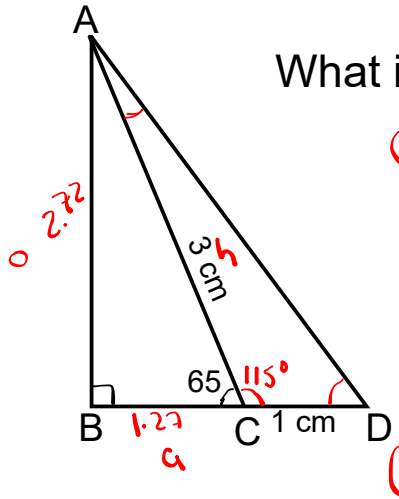
Warm Up



What is the perimeter of ABD?

① $\overline{AB}$: $\sin 65° = \frac{\overline{AB}}{3}$

or

$\frac{3}{\sin 90°} = \frac{\overline{AB}}{\sin 65°}$

$\overline{AB} = 2.72$

② $\overline{BC}$: $\sqrt{3^2 - 2.72^2}$ $\cos 65 = \frac{\overline{BC}}{3}$

or

$\overline{BC} = 1.27$

③ $\overline{AD} = 3.54$

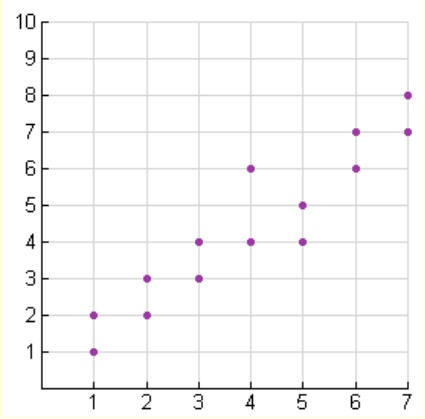
④ $P = 3.54 + 2.72 + 2.27 = 8.53\text{cm}$

May 14-10:44 PM

Lesson 40

May 4-12:48 AM

When data is displayed with a **scatter plot**, it is often useful to attempt to represent that data with the ***equation of a straight line*** for purposes of predicting values that may not be displayed on the plot.



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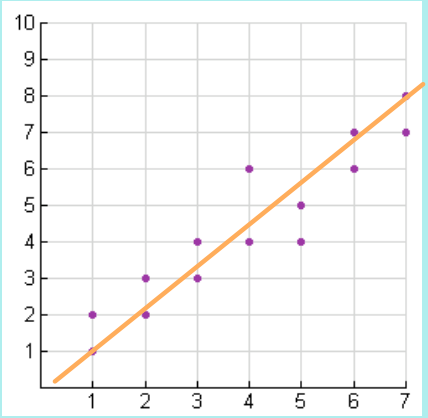
Such a straight line is called the "**line of best fit**"



There are two ways of finding the line of best fit:

1- Regression Line

2- Mayer Line

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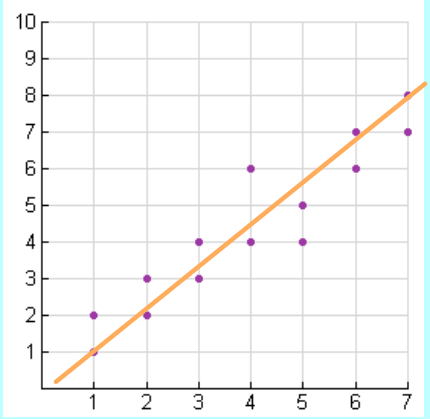
A **line of best fit** is a straight line that **best represents the data** on a scatter plot.



This line may pass through some of the points, none of the points, or all of the points.

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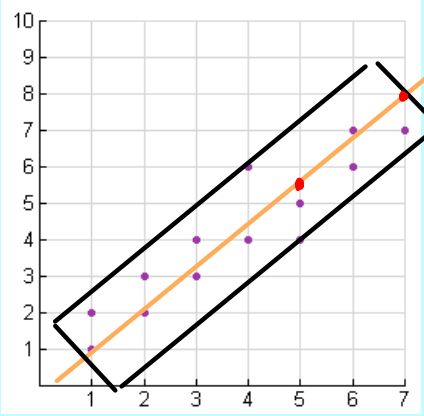
Regression Line



Step 1: After drawing the rectangle around the scatter points, draw a line down the middle of the rectangle.

Step 2: Select 2 points that are on this line.

NB: These points do NOT have to be one of your data points, but MUST be **on** the line.

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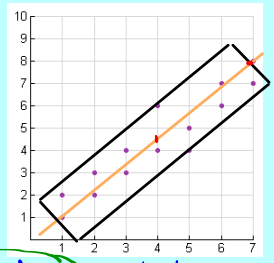
Regression Line



Step 3: Use these points to find the equation of the Regression line.

$y = ax + b$

$(x_1, y_1) = (4, 4.5)$ $(x_2, y_2) = (7, 8)$

(1) $a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8 - 4.5}{7 - 4} = \frac{3.5}{3} = \frac{7}{6}$

(2) $4.5 = \frac{7}{6}(4) + b$

$4.5 = \frac{14}{3} + b$

$-\frac{14}{3}$

$-\frac{1}{6} = b$

(3) $y = \frac{7}{6}x - \frac{1}{6}$

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Ex. Is there a relationship between grams of fat and total calories in fast food?

Sandwich	Total Fat (g) (x)	Total Calories (y)
Hamburger	9	260
Cheeseburger	13	320
Quarter Pounder	21	420
Quarter Pounder with Cheese	30	530
Big Mac	31	560
Arch Sandwich Special	31	550
Arch Special with Bacon	34	590
Crispy Chicken	25	500
Fish Fillet	28	560
Grilled Chicken	20	440
Grilled Chicken Light	5	300

If there is, can we predict the number of total calories based upon the total fat grams?

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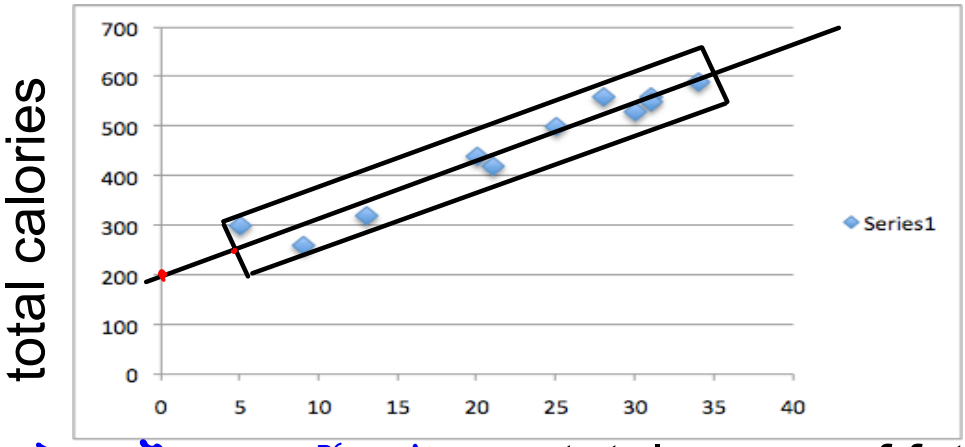
Fast Food Sandwich



(x_1, y_1) $(0, 200)$ (x_2, y_2) $(5, 250)$

① $m = \frac{250-200}{5-0} = \frac{50}{5} = 10$

② $y = 10x + 200$

③ at 50g $\Rightarrow y = 10(50) + 200 = 700$ cal

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Mayer Line of Best Fit:

1. Put the ordered pairs into numerical order ***based on the x-values***.

2. Separate this ordered data into two groups (G_1 and G_2) containing the SAME number of points.

If there are an odd number of data, let one group have an extra ordered pair.

3. For each group, calculate the **mean of the x values and the mean of the y values**. From this you will create two new points called the ***mean points***.

4. The *Mayer Line of Best Fit* is the line passing through these ***mean points***..... determine the equation of the straight line passing through the mean points.

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1. Put the ordered pairs into numerical order based on the x-values. Using Ex. 1 we get:

x	y
5	300
9	260
13	320
20	440
21	420
25	500
28	560
30	530
31	560
31	550
34	590

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2. Separate the scatter plot into two groups (G_1 and G_2) containing the SAME number of points.

If there are an odd number of data, let one group have an extra ordered pair.

G_1

5	300
9	260
13	320
20	440
21	420

G_2

25	500
28	560
30	530
31	560
31	550
34	590

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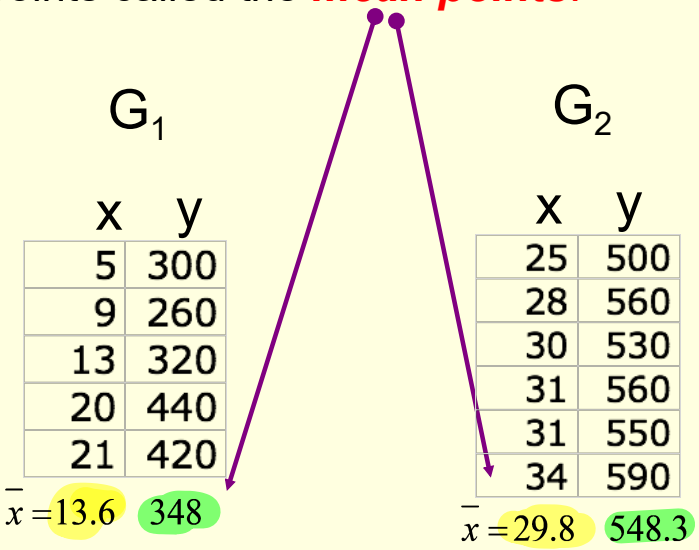
3. For each group, calculate the **mean of the x values and the mean of the y values**. From this you will create two new points called the ***mean points***.



G_1

x	y
5	300
9	260
13	320
20	440
21	420

$\bar{x} = 13.6$ 348

G_2

x	y
25	500
28	560
30	530
31	560
31	550
34	590

$\bar{x} = 29.8$ 548.3

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4. The *Mayer Line of Best Fit* is the line passing through these ***mean points***..... determine the equation of the straight line passing through the mean points.

x_1	13.6	348 x_2
y_1	29.833	548.33 y_2

$y = ax + b$

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Question:

Predict the total calories based upon 22 grams of fat.

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Predicting:

- If you are looking for values that fall within the plotted values, you are ***interpolating***.
- If you are looking for values that fall outside the plotted values, you are ***extrapolating***. **Be careful** when extrapolating. The further away from the plotted values you go, the less reliable is your prediction.

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Example:

A study was conducted on 20 drivers to determine the relationship between the drivers' speed and the braking distance at the sight of an obstacle. The following results were recorded from a sample of 20 drivers

X km/h	40	45	50	55	60	65	70	75	80	85
Y m	2.80	3.30	3.75	4.2	5.05	6.10	6.60	7.20	7.80	8.60
X	90	95	100	105	110	115	120	125	130	135
Y	9.20	9.95	10.60	11.05	11.85	12.90	13.30	13.60	14.00	14.50

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L_1	L_2
40	2.8
45	3.3
50	3.75
55	4.2
60	5.05
65	6.1
70	6.6
75	7.2
80	7.8
85	8.6
90	9.2
95	9.95
100	10.6
105	11.05
110	11.85
115	12.9
120	13.3
125	13.6
130	14
135	14.5

Put these into your **calculator** or **excel** and build a scatter plot to determine if there is a correlation

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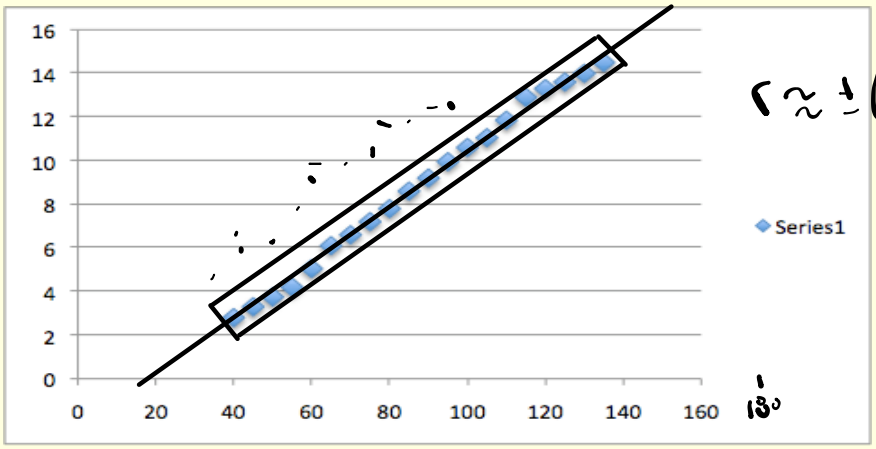

Clearly there is a **strong** positive correlation

We would like to know the LINE OF BEST FIT

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Mayer Line of Best Fit:

1. Put the ordered pairs into numerical order based on the x-values.

40	2.8
45	3.3
50	3.75
55	4.2
60	5.05
65	6.1
70	6.6
75	7.2
80	7.8
85	8.6
90	9.2
95	9.95
100	10.6
105	11.05
110	11.85
115	12.9
120	13.3
125	13.6
130	14
135	14.5

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2. Separate the scatter plot into two groups (G_1 and G_2) containing the SAME number of points.

x	y
40	2.8
45	3.3
50	3.8
55	4.2
60	5.1
65	6.1
70	6.6
75	7.2
80	7.8
85	8.6
62.5	5.54

x	y
90	9.2
95	10
100	11
105	11
110	12
115	13
120	13
125	14
130	14
135	15

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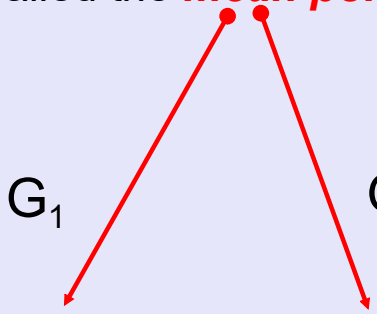
3. For each group, calculate the **mean of the x values and the mean of the y values**. From this you will create two new points called the ***mean points***.



x_1	y_1
62.5	5.54

x_2	y_2
112.5	12.095

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4. The *Mayer Line of Best Fit* is the line passing through these ***mean points***..... determine the equation of the straight line passing through the mean points.

$$slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{12.095 - 5.5}{112.5 - 62.5} = .1319$$

$$y = .1319x + b$$
$$5.5 = .1319(62.5) + b$$
$$5.5 = 8.24375 + b$$
$$5.5 - 8.24375 = b$$
$$b = -2.74375$$

$$y = .1319x - 2.74375$$

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Can you predict the braking distance of a car traveling 180 km/hr?

$$y = .1319x - 2.74375$$
$$y = .1319(180) - 2.74375$$
$$y = 21. \text{ m}$$

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Using the regression line to predict a y value is only valid when the x value being used is located in the variation interval of the variable x.

It means that a prediction can only **really** be made for a y value, if the x value lies between 40 and 135.

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You may be asked to make predictions **beyond** the variation. You CAN do this but you should note that it will certainly decrease the validity of the analysis if you do so. Always use your common sense.

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Homework

Workbook:

P. 296 # 1, 3 (a-e)

P. 300 # 4 & 5

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Homework

Review Pack.

P 90 – 106

P 126 – 131

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