Recognizing Quadratic Relations Assignment

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MPM2DE-B

Contents

1 Question 1

1.1 Part A and B

x	y	1st Difference	2nd Difference
0	0	N/A	N/A
1	1	1	N/A
2	4	3	2
3	9	5	2
4	16	7	2
5	25	9	2
6	36	11	2
7	49	13	2
8	64	15	2
9	81	17	2
10	100	19	2

1.2 Part C

We can observe that the first differences are increasing at a constant rate, and that as a result, the second differences are all constant (in this case, 2). From previous observations of the behaviour of parabolas, we can conclude that this data can represent a parabola.

1.3 Part D

I believe that this data can be modelled with the equation:

$$\boxed{y = x^2}$$

1.4 Part E and F

From Figure 1, it can be seen visually that the linear trendline does not fit the data perfectly. The R^2 value corroborates this: in this case, $R^2 = 0.93$, which is not 1 (a perfect fit).

1.5 Part G

From Figure 2, it can be seen visually that the polynomial trendline fits the data perfectly. The R^2 value of 1 (indicating a perfect fit) corroborates this.

1.6 Part H

From Figure 3, it can be seen visually that the polynomial trendline fits the data perfectly. The R^2 value of 1 (indicating a perfect fit) corroborates this.

It can also be observed that the equation of best fit of degree 3 is actually equivalent to the equation of degree w obtained in Figure 2, because the coefficient of the term of degree 3 is 0, meaning that the term doesn't actually change anything.

1.7 Part I

I believe that my table of values represents a quadratic relation, because the polynomial trendline of degree 2 fit the data perfectly, as indicated by the R^2 value of 1, and the polynomial trendline of degree 3 was actually equivalent to the trendline equation of degree 2.

1.8 Part J

The equation displayed for the trendline of best fit in Figure 2 is $y = 0 + 0x + 1x^2$, while the equation I wrote in part D was $y = x^2$. Obviously, these equations are equivalent.

1.9 Part K

The trendline of best fit has a zero at $(0, 0)$, and the vertex is also located there.
This vertex and zero indicates that a square will have a side length of 0 when it has a sidelength of 0, and that the lowest value (the vertex in this case represents a minimum) of the square's area is given when its side length is 0, and that it is 0. This obviously makes sense: 0 is the smallest area of any shape, given that shapes cannot actually have negative values for their area.

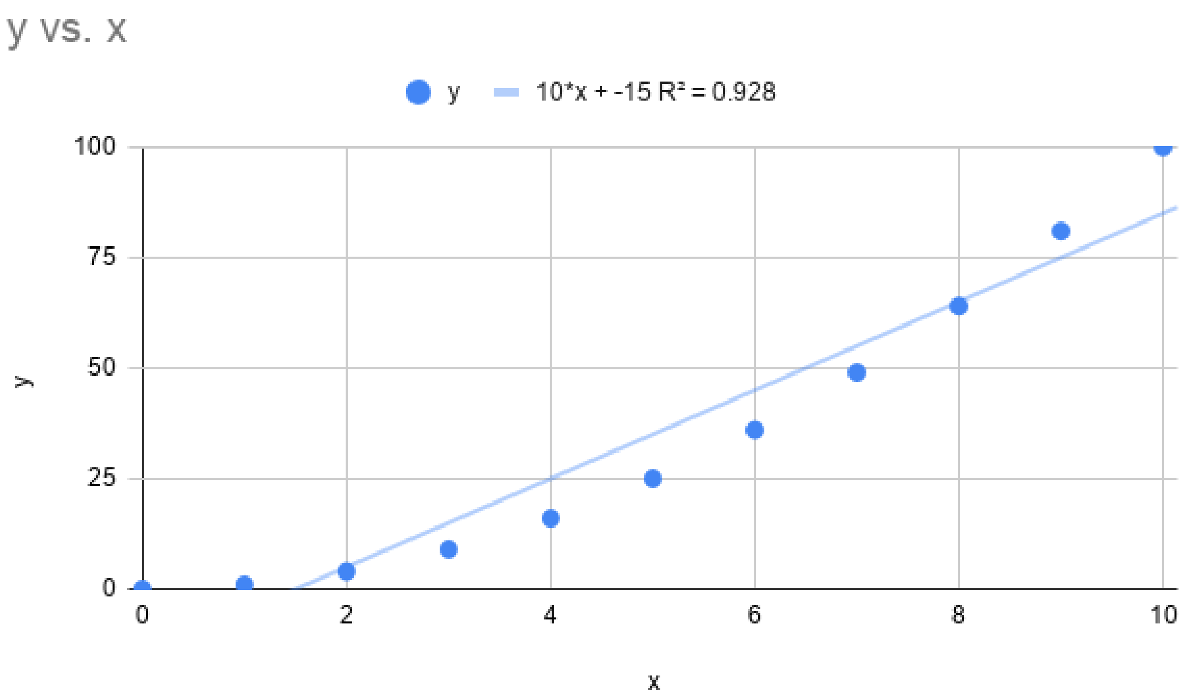

Figure 1: A scatterplot of the data, with a linear trendline and R^2 value for this trendline shown. Using a linear regression, it can be shown that the equation of this trendline is $y = 10x - 15$.

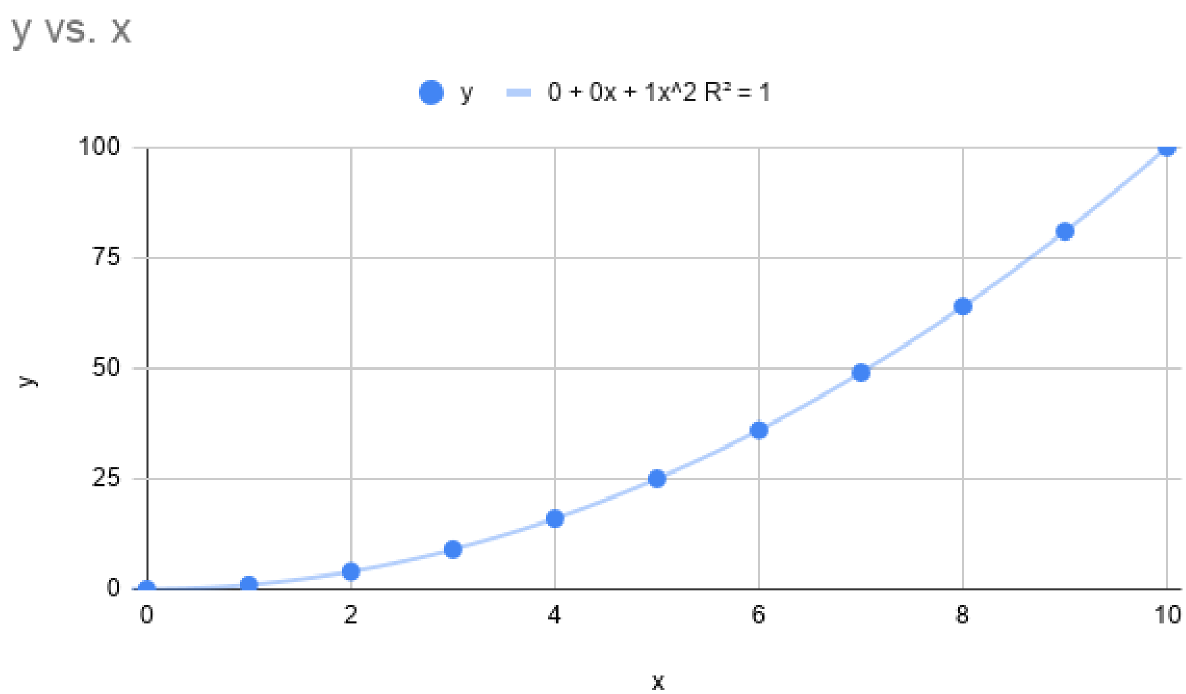

Figure 2: A scatterplot of the data, with a polynomial trendline of degree 2 and R^2 value for this trendline shown. It can be seen that the equation of this trendline is $y = x^2$.

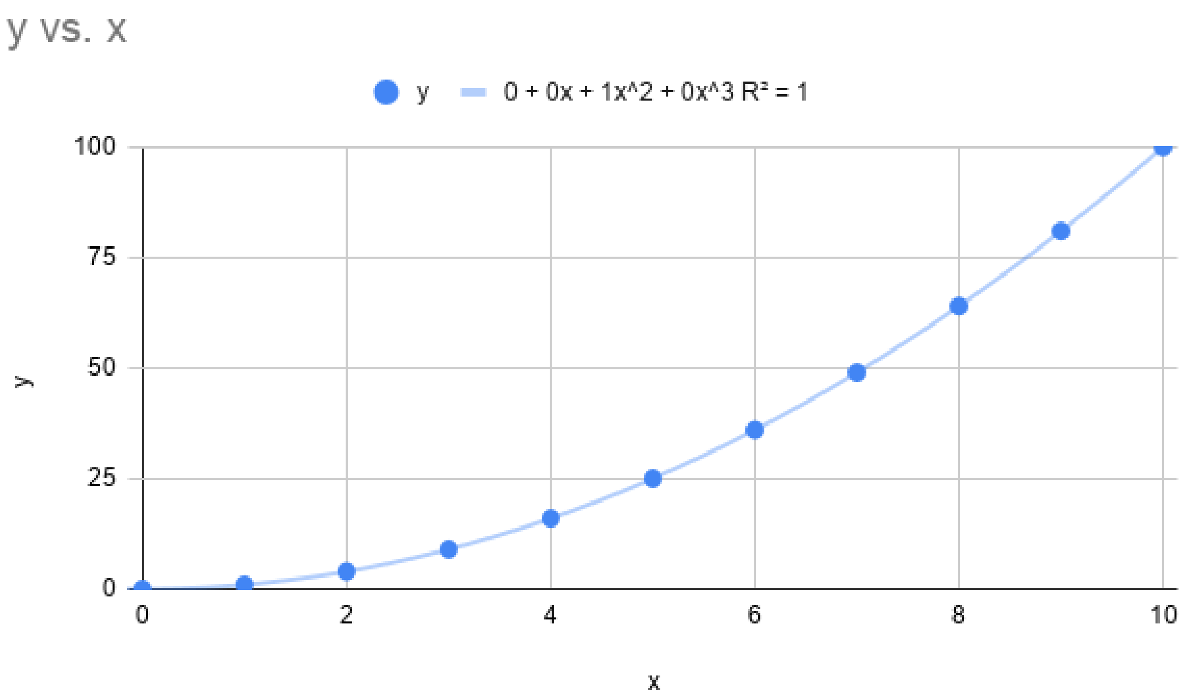

Figure 3: A scatterplot of the data, with a polynomial trendline of degree 3 and R^2 value for this trendline shown. It can be seen that the equation of this trendline is $y = x^2$: the coefficient of the term of degree 3 is 0.