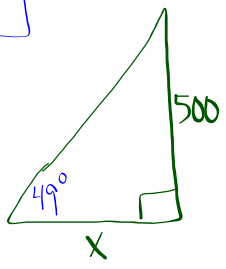
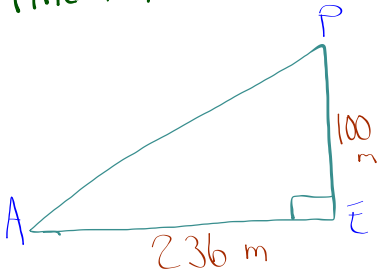
# HW Tally as needed

warm up

find $x$

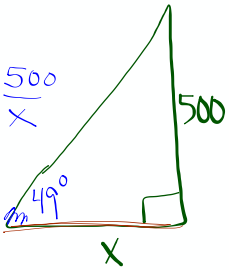



find $\widehat{APE}$



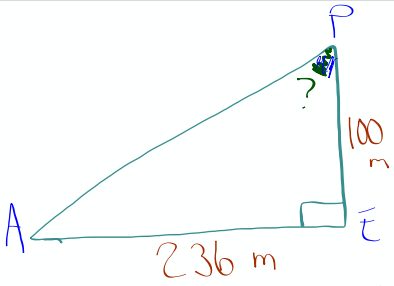

Soh-Cah-Toa

$\tan(49) = \frac{500}{x}$




$x = \frac{500}{\tan(49)} \approx 434.64\ldots$

435 feet




$\tan(\widehat{APE}) = \frac{236}{100}$

$\widehat{APE} = \tan^{-1}\left(\frac{236}{100}\right)$

$67.0362669 \approx 67.0°$

$$\frac{2}{6} = \frac{10}{30} \qquad \frac{2}{10} = \frac{6}{30}$$

$$\frac{30}{6} = \frac{10}{2}$$

HW

6C

| Life (hours) | | No. globes |
|---|---|---|
| 0 | 500 | 5 |
| 500 | 1000 | 17 |
| 1000 | 2000 | 46 |
| 2000 | 3600 | 79 |
| 3600 | 4600 | 27 |
| 4000 | 500 | 4 |

$$\bar{x} = \frac{\sum fx}{n}$$

Recap of Recent GDC items

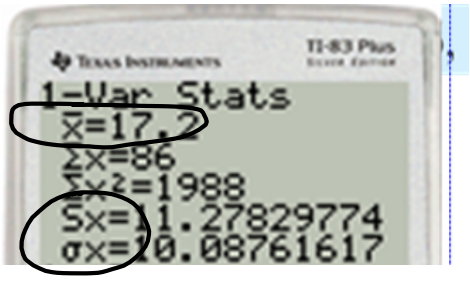
# Review of Calculating the *Mean*, $\bar{x}$

If each piece of data is not repeated, as in this set.....

13, 12, 15, 13, 18, 14, 16, 15, 15, 17

which means you can quickly enter the data in your GDC and use

**STAT-CALC-1variable statistics**




However, if .....

| *Score* | *Frequency* |
|---|---|
| 11 | 3 |
| 12 | 4 |
| 13 | 5 |
| 14 | 2 |
| 15 | 8 |

or like this.....

| *Mark* | *Frequency* |
|---|---|
| 50 - 59 | 16 |
| 60 - 69 | 24 |
| 70 - 79 | 13 |
| 80 - 89 | 6 |
| 90 - 99 | 2 |

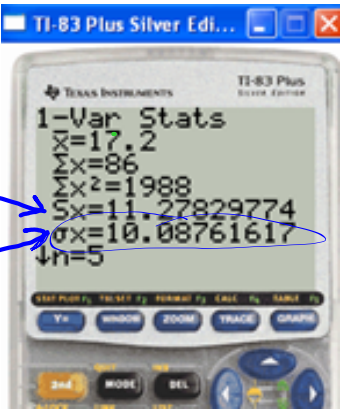
$$\bar{x} = \frac{\sum f \cdot x}{n} = m$$

STAT/CALC/1-V

## *Your GDC will calculate both versions of the standard deviation.*

***Sample*** standard deviation
(not for IB)

***Population*** standard deviation
(always use for any IB work)




**For IB, always use the value given for the second one $\sigma_x$, but *write it* using the notation $s_x$**

$S_x = 10.0876$

for Standard Deviation:

Yesterday.....we only looked at data **not** grouped in intervals when calculating $S_x$

13, 12, 15, 13, 18, 14, 16, 15, 15, 17

The formula is

$$s_x = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n}}$$

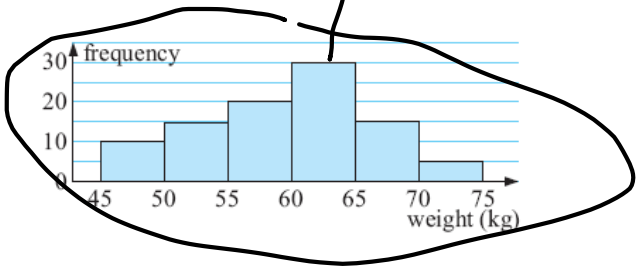
However, if each pieceof data has frequencies (and possibly grouped into intervals) like this.....

| Score | Frequency |
|---|---|
| 11 | 3 |
| 12 | 4 |
| 13 | 5 |
| 14 | 2 |
| 15 | 8 |

or like this.....

| Mark | Frequency |
|---|---|
| 50 - 59 | 16 |
| 60 - 69 | 24 |
| 70 - 79 | 13 |
| 80 - 89 | 6 |
| 90 - 99 | 2 |

or like this.....




TODAY

Calculate standard deviation if data is grouped into intervals

$$\bar{x} = \frac{\sum f x_i}{n} \qquad s = \sqrt{\frac{\sum f (x_i - \bar{x})^2}{n}}$$

NOTES recommended

then the more complicated formula is required

Regular Data

Grouped

Mean $\bar{x} = \frac{\sum x_i}{n}$

$\bar{x} = \frac{\sum f \cdot x}{\sum f}$

$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n}}$

$s = \sqrt{\frac{\sum f(x_i - \bar{x})^2}{\sum f}}$

$s = \sqrt{\frac{\sum f(x_i - \bar{x})^2}{\sum f}}$

You must calculate the mean, $\bar{x}$, ahead of time

# example

Find the estimated mean and standard deviation. Show all critical values.

We'll use our GDC lists as a spreadsheet.

| x (mid interval) | Marks | f (Frequency) |
|---|---|---|
| 4.5 | 0 - 9 | 2 |
| 14.5 | 10 - 19 | 31 |
| 24.5 | 20 - 29 | 73 |
| 34.5 | 30 - 39 | 85 |
| 44.5 | 40 - 49 | 28 |

$\bar{x} = \frac{6425}{219} = 29.3$ marks $\quad s = \sqrt{\frac{?}{219}} = 9.18$ marks

| Marks | Frequency |
|---|---|
| 0 - 9 | 2 |
| 10 - 19 | 31 |
| 20 - 29 | 73 |
| 30 - 39 | 85 |
| 40 - 49 | 28 |

mean

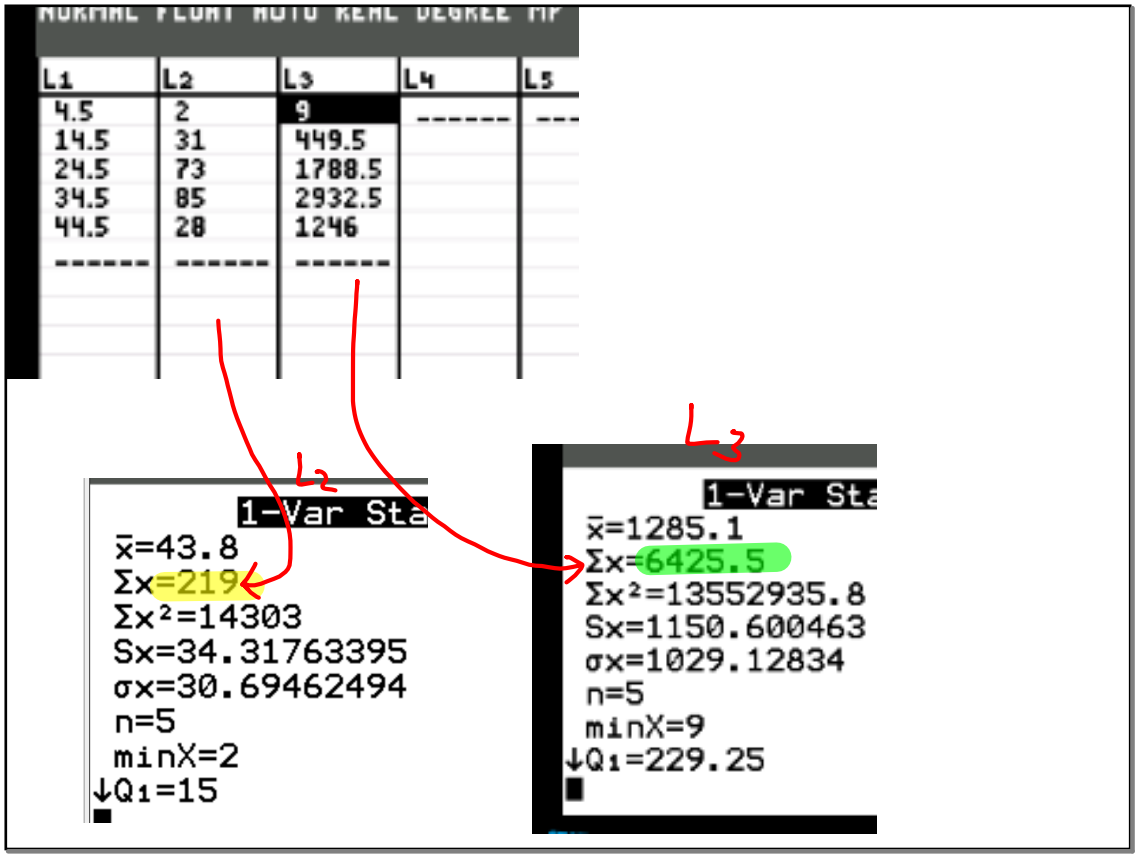
$\bar{x} = \frac{\sum f \cdot x}{\sum f} =$ ____

mid-interval mark $x_i$

| Marks | Frequency ($f$) | $fx$ |
|---|---|---|
| 0 - 9 | 2 | |
| 10 - 19 | 31 | |
| 20 - 29 | 73 | |
| 30 - 39 | 85 | |
| 40 - 49 | 28 | |

Mean

$$\bar{x} = \frac{\sum fx}{\sum f} = \text{---} =$$



mid-interval mark $x_i$

| | Marks | Frequency $f$ |
|---|---|---|
| 4.5 | 0 - 9 | 2 |
| 14.5 | 10 - 19 | 31 |
| 24.5 | 20 - 29 | 73 |
| 34.5 | 30 - 39 | 85 |
| 44.5 | 40 - 49 | 28 |
| | | 219 |

$f(x-\bar{x})^2$

$$s = \sqrt{\frac{\sum f(x-\bar{x})^2}{n}}$$

sum

$$\sqrt{\frac{1846.76}{219}}$$

$$= 9.18$$

Mean $\bar{x} = 29.3$

$$\bar{x} = \frac{\sum fx}{\sum f} = \frac{6425.5}{219} = 29.34018 \doteq 29.3 \text{ marks}$$

Use 29.3402 for Std. Dev.

Now the Standard Deviation

$\Rightarrow$ You won't need List 3 $\sum fx$

List 2

| mid-interval mark $x_i$ | Marks | Frequency $f$ | $f \cdot x$ | $f(x_i - \bar{x})^2$ |
|---|---|---|---|---|
| 4.5 | 0 - 9 | 2 | | |
| 14.5 | 10 - 19 | 31 | | |
| 24.5 | 20 - 29 | 73 | | |
| 34.5 | 30 - 39 | 85 | | |
| 44.5 | 40 - 49 | 28 | | |
| | | 219 | 6425.5 | |

$$s_x = \sqrt{\frac{\sum f(x_i - \bar{x})}{\sum f}} = \sqrt{\quad} \approx$$

mean = 29.3402

List 2

| mid-interval mark $x_i$ | Marks | Frequency $f$ | $f \cdot x$ | $f(x_i - \bar{x})^2$ |
|---|---|---|---|---|
| 4.5 | 0 - 9 | 2 | | |
| 14.5 | 10 - 19 | 31 | | |
| 24.5 | 20 - 29 | 73 | | |
| 34.5 | 30 - 39 | 85 | | |
| 44.5 | 40 - 49 | 28 | | |
| | | 219 | 6425.5 | 18469.4 |

$$s_x = \sqrt{\frac{\sum f(x_i - \bar{x})}{\sum f}} = \sqrt{\frac{18469.4}{219}} \approx 9.18 \text{ marks}$$

Mean 29.3402

Example 2 Families at a school in Australia were surveyed, and the number of children in each family recorded. The results of the survey are shown alongside.

| *Number of children* | *Frequency* |
|---|---|
| 1 | 5 |
| 2 | 28 |
| 3 | 15 |
| 4 | 8 |
| 5 | 2 |
| 6 | 1 |
| *Total* | 59 |

$\sum f(x-\bar{x})^2$

$f$: 5, 28, 15, 8, 2, 1 — $x$: 1, 2, 3, 4, 5, 6 — $\bar{x}$: 2.61

Instructions

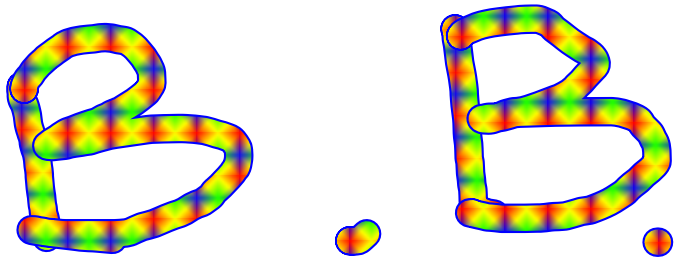
Quickly calculate:

a) Mean

$\bar{x} = \frac{154}{59} = 2.61$

b) Std. Deviation

$s = \sqrt{\frac{64.03}{59}} = 1.04$



A guy was walking along and saw a frog sitting on the side of the road. The frog said, "If you kiss me, I'll turn into a beautiful princess."

The guy picked up the frog, looked it over, smiled, put it into his pocket and continued on his way.

A few minutes later the frog said, "If you kiss me, I'll turn into a beautiful princess and stay with you for a week!" The guy took the frog out of his pocket, smiled, and put it back into his pocket.

A few minutes later the frog said "If you kiss me, I'll turn into a beautiful princess, stay with you for a week and do ANYTHING you want!!" The guy took the frog out of his pocket again, smiled at it, and put it back into his pocket.

Finally, the frog said, "I SAID that if you would just kiss me, I would turn into a beautiful princess and do ANYTHING you want for a whole week!

Why won't you kiss me?"

The guy said, "Look, I'm a statistician and I don't have time for girl friends, but a talking frog is kind of neat."

# Example with a laptop.

find the mean and std. deviation

| *Number of children* | *Frequency* |
|---|---|
| 1 | 5 |
| 2 | 28 |
| 3 | 15 |
| 4 | 8 |
| 5 | 2 |
| 6 | 1 |
| *Total* | 59 |

| | |
|---|---|
| 1 | Bazer, Madison R. |
| 2 | Cervantes-Frank, Valentina D. |
| 3 | Conaghan, Whitney A. |
| 4 | Duhaime, Hope |
| 5 | Gittins, Benjamin T. |
| 6 | Kennedy, John B. III |
| 7 | Kinner, Nicole A. |
| 8 | Leach, Camille N. |
| 9 | Lugo, Isaiah P. |
| 10 | McKenzie, Caleb J. |
| 11 | McNair, Morgan A. |
| 12 | Melconian, Alexandra M. |
| 13 | Nashawi, Lynn |
| 14 | Pelayo, Miriam E. |
| 15 | Roome, Calvin S. |
| 16 | Sain, Margaret M. |
| 17 | Saunders, Morgan C. |
| 18 | Suryanata, Natania |
| 19 | Thomas, Morgan A. |
| 20 | Todahl, Andrew C. |
| 21 | Tort, Luis E. |
| 22 | Ulm, Sophie E. |
| 23 | Vasquez, Isaac R. |
| 24 | Villada-Youel, Stella M. |
| 25 | Wagner, Ethan P. |
| 26 | Wagner, Tristan A. |
| 27 | Warner, Liam G. |
| 28 | Wood, Jacob |
| 29 | Yeh, Nathan H. |

first the mean

$$\bar{X} = \frac{\sum fx}{\sum f}$$

=

$$\bar{X} = \sqrt{\frac{\sum f(x-\bar{x})}{\sum f}}$$

$$= \sqrt{\quad\quad} \quad \stackrel{?}{=} \quad 0$$

What would be different if finding the standard deviation of the following ?

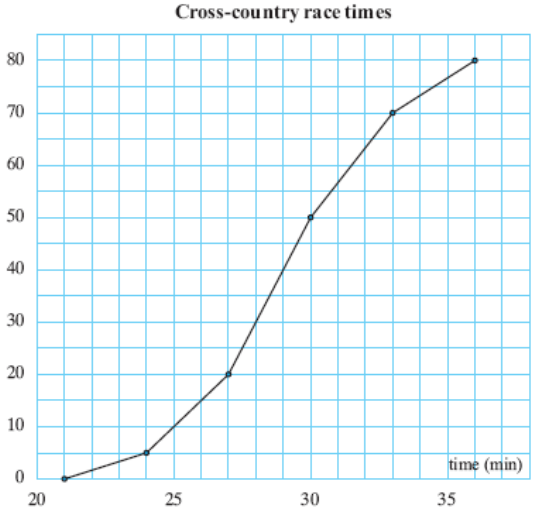
| *Number of vehicles* | *Frequency* |
|---|---|
| 1 - 5 | 4 |
| 6 - 10 | 16 |
| 11 - 15 | 22 |
| 16 - 20 | 28 |
| 21 - 25 | 14 |
| 26 - 30 | 9 |
| 31 - 35 | 5 |
| 36 - 40 | 2 |

Assignment

## Worksheet for Day 2 of Standard Deviation

↕ Graph paper expected on the cumulative frequency graph

The following cumulative frequency graph displays the performance of 80 competitors in a cross-country race.




Find:

a the lower quartile time

b the median

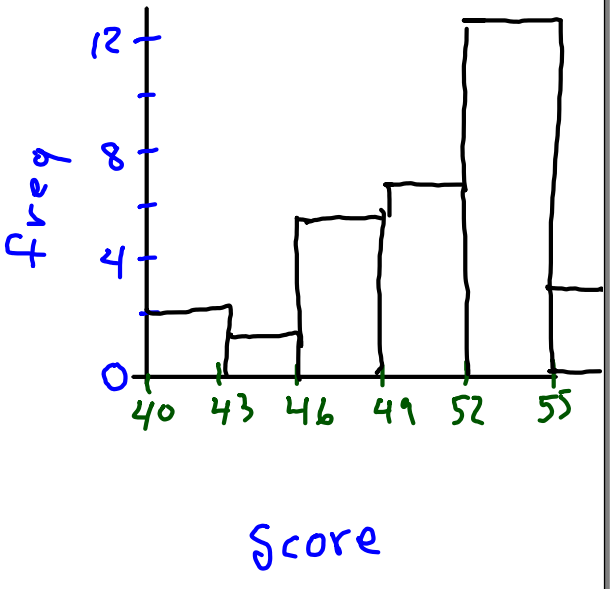
c the upper quartile

d the interquartile range

e an estimate of the 40th percentile.

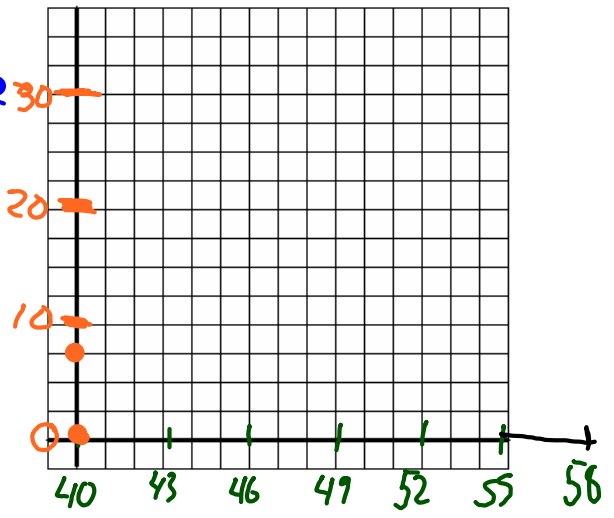
1.

| | Score (X) | freq (f) |
|---|---|---|
| 40- | 40–42 | 2 |
| 43- | 43–45 | 1 |
| 46- | 46–48 | 5 |
| 49- | 49–51 | 6 |
| 52 | 52–54 | 12 |
| 55- | 55–57 | 3 |



2.

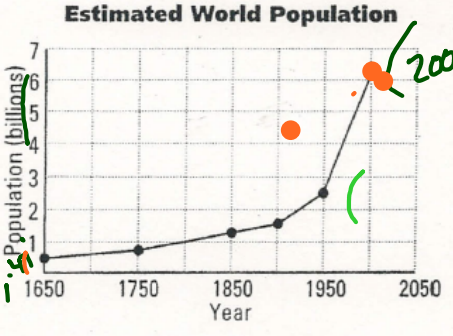
| | Score (X) | freq (f) | Cumul. freq |
|---|---|---|---|
| 40– | 40– | 2 | 2 |
| 43– | 43– | 1 | 3 |
| 46– | 46– | 5 | 8 |
| 49– | 49– | 6 | 14 |
| 52 | 52– | 12 | 26 |
| 55– | 55 | 3 | 29 |




3.

**Estimated World Population**

| Year | Population (billions) |
|---|---|
| 1650 | 0.470 |
| 1750 | 0.790 |
| 1850 | 1.260 |
| 1900 | 1.650 |
| 1950 | 2.520 |
| 2000 | 6.090 |




a. Data are given for six years. Between which two of these years is the rate of population growth the greatest?

1. a. 1950–2000

b. Calculate the average rate of change of the world population over the time interval in part a.

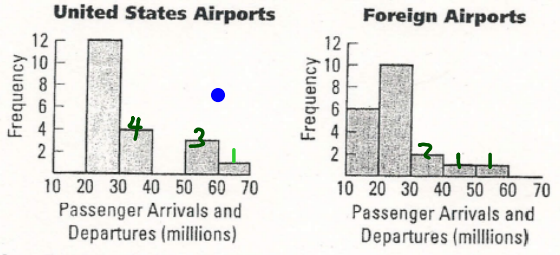
b. _____

Find the average rate of change of the world population per year between 1650 and 2000.

2. _____

$$\frac{6090 - .470}{2000 - 1650} = \frac{5562}{350} = .016\,69 \text{ or } 16.057 \text{ mil/year}$$

4. ..., use the histograms below, which show the distributions of passenger traffic during 1995 at the busiest United States and foreign airports. There are twenty airports in each group. Each interval includes the left endpoint, but not the right.




Source: *The World Almanac and Book of Facts 1997.*

In which interval does the first quartile for foreign airports lie? between 5th & 6th place of data

7. 10-20 mil

In 1995, how many more United States airports than foreign airports had at least 30 million passenger arrivals and departures?

8. 4 more

8 - 4 = 4

5. The birth weights, in kilograms, of 27 babies are given in the diagram below.

$\frac{27+1}{2} = 14$

| | | |
|---|---|---|
| 1 | 7, 8, 9 | key 1\|7 = 1.7 kg |
| 2 | 1, 2, 2, 3, 5, 5, 7, 8, 9 | |
| 3 | 0, (1), 3, 4, 5, 5, 6, 6, 7, 9 | |
| 4 | 1, 1, 2, 3, 7 | |

Write down:

(i) the median weight, 3.1 kg

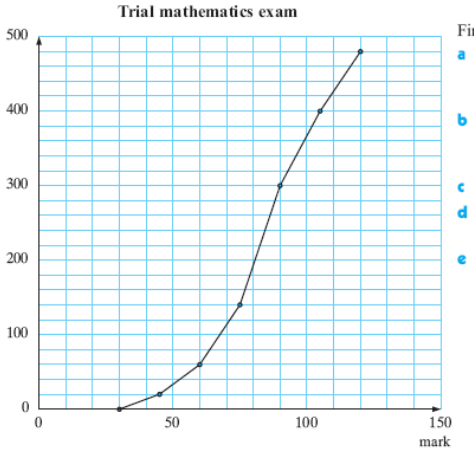
(ii) the upper quartile. 3.7 kg

(iii) Find the weight closest to the 60th percentile.

60% of 27 positions $\simeq$ 16.2 $\simeq$ 16th position $\rightarrow$ 3.4 kg

6

The cumulative frequency graph below displays the marks scored by year 12 students from a cluster of schools in a common trial mathematics exam.




Find:

a how many students sat for the examination

b the probable maximum possible mark for the exam

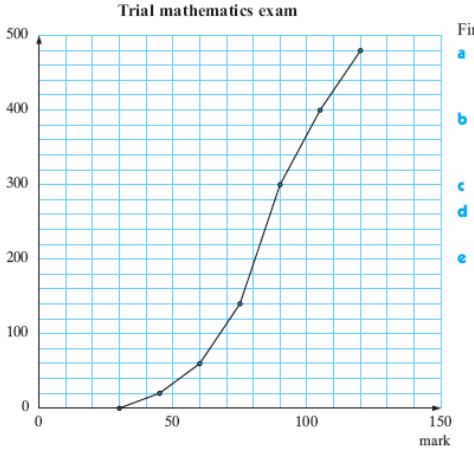
c the median mark

d the interquartile range

e an estimate of the 85th percentile.

6

The cumulative frequency graph below displays the marks scored by year 12 students from a cluster of schools in a common trial mathematics exam.




Find:

a how many students sat for the examination

b the probable maximum possible mark for the exam

c the median mark

d the interquartile range

e an estimate of the 85th percentile.

1-6 #19

10 students, 40 rolls each = 400 rolls total

Mean heads per student = 18.2 heads

for all students, multiply by 10

= 182 heads