Student D: Elizabeth

The Mayfield Data Handling Project

Hypothesis

As the height of a person increases so does their weight. I think that this relationship will be more apparent in girls than boys. I think that in year 7 the spread of data of Y7 girls will be wide as some are very small and thin but others have developed far more. I think that Y7 boys on the other hand will have much more similar heights and weights as they tend to have growth spurts later on. By Y9 I would have expected the girls to have evened out and all be of a similar height and weight because girls generally have had their growth spurts by this time. I would have expected the boys data to have spread even more. By Y11 I think that the girls data will have started to spread out again but I would expect the boys to be closer.

Collecting data

I will start by discarding any outliers (unrealistic data) from the data as these could affect my end conclusions.

- In the Y7 boys category I found one outlier, number 134. There was no weight recorded and in the Y10 boys category I removed number 104 because it had a weight of 9 kg. This is not believable for a person in Y10 and of height 1.6 metres.

I will use a sample of 100 pupils. I will stratify my sample with year groups and gender. I will do this so that I can look at the relationships within the school and compare year groups and gender.

Year Group	Sample no. from year	Girls	Boys
Y7	282/1183 × 100 = **24**	47.16% = **11**	52.84% = **13**
Y8	270/1183 × 100 = **23**	46.3% = **11**	53.7% = **12**
Y9	261/1183 × 100 = **22**	54.8% = **12**	45.2% = **10**
Y10	200/1183 × 100 = **17**	47% = **8**	53% = **9**
Y11	170/1183 × 100 = **14**	50.59% = **7**	49.41% = **7**

I will sort the data into alphabetcial order according to surname, gender and year group. I will take the first names in the list, as surname has no effect on someone's weight or height.

In order to prove my hypothesis I will carry out a range of analysis. They will help me identify the strengths and weaknesses of relationships between height and weight. I will start by plotting scatter graphs of my data and using a line of best fit. I will look at the average vertical distance of the points from the line. This will allow me to compare strengths in different year groups and gender.

Stratified sample

Y7 Girls

Year Group	Surname	Forename 1	Forename2	Gender	Height(m)	Weight(kg)
7	Anderson	Zahrah		Female	1.56	53
7	Anderson	Mark	Adam	Male	1.45	40
7	Anderson	Lisa	Marie	Female	1.52	40
7	Anderson	Kylie	Jane	Female	1.42	41
7	Barnes	Chloe	Emma	Female	1.61	45
7	Bashir	Samirah		Female	1.62	40
7	Bates	Holly	Dempsey	Female	1.61	47
7	Bell	Leah	Ann	Female	1.65	45
7	Benjamin	Emma	Veronica	Female	1.63	45
7	Black	Sarah		Female	1.48	42
7	Boyce	Michelle	Louise	Female	1.51	50

Y7 Boys

Year Group	Surname	Forename 1	Forename2	Gender	Height(m)	Weight(kg)
7	Abejuro	Savt		Male	1.48	44
7	Afsal	Oliver	Fred	Male	1.55	53
7	Ahmed	DJ		Male	1.62	48
7	Ahmed	Wasim		Male	1.60	40
7	Ahmoud	Asif		Male	1.42	26
7	Alexander	Jack		Male	1.59	45
7	Anderson	Mark	Adam	Male	1.45	40
7	Andrew	Sohail	Farooq	Male	1.50	41
7	Andrews	John		Male	1.41	45
7	Asam	Ali	Raza	Male	1.36	38
7	Ashcroft	Wayne	Paul	Male	1.52	37
7	Austin	Steven		Male	1.54	43
7	Bandicoot	Garth	Joseph	Male	1.52	25

Y8 Girls

Year Group	Surname	Forename 1	Forename2	Gender	Height(m)	Weight(kg)
8	Abbott	Zahara		Female	1.57	53
8	Abejuro	Laura		Female	1.60	53
8	Aldridge	Kristina		Female	1.55	42
8	Anderson	Kylie	Jane	Female	1.52	52
8	Angabus	Kristina		Female	1.55	42
8	Angus	Laura		Female	1.55	50
8	Bailey	Mellisa		Female	1.75	72
8	Bamford	Emma		Female	1.61	48
8	Banken	Lilly		Female	1.68	56
8	Barlow	Billie		Female	1.62	49
8	Bateman	Lisa	Louise	Female	1.72	50
8	Bates	Leah	Nealey	Female	1.60	50

Y8 Boys

Year Group	Surname	Forename 1	Forename2	Gender	Height(m)	Weight(kg)
8	Adam	Alander	Anthony	Male	1.77	54
8	Ahaz	Asif		Male	1.70	49
8	Alderson	Matthew		Male	1.52	52
8	Alexander	Ashiq	Farood	Male	1.50	41
8	Alfred	Anthony		Male	1.72	51
8	Anderson	Paul		Male	1.67	52
8	Argah	Raza	Ali	Male	1.86	58
8	Asheq	Amir		Male	1.42	26
8	Ashton	Luke	Wayne	Male	1.54	37
8	Atkinson	Pauya		Male	1.65	45
8	Barlow	Paul	Daniel	Male	1.62	53
8	Bath	Arthur	Gordon	Male	1.52	52

Y9 Girls

Year Group	Surname	Forename 1	Forename2	Gender	Height(m)	Weight(kg)
9	Ali	Aisha		Female	1.52	45
9	Ali	Hannah		Female	1.62	52
9	Al-Jiboun	Tarah		Female	1.8	60
9	Amjad	Samia		Female	1.55	36
9	Aneillz	Christina		Female	1.53	65
9	Ashworth	Samantha	Kay	Female	1.6	48
9	Atkins	Patience		Female	1.57	40
9	Bagnall	veronica	Jane	Female	1.49	37
9	Barlow	Billie		Female	1.62	49
9	Barlow	Sandra	Jane	Female	1.64	55
9	Bellfield	Janet		Female	1.58	40
9	Bennett	Susan	Elizabeth	Female	1.6	41

Y9 Boys

Year Group	Surname	Forename 1	Forename2	Gender	Height(m)	Weight(kg)
9	Abejuro	Herman		Male	1.60	60
9	Adnan	Mahmood		Male	1.56	60
9	Agha	Hosaib		Male	1.66	54
9	Agha	Hosiab		Male	1.66	70
9	Alsderson	Matthew		Male	1.52	52
9	Amin	Khuram		Male	1.75	75
9	Anakin	Pauya		Male	1.65	45
9	Angle	Kurt		Male	1.52	54
9	Armarnio	Vintchenzo	Courtino	Male	1.67	54
9	Asam		Muneer	Male	1.71	60
9	Austin	Steve		Male	1.80	48
9	Banks	Robin		Male	1.73	66
9	Bean	Stanley		Male	1.55	50

Y10 Girls

Year Group	Surname	Forename 1	Forename2	Gender	Height(m)	Weight(kg)
10	Ali	Aisha		Female	1.52	45
10	Anderson	Taz		Female	1.80	60
10	Armstrong	Sarah		Female	1.67	66
10	Ashiq	Azra		Female	1.60	56
10	Barn	Samantha	Robey	Female	1.40	45
10	Barry	Kayleigh		Female	1.73	51
10	Bhatti	Hannah		Female	1.72	56
10	Bhatti	Sadia		Female	1.62	48

Y10 Boys

Year Group	Surname	Forename 1	Forename2	Gender	Height(m)	Weight(kg)
10	Abejorouge	Henry		Male	1.63	60
10	Aberdeen	Richard		Male	1.75	45
10	Adam	Stanley	Stevens	Male	1.80	49
10	Agha	Shohaib		Male	1.66	70
10	Air	Jason	David	Male	1.90	70
10	Arnold	Kevin		Male	1.70	57
10	Banks	Robbin	Adam	Male	1.66	66
10	Bates	Markus	Edward	Male	1.80	60
10	Bennet	Norman		Male	1.75	56

Y11 Girls

Year Group	Surname	Forename 1	Forename2	Gender	Height(m)	Weight(kg)
11	Ableson	Anbigale	Angela	Female	1.83	60
11	Acton	Jenny	Sarah	Female	1.67	52
11	Alexander	Claire		Female	1.60	54
11	Ali	Amera		Female	1.62	56
11	Alsam	Samia		Female	1.55	36
11	Barlow	Hanah	Mary	Female	1.63	44
11	Barlow	Louise	Jane	Female	1.63	44

Y11 Boys

Year Group	Surname	Forename 1	Forename2	Gender	Height(m)	Weight(kg)
11	Armstrong	Simon	Paul	Male	1.67	66
11	Askabat	Fernado	Mikey	Male	1.71	57
11	Ballson	James	Lawrence	Male	1.52	60
11	Beck	William	Lewis	Male	1.72	63
11	Bentley	James	Christopher	Male	1.91	82
11	Berk	Stephan	Donald	Male	1.77	57
11	Biggleoskess	Frederick	Rashid	Male	1.8	60

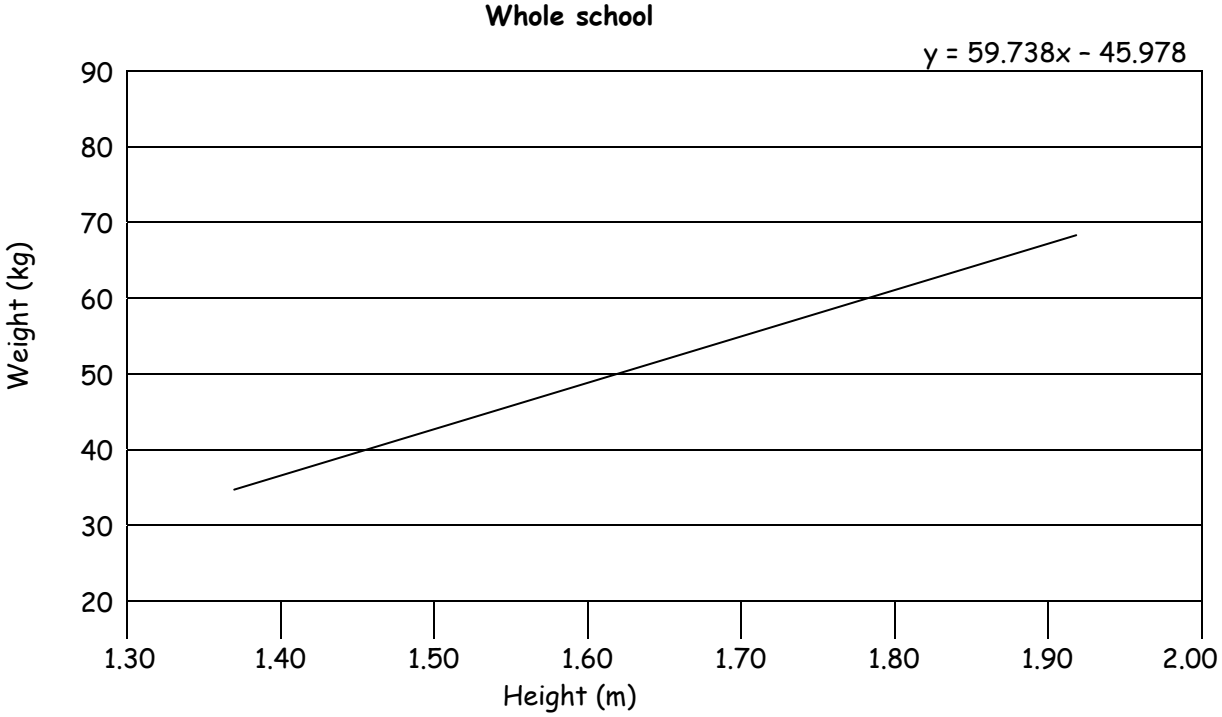
Processing Data

I will start by drawing a scatter graph of heights and weights of the whole school. I will then find the strength of the relationship for each year by finding the distance of each point from the line of best fit and taking the average. I will do this by:

1. Putting the x-coordinates into the equation from the graph.
2. Subtract the y value from the answer I calculated in 1.
3. Square the values to eliminate negatives.
4. Square root the values.
5. Take an average vertical height from the line of best fit.

Forename 1	Forename2	Gender	x Height (m)	y Weight (kg)		Vertical height difference	Square to remove -	Square root
Zahrah		Female	1.56	53	43.6086	9.39136	88.197643	9.39136
Mark	Adam	Male	1.45	40	42.2409	-2.24088	5.0215432	2.24088
Lisa	Marie	Female	1.52	40	38.8215	2.17852	4.7459494	2.17852
Kylie	Jane	Female	1.42	41	45.3183	-0.31834	0.1013404	0.31834
Chloe	Emma	Female	1.61	45	45.6603	-5.66028	32.03877	5.66028
Samirah		Female	1.62	40	45.3183	1.68166	2.8279804	1.68166
Holly	Dempsey	Female	1.61	47	46.6861	-1.6861	2.8429332	1.6861
Leah	Ann	Female	1.65	45	46.0022	-1.00222	1.0044449	1.00222
Emma	Veronica	Female	1.63	45	44.2925	5.70748	32.575328	5.70748
Sarah		Female	1.48	42	40.8731	1.12688	1.2698585	1.12688
Michelle	Louise	Female	1.51	50	41.8989	8.10106	65.627173	8.10106
Savt		Male	1.48	44	94.309	-50.30902	2530.9971	50.30902
Oliver	Fred	Male	1.55	53	43.2667	9.7333	94.737129	9.7333
DJ		Male	1.62	48	45.6603	2.33972	5.4742897	2.33972
Wasim		Male	1.60	40	44.9764	-4.9764	24.764557	4.9764
Asif		Male	1.42	26	38.8215	-12.82148	164.39035	12.82148
Jack		Male	1.59	45	44.6345	0.36554	0.1336195	0.36554
Mark	Adam	Male	1.45	40	39.8473	0.1527	0.0233173	0.1527
Sohail	Farooq	Male	1.50	41	41.557	-0.557	0.310249	0.557
John		Male	1.41	45	38.4795	6.52046	42.516399	6.52046
Ali	Raza	Male	1.36	38	36.7698	1.23016	1.5132936	1.23016
Wayne	Paul	Male	1.52	37	42.2409	-5.24088	27.466823	5.24088
Steven		Male	1.54	43	42.9248	0.07524	0.0056611	0.07524
Garth	Joseph	Male	1.52	25	42.2409	-17.24088	297.24794	17.24088

Average 6.27739818



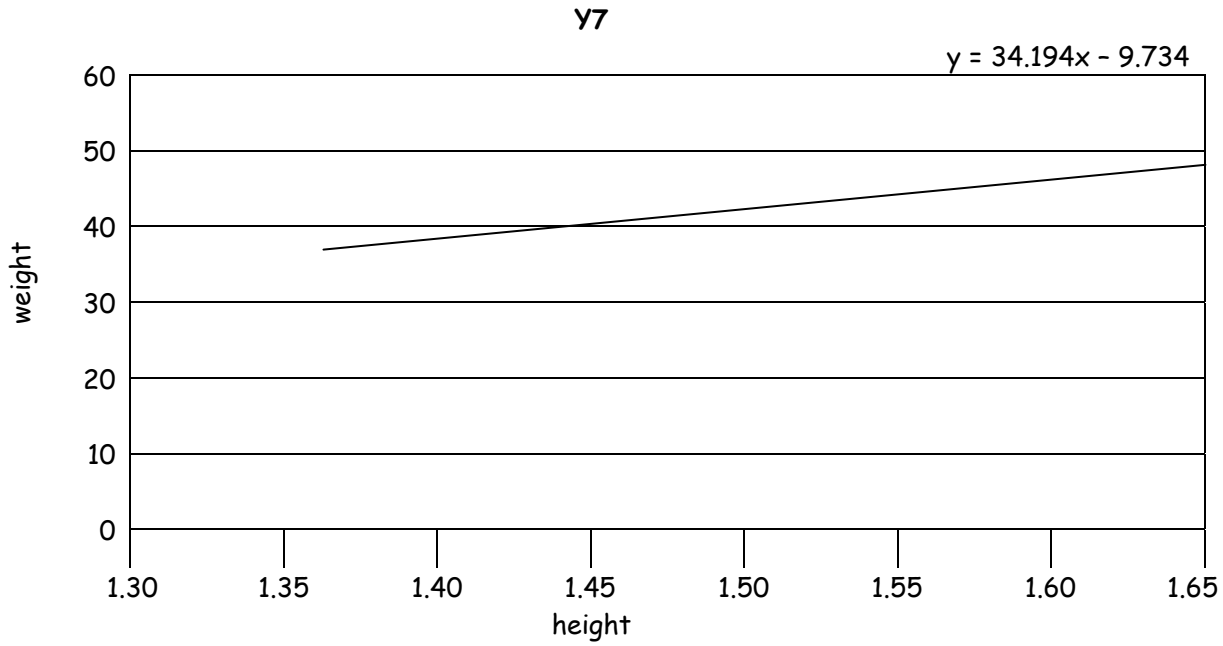
There is a fairly strong relationship between the height and weight of a person. The average vertical distance of the points from the line is 24.5 (to 1 d.p.). As the height of a person increases, so does their weight.

I have calculated the standard deviation of heights and weights of people in the school computer.

$$\sum \frac{(x-x)^2}{n}$$

The mean height in the whole school is 1.62. The standard deviation of the height of people from the whole school is 0.11 (to 2 d.ps)

The mean weight in the whole school is 50.36. The standard deviation of the weight of people from the whole school is 10.26 (to 2 d.ps)


Y7
y = 34.194x – 9.734
60
50
40
30
20
10
0
weight
1.30
1.35
1.40
1.45
1.50
1.55
1.60
1.65
height

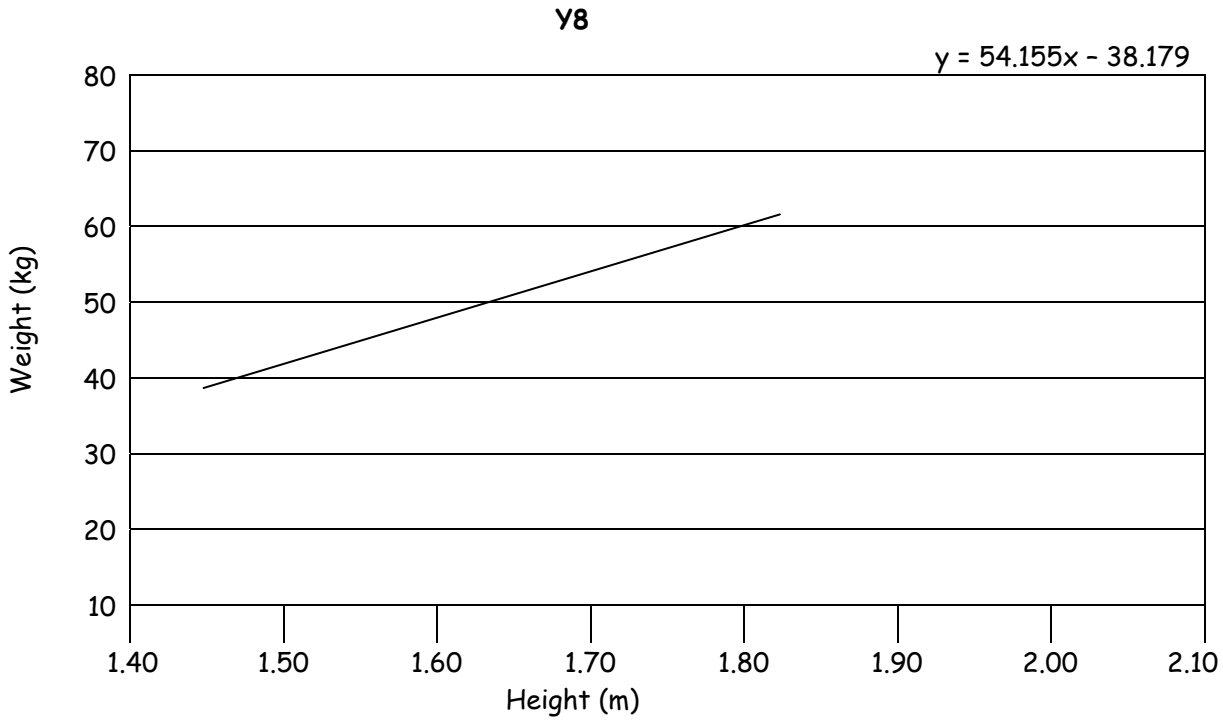

Y7 Girls
y = 12.338x – 25.991
60
50
40
30
20
10
0
weight
1.40
1.45
1.50
1.55
1.60
1.65
1.70
1.75
height

The graph shows that in year 7 there is a reasonably strong relationship between height and weight. The average vertical distance of the points from the line of best fit is 4.3 (to 1 d.p.). This shows that the relationship is stronger on Year 7 than it is for the whole school.

In my hypothesis I thought that in Y& the relationship between height and weight would be stronger in boys. Using my sample of Y7s from this school my hypothesis was incorrect. The average vertical distance of the points from the line of best fit for the girls was 3.4 and for the boys was 5.4.

The mean height for Y7 is 1.6 m. The standard deviation of the heights is: 0.08 (to 2 dps).

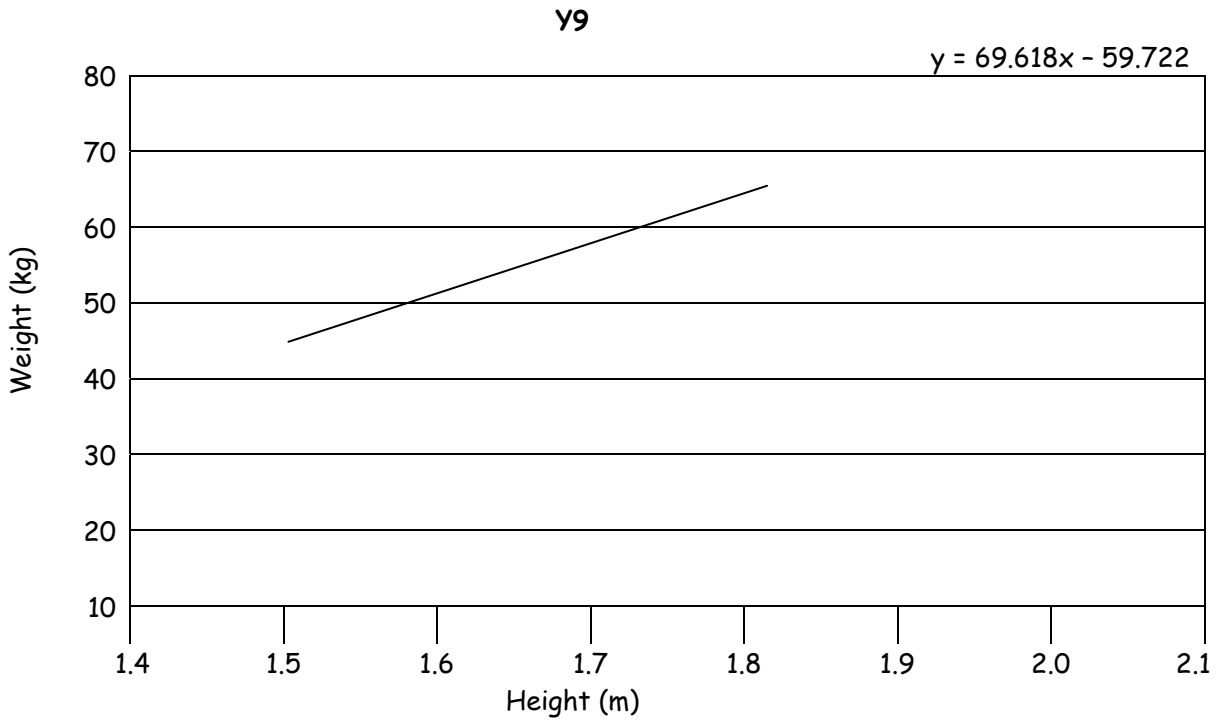
The mean weight Y7 is 42.6 kg. The standard deviation of the weights is: 6.84 (to 2 d.ps)

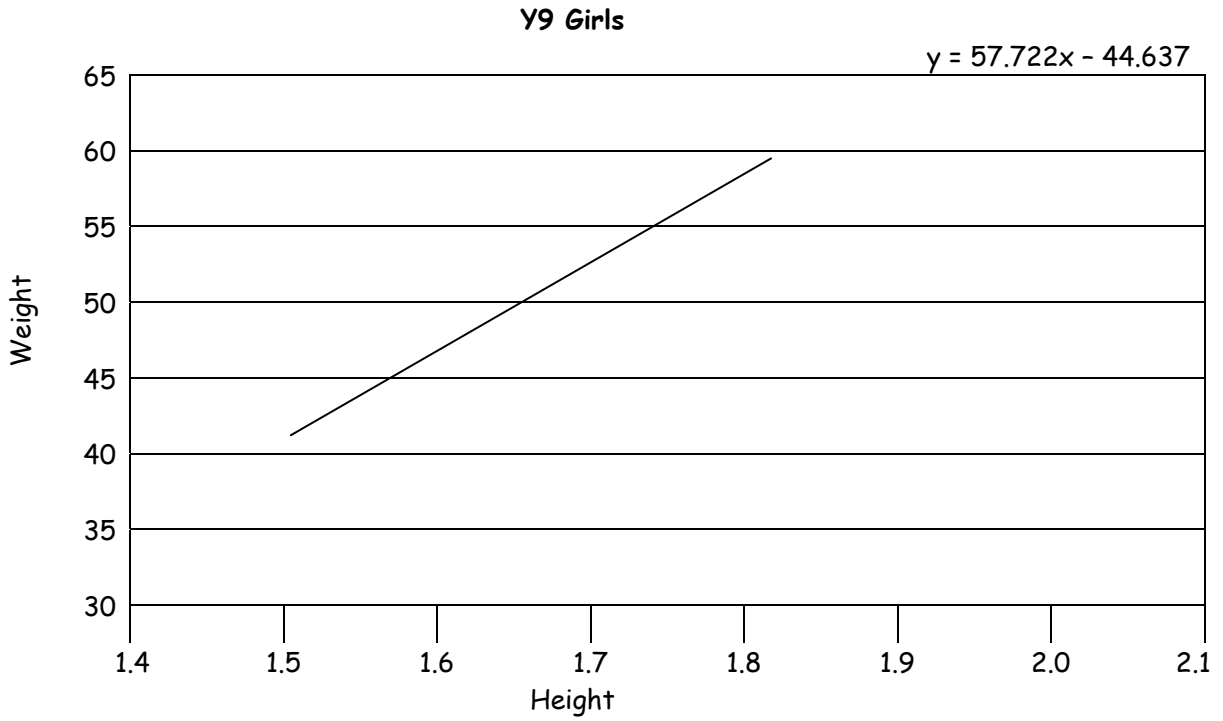


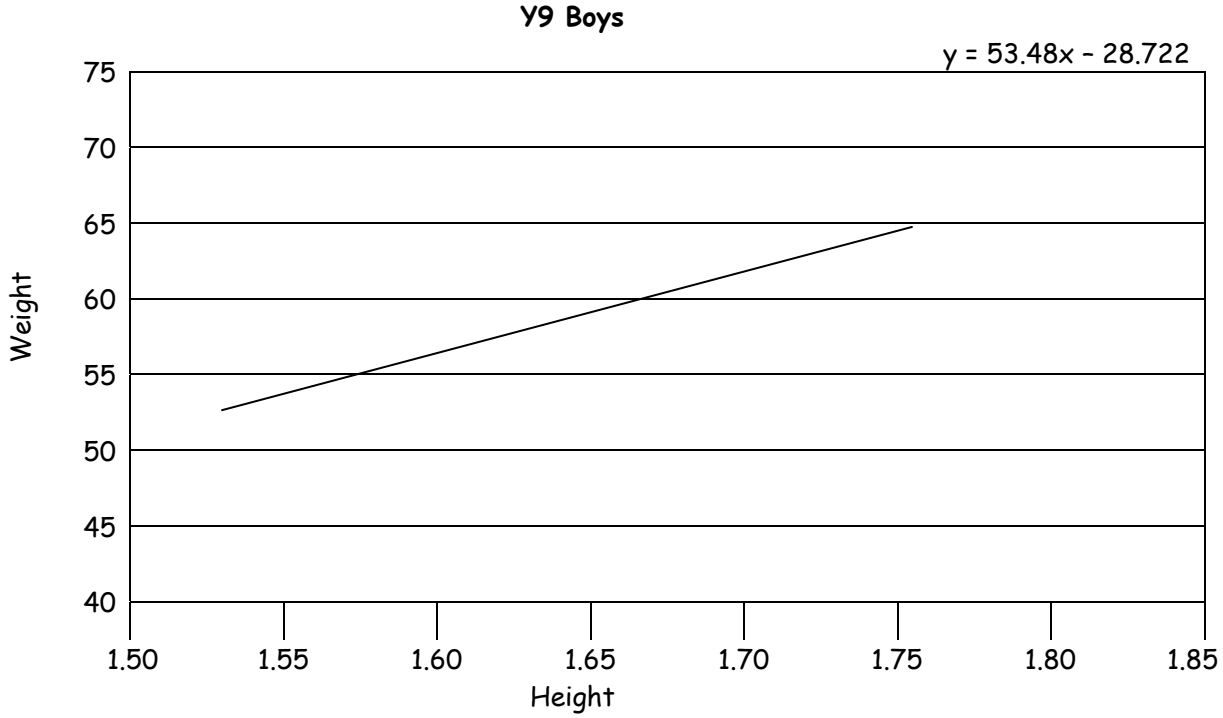
In year 8 the relationship is not quite as strong. The average vertical distance of the points from the line of best fit is 5.3 (to 1 d.p)

The mean height for Y8 is 1.62 m. The standard deviation of the heights is: 0.10 (to 2 dps).

The mean weight Y8 is 49.4 kg. The standard deviation of the weights is: 8.59 (to 2 d.ps)





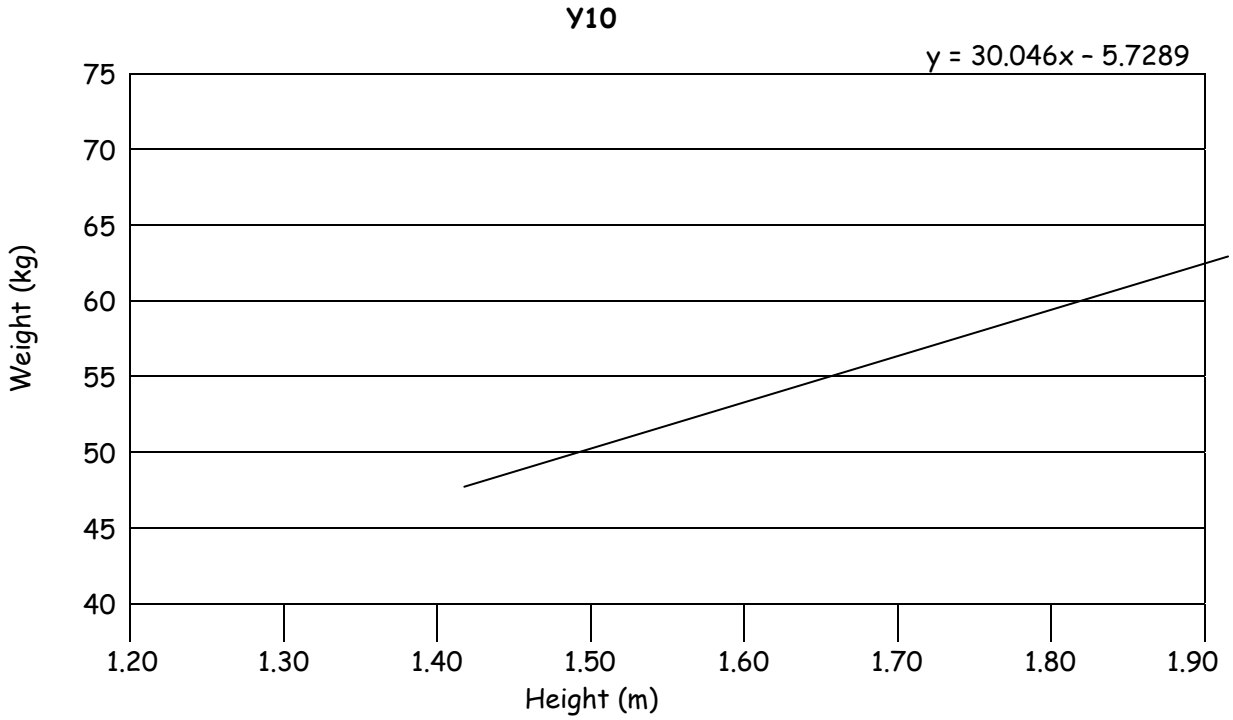


Although the relationship does not appear to be as strong as in previous years, the average vertical distance of the points from the line of best fit is 2.7 (to 1 d.p) making this the strongest relationship yet.

In my hypothesis 1 thought that by year 9 1 thought the relationship for the girls would have started to strengthen and that for the boys the relationship would have weakened since Y7. The average vertical distance of the points from the line of best fit for the girls 5.4 and for the boys 7.4. This means that this part of my hypothesis was incorrect for the girls (the relationship has weakened) but correct for the boys (the relationship has weakened.)

The mean height of Y9 is 1.61. The standard deviation of the heights is: 0.08 (to 2dps).

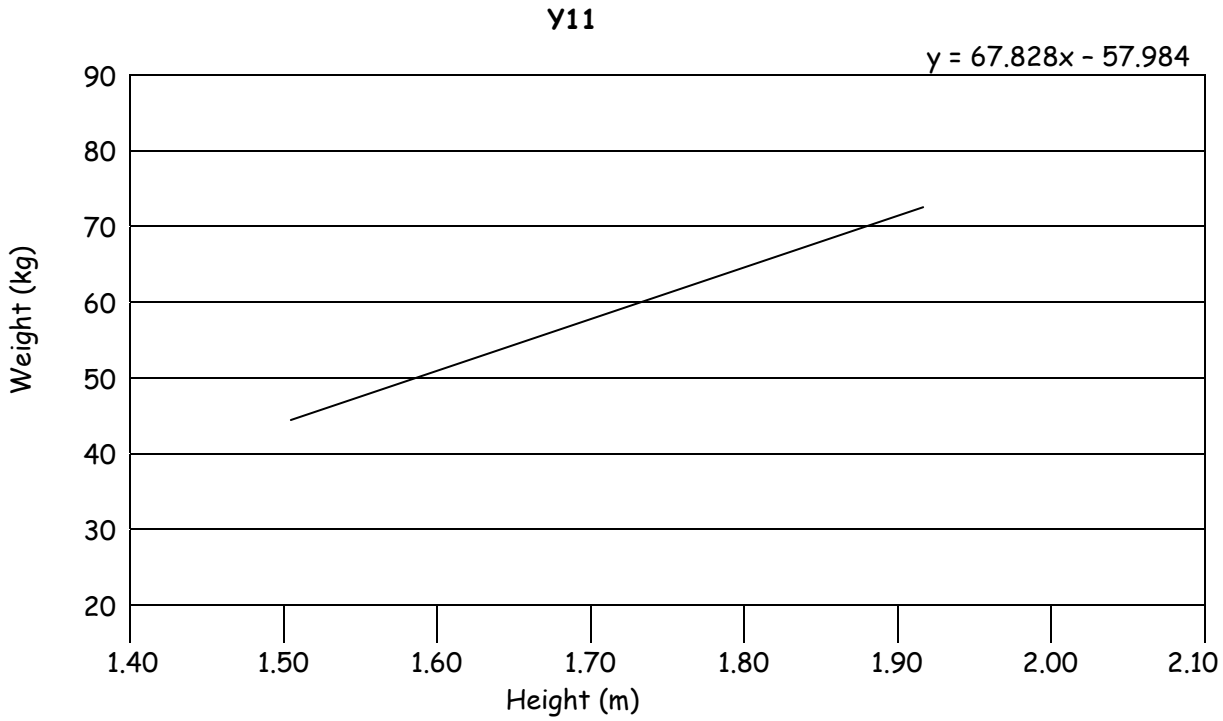
The mean weight of Y9 is 52.4 (to 2dps). The standard deviation of the weights is: 10.49 (to 2dps)

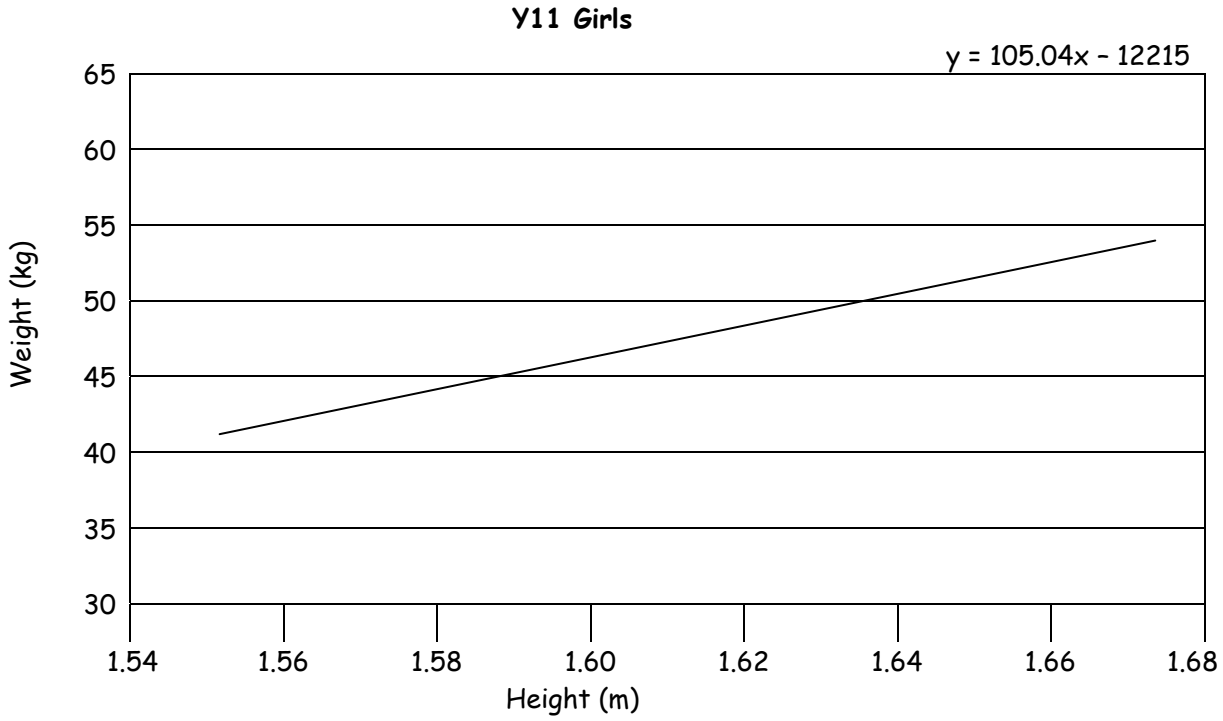


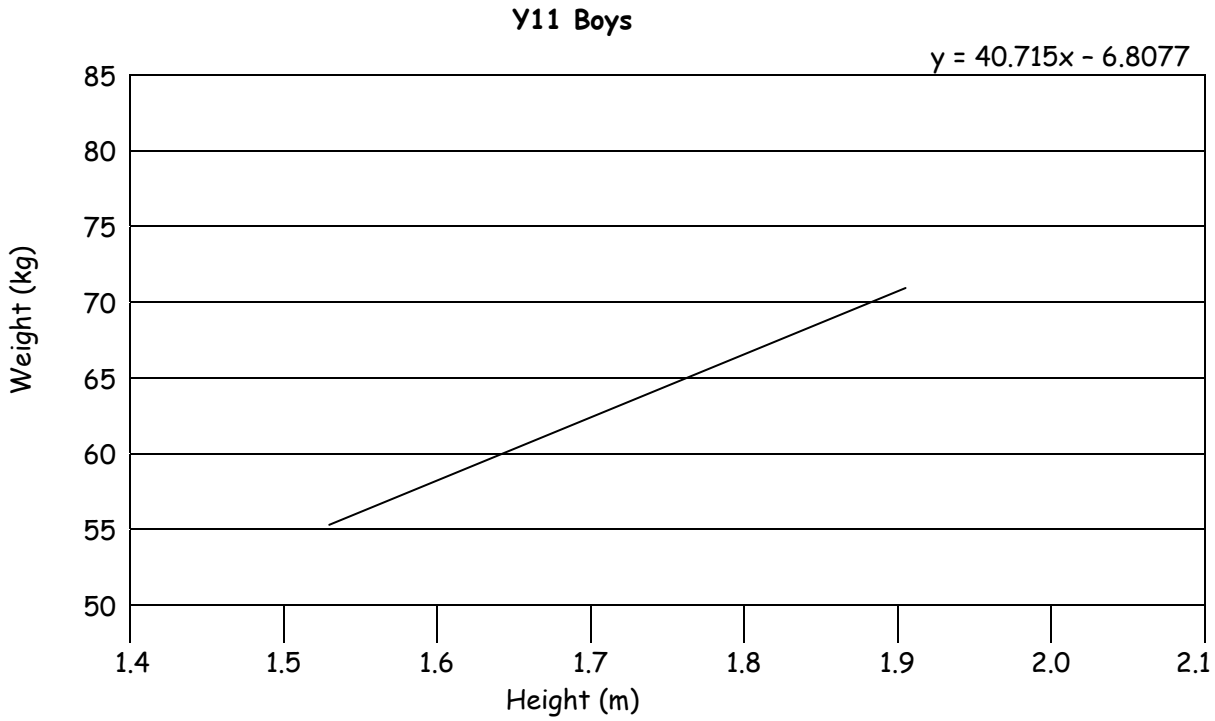
The data for Y10 is very spread out and does not show a very strong relationship. The average vertical distance of the points from the line of best fit is 5.9. This is the biggest distance we have seen so far.

The mean height for Y10 is 1.69. The standard deviation of the heights is: 0.12 (to 2dps).

The mean weight for Y10 is 56.5 (to 1dp). The standard deviation of the weights is: 8.43 (to 2dps)


Y11
y = 67.828x – 57.984
90
80
70
60
50
40
30
20
Weight (kg)
1.40
1.50
1.60
1.70
1.80
1.90
2.00
2.10
Height (m)


Y11 Girls
y = 105.04x – 12215
65
60
55
50
45
40
35
30
Weight (kg)
1.54
1.56
1.58
1.60
1.62
1.64
1.66
1.68
Height (m)



In my hypothesis I said that I thought that by Y11 the data relationship for the girls data would have started to spread out again and that for the boys the data will have started to strengthen. The average vertical distance of the points from the line for the girls is 6.02, this is what I thought in my hypothesis. For the boys I thought that the relationship would be stronger. The average vertical distance of the points from the line of best fit is 5.9, the relationship has strengthened from Y9 and this is the same as what I thought in my hypothesis.

The year 11 graph visually shows more relationship of the points than the Y10 graph but the average vertical distance of the points from the line of best fit is the bigger: 6.8 (to 1 d.p) this tells us that the relationship is not as strong.

The mean height for Y11 is 1.69. The standard deviation of the heights is: 0.11 (to 2dps).

The mean weight for Y11 is 56.5 (to 2dps). The standard deviation of the weights is: 11.02 (to 2dps)

Standard Deviation of Height

The range of heights in the school is 1.36 — 1.91 m

Year Group	Mean Height	Standard Deviation
7	1.6	0.08
8	1.62	0.10
9	1.61	0.08
10	1.69	0.12
11	1.69	0.11

Smallest standard deviation = tightest around the mean

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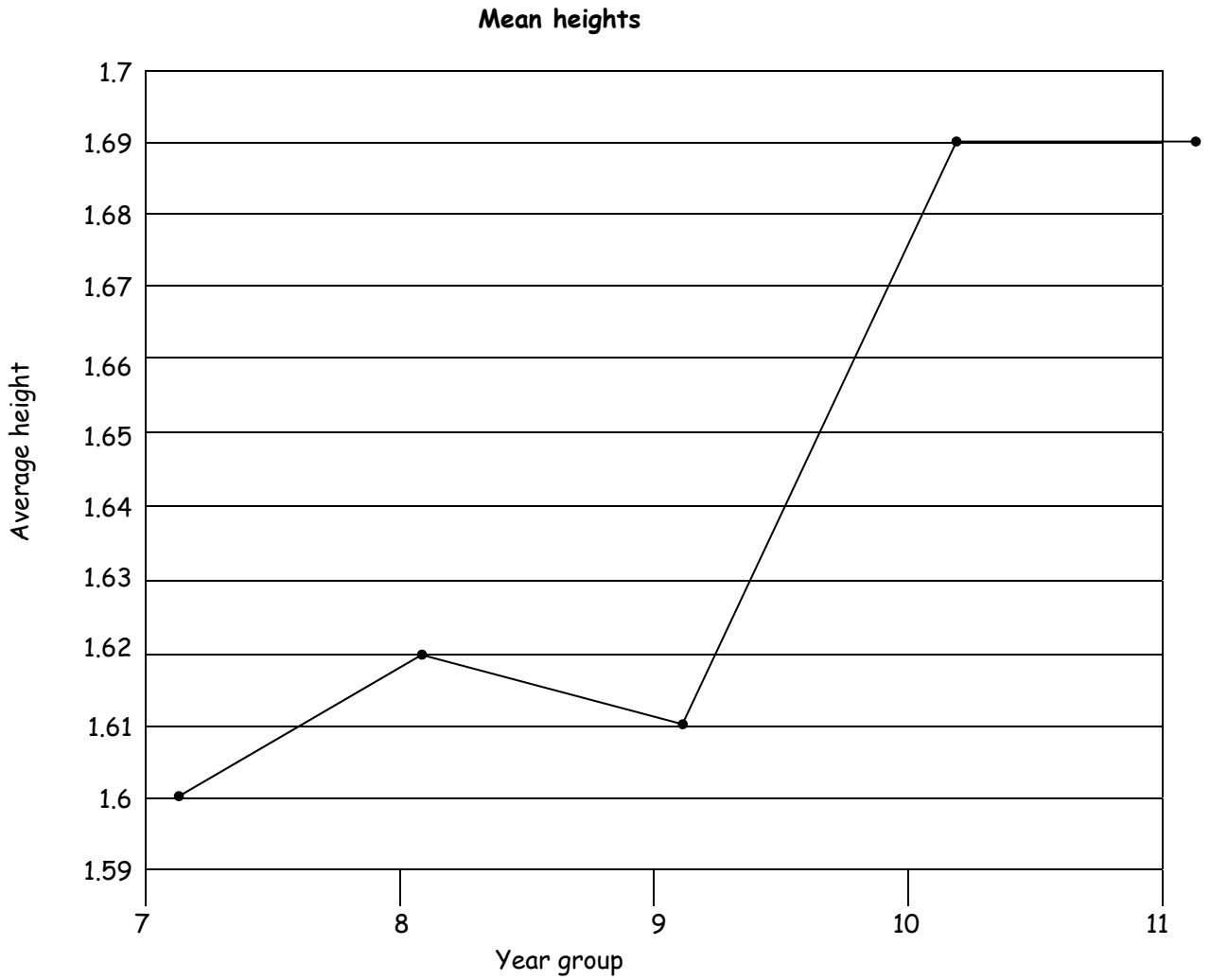
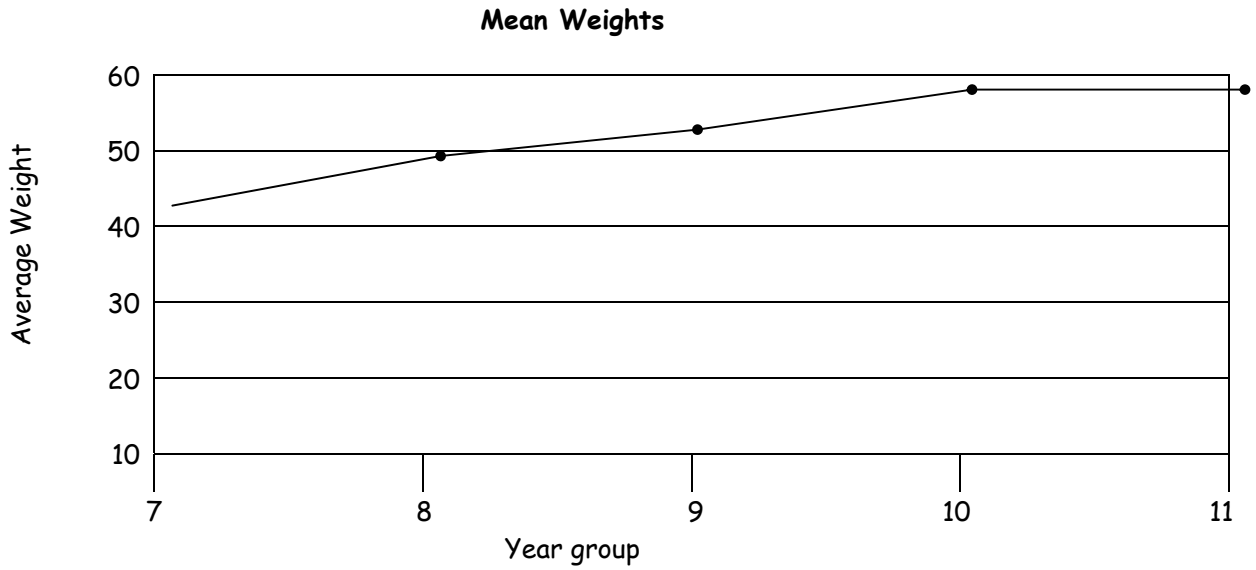


We can see from this graph that, although we would assume that the older you get the taller you get, in this school on average the Y9s are smaller than the y8s. This could be because my sample was not big enough. The height evens out in Y10 and Y11. This could be because people grow very fast until Y10 and then start to slow down.

Standard Deviation of Weight

The range of heights in the school is 25 — 82 kg

Year Group	Mean Weight	Standard Deviation
7	42.6	6.84
8	49.4	8.59
9	52.4	10.49
10	56.5	8.43
11	56.5	11.02



The table shows that as the age of a person increases so does their weight. It also tells us that when pupils reach Y10 they begin to even out we can see this is because the mean weight is the same in both Y10 and Y11. In Y7 the standard deviation is closest to the mean. This means that in Y7 the pupils are all of a similar height than in other years.

In Y10 and Y11 I found that the mean weights were the same and so were the mean heights. This means that around this age people must start to slow down growing. It could be the fault of my sample not being big enough. In Y11 the heights are closer to the mean and in Y10 the weights are closer to the mean. This shows that we slow down growing before we slow down putting weight on.

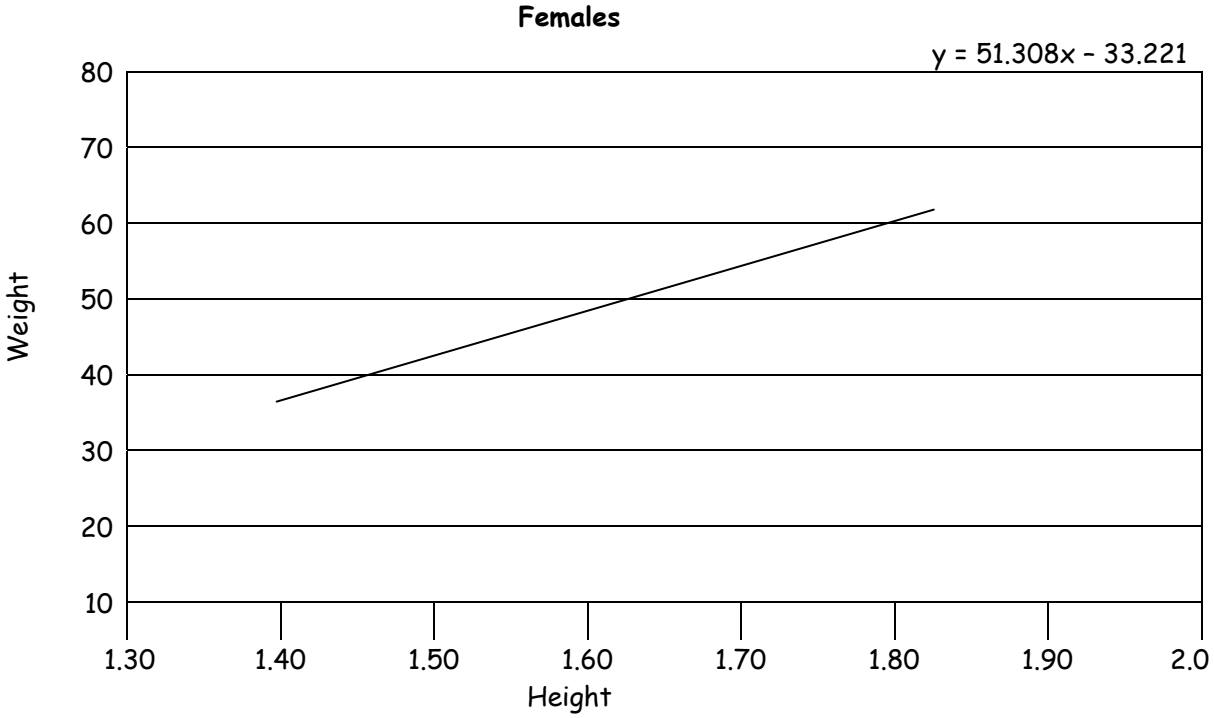
Looking at the relationship between height and weight

Year group	Average vertical distance from the line of best fit
7	4.3
8	5.3
9	2.7
10	5.9
11	6.8

This shows that the older the pupils of the school get, the less height and weight are related. In Y9 the relationship is very strong. This could be because my sample is unusually average. Or it could be because at that age the relationship is strong. In Y11 the relationship is at its weakest. This is what I predicted in my hypothesis. This may be because as people get older there is a greater variation of small/tall people and skinny/big people.

I will now look at how gender affects the relationship.

Firstly I will look at girls



The average vertical distance of the points from the line of best fit is: 4.97. This shows that there is a fairly strong relationship between the heights and weights of girls.

The mean height is 1.6 m. The standard deviation is 0.09 (to 1 dp). The mean weight is 49.1 (to 1 dp). The standard deviation is 7.9 (to 1 dp).

Now I will look at boys.

The average vertical distance of the points from the line of best fit is 7.2 (to 1 dp). This tells us that the relationship is stronger in girls than it is in boys. This is not what I predicted in my hypothesis. This could be because I was wrong or because my sample is not big enough.

The mean height is 1.63. The standard deviation is 1.3 (to 1 dp). The mean weight is 52.1 (to 1 dp). The standard deviation is 11.99 (to 2dps).

Gender and height

Gender	Mean Height (m)	Standard Deviation
Girls	1.06	0.09
Boys	1.63	1.3

This shows that the average height of a boy is 57 cm more than the average height of a girl. The standard deviation shows us that the heights of girls are a lot closer together than the heights of boys.

Gender and weight

Gender	Mean Weight (kg)	Standard Deviation
Girls	49.1	7.9
Boys	52.1	11.99

This shows that the average weight of a boy is 3 kg more than the average weight of a girl. The standard deviation shows us that the weights of girls are a lot closer together than the weights of boys.

Looking at the relationship between gender and height and weight

Gender	Average vertical distance of the points from the line of best fit
Female	4.98
Male	7.2

This shows that the relationship between height and weight is far stronger in girls than it is in boys. This goes against what I said in my hypothesis. I thought that it would be far more apparent in boys. This could be because my sample is not big enough to show a fair spread of data or this could be true.

Conclusion

I think that although I took a representative sample of students from Mayfield School, the data could have been more accurate if I took a bigger sample as 100 students is not very many. This sample was also unique to Mayfield School, if I had wanted more general results I could have sampled in a different way, e.g. taken the same amount of students from each year, with the same amount of boys and girls. In conclusion, I have found that the relationship between height and weight is far more apparent in girls than in boys. I have found that as you get older your height and weight increase until Y9. In Y9 I found that pupils got smaller. As we know that it is not physically possible to get smaller height ways I tried to find reasons for this. It could have been that the data in my sample was not accurate or my sample being big enough. To overcome this problem I could have taken a bigger sample from Y9 or I could have used Y9s from a different school – maybe Mayfield School had an exceptionally small year group.

Another way of ruling out this problem was to look at data in a different way. I chose to look at standard deviation. However even using this way of looking at the records I still found that Y9 was on average smaller than Y8.

Year Group	Mean height	Standard deviation
7	1.6	0.08
8	1.62	0.10
9	**1.61**	**0.08**
10	1.69	0.12
11	1.69	0.11