
- Represent the data on a cumulative frequency graph.
- Use your graph to estimate how many people used the bike for:
 - less than 12 minutes
 - more than 23 minutes.
- Estimate the median time spent on the bike.

<i>Time t (min)</i>	<i>Frequency</i>	<i>Cumulative Frequency</i>
$0 \leq t < 5$	5	5
$5 \leq t < 10$	8 + 5	13
$10 \leq t < 15$	10 + 13	23
$15 \leq t < 20$	12 +	35
$20 \leq t < 25$	9	44
$25 \leq t < 30$	6	50

E Example

CUMULATIVE DATA

a Cumulative frequency table

<i>a</i>	<i>Time t (min)</i>	<i>Frequency</i>	<i>Cumulative frequency</i>
	$0 \leq t < 5$	5	5
	$5 \leq t < 10$	8	13
	$10 \leq t < 15$	10	23
	$15 \leq t < 20$	12	35
	$20 \leq t < 25$	9	44
	$25 \leq t < 30$	6	50

This is $5 + 8$
 $5 + 8 + 10 = 23$ people used the bike for less than 15 minutes.

Note: The time intervals are ***up to certain minutes***. For example, 5 people were on the bike for ***under 5 minutes***.

E Example

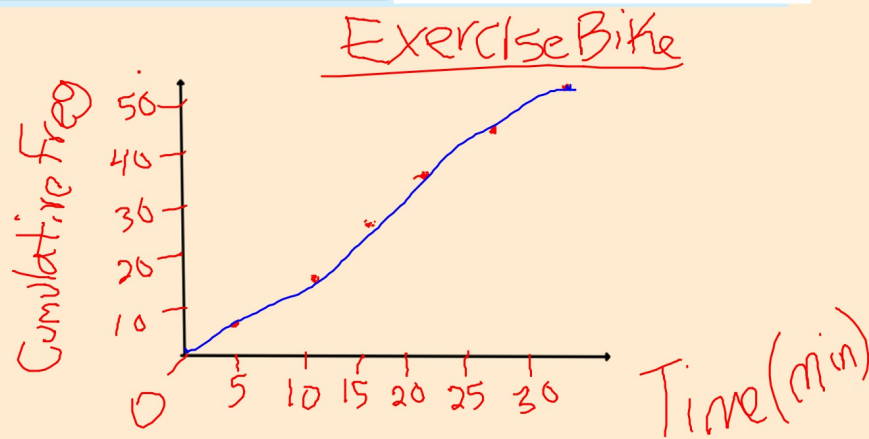
CUMULATIVE DATA

a

Time t (min)	Frequency	Cumulative frequency
$0 \leq t < 5$	5	5
$5 \leq t < 10$	8	13
$10 \leq t < 15$	10	23
$15 \leq t < 20$	12	35
$20 \leq t < 25$	9	44
$25 \leq t < 30$	6	50

x-axis (Time)

y-axis (Cumulative frequency)

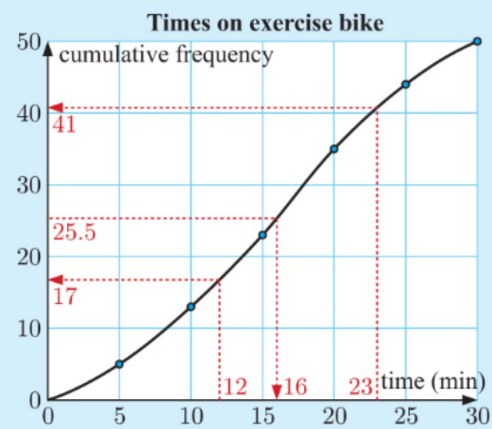


E Example

CUMULATIVE DATA

b Cumulative frequency graph

- b At the end of each time interval, we plot the cumulative frequency up to that point. We then draw a curve through these points.



E Example

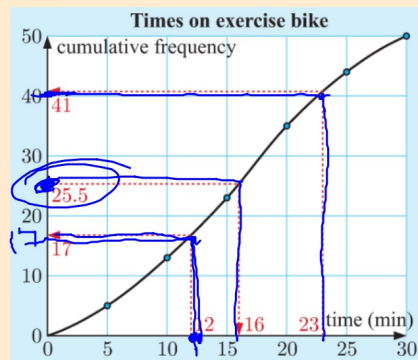
CUMULATIVE DATA

Estimate how many people biked:

c) $<12 \text{ min}$, $>23 \text{ min}$

d) median time.

1 1 2 3 4 | 5 7 8 9 10



c Reading from the graph, we estimate that:

i 17 people used the bike for less than 12 minutes

ii $50 - 41 = 9$ people used the bike for more than 23 minutes.

d The median is the average of the 25th and 26th times.

Reading from the graph, the median ≈ 16 minutes.

E Example**CUMULATIVE DATA**

Estimate the mean time on the bike.

<i>Interval midpoint</i>	<i>Time t (min)</i>	<i>Frequency</i>	<i>Product</i>
2.5	$0 \leq t < 5$	5	12.5
7.5	$5 \leq t < 10$	8	60
12.5	$10 \leq t < 15$	10	125
17.5	$15 \leq t < 20$	12	210
22.5	$20 \leq t < 25$	9	202.5
27.5	$25 \leq t < 30$	6	165
		Sum	775

$$\bar{x} \approx \frac{775}{50} = 15.5 \text{ min}$$

E Example**CUMULATIVE DATA**

Estimate the mean time on the bike.

<i>Interval midpoint</i>	<i>Time t (min)</i>	<i>Frequency</i>	<i>Product</i>
2.5	$0 \leq t < 5$	5	12.5
7.5	$5 \leq t < 10$	8	60
12.5	$10 \leq t < 15$	10	125
17.5	$15 \leq t < 20$	12	210
22.5	$20 \leq t < 25$	9	202.5
27.5	$25 \leq t < 30$	6	165
	Sum		775

$$\bar{x} \approx \frac{775}{50} = 15.5 \text{ minutes}$$

E

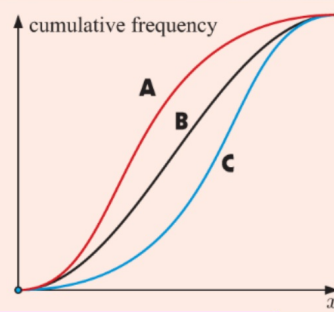
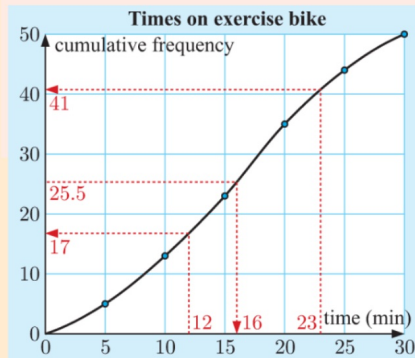
CUMULATIVE DATA

How do we know if the cumulative data is positively or negatively skewed?

DISCUSSION

Which of these cumulative frequency graphs indicates:

- a a symmetric distribution
- b a positively skewed distribution
- c a negatively skewed distribution?

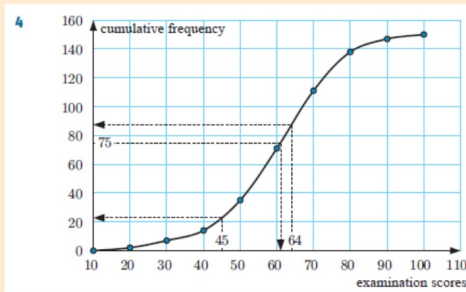
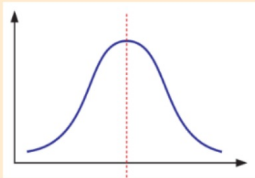


Nearly symmetric

How do we know if the cumulative data is positively or negatively skewed?

Exam Scores

Score	Frequency
$10 \leq x < 20$	2
$20 \leq x < 30$	5
$30 \leq x < 40$	7
$40 \leq x < 50$	21
$50 \leq x < 60$	36
$60 \leq x < 70$	40
$70 \leq x < 80$	27
$80 \leq x < 90$	9
$90 \leq x < 100$	3

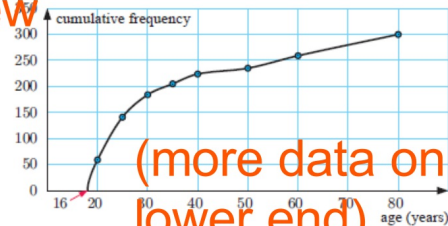


How do we know if the cumulative data is positively or negatively skewed?

Number of Accidents

Age (in years)	No. of accidents
$16 \leq x < 20$	59
$20 \leq x < 25$	82
$25 \leq x < 30$	43
$30 \leq x < 35$	21
$35 \leq x < 40$	19
$40 \leq x < 50$	11
$50 \leq x < 60$	24
$60 \leq x < 80$	41

Positive Skew

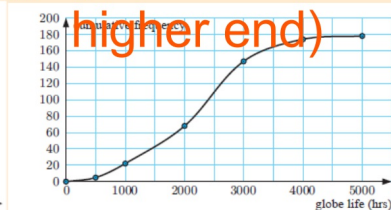
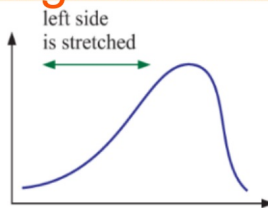


(more data on lower end)

Light Bulb Life

Life (hours)	Number of globes
$0 \leq l < 500$	5
$500 \leq l < 1000$	17
$1000 \leq l < 2000$	46
$2000 \leq l < 3000$	79
$3000 \leq l < 4000$	27
$4000 \leq l < 5000$	4

Negative Skew (more data on higher end)

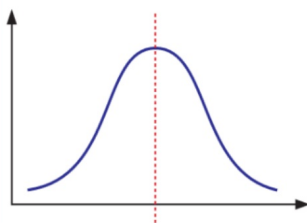


E

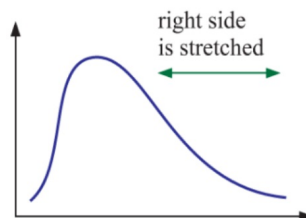
CUMULATIVE DATA

How do we know if the cumulative data is positively or negatively skewed?

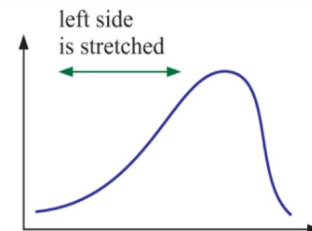
Recall from Monday (10B)



Symmetrical
"Normal" Distribution



Positively
Skewed Distribution
(Less data on the
positive side)

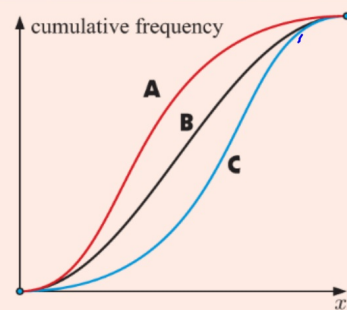


Negatively
Skewed Distribution
(Less data on the
negative side)

E**CUMULATIVE DATA****DISCUSSION**

Which of these cumulative frequency graphs indicates:

- a** a symmetric distribution
- b** a positively skewed distribution
- c** a negatively skewed distribution?



A: Positive Skewed (More data on the lower end)

B: Symmetric distribution (normally distributed)

C: Negative skewed (More data on higher end)

E Additional Example

CUMULATIVE DATA

The times taken for trampers to climb Ben Nevis were recorded and the results tabled below:

Time t (min)	$175 \leq t < 190$	$190 \leq t < 205$	$205 \leq t < 220$	$220 \leq t < 235$	$235 \leq t < 250$
Frequency	11	35	74	32	8

- Construct a cumulative frequency table for the data.
- Draw a cumulative frequency graph for the data.
- Estimate the median time for the walk.
- Guides on the walk say that anyone who completes the walk in 3 hours 15 min or less is extremely fit. Estimate the number of extremely fit trampers in this group.

Ben Nevis Highest mountain range in Scotland



E Example Solution

CUMULATIVE DATA

a

Time t (min)	Frequency	Cumulative frequency
$175 \leq t < 190$	11	11
$190 \leq t < 205$	35	46
$205 \leq t < 220$	74	120
$220 \leq t < 235$	32	152
$235 \leq t < 250$	8	160

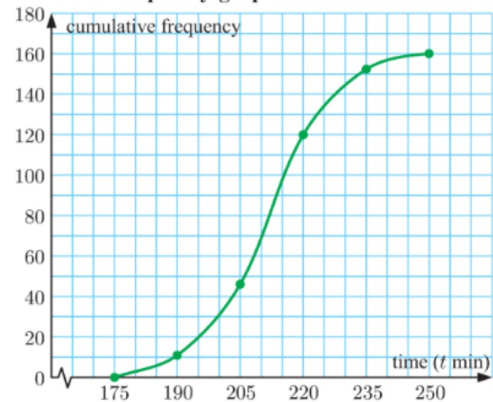
tramper

/'trampər/

noun NZ

a person who walks for long distances in rough country for recreation.
"a helicopter will continue the search for the missing tramper"

b Cumulative frequency graph of Ben Nevis climb data



c ≈ 212 min

d ≈ 20 trampers

Real-life comparison using GPA

Cummulative GPA vs. Overall GPA

Cumulative GPA

Cumulative GPA (grade point average) can be defined as the average of all the grades that a student has secured in the entire semester or term examinations. This calculation involves all the subjects. It can be easily understood by this example. In a particular semester, a student gets an “A, A,” and “B” grades. For this particular student, the cumulative GPA will be an average of 4, 4 and 3 which comes out to be 3.67. Here we are assuming that the school is measuring on a 4-point scale. In some nations, this grading of performance is done on a 10-point scale.

Overall GPA

Overall GPA (grade point average) can be defined as the average of all cumulative GPAs that a student has secured in all the courses in the total academic duration. This can be explained easily by an example. If a student's score of a cumulative GPA in four terms is 4, 4, 3.5, 3.5, then his or her overall GPA will be 3.75.

<http://www.differencebetween.net/language/difference-between-cummulative-gpa-and-overall-gpa/>

Real-life comparison using GPA **Cummulative GPA vs. Overall GPA**

Summary:

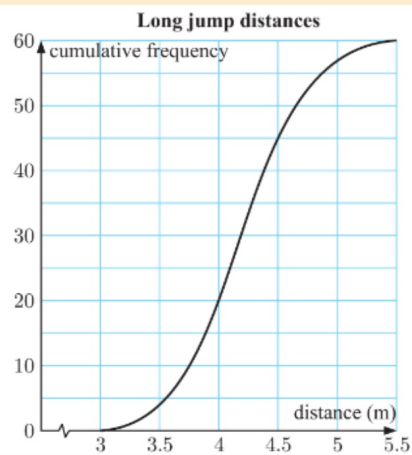
- 1.Cumulative GPA is an average grade of a particular semester or term while the overall GPA is the average of all the cumulative GPAs.
- 2.Absolute performance of a student is judged on the basis of overall GPA and not on the basis of cumulative GPA.
- 3.Cumulative GPA is the score that the student has received from the most recent institute while the overall GPA also includes the transfer grades as well.
- 4.Overall GPA is calculated taking into account all the grades regardless of the institution while cumulative GPA is for one particular institute.

<http://www.differencebetween.net/language/difference-between-cummulative-gpa-and-overall-gpa/>

Exercises: Read additional example, & #1, #2.

1 This cumulative frequency graph shows the distances jumped by students in a long jump competition.

- a How many students were in the competition?
- b How many students jumped:
 - i less than 4 m
 - ii more than 4.5 m?



2 The table alongside shows the heights of dancers in a ballet class.

- a Construct a cumulative frequency table for the data.
- b How many dancers are in the class?
- c Represent the data on a cumulative frequency graph.
- d Use your graph to estimate the number of dancers who are:
 - i shorter than 155 cm
 - ii taller than 145 cm.

Height h (cm)	Frequency
$120 \leq h < 130$	5
$130 \leq h < 140$	7
$140 \leq h < 150$	12
$150 \leq h < 160$	10
$160 \leq h < 170$	6

Additional Exercises:

<i>Speed v (km/h)</i>	<i>Frequency</i>
$200 \leq v < 220$	12
$220 \leq v < 240$	16
$240 \leq v < 260$	21
$260 \leq v < 280$	18
$280 \leq v < 300$	13

An airport authority measured the speeds of planes as they touched down on the runway during a particular day.

- Construct a cumulative frequency table for the data.
- Draw a cumulative frequency graph of the data.
- Estimate the number of planes travelling faster than 230 km/h when they touched down.
- Estimate the median speed.

- 4 The table alongside shows the weights of competitors in a boxing tournament.

- Estimate the mean weight of the boxers.
- Construct a cumulative frequency table for the data.
- Draw a cumulative frequency graph of the data.
- Boxers weighing between 79 kg and 91 kg are in the cruiserweight class. Estimate the number of boxers in this class.
- Estimate the median weight of the boxers.

<i>Weight w (kg)</i>	<i>Frequency</i>
$50 \leq w < 60$	14
$60 \leq w < 70$	19
$70 \leq w < 80$	28
$80 \leq w < 90$	23
$90 \leq w < 100$	16

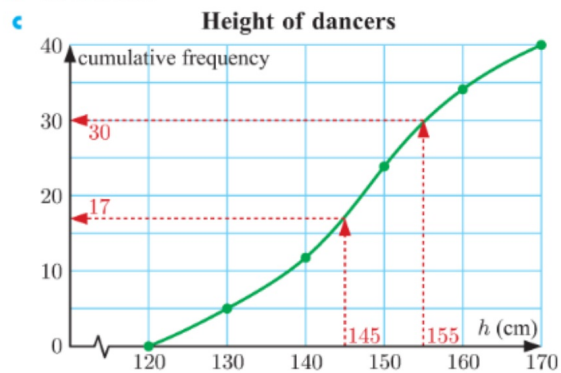
Exercise Solutions:

1 a 60 students b i ≈ 20 students ii ≈ 15 students

2 a

Height h (cm)	Frequency	Cumulative frequency
$120 \leq h < 130$	5	5
$130 \leq h < 140$	7	12
$140 \leq h < 150$	12	24
$150 \leq h < 160$	10	34
$160 \leq h < 170$	6	40

b 40 dancers

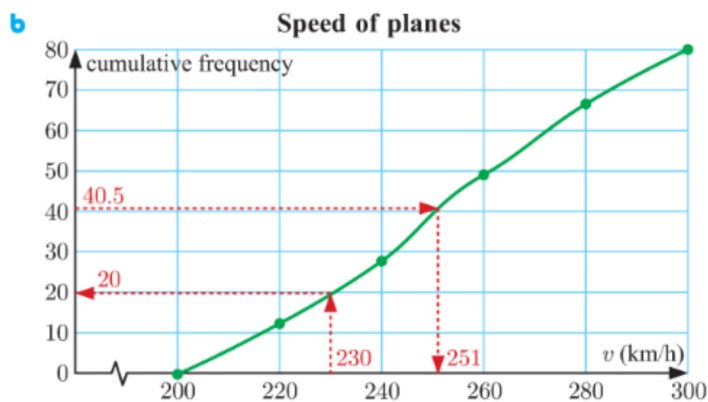


d i ≈ 30 dancers ii ≈ 23 dancers

Exercise Solutions:

3 a

Speed v (km/h)	Frequency	Cumulative frequency
$200 \leq v < 220$	12	12
$220 \leq v < 240$	16	28
$240 \leq v < 260$	21	49
$260 \leq v < 280$	18	67
$280 \leq v < 300$	13	80



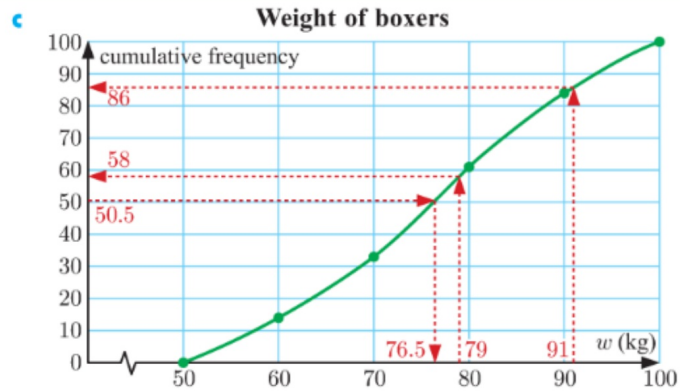
c ≈ 60 planes **d** ≈ 251 km/h

Exercise Solutions:

4 a $\bar{x} \approx 75.8$ kg

b

Weight w (kg)	Frequency	Cumulative frequency
$50 \leq w < 60$	14	14
$60 \leq w < 70$	19	33
$70 \leq w < 80$	28	61
$80 \leq w < 90$	23	84
$90 \leq w < 100$	16	100



d ≈ 28 boxers

e ≈ 76.5 kg