Project Maths Workshop 5

A Further Exploration of Statistics & Algebra

Name: _____

School: _____

A Further Exploration of Statistics & Algebra

Project Maths would like to acknowledge the use of the following resources adapted for this workbook.

http://www.learner.org/learnmath
http://www.nationalstemcentre.org.uk/elibrary/file/6399/A1.pdf

Supplementary Material for this workshop can be found at the link below or by scanning the QR code opposite.

*http://**www.projectmaths.ie**/documents/workshops/workshop_5.asp*

Contents

Phase 10 *CensusAtSchool* Questionnaire

1. Are you:

❑ female?   ❑ male?

2. Please state your age in completed years.

……………………………years

3. What year are you in at school?

Year ………… e.g. 5th year

4. Where were you born?
- ❑ Republic of Ireland
- ❑ Northern Ireland
- ❑ England
- ❑ Scotland
- ❑ Wales
- ❑ Other European Country
- ❑ Outside Europe

5. What county do you live in?

………………………………

6. a) How tall are you without shoes? *(Answer in centimetres)*

………………………. centimetres

b) What is the length of your right foot to the nearest tenth of a centimetre?

………………………. centimetres

c) What is your open arm span? (Answer in centimetres)

……………………………centimetres

d) Which hand do you write with?

❑ Right   ❑ Left
❑ either (ambidextrous)

7. What is your favourite football team ?

Team name ……………………………………

8. What is your favourite Olympic sport?

………………………………………

9. a) State how many soft drinks you had in the last 2 days.

…………………

9. b) How many of the containers did you recycle?

…………………………

10. How many people live in your household? (Include yourself)

………………………………… people

11. Have you moved house in the last year?
- ❑ no   ❑ moved within Ireland
- ❑ moved from abroad

12. How many cars belong to people in your household?

…………………………………… cars

13. Tick the box if you have:
(You may tick more than one box)
- ❑ a mobile phone without Internet
- ❑ a mobile phone with Internet
- ❑ a home computer without Internet
- ❑ a home computer with Internet
- ❑ your own computer
- ❑ your own television
- ❑ an i-pod/portable media player
- ❑ a games console

14. Which of these methods do you most often use to communicate with your friends? (Select one)
- ❑ in person   ❑ telephone (landline)
- ❑ text messaging   ❑ e-mail
- ❑ mobile phone (conversation)
- ❑ Internet chat or MSN
- ❑ Myspace, Facebook, blog
- ❑ Other

15. What is the main way you keep up with the news/media? (Select one only)
- ❑ newspaper   ❑ television
- ❑ Internet on a computer
- ❑ Internet on a mobile phone
- ❑ Radio   ❑ magazines
- ❑ talking to your friends
- ❑ not interested in news   ❑ other

16. What is your favourite type of media story? (Select one only)
- ❑ business   ❑ fashion
- ❑ sport   ❑ celebrity
- ❑ technology   ❑ music + film
- ❑ health + beauty
- ❑ science and the environment
- ❑ politics/world affairs
- ❑ other   ❑ none

17. What type of TV programme do you watch the most?

………………………………………

18. What is your favourite subject at school?

………………………………………

19. How do you usually travel to school?(Select one answer)
- ❑ Walk   ❑ Bus
- ❑ Car   ❑ Cycle
- ❑ Luas/Train/Dart
- ❑ Other (pls specify) ………………………

20. How long does it usually take you to travel to school?

………………………minutes

21. There is a national census in Ireland in 2011. During which month is Census Day?

………………………………………

22. How important do you think the Census is to:
(Give your views below by marking a point on the line.)

Education?

Very unimportant   Very important
●————————————————————————●

Public Services (eg police)?
Very unimportant   Very important
●————————————————————————●

Environment?
Very unimportant   Very important
●————————————————————————●

Community Facilities (eg sport centres)?
Very unimportant   Very important
●————————————————————————●

23. a) What pets do you have?
(You may tick more than one box)
- ❑ dog   ❑ cat
- ❑ rabbit   ❑ goldfish
- ❑ other   ………………………
- ❑ I have no pets

23. b) What do you like best about your pet(s)?
- ❑ They are fun to be with
- ❑ I like to look after them
- ❑ They make me feel loved
- ❑ I like to take them for walks
- ❑ I can talk to them
- ❑ I like to cuddle them

<table>
<tr><td rowspan="2">*Pose Question & Collect Data*</td><td>

Come up with a specific question to answer

- Summary Question: (one variable) e.g., Find the typical height of the students in the class.
- Comparison Question: (one variable) e.g., Do boys or girls spend more time on the internet?
- Relationship Question: (two variables) e.g., Do students who study more do better in exams?

</td></tr>
<tr><td>

Collect Data

- What data do I need?   Categorical (Qualitative): Nominal, Ordered
                          Numerical (Quantitative): Discrete, Continuous
- What sampling method will I use? Simple Random, Stratified, Cluster, Quota
- How will I eliminate bias? random selection, careful questioning, who, when & where
- What will the source of data be? Primary/Secondary, questionnaire, C@S, official records

</td></tr>
</table>

<table>
<tr><td rowspan="6">*Analyse the Data*</td><td>

Analyse the Data – Descriptive Statistics

Statistics on the sample data

</td></tr>
<tr><td>

Distribution

Statistical distribution describes the number of times each possible outcome occurs in a sample.
Distribution Table / Frequency Distribution Table / Grouped Frequency Distribution Table

</td></tr>
<tr><td>

Choose the Appropriate Visual Representation

Nominal (male/female): Bar Chart, Line Plot (Dot Plot), Pie Chart
Ordinal (never/sometimes): Bar Chart, Line Plot, Pie Chart
Discrete (no. of cars/age in years): Bar Chart, Pie Chart, Line Plot, Stem and Leaf Plot
Continuous (height/foot length): Histogram, Stem and Leaf Plot

- Bar Charts good for comparing frequencies
- Pie Charts good for showing proportion of the total sample
- Dot plots useful for representing a small sample. Particularly good for showing central tendency, dispersion and shape.
- Stem and Leaf Plots useful for representing a sample of discrete or continuous data. Particularly good for showing central tendency, dispersion and shape.

</td></tr>
<tr><td>

Summary of the Data (Univariate)

- Central Tendency
    - → Mean
    - → Median
    - → Mode

- Dispersion (Spread, Variability)
    - → Range
    - → IQR: Inter Quartile Range
    - → Standard Deviation
- Shape
    - → Gaps/ Clusters
    - → Outliers
    - → Modality
    - → Symmetric
    - → Bell Shaped
    - → Skewed
    - → Normal

> *The Five-Number Summary*
>
> 1. Maximum
> 2. Minimum
> 3. Median
> 4. First Quartile
> 5. Third Quartile

</td></tr>
<tr><td>

Comparison of Data (Univariate)

- All of the above summary techniques used to compare sets of data

</td></tr>
<tr><td>

Relationship between Variables (Bivariate)

- Scatterplots
- Correlation Coefficient
- Line of Best Fit

</td></tr>
</table>

Interpretation of the Results to Answer the Question Posed

Non-Inferential Statistics

Making a generalisation about the sample data or when the sample data is the same as the population

- Interpreting the summary statistics to answer the question posed.

- Making a comparison between summary statistics: differences/similarities.

- Empirical Rule: Interpreting a Normal Distribution (for a normal distribution, almost all data will fall within three standard deviations of the mean). Otherwise known as the 68 – 95 – 99.7 rule.
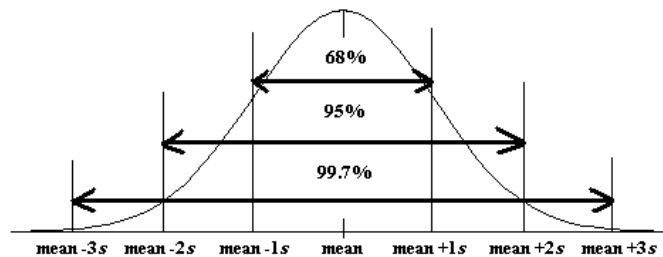
- Z–scores: A z-score gives us an indication of how unusual a value is because it tells us how far it is from the mean on a Standardised Distribution Curve. If the data value sits right at the mean, it's not very far at all and its z-score is 0. A z-score of 1 tells us the data value is one standard deviation above the mean, while a z-score of –1 tells us that the value is one standard deviation below the mean.

Inferential Statistics

The data is taken a step further to make a generalisation about the population from which the sample is taken.

No deterministic statements

- We cannot make a deterministic (definite/absolute) statement about the population because the sample we took was just our best attempt to represent the population. There will be some variation.
- The vocabulary used in statements about the population must not be deterministic – use: "tends to", "estimation" , "inference"

Correlation and Association

- Is there an association between the two variables? Causation: Does one variable change because the other variable changes?
- Is there a correlation between the two variables? What does the correlation suggest about the population? E.g., One variable "tends to" increase as the other variable increases.

Margin of Error

- Since the sample is not the same size as the population there is a margin of error that accompanies any inferred statistic about the population.

- The bigger the sample, the smaller the margin of error, $\dfrac{1}{\sqrt{n}}$.

Hypothesis Testing using the Margin of Error

- Using the margin of error and the statistics from the sample to test if a statement about the population could be true.

Terms: Descriptive/Non-Inferential/Inferential Statistics for teacher's information only.

Rnd#	Sex	Born	Travel	Subject	Media Story	Household	Height	Right Foot	Arm Span	Age	Cars	Soft Drinks	Travel
1	Male	Republic of Irel	Bus	PE	Sport	7	154	24	154	12	2	3	45
2	Female	Republic of Irel	Car	CSPE	Health + Beau	2	165	12	90	12	2	2	20
3	Male	Republic of Irel	Bus	PE	Sport	4	179	27	178	15	2	0	25
4	Female	Republic of Irel	Walk	PE	Fashion	5	145	21.2	141	13	1	3	10
5	Male	Republic of Irel	Bus	Art	Technology	3	160	35	100	13	4	5	100
6	Male	Republic of Irel	Car	Gaeilge	Music + Film	5	173	30	170	17	2	1	10
7	Male	Republic of Irel	Car	Science	Sport	4	175	19	178	16	1	0	45
8	Female	Republic of Irel	Walk	Science	Fashion	4	156	20	150	17	1	0	5
9	Male	Republic of Irel	Car	Art	Other	5	178	28	193	16	2	1	5
10	Male	Outside Europe	Rail (Luas	Mathematics	Celebrity	3	168	23	167	16	1	0	20
11	Female	Republic of Irel	Car	Other	Celebrity	3	169	27	150	12	1	0	15
12	Male	Republic of Irel	Car	Mathematics	Sport	4	184	24.9	173	16	2	0	5
13	Male	Republic of Irel	Bus	History	Sport	4	179	26	180	15	2	0	25
14	Male	Republic of Irel	Bus	Geography	Music + Film	7	168	24	168	16	4	2	15
15	Female	Republic of Irel	Walk	PE	Music + Film	5	179	25	179	15	2	1	15
16	Male	Republic of Irel	Bus	PE	Sport	5	161	25	166	12	2	3	20
17	Female	Republic of Irel	Bus	History	Science and	4	167	25	100	12	3	4	70
18	Male	Republic of Irel	Car	Other	Sport	6	163	26	166	13	3	0	30
19	Female	Republic of Irel	Car	Mathematics	Health + Beau	6	134	29	145	15	2	0	15
20	Male	Republic of Irel	Car	Music	Music + Film	2	152	22	152	12	1	4	7
21	Male	Republic of Irel	Car	Other	Sport	5	181	25	125	15	1	8	20
22	Male	Republic of Irel	Walk	English	Sport	6	173	27	170	16	2	3	35
23	Male	Republic of Irel	Walk	I do not have	Music + Film	6	180	18	180	16	2	2	10
24	Male	Republic of Irel	Car	Technology S	Sport	6	165	25	170	13	2	1	7
25	Male	Republic of Irel	Walk	Art	World Affairs/	5	155	25	90	12	1	2	30
26	Male	Republic of Irel	Car	Gaeilge	World Affairs/	1	165	20	102	16	1	0	15
27	Female	Republic of Irel	Car	Geography	Music + Film	5	157	23.5	157	17	3	3	5
28	Female	Republic of Irel	Car	Other	Music + Film	8	181	24	176	15	4	1	12
29	Male	Republic of Irel	Bus	Art	Sport	4	186	27	184	16	2	7	30
30	Male	Republic of Irel	Bus	PE	Sport	5	194	25	200	15	4	1	50
31	Male	Republic of Irel	Walk	English	Sport	6	150	34	100	21 or ov	2	4	20
32	Male	Republic of Irel	Walk	English	Sport	7	168	23	173	15	0	3	3
33	Male	Republic of Irel	Bus	History	Sport	4	173	27	173	14	2	1	20
34	Male	Other European	Bus	Mathematics	Other	1	174	29	175	21 or ov	0	0	25
35	Female	Republic of Irel	Car	Business Subje	Celebrity	5	164	21	165	13	2	0	5
36	Male	Republic of Irel	Bus	PE	Sport	4	174	25	174	16	2	0	30
37	Male	Republic of Irel	Bus	Technology S	Music + Film	4	157	24	155	12	2	9	60
38	Female	Republic of Irel	Bus	History	Music + Film	4	165	21	161	15	2	0	30
39	Female	Republic of Irel	Car	History	Music + Film	5	165.1	22	160	15	3	0	15
40	Male	Republic of Irel	Bus	History	Other	4	175.26	30	175.26	17	2	2	20
41	Female	Republic of Irel	Walk	Other	Health + Beau	3	153	26	148	13	1	3	10
42	Female	Other European	Walk	Languages	Health + Beau	2	171	24	168	21 or ov	0	0	20
43	Female	Republic of Irel	Car	Languages	Celebrity	5	173	20	165	15	2	0	10
44	Male	Republic of Irel	Bus	Other	Sport	4	183	30	189	15	2	3	15
45	Female	Republic of Irel	Car	PE	Fashion	5	150	25	152	12	2	4	5
46	Female	Republic of Irel	Bus	PE	Sport	4	167 5	22.7	160 5	15	2	0	15
47	Male	Republic of Irel	Car	Business Subje	Technology	4	185	25.6	195	16	2	3	5
48	Male	Outside Europe	Car	I do not have	Sport	4	170	25	170	15	2	1	20
49	Female	Outside Europe	Bus	Art	Celebrity	6	157	20	160	12	2	0	30
50	Male	Republic of Irel	Bus	History	Sport	4	178	27	181	16	2	0	65
51	Female	Republic of Irel	Rail (Luas	History	Health + Beau	8	163	26	172	15	3	4	20
52	Female	Republic of Irel	Walk	I do not have	Celebrity	6	165	24	166	15	2	2	15
53	Female	Republic of Irel	Walk	Other	Celebrity	6	159	24	159	13	1	0	20
54	Male	Republic of Irel	Walk	Mathematics	Technology	8	146	27	147	12	2	0	2
55	Female	England	Car	I do not have	Sport	5	164	25	164	13	2	0	20
56	Female	Republic of Irel	Bus	Art	Celebrity	5	165	21	165	13	2	1	20
57	Female	Republic of Irel	Car	Art	Music + Film	4	155	20	160	13	4	3	10
58	Female	Republic of Irel	Car	Other	Music + Film	4	179 832	21	150	17	2	0	10
59	Female	Republic of Irel	Car	Technology S	Celebrity	5	164	22	163	14	2	5	5
60	Male	Republic of Irel	Bus	Other	Sport	6	155	25	165	15	3	4	20
61	Female	Republic of Irel	Bus	Science	Music + Film	4	154	21.6	154	16	3	1	15
62	Male	Republic of Irel	Walk	Technology S	Sport	5	155	23	157	12	2	2	10
63	Male	Republic of Irel	Bus	Science	Sport	6	170	17	174	13	3	0	20
64	Male	Republic of Irel	Car	Mathematics	Music + Film	4	175	27	179	21 or ov	2	0	30
65	Male	Republic of Irel	Walk	PE	Other	5	140	25	139	13	1	6	30
66	Female	Republic of Irel	Walk	Science	Fashion	6	163	22	161	13	2	1	25
67	Male	Republic of Irel	Walk	Science	Music + Film	4	165	23	157	17	2	2	15
68	Male	Republic of Irel	Walk	Mathematics	Sport	5	179	23	145	16	2	9	15
69	Female	Republic of Irel	Bus	Mathematics	Sport	5	150	24	150	12	2	2	20
70	Male	Republic of Irel	Car	I do not have	Other	5	152	35	158	13	2	20	20
71	Male	Republic of Irel	Car	PE	Sport	5	188.976	29	150	15	3	5	15
72	Male	Republic of Irel	Bus	PE	Sport	5	185	28	186	16	1	0	30
73	Female	Republic of Irel	Walk	Languages	Fashion	4	170	26	172	15	2	2	20
74	Female	Republic of Irel	Car	I do not have	Fashion	5	167	25	158	13	3	0	15
75	Male	Republic of Irel	Bus	PE	Sport	4	148	23	148	12	0	0	20
76	Male	Other European	Cycle	History	Sport	4	177	28	177	14	2	3	7
77	Female	Republic of Irel	Walk	Other	Celebrity	4	161	25	159	15	2	0	3
78	Female	Republic of Irel	Bus	Science	Celebrity	3	181	24	166	16	1	2	20
79	Female	Republic of Irel	Car	Gaeilge	Celebrity	5	167 5	23.6	163	19	3	2	2
80	Male	Republic of Irel	Bus	Geography	Music + Film	5	176	29	176	15	1	0	30
81	Female	Republic of Irel	Walk	Music	Fashion	9	149	22	146	16	2	7	10
82	Male	Republic of Irel	Bus	PE	Sport	5	170	25.5	170	16	1	1	40
83	Female	Outside Europe	Car	English	Music + Film	5	145	20	145	12	2	1	2
84	Male	England	Car	PE	Sport	4	161	20	158	12	2	3	10
85	Male	Republic of Irel	Bus	English	Music + Film	4	168	25	160	15	1	2	25
86	Female	Republic of Irel	Car	Music	Music + Film	4	167 5	21	120	15	2	1	2
87	Male	Other European	Bus	ICT	Sport	5	174	25.2	182	17	1	6	20
88	Male	Republic of Irel	Car	History	World Affairs/	4	182	20	182	17	3	2	5
89	Female	Republic of Irel	Walk	Geography	Fashion	5	150	15	144	12	2	15	7
90	Male	Republic of Irel	Bus	Other	Sport	5	174	27	175	15	2	0	25
91	Female	Republic of Irel	Bus	I do not have	Fashion	5	158	22	162	15	3	0	20
92	Male	Republic of Irel	Walk	PE	Sport	4	190	32	186	18	4	6	4
93	Female	Republic of Irel	Bus	Science	Health + Beau	5	150	23	112	15	1	0	30
94	Female	Republic of Irel	Bus	Business Subje	Celebrity	5	152	24	150	12	3	1	30
95	Male	England	Bus	PE	Sport	7	164	22	164	16	3	1	45
96	Male	Republic of Irel	Car	Science	Music + Film	4	147	22.5	147	12	1	0	50
97	Female	Republic of Irel	Car	Art	Celebrity	4	158	22	149	12	2	2	15
98	Female	Republic of Irel	Bus	I do not have	Fashion	6	200	26	99	12	6	5	15
99	Male	Republic of Irel	Car	Mathematics	Science and	6	192	28.5	189	15	4	10	10
100	Male	Republic of Irel	Car	PE	Sport	6	163	34	163	13	4	3	20

Rnd#	Sex	Born	Travel	Subject	Media Story	Household	Height	Right Foot	Arm Span	Age	Cars	Soft Drinks	Travel
101	Female	Republic of Irel	Car	Art	Music + Film	5	165	24	128	13	2	6	5
102	Male	Other European	Car	Music	Music + Film	3	173	24	175	15	2	2	20
103	Male	Republic of Irel	Bus	PE	Sport	4	173	28	174	15	1	2	25
104	Female	Republic of Irel	Walk	Music	Music + Film	3	175	24.5	170	17	2	4	20
105	Female	Republic of Irel	Car	Art	Music + Film	4	174	35	166	15	2	0	10
106	Female	Republic of Irel	Bus	Art	Science and	5	169	24	167	16	3	0	20
107	Male	Republic of Irel	Walk	Art	Music + Film	4	168	12	170	16	1	0	25
108	Male	Republic of Irel	Bus	English	none	7	181	28	175	16	2	5	20
109	Male	Republic of Irel	Cycle	History	Other	4	182	28	185	15	2	5	20
110	Female	Outside Europe	Bus	Art	Music + Film	6	165	21	156	16	2	0	35
111	Male	Republic of Irel	Bus	Geography	Music + Film	6	181	29	176	16	2	0	30
112	Female	Republic of Irel	Walk	Gaeilge	Music + Film	4	167	23	162	15	2	7	10
113	Female	Republic of Irel	Walk	Mathematics	Celebrity	4	165	24	173	16	3	5	30
114	Male	Republic of Irel	Car	PE	Sport	5	160	25	158	13	2	0	35
115	Male	Republic of Irel	Bus	English	Sport	5	155	26	155	17	1	3	10
116	Male	Republic of Irel	Walk	ICT	Technology	5	162	25	165	16	2	5	15
117	Female	Republic of Irel	Car	Business Subje	Business	5	155	20	154	12	2	0	30
118	Male	Republic of Irel	Bus	I do not have	Fashion	4	172	23	171	15	0	3	20
119	Male	Republic of Irel	Walk	PE	Sport	4	150	28	120	12	3	6	13
120	Female	Republic of Irel	Car	Languages	Celebrity	4	175	20	172	16	2	0	15
121	Female	Republic of Irel	Car	Gaeilge	Music + Film	6	150	24	148	12	2	0	5
122	Male	Republic of Irel	Bus	Art	Music + Film	4	179	30.2	179	16	1	0	10
123	Male	Republic of Irel	Cycle	Mathematics	Sport	5	188	28.2	185	15	1	20	8
124	Male	Republic of Irel	Walk	PE	Sport	4	165	24	156	13	2	2	10
125	Male	Republic of Irel	Car	Science	Sport	5	176	26	173	16	2	0	5
126	Male	Republic of Irel	Bus	Geography	Celebrity	4	164	25	160	16	2	5	25
127	Female	Republic of Irel	Bus	Business Subje	Sport	7	173	24.5	171	15	4	2	20
128	Male	Republic of Irel	Car	PE	Sport	4	178	27	176	16	3	0	15
129	Male	Republic of Irel	Bus	Art	Sport	5	150	23.5	159	13	2	0	20
130	Female	Republic of Irel	Walk	PE	Music + Film	5	168	23	158	15	2	1	20
131	Female	Republic of Irel	Bus	History	none	5	161	23.5	165	15	2	1	40
132	Female	Republic of Irel	Walk	Art	Music + Film	7	153	20	150	16	3	2	10
133	Male	Republic of Irel	Bus	Mathematics	Music + Film	4	184	30	180	19	2	2	15
134	Female	Republic of Irel	Bus	PE	Sport	5	153	21	152	12	3	2	20
135	Male	Republic of Irel	Bus	Science	Sport	7	183	25	183	15	2	2	15
136	Male	England	Car	Art	Sport	5	155	23	154	12	1	7	10
137	Male	Republic of Irel	Bus	PE	Sport	6	188	29	180	16	6	0	20
138	Female	Republic of Irel	Bus	Mathematics	Health + Beau	6	150	20	150	17	2	0	30
139	Male	Republic of Irel	Car	Technology S	Music + Film	3	186	35.2	189	16	1	3	5
140	Male	England	Car	PE	Sport	5	106 6	22	163	18	5	5	15
141	Male	Republic of Irel	Walk	Art	Sport	3	182	26	181	17	1	3	5
142	Female	Republic of Irel	Walk	English	Celebrity	4	150	15	115	15	2	2	15
143	Female	Republic of Irel	Bus	PE	Sport	4	167	29	168	16	2	0	15
144	Female	Outside Europe	Car	Art	Sport	5	160	20	154	13	2	1	10
145	Female	Republic of Irel	Car	Music	World Affairs/	6	160	27.5	165	13	3	1	12
146	Male	Republic of Irel	Walk	Art	Sport	4	185	20	120	14	1	11	15
147	Male	Republic of Irel	Walk	Business Subje	Music + Film	6	155	24	155	19	2	0	15
148	Female	Republic of Irel	Bus	English	Music + Film	3	163	23	160	16	1	1	40
149	Male	Republic of Irel	Walk	Technology S	Sport	5	180	26	186	15	2	1	3
150	Male	Republic of Irel	Car	Music	Music + Film	3	168	24	166	15	2	1	25
151	Female	Republic of Irel	Car	Art	Music + Film	6	147	13	149	15	1	4	10
152	Male	Republic of Irel	Walk	PE	Sport	6	174	26	174	15	1	2	20
153	Female	Republic of Irel	Rail (Luas	Music	Music + Film	4	170	23	120	16	3	0	45
154#	Female	Republic of Irel	Bus	Art	Music + Film	4	156	22.6	156	14	0	1	40
155	Female	Republic of Irel	Car	Art	Music + Film	5	153	21.4	143	16	2	2	3
156	Male	Republic of Irel	Walk	Other	Music + Film	4	180	27	176	16	1	2	10
157	Male	Republic of Irel	Car	PE	Other	4	162	26	162	13	4	0	2 5
158	Male	Outside Europe	Car	Science	Music + Film	5	169	23	169	16	2	2	30
159	Male	Republic of Irel	Cycle	History	Music + Film	5	180	27	184	15	2	1	10
160	Female	Republic of Irel	Car	Business Subje	Sport	3	168	20	164	16	1	1	10
161	Male	Republic of Irel	Car	PE	Music + Film	5	157	29	177	15	4	2	5
162	Male	England	Walk	English	Sport	4	153	22	90	12	2	2	2
163	Male	Republic of Irel	Car	Mathematics	World Affairs/	2	120	35	150	16	2	0	1
164	Male	Republic of Irel	Car	Technology S	Technology	5	161	24.5	156	12	4	3	20
165	Female	England	Car	Music	Celebrity	4	168	23.1	167	16	2	2	7
166	Male	Republic of Irel	Walk	PE	Sport	5	165	24	162	16	4	4	8
167	Female	Republic of Irel	Bus	Art	Fashion	5	175.26	26	165	16	2	2	45
168	Male	Republic of Irel	Car	Business Subje	Music + Film	7	174	21	142	16	2	11	35
169	Female	Republic of Irel	Car	Science	Sport	5	170	20	164	13	3	2	20
170	Female	England	Car	I do not have	Celebrity	5	159	22	132	17	2	0	10
171	Male	Republic of Irel	Car	Business Subje	Sport	5	170	30	170	13	2	1	12
172	Male	Republic of Irel	Bus	RE	Sport	6	169	25	170	16	1	1	20
173	Male	Republic of Irel	Car	Science	Sport	5	185	28	197	16	2	1	15
174	Female	Other European	Bus	English	Health + Beau	3	161	25	166	21 or ov	2	3	25
175	Male	Republic of Irel	Walk	ICT	Technology	5	170	25	170	16	2	2	15
176	Female	Republic of Irel	Car	I do not have	Health + Beau	4	165	28	90	15	1	3	10
177	Female	Republic of Irel	Car	Other	Health + Beau	4	173	22	175	16	2	1	8
178	Female	Republic of Irel	Other	Mathematics	Business	3	156	17	155	21 or ov	2	0	30
179	Male	Republic of Irel	Car	Science	Sport	3	186	30	183	18	2	4	15
180	Male	Republic of Irel	Car	PE	Sport	5	150	26	150	12	4	10	40
181	Male	Northern Irelan	Bus	Other	Music + Film	8	177	28	177	15	2	7	25
182	Male	Republic of Irel	Bus	Other	Sport	2	168	20	168	15	2	9	30
183	Female	Republic of Irel	Car	Mathematics	World Affairs/	5	160	24.5	158	21 or ov	3	0	25
184	Male	Other European	Car	Other	Music + Film	6	134	25	168	14	1	10	10
185	Female	England	Walk	Business Subje	Fashion	4	166	27	173	15	2	3	15
186	Male	Other European	Bus	Science	Technology	4	179	29	201	15	1	2	40
187	Female	Republic of Irel	Walk	Art	Music + Film	6	156	12.5	156	17	2	2	5
188	Male	Republic of Irel	Bus	Gaeilge	Sport	5	170	26	178	16	4	1	25
189	Male	Republic of Irel	Walk	Technology S	Fashion	3	199	34	99	14	3	2	32
190	Female	Republic of Irel	Walk	English	Health + Beau	5	160	24	160	16	0	2	5
191	Male	Republic of Irel	Walk	Art	Sport	5	182	28	188	15	4	1	35
192	Female	Republic of Irel	Car	PE	Health + Beau	4	166	24.1	164	15	2	1	5
193	Female	Republic of Irel	Walk	Other	Celebrity	3	171	25	168	16	1	1	30
194	Male	Republic of Irel	Cycle	History	Technology	3	172	22	168	20	2	2	3
195	Male	Republic of Irel	Bus	Other	Sport	5	178	30	187	16	2	5	45
196	Male	Republic of Irel	Walk	Science	Sport	5	182	30	182	17	3	0	15
197	Male	Republic of Irel	Car	Other	Sport	2	154	27	151	13	1	4	20
198	Female	Republic of Irel	Bus	Languages	Celebrity	4	161	20	158	15	2	1	40
199	Male	Republic of Irel	Walk	Art	none	3	186	32	184	17	3	20	20
200	Male	Republic of Irel	Bus	Other	Sport	4	150	23	120	15	2	1	30
min						1	107	12	90	12	0	0	1
max						9	200	35	201	20	6	20	100

1.   What is the minimum (smallest) people count for a typical household?

2.   What is the maximum (largest) people count?

3.   How many households have between 4 and 6 people, inclusively.
           (i.e. including 4 and 6)?

4.   How many households have between 1 and 9 people, inclusively.
           (i.e. including 1 and 9)?

5.   Which people count occurred most frequently?

6.   How many households contain more than 6 people?

7.   How many households contain 6 or fewer people?

8.   How many households contain fewer than 5 people?

9.   How many households contain 4 or fewer people?

10.   How many households contain between 4 and 7 people, inclusively?

11.   Look at the answers you gave in problem 6 and 7. Are these answers related? If so, How? And
           why? What about your answers to problem 8 and 9?

12.   Describe the data in as many ways as you can using numerical and shape descriptions.
           (Fractions and decimals permitted and of course words!).

WS5.05   Fair Share

	1	2	3	4	5	6	7	8	9	Ranking	Median	Moves	Mean	
A	6	5	5	4	5	5	6	5	4					
B	1	10	10	1	1	10	1	10	1					
C	2	4	8	3	4	6	6	7	5					
D	4	4	7	4	4	5	6	7	4					
E	1	4	8	4	4	6	6	8	4					
F	8	1	7	7	4	1	3	7	7					

WS5.06   The Median

1. Do you expect that the median stack size for the 9 stacks will always be the same for any allocation? Why or why not?

2. Put your 45 blocks into this allocation: 2, 4, 8, 3, 4, 6, 6, 7, 5
   Why is the median *not* the fifth stack in the allocation?

3. How would you go about finding the median stack size for this allocation?

4. Create a new allocation of the 45 cubes into 9 stacks so that the median is equal to 5.
   (Do not use the allocation with 5 cubes in each stack.)

5. Create a new allocation of the 45 cubes into 9 stacks so that the median is *not* equal to 5.

6. What is the mean for your new allocation?

7. Find a third allocation that has a median different from the ones in the previous two problems.

8. What is the smallest possible value for the median?

9. What is the largest possible value for the median? (Remember that there must be 9 stacks for the 45 cubes, and each stack must contain at least 1 cube).

Below is the spread sheet data for "Right Foot Lengths" for 200 students taken from *Census At School*. The data is in ascending order. There are 20 pieces of data in each column.

	A	B	C	D	E	F	G	H	I	J
1	12	20	22	23	24	24.9	25	26	28	29
2	12	20	22	23	24	25	25	26	28	30
3	12.5	20	22	23	24	25	25	26	28	30
4	13	20	22	23	24	25	25	26	28	30
5	15	20	22	23	24	25	25	27	28	30
6	15	20	22	23	24	25	25	27	28	30
7	17	20	22	23	24	25	25.2	27	28	30
8	17	20	22	23	24	25	25.5	27	28	30
9	18	21	22	23	24	25	25.6	27	28	30
10	19	21	22	23	24	25	26	27	28	30.2
11	20	21	22	23.1	24	25	26	27	28.2	32
12	20	21	22	23.5	24	25	26	27	28.5	32
13	20	21	22.5	23.5	24	25	26	27	29	34
14	20	21	22.6	23.5	24	25	26	27	29	34
15	20	21	22.7	23.6	24	25	26	27	29	34
16	20	21	23	24	24.1	25	26	27	29	35
17	20	21.2	23	24	24.5	25	26	27	29	35
18	20	21.4	23	24	24.5	25	26	27	29	35
19	20	21.6	23	24	24.5	25	26	27.5	29	35
20	20	22	23	24	24.5	25	26	28	29	35.2

Mean $= 24.6$ cm   Standard Deviation $= 4.06$ cm ≈ 4 cm

Fill in the following table:

3 standard deviations below the mean	2 standard deviations below the mean	1 standard deviation below the mean	Mean	1 standard deviation above the mean	2 standard deviations above the mean	3 standard deviations above the mean
			24.6 cm	28.6 cm		

From the table above, count how many numbers are between 1 standard deviation below the mean and 1 standard deviation above the mean?		What percentage of the 200 numbers is to be found within 1 standard deviation of the mean?	
From the table above, count how many numbers are between 2 standard deviations below the mean and 2 standard deviations above the mean?		What percentage of the 200 numbers is to be found within 2 standard deviations of the mean?	
From the table above, count how many numbers are between 3 standard deviations below the mean and 3 standard deviations above the mean?		What percentage of the 200 numbers is to be found within 3 standard deviations of the mean?	

The mean height of a group is 166.6cm and the standard deviation is 13.3cm.

Based on an assumption that the distribution of heights is approximately normal, use the empirical rule for the following questions:

(i)   68% of this school's students have heights between _____ cm and _____ cm.

(ii)   What percentage of students have heights between 140 cm and 193.2 cm?

(iii)   A school tour is being organised. All students can apply to go on it. There is a rollercoaster at one location on the tour. You have to be over 140cm to be allowed on the rollercoaster. What percentage of students are not tall enough to ride the rollercoaster?

WS5.08   *Aptitude Test*

To enter a particular college course, candidates must complete an aptitude test. In 2010 the mean score was 490 with a standard deviation of 100. The distribution of the scores on the aptitude test is a normal distribution.

(i)   What percentage of candidates scored between 390 and 590 on this aptitude test?

(ii)   One student scored 795 on this test. How does this student's score compare to the rest of the scores?

(iii)   The college admits only students who were among the highest 16% of the scores on this test. What score would a student need on this test to be qualified for admission to this college? Explain your answer.

You wanted to work out which mobile phone company is the most popular among Irish second level students. You used a sample of 100 students and found that Meteor topped the survey with 42%. What percentage of all second level students in the country use Meteor?
(Can we use the sample to talk about the population?)

```
|——————————————————|—|————————————————|
0%               42% 50%              100%
```

Problem 1:
A drug company claims that their new drug relieves migraine 70% of the time.
A newspaper investigates this claim by getting migraine sufferers to try the new drug. They get 100 results that say it relieves migraine 62% of the time.

What could the newspaper say about this?
What could the newspaper headline be?

_____

_____

_____

_____

_____

_____

_____

_____

_____

Problem 2:
A teacher claims that 30% of second level students in Ireland are 180 cm or taller.
(i)   If we treat the 200 results from our school as the results of a simple random sample of all second level students then what is the overall margin of error of the survey, at 95% confidence?

(ii)   Of the students in the sample above, 34 are 180 cm or taller. Is this sufficient evidence to reject the teacher's claim, at the 5% level of significance?

_____

_____

_____

_____

_____

_____

_____

_____

Arm Span	Height
128	165
141	145
145	134
147	147
148	153
149	147
150	152
150	150
150	153
158	161
158	160
159	150
160	165.1
160	155
161	165
162	162
165	155
166	161
166	174
170	173
172	175
177	177
186	180
200	194
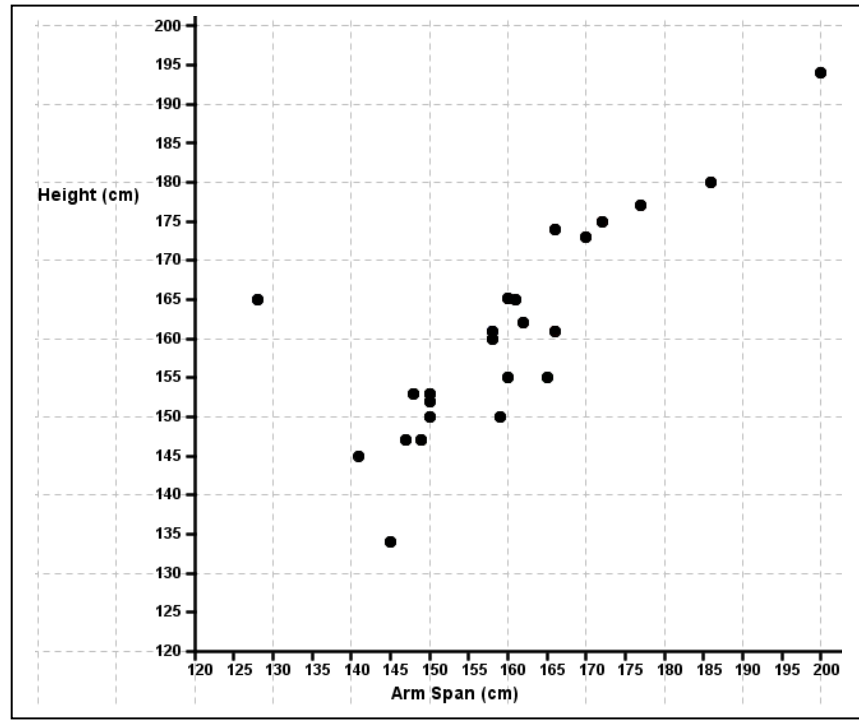
The following table shows the weekly rainfall (x cm) and the number of tourists (y thousand) visiting a certain beauty spot, for 9 successive weeks.

Rainfall (x)	4.5	3.0	5.2	5.0	2.1	0	0	1.2	3.2
No. of tourists (y thousands)	5.0	8.0	0.8	4.2	4.8	7.4	9.4	8.6	2.6

(i)   Draw a scatter plot for this data.
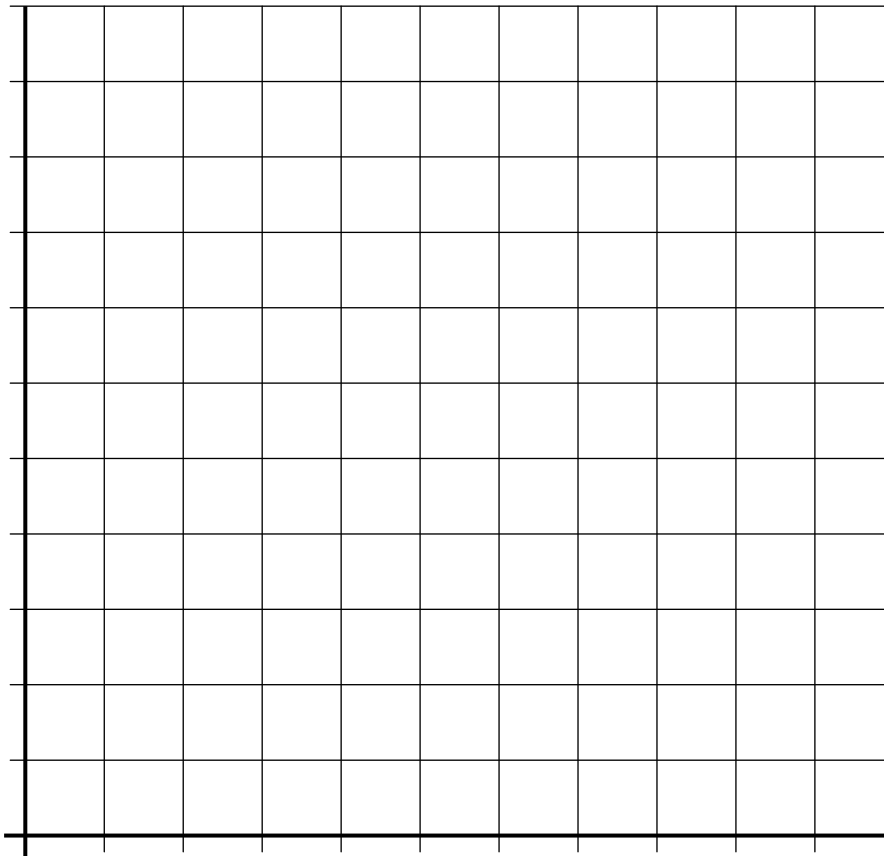
(ii)   Find the mean rainfall ($\bar{x}$)

(iii)   Find the mean number of tourists ($\bar{y}$)

(iv)   Plot the point ($\bar{x}$, $\bar{y}$). Draw lines parallel to the x-axis and y-axis through this point.

(v)   This splits the scatter plot into 4 quadrants. In which quadrants do you find the most points?

(vi)   Draw a line of best fit. Draw an oval around the data. The line must go through ($\bar{x}$, $\bar{y}$). The line of best fit should go through the two quadrants that contain the most data points.

(vii)   On the 10th week there was 4 cm of rainfall. Use your line of best fit to estimate the number of tourists that had visited the beauty spot in the 10th week.

(viii) By picking appropriate points find the slope of the line of best fit.

(ix) Interpret the slope in the context of rainfall and the number of tourists.

(x) Find the equation of the line of best fit and use it to check your answer to part (vii).

(xi) The manager of the café at this beauty spot has to plan staffing levels. A mix of full-time and part-time staff are employed. In the light of the information above and the fact that the correlation coefficient is –0.78 what advice would you give the manager?

The data given in the table below and represented in the scatter diagram are pairs of observations of the variables x and y.

x	1	2	3	4	5	6	7
y	2	7	10	11	10	7	2
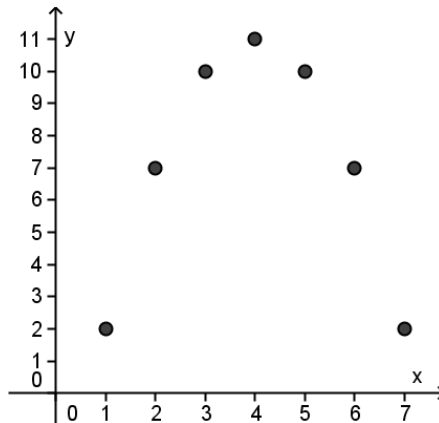
(i)   From looking at the diagram would it be appropriate to work out the correlation coefficient of the data? Explain your reasoning.

(ii)   From looking at the diagram would it be appropriate to draw in the line of best fit of the data? Explain your reasoning.

(iii)   What kind of relationship, if any, do the observed data suggest exists between x and y?

WS5.14 Tasks Related to "Correlation and Line of Best Fit 2"

Use in connection with the interactive file, *'Correlation and Line of Best Fit 2'*, on the **Student's CD**.

Calculating the point (Mean of x s, Mean of y s) and using it to split the plane into 4 quadrants is <u>not</u> specifically mentioned in the syllabus. However, it is a helpful way of learning about relationships in the data.

> *The purpose of this task sheet is to explore the relationship between the pattern of the points in a scatter plot, the correlation coefficient, line of best fit, outliers, the point (Mean of x's, Mean of y's) and the numbers of points in each quadrant.*
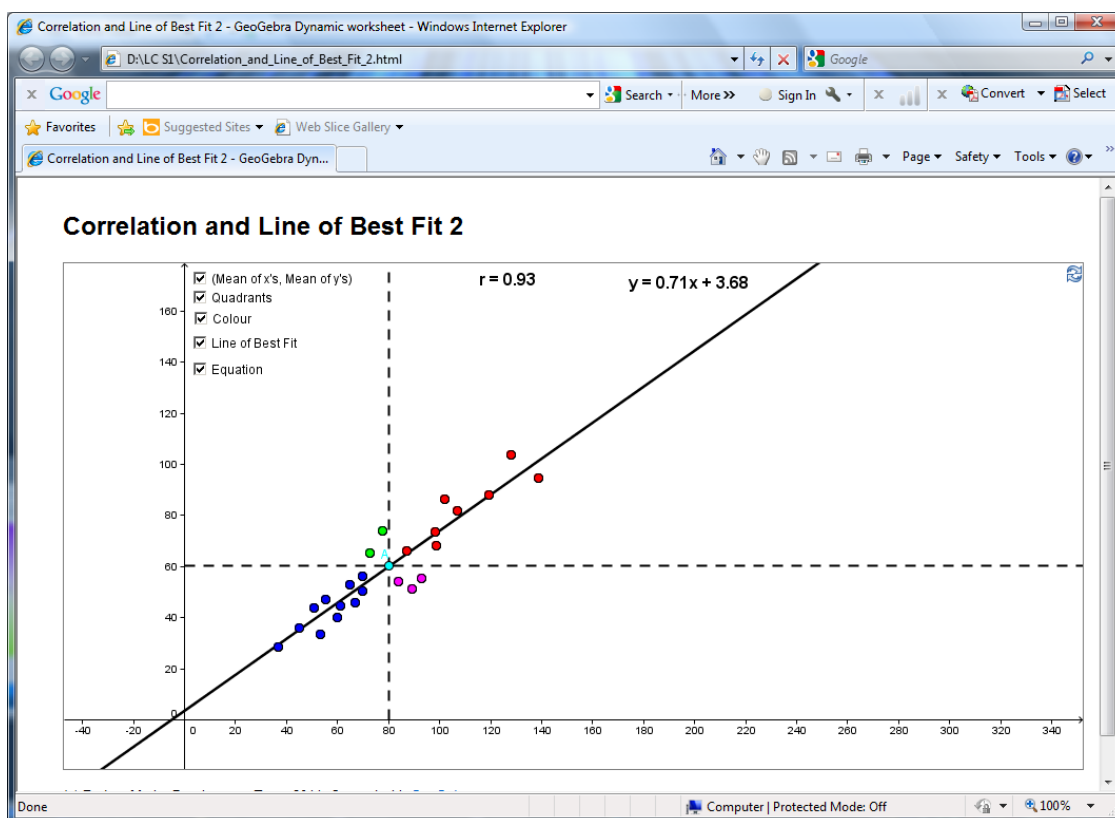
Task 1

Leave the 24 points as they are. Click on **"(Mean of x s, Mean of y s)"**.
This shows the point that is the centre of the data. We will call this the point A

Click on **"Quadrants"**.

Complete the sentence:
The bottom left quadrant has all the points that have below average x-values and _____ average y-values.

Complete the sentence:
The top right quadrant has all the points that have above average x-values and _____ average y-values.

Click on **"Colour"**.
Count up all the points in each of the quadrants. Does the amount of points in each quadrant hint at a relationship in the data?

By looking at your answers to the previous questions and the diagram is there a <u>**linear**</u> relationship in the data?

By looking at both the correlation coefficient and the scatter plot could you say that as the x-values of the points increase the y-values of the points tend to increase?

Click on **"Line of Best Fit"** and **"Equation"**.

Does the line of best fit pass through all the points in the scatter plot?

Does the line of best fit have to go through any of the points in the scatter plot?

What can you say about the point A and the line of best fit?

Your friend George asks "Does the line of best fit have to have half the points on either side of it?" Move the points and see if you can answer George's question.

Drag some of the points around the screen so that the linear relationship is maintained. Which 2 quadrants does the line of best fit pass through when the correlation coefficient (r) is close to 1?

Drag some of the points around the screen so that the points are still in a linear relationship. Which 2 quadrants does the line of best fit pass through when the correlation coefficient (r) is close to –1?

Task 2

Reset the scatter plot using the icon at the top right-hand corner of the screen 🔃.
Move the points so that there are an <u>equal number of points in all four quadrants</u>.

(a) Arrange the points so that they are bunched together into a "cloud" or "swarm". Is the correlation coefficient close to 1, –1 or 0?
(b) Arrange the points so that they resemble the outline of a circle. Is the correlation coefficient close to 1, –1 or 0?
(c) Arrange it so that the points in two of the quadrants are stretched out into a line and the points in the other two quadrants are close to the point A is the correlation coefficient close to 1, –1 or 0?

Task 3

Reset the scatter plot using the icon at the top right-hand corner of the screen 🔃.
  - Put 10 points in the top right quadrant.
  - Put 10 points in the bottom left quadrant.
  - Put 2 points in the top left quadrant.
  - Put 2 points in the bottom right quadrant.

While keeping the number of points in each quadrant as outlined above, can you adjust the points so that there is a correlation close to –1 or 1?

While keeping the number of points in each quadrant as outlined above, can you adjust the points so that there is a correlation close to 0?

Having a large number of points in the bottom left and top right quadrants doesn't always indicate association between the variables. There must be a linear pattern for the correlation coefficient (r) to be close to –1 or 1.

Task 4

Reset the scatter plot using the icon at the top right-hand corner of the screen 🔃.
  - Move the points so that the pattern looks like a quadratic.

Is there a pattern to the points?
Is the pattern linear?

There may be a strong association between the variables, but since the relationship is not linear it wouldn't be useful to summarise the strength of the relationship with the correlation coefficient (r) or to draw a line of best fit.

Reset the scatter plot using the icon at the top right-hand corner of the screen ⟳.
- Group all the points into a tight bunch in one of the corners of the screen.
- Adjust the points until you have a correlation coefficient close to 0.
- Drag one point very far away from this bunch e.g. to towards the opposite corner of the screen.

Watch the correlation coefficient changing.
23 of the points are in a bunch and there is 1 point far away from the rest.
Is there a linear relationship between the points?

What conclusion can you draw about the effect of the outlier on the level of correlation?

The correlation coefficient indicates a strong linear relationship but by looking at the graph you see that the relationship is not linear (without the outlier the correlation coefficient is near 0).

It is important to analyse the data both numerically (correlation coefficient) and graphically (scatter plot).
A single outlier can bring the value of r close to –1 or 1.

Set the points up so that they are (almost) in a line (that isn't horizontal or vertical).
Take note of the correlation coefficient (r).
Drag one point very far away from this line of dots.

How does the correlation coefficient (r) change?

A single outlier can bring the correlation coefficient close to zero.

Algebra

> "For effective learning, algebraic thinking must be nurtured in parallel with arithmetic understanding"
> *Lynn Arthur Steen*

Pre-Algebra →	Understanding Variables →	Algebra →	Extension
Number Theory Solid understanding of Number Theory from Strand 3 Useful Methodology: Array Models, T&L on Integers, Fractions & Ratio **1**		**Algebra skills seen as "generalised arithmetic"**. Make an explicit association between symbols and numbers. Use array models and algebra tiles (drawings) to help misconceptions. **3**	"Most of the major principles of algebra and geometry emerge as generalisations of patterns in number and shape"
Patterns **2** **Fostering 'Algebraic Thinking' through exposure to patterns, relationships, generalising and problem solving.**	"Algebra provides finite ways of managing the infinite." **2**	**Money Box Problem extended:** **3** We can show adding like terms as part of a real-world problem solving question. For example: 2 family members combining their savings to buy a computer console costing €249	- **Factorising**
Develop pattern-based thinking - recognise, construct and extend patterns (T&L on Patterns) - use tables to represent a pattern (patterns with unifix cubes) - use patterns to represent real-world situations - develop language to describe patterns precisely, both orally and in writing, as a prelude to using symbols. - use patterns to solve problems (Locker Problem)	**Variables can be used in 4 different ways:** - A formula like $A = l \times b$ (infinite amount of possibilities) - A Law/Identity like the Commutative Law, $x + y = y + x$ (for all cases) - A Relationship/Rule like $\{(x,y)\|y = 2x + 3,\ x \in R\}$ (infinite amount of points that fit a rule) - An unknown like $2x = 6$ (one number from an infinite set of possibilities)	**Skills for Solving Equations:** After Money Box / Sunflowers Problem is used to explain an unknown in context of a real-world problem, extend this to teach the skills for solving equations. Methodology: T&L on Equations, stabilisers	- Construct some **Perimeter and Area Formulae** using patterns and variables - Discover **theorems** through patterns
Deliberate focus on relationships involving two variables - develop an understanding of how one quantity changes as a result of the change in another quantity: $y = mx + c$ Methodologies: Money Box Problem/ Sunflowers Problem - Students use tables and graphs to represent a relationship - Students introduced to linear relationships, constant rate of change, variables, increasing/decreasing change, slope = rise/run	All of the above can be explored using patterns.	**Solving Word Problems using Algebra:** Show that algebra allows choice and flexibility in solving problems. Let students discover that algebra is often the most efficient way to solve a problem, especially word problems.	- Extend rise over run triangle into the formula for slope, then the distance between 2 points. **Co-ordinate Geometry** understood as the marriage of geometry and algebra. - Discover **quadratic, cubic and exponential relationships** through patterns
Generalising using symbols - Simplification: Letters employed to reduce the language used to describe patterns. (Doesn't matter what letter/symbol is used) - Students generalise the pattern, using symbols, and make their first formula.	**Problem Solving:** Using a variable as an unknown can be introduced and explored through problem solving. Example: For how many days did John need to save in order to accumulate €45 for a new computer game?	***Overview of the learning outcome for teaching algebra:*** *The relationship based approach to learning algebra should culminate in students having a deep understanding of algebra which allows easy movement between story, table, graph and equation.*	- Look at patterns in **Statistics** - Discover **Trigonometric Ratios** through patterns
The Power of Pattern-Based Thinking: Problem Solving - Patterns and relationships are used to model maths and real-world situations, particularly for solving problems. - Symbols are used to generalise the rule of a pattern observed in a situation. Then that rule can be used to solve the problem. *By doing Patterns first:* *Algebra is seen as the language we use to describe patterns and relationships for the ultimate goal of problem solving.* *Students also get a very good introduction to a variable as a changing quantity.*		*Learners should also have an appreciation that the power of algebra lies in its capacity to describe relationships for the purpose of problem solving.*	- Investigate patterns of change in **Periodic and Trigonometric functions** - Rates of change observed in patterns can be extended to change at an instantaneous point in **Calculus.** - Extend patterns and symbols into **Sequences and Series**
Functions Introduce the terms inputs, outputs, a mapping, domain and range. Money Box Problem N → N, Sunflowers Question N → R	Play "Guess the Rule" game.		- Formalise **Functions**

Draw the following arrays:

$$x, \quad y, \quad 2x, \quad x^2, \quad 4x^2, \quad 2(x+y), \quad 2x+2y$$
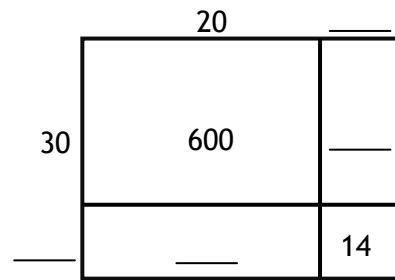
where $x \neq y$.
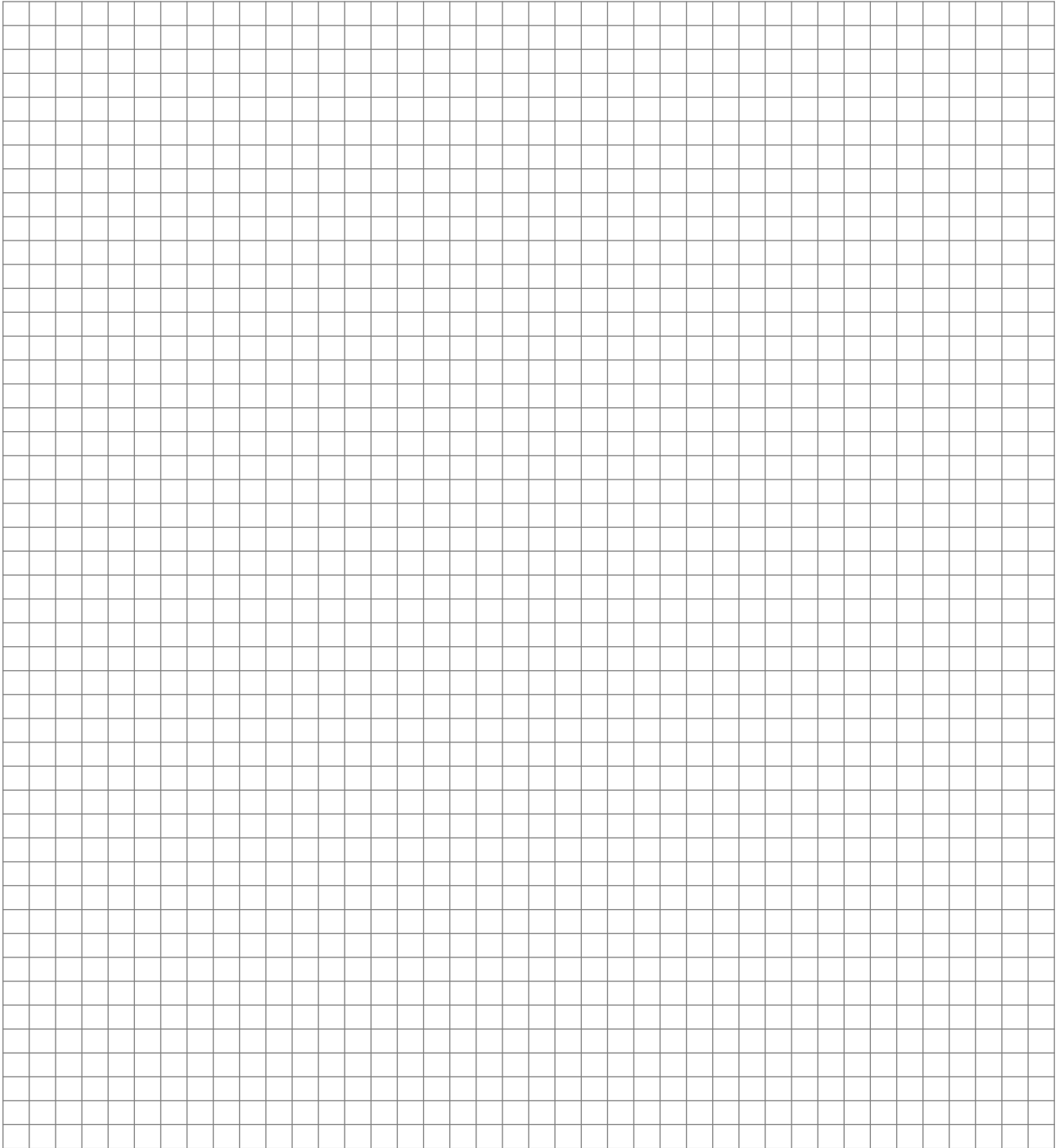
Question: Is $2(x+y) = 2x+2y$? Discuss.

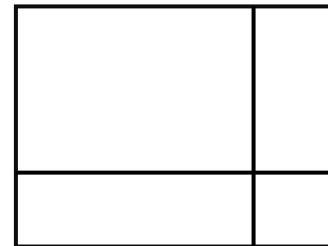Question: Is $2x \neq x^2$ always, sometimes or never?

WS5.17   *Array Model with Numbers*

(a) $27 \times 32 = (20 + \underline{\quad}) \times (30 + \underline{\quad})$

$\qquad\qquad = \underline{\quad\quad} + \underline{\quad\quad} + \underline{\quad\quad} + \underline{\quad\quad}$

$\qquad\qquad = \underline{\quad\quad}$

	20	___
30	600	___
___	___	14

(b) $35 \times 41 =$

WS5.18   *Array Model with Algebra*

Example

$(x + 2)(x + 4)$

$= x(x + 4) + 2(x + 4)$

$= x^2 + 4x + 2x + 8$

$= x^2 + 6x + 8$

Check work using an array model
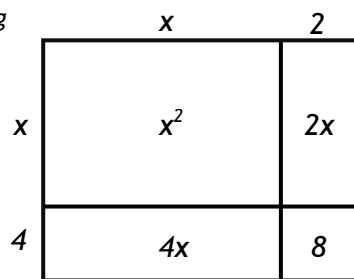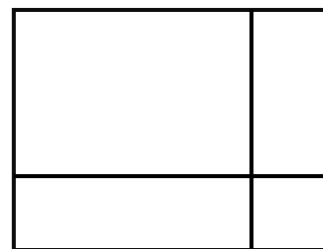
	x	2
x	x^2	2x
4	4x	8

(c) $(x + 5)(x + 3)$

$=$

$=$

$=$

1.   Evaluate $2 + 3 \times 4$.

Answer:

Class discussion on everyone's answers

Mathematicians made an agreement that:

multiplication takes precedence over addition.

2.   Considering the agreement, which word problem below describes the arithmetic sentence $2 + 3 \times 4$

A.   You work for 3 hours babysitting and you normally get €4 per hour. But this time the people tip you an extra €2. How much did you earn?

B.   A gardener decides to plant trees around the edges of a square park. He decides to plant 3 willow trees and 2 cherry blossom trees on each edge of the park. How many trees does he plant?

A or B?

3.   If we want to have addition done before multiplication we use brackets: $(2 + 3) \times 4$

we always simplify inside the brackets first

Put brackets on the following statements to make them true.

(i) $7 \times 8 + 2 = 70$ **(iii)** $6 + 3 \times 2 + 5 = 23$

(ii) $2 + 3 \times 4 + 5 = 45$ **(iv)** $3 \times 7 + 1 + 1 = 25$

4.   Another operation to consider is powers. Match the numerical expressions with their corresponding array models by placing A, B, C or D into the box.

(i) 3×2 *Place A or B in the boxes*

     3^2
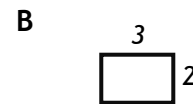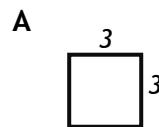
(ii) $3^2 + 4^2$ *Place one of the letters A, B, C or D in each box*

     3×4^2

     $(3 \times 4)^2$

     $(3 + 4)^2$
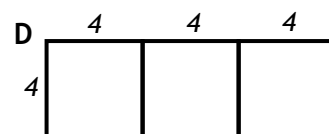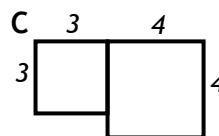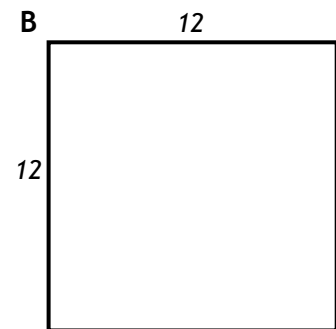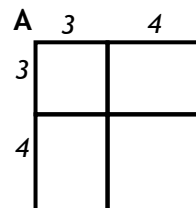
Class discussion on where the powers come in the order of operations and formalise:

     B   I

   M   D

A   S

Match the algebraic expressions with their corresponding array models by placing
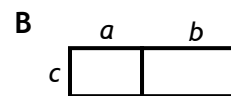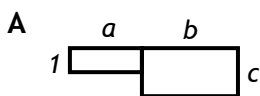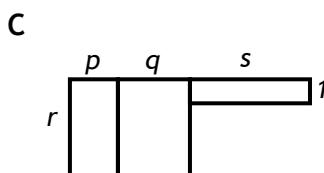A, B, C or D into the box

(i) $x \times y$ ☐

x^2 ☐

A $\quad x$ B $\quad x$

(ii) $a + b \times c$ ☐

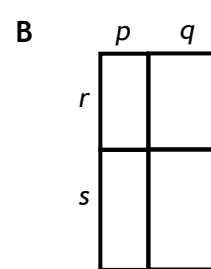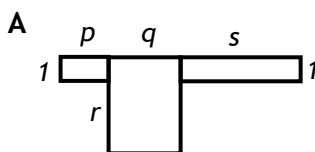$(a + b) \times c$ ☐

A $\quad a \quad b$ B $\quad a \quad b$

(iii) $(p + q) \times (r + s)$ ☐
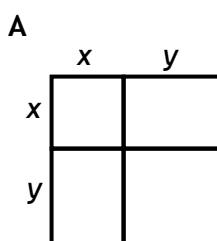
$p + q \times r + s$ ☐

$(p + q) \times r + s$ ☐

A $\quad p \quad q \quad s$ B $\quad p \quad q$
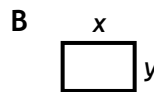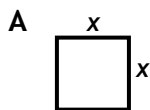
C $\quad p \quad q \quad s$

(iv) $x^2 + y^2$ ☐

$3 \times y^2$ ☐

$(x \times y)^2$ ☐

$(x + y)^2$ ☐

A $\quad x \quad y$ B $\quad xy$

C $\quad x \quad y$

D $\quad y \quad y \quad y$
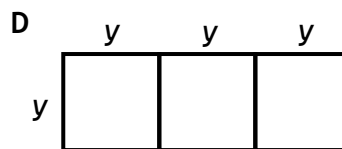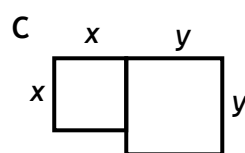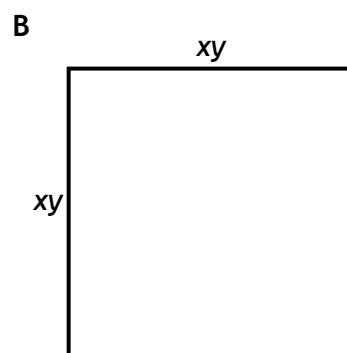
(v)   Is $x^2 + y^2 = (x + y)^2$?
Justify your answer:

1.   **Parking Bays**
      You work for a campsite owner. He wants to sell bays in his campsite and wants to include parking for the campers' car beside their tent. The owner wants the parking bay to be suitable for different sized cars and so wants the bays to be as follows:

      The length of a bay is 5 m longer than the width of the camper's car.
      The width of the bay is 2 m longer than the width of the camper's car.

      Draw a diagram to show the area of the car parking space for any width of car.

      If the width of John's car is 1.5 m, what area will his parking space be when he buys a campsite bay.

2.   **Sums of Pairs**
      Caroline has three numbers. She adds them in pairs and records the answer in each case. When she does this she has three different totals: 11, 17 and 22.

      What are the three numbers Caroline had to start with?

      Can you describe a method that would enable you to work out the three numbers given any three totals?

3.   **A Walk Around the Earth**
      Suppose you are six feet tall and walk around the Earth's equator.
      How much farther does your head travel than your feet?

4.   **Burning Candles**
      Two different candles are lit. They burn at different rates and one is 3 cm longer than the other.

      The longer one was lit at 5.30 p.m. and the shorter one at 7 p.m.
      At 9.30 p.m. they were both the same length.

      The longer one, burned out at 11.30 p.m. and the shorter one burned out at 11 p.m.

      How long was each candle originally?

5.   **Bernie's Field**
      Bernie has been given a field in the shape of a triangle. Two sides of the triangle are exactly 10 metres long.

      What is the largest possible area, in square metres, of Bernie's triangular field?

WS5.22   *Factorising*

1.   *Taking out a common factor*

Factorise $3x + 6$

	x	2
3	$3x$	6

The factors are $3(x + 2)$

🖊 Over to you:
Factorise $5x^2 + 20x,$ using the table model.

2.   *Grouping*

Factorise $ab - bc + da - dc$

	a	$-c$
b	ab	$-bc$
d	da	$-dc$

The factors are $(b + d)(a - c)$

🖊 Over to you:
Factorise $2ax - 6ay - 3x + 9y$ using a table model.

Example A

Guide Number

$+6$

6×1
-6×-1
3×2
-3×-2

$x^2 - 5x + 6$
$x^2 - 3x - 2x + 6$
$x(x-3) - 2(x-3)$
$(x-3)(x-2)$

	x	-3
x	x^2	$-3x$
-2	$-2x$	$+6$

Example B

Guide Number

$- 42$

1×42
2×21
$\pm \begin{cases} 3 \times 14 \\ 6 \times 7 \end{cases}$

$2x^2 - 11x - 21$
$2x^2 - 14x + 3x - 21$
$2x(x-7) + 3(x-7)$
$(2x+3)(x-7)$

	x	-7
$2x$	$2x^2$	$-14x$
$+3$	$+3x$	-21

Over to you:

Factorise the following quadratic using grouping: $3x^2 - 17x + 20$.
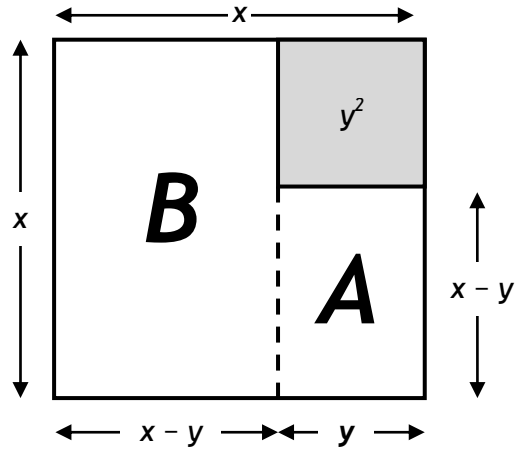
Factorise: $x^2 - y^2$

Area of $A = y(x - y)$

Area of $B = x(x - y)$

Area of $A + B = y(x - y) + x(x - y)$

$$= (x - y)(x + y)$$

Over to you:

Factorise $9a^2 - 4b^2$ using an area model.

Random Number Generator

fx - 83ES	fx - 83GT PLUS	Sharp EL-W531 WriteView

fx - 83ES:

[ALPHA] [•] 1 [SHIFT] [)] 200 [)] [=] [=]

fx - 83GT PLUS: *(none shown)*

Sharp EL-W531 WriteView:

[SET UP] [1] [0] [0]

[SET UP] [2] [1]

199 [2ndF] [RANDOM] [0] [+] 1 [=] [=] [=]

Standard Deviation

fx - 83ES	fx - 83GT PLUS	Sharp EL-W531 WriteView

fx - 83ES:

[MODE] [2] [1]

```
1:COMP   2:STAT
3:TABLE
```

```
1:1-VAR  2:A+BX
3:_+cX2  4:1n X
5:e^X    6:A·B^X
7:A·X^B  8:1/X
```

6 [=]
5 [=]
5 [=]
. . .
4 [=]

[AC]

[SHIFT] [1] [5] [3] [=]

```
1:Type   2:Data
3:Edit   4:Sum
5:Var    6:MinMax
```

```
1:n      2:x̄
3:Σx6n   4:Σxбn-1
```

fx - 83GT PLUS:

[MODE] [2] [1]

```
1:COMP   2:STAT
3:TABLE  4:VERIF
```

```
1:1-VAR  2:A+BX
3:_+cX2  4:1n X
5:e^X    6:A·B^X
7:A·X^B  8:1/X
```

6 [=]
5 [=]
5 [=]
. . .
4 [=]

[SHIFT] [1] [4] [3] [=]

```
1:Type   2:Data
3:Sum    4:Var
5:MinMax
```

```
1:n      2:x̄
3:бx     4:sx
```

Sharp EL-W531 WriteView:

```
<MODE>
0:NORMAL 1:STAT
2:DRILL
```

```
<STAT-1>
0:SD  1:LINE
2:QUAD 3:EXP
4:LOG  5:POWER
```

```
Stat 0 [SD]
              0.
```

[MODE] [1] [0]

6 [DATA]
5 [DATA]
5 [DATA]
. . .
4 [DATA]

[ALPHA] [6] [=]

Correlation Coefficient

fx - 83ES	fx - 83GT PLUS	Sharp EL-W531 WriteView

fx - 83ES

MODE 2 2

```
1:COMP   2:STAT
3:TABLE
```

4.5 =
3.0 =
.
.

```
1:1-VAR 2:A+BX
3:_+cx2 4:ln X
5:e^X   6:A·B^X
7:A·X^B 8:1/X
```

3.2 = ◄....
(▲)(◄)
5.0 =
8.0 =
.
.

```
1:Type 2:Data
3:Edit 4:Sum
5:Var  6:MinMax
7:Reg
```

2.6 =

```
1:A  2:B
3:r  4:x̂
5:ŷ
```

AC SHIFT 1 7 3 =

fx - 83GT PLUS

MODE 2 2

```
1:COMP   2:STAT
3:TABLE 4:VERIF
```

4.5 =
3.0 =
.
.

```
1:1-VAR 2:A+BX
3:_+cx2 4:ln X
5:e^X   6:A·B^X
7:A·X^B 8:1/X
```

3.2 = ◄
(▲)(◄)
5.0 =
8.0 =
.
.

```
1:Type 2:Data
3:Sum  4:Var
5:Reg  6:MinMax
```

2.6 =

```
1:A  2:B
3:r  4:x̂
5:ŷ
```

SHIFT 1 5 3 =

Sharp EL-W531 WriteView

MODE 1 1

```
<MODE>
0:NORMAL 1:STAT
2:DRILL
```

```
<STAT-1>
0:SD   1:LINE
2:QUAD 3:E_EXP
4:LOG  5:POWER
```

```
Stat 1 [LINE]
             0.
```

4.5 (x,y) 5.0 DATA
3.0 (x,y) 8.0 DATA
. .
3.2 (x,y) 2.6 DATA

ALPHA r