Year 9 Statistics

Name:

2020

CHECKLIST

4	TOPIC	DETAIL	FLUENCY	PROBLEM-SOLVING	REASONING & ENRICHMENT
9 A	**Probability Review (pre-test/assess learning)**		**All (or as much as possible in one lesson)**		
9 B	**Venn Diagrams and Two-way Tables**		**1, 3, 5**	**6, 9**	**12, 13,**
9 D	**Using arrays for two step experiments**		**1-3**	**6, 7**	**9, 11, 14**
9 G	**Summarising data: measures of centre**		**1 2 a c e 3 b d 4 a c**	**7, 8**	**10, 12, 14**
		Mean			
		Median			
		Mode			
9 H	**Stem-and-leaf plots**		**1 a b c d 2 3 a**	**6, 7**	**9, 11,12**
		Stem-and-leaf plot			
		Back-to-back stem-and-leaf plot			
9I	**Grouped data**		**1, 3, 4**	**5, 6**	**8, 11**
		frequency table			
		histogram			
		percentage frequency histogram			
9 J	**Measures of Spread**		**1ace 2**	**4, 5**	**9, 10**

		Range	**3**		
		interquartile range			
		outliers			
9 K	**Box -Plots (Extension)**		**2, 3**	**5, 6**	**7, 9, 10, 11**
	TEST				

EXERCISES

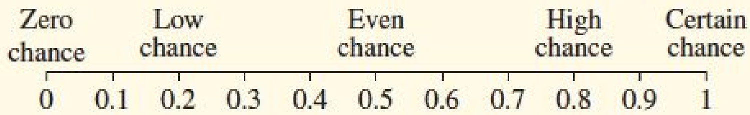
	9 A	9 B	9 D	9 G	9 H	9 I	9 J	9 K
SUBMITTED								

9A Probability Review

- The probability of an event in which all outcomes are **equally likely** is given by:

$$\Pr(\text{Event}) = \frac{\text{Number of outcomes in which event occurs}}{\text{Total number of outcomes}}$$

- Probabilities are numbers between 0 and 1 inclusive, and can be written as a decimal, fraction or percentage. For example: 0.55 or $\frac{11}{20}$ or 55%
- For all events, $0 \leqslant \Pr(\text{Event}) \leqslant 1$.



- The **complement** of an event A is the event in which A does not occur.

$$\Pr(\text{not A}) = 1 - \Pr(\text{A})$$

BUILDING UNDERSTANDING

1 Jim believes that there is a 1 in 4 chance that the flower on his prized rose will bloom tomorrow.

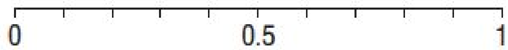
a Express the chance '1 in 4' as:

i a fraction

ii a decimal

iii a percentage.

b Indicate the level of chance described by Jim on this number line.



2 State the components missing from this table.

	Percentage	Decimal	Fraction	Number line
	50%	0.5	$\frac{1}{2}$	0 0.5 1
a	25%			0 0.5 1
b				0 0.2 0.5 1
c		0.6		0 0.2 0.5 1
d			$\frac{17}{20}$	0 0.2 0.5 1

3 Ten people make the following guesses of the chance that they will get a salary bonus this year.

0.7, $\frac{2}{5}$, 0.9, $\frac{1}{3}$, 2 in 3, $\frac{3}{7}$, 1 in 4, 0.28, $\frac{2}{9}$, 0.15

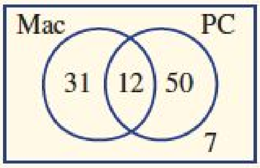
Can you order their chances from lowest to highest? (*Hint*: Change each into a decimal.)

9B Venn Diagrams and Two-way Tables

KEY IDEAS

- A **Venn diagram** and a **two-way table** help to organise outcomes into different categories. This example shows the type of computers owned by 100 people.

Venn diagram



Two-way table

	Mac	No Mac	Total
PC	12	50	62
No PC	31	7	38
Total	43	57	100

These diagrams show, for example, that:

- 12 people own both a Mac and a PC
- 62 people own a PC
- 57 people do not own a Mac
- $\Pr(\text{Mac}) = \frac{43}{100}$
- $\Pr(\text{only Mac}) = \frac{31}{100}$
- $\Pr(\text{Mac or PC}) = \frac{93}{100}$
- $\Pr(\text{Mac and PC}) = \frac{12}{100} = \frac{3}{25}$

Worked Examples

1. A class of 35 students were surveyed and it was found that 21 enjoyed Maths classes, 16 enjoyed English classes, 7 enjoyed both Maths and English and 5 didn't like either.

   a. Construct A Venn diagram to represent these results.

   b. How many students
      i. Like Maths **or** English?
      ii. Do not like Maths?
      iii Like only Maths?

   c. If one student was selected randomly find
      i. Pr(Like Maths and English)
      ii. Pr(Don't like English)
      iii. Pr(Only like Maths)

2. Filipe surveyed his year 9's and found that 78 owned a Mobile Phone, 57 of those students had an X-Box. 13 students did not have a phone but have an X-Box and 9 students had neither. Complete the 2 way table to display this data

	Has X- Box	No X- Box	Total
Has Mobile Phone			
No Mobile Phone			
Total			

From the table:

a. How many students were surveyed?
b. How many do not have a phone?
c. Pr(student has both phone and an x-box)

9D Using Arrays for Two-step Experiments (Extension)

KEY IDEAS

- An **array** or table is often used to list the sample space for experiments with two steps.
- When listing outcomes it is important to be consistent with the order for each outcome.
  For example: the outcome (heads, tails) should be distinguished from the outcome (tails, heads).
- Some experiments are conducted **without replacement**, which means some outcomes that may be possible **with replacement** are not possible.
  For example: Two letters are chosen from the word CAT.

With replacement

		1st		
		C	A	T
2nd	C	(C, C)	(A, C)	(T, C)
	A	(C, A)	(A, A)	(T, A)
	T	(C, T)	(A, T)	(T, T)

9 outcomes

Without replacement

		1st		
		C	A	T
2nd	C	×	(A, C)	(T, C)
	A	(C, A)	×	(T, A)
	T	(C, T)	(A, T)	×

6 outcomes

BUILDING UNDERSTANDING

1 State the missing outcomes, then count the total number of outcomes. Part **a** is *with replacement* and part **b** is *without replacement*.

a

		1st		
		1	2	3
2nd	1	(1, 1)	(2, 1)	
	2			
	3			

b

		1st		
		A	B	C
2nd	A	×	(B, A)	(C, A)
	B		×	
	C			×

2 These two tables list the outcomes for the selection of two letters at random from the word MAT.

	Table A		
	M	A	T
M	(M, M)	(A, M)	(T, M)
A	(M, A)	(A, A)	(T, A)
T	(M, T)	(A, T)	(T, T)

	Table B		
	M	A	T
M	×	(A, M)	(T, M)
A	(M, A)	×	(T, A)
T	(M, T)	(A, T)	×

a Which table shows selection where replacement is allowed (with replacement)?

b Which table shows selection where replacement is not allowed (without replacement)?

c What is the probability of choosing the outcome (T, M) from:

i Table A? **ii** Table B?

d How many outcomes include the letter A using:

i Table A? **ii** Table B?

9G Summary Statistics

Some statistics are used to measure the centre of a set of data. Three commonly used statistics are:

Mean – (also called the average). Add all the numbers (scores) and divide by the number of scores

Median – (the middle). Place the numbers in order (lowest to highest) and the median is the middle value (or the average of the middle two numbers).

Mode – (the most common). The mode is the most common number in the data set.

EXAMPLE Gordon is a keen cricketer. Find the mean, median and mode of his scores for last season **80 14 11 2 33 26 17 20 6 14 64 10 33 3 44 54 22**
Mean
Median
Mode

1. EXERCISE

Ben is an avid but inconsistent golfer. So far this year, his scores are as follows:

69, 92, 75, 94, 92, 116, 87, 80, 99, 79, 78, 77, 99, 104, 96, 91, 96, 102, 118, 76, 91, 84, 90, 83, 72

Find the mean, median and mode of Ben's scores for the season.

Mean
Median
Mode

2. EXERCISE

BEN HAS A LOT OF TROUBLE WITH HIS PUTTER. HE COUNTS HIS PUTTS EACH WEEK TO HELP REFINE HIS GAME:

30, 43, 21, 41, 44, 48, 40, 38, 39, 35, 42, 24, 42, 47, 36, 41, 34, 36, 38, 28, 35, 34, 39, 38, 22,

Find the mean, median and mode of Ben's putts for the season.

Mean
Median
Mode

9H Stem plots

A stem plot (or sometimes called a stem and leaf plot), summarises a set of data without losing the raw data. Each number in the dataset is represented by a leaf (the final digit in the number) coming off a stem (the first digit or digits in the number). Leaves are arranged so that the smallest numbers are closest to the stem.

Example.

Represent Gordon's cricket scores as a stem plot

80 14 11 2 33 26 17 20 6 14 64 10 33 3 44 54 22

3. EXERCISE

Construct a stem plot representing Ben's scores for the season.

69, 92, 75, 94, 92, 116, 87, 80, 99, 79, 78, 77, 99, 104, 96, 91, 96, 102, 118, 76, 91, 84, 90, 83, 72

4. EXERCISE

Construct a back-to-back stem plot representing the heights of Yr 9 Rite Journey classes for 2018 based on the following data:

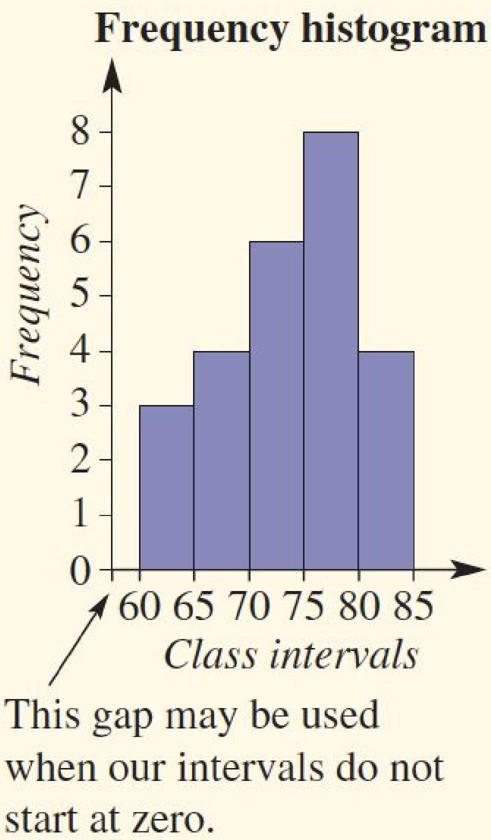
Girls 154, 166, 168, 171, 164, 159, 157, 148, 163, 167, 157, 168, 151
Boys 162, 180, 185, 161, 173, 190, 177, 173, 177, 185, 177, 186, 186, 172, 168,

9I Grouped Data

Histograms

A histogram shows a vertical column representing each data value.

Frequency table		
Class interval	Frequency	Percentage frequency
60–	3	12
65–	4	16
70–	6	24
75–	8	32
80–85	4	16
Total	25	100



5. EXERCISE

Q1. Create a histogram for Ben’s scores for the season

69, 92, 75, 94, 92, 116, 87, 80, 99, 79, 78, 77, 99, 104, 96, 91, 96, 102, 118, 76, 91, 84, 90, 83, 72

Frequency Tables

A frequency table can be used to summarise a set of data. A frequency table can summarise discrete data values of grouped data ranges.

EXAMPLE

Ben's scores for the season are given below.

69, 92, 75, 94, 92, 116, 87, 80, 99, 79, 78, 77, 99, 104, 96, 91, 96, 102, 118, 76, 91, 84, 90, 83, 72

Complete the following frequency table to summarise Ben's scores during the year.

Score Range	Tally	Frequency
0-9		
10-19		
20-29		
30-39		
40-49		
50-59		
60-69		
70-79		
80-89		
90-99		
100-109		
>110		
Total		

6. EXERCISE

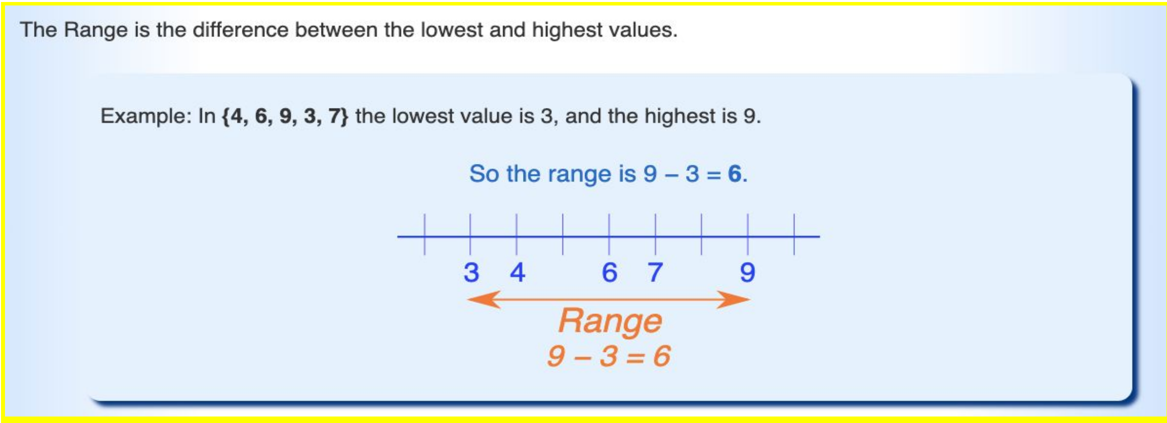
Complete the following frequency table that summarises Gordon’s cricket scores.

8	1	1		3	2	1	2		1	6	1	3		4	5	2
0	4	1	2	3	6	7	0	6	4	4	0	3	3	4	4	2

Score Range	**Tally**	**Frequency**
0-9		
10-19		
20-29		
30-39		
40-49		
>49		
Total		

9J Measures of Spread

- Two measures that help to describe how data is spread are the **range** and **interquartile range**. These are called measures of spread.



Find the range of the following set of data:

8, 2, 9, 9, 4, 7, 6, 6, 5, 3, 9, 11

Quartiles

Quartiles are the values that divide a list of numbers into quarters:

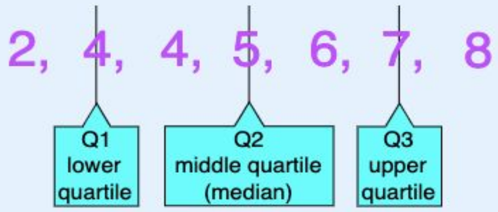
- Put the list of numbers **in order**
- Then cut the list into **four equal parts**
- The Quartiles are at the "cuts"

Like this:

Example: 5, 7, 4, 4, 6, 2, 8

Put them in order: 2, 4, 4, 5, 6, 7, 8

Cut the list into quarters:



And the result is:

- Quartile 1 (Q1) = **4**
- Quartile 2 (Q2), which is also the Median, = **5**
- Quartile 3 (Q3) = **7**

Sometimes a "cut" is between two numbers ... the Quartile is the average of the two numbers.

Example: 1, 3, 3, 4, 5, 6, 6, 7, 8, 8

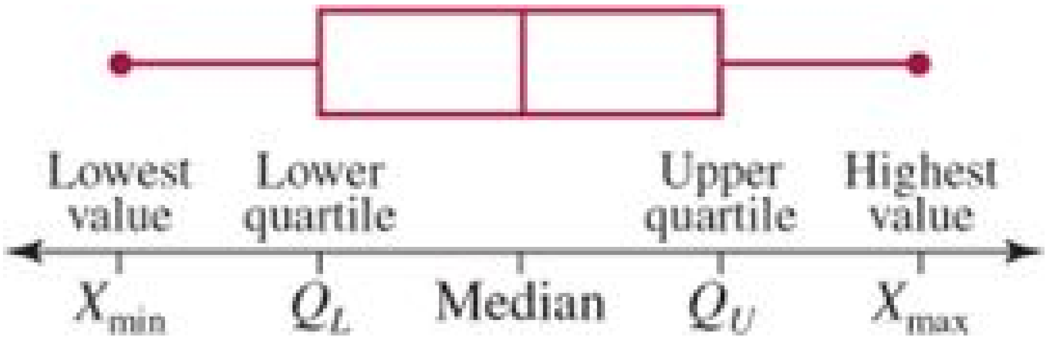
The numbers are already in order

Cut the list into quarters:

9K Box Plots (Extension)

Boxplots (or box-and-whisker plots) are constructed using a five number summary, which includes:

1. *The lowest value of the set, MinX*
2. *The lower quartile, Q_1X*
3. *The median,*
4. *The upper quartile, Q_3X*
5. *The highest value of the set, MaxX*



From the boxplot above, it can be seen that:

1. The interquartile range (IQR) is represented by the partitioned box.

2. The median is a vertical line within the box.

3. The whiskers (horizontal lines) represent the range of scores.

The number line should be drawn to scale and the values included.

Example:
Construct a box plot representing the following data

4, 5, 5, 6, 9, 10, 12, 14, 15.

Working:

MinX =

Q1X =

Median =

Q3X =

MaxX =