

3.1 Investigating Non-Linear Relationships

Line of Best Fit: a line drawn through a scatter plot when the data appears to follow a linear relation.

Curve of Best Fit: a smooth curve that represents the "shape" of the data. Non-linear data will have a non-linear curve of best fit.

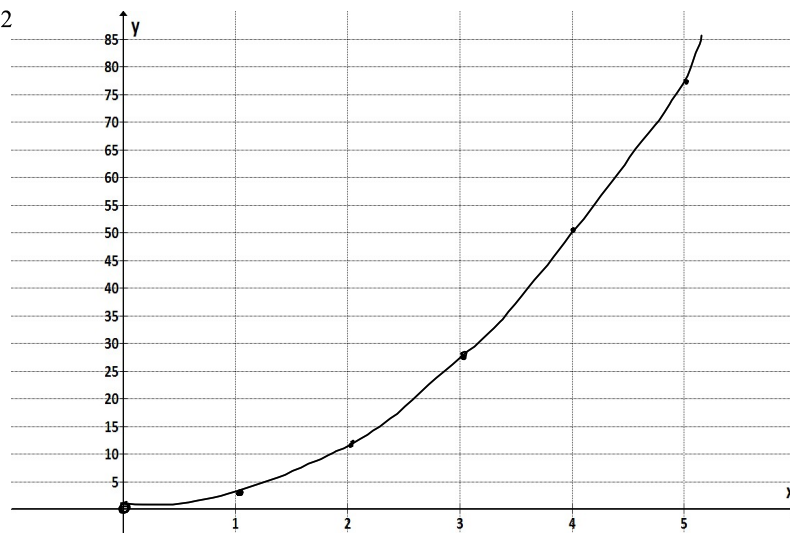
Ex 1: Determine whether the data represents a linear or non-linear relation, then draw the line or curve of best fit.



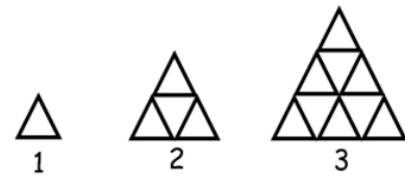
Ex 2: What is the relationship between the radius of a circle and its area?

radius	area
0	0
1	3.1
2	12.6
3	28.3
4	50.3
5	78.5

$A = \pi r^2$



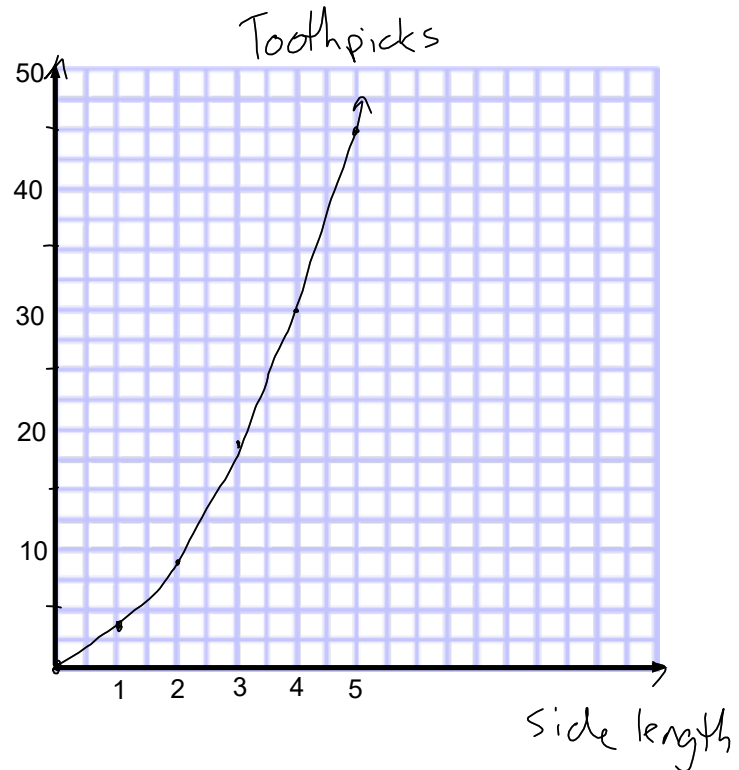
Ex. 3 Toothpicks can be arranged to create equilateral triangles as shown.



a) Complete the table and create a scatter plot for the data.

Side Length	Total # of Toothpicks
0	0
1	3
2	9
3	18
4	30
5	45
6	63

+3
 +6
 +9
 +12
 +15
 +18



b) Describe the relation.

- Non-linear
- Increasing

c) Draw a curve of best fit.

d) Use your model to predict the number of toothpicks needed to build a triangle with a side length of 6 toothpicks.

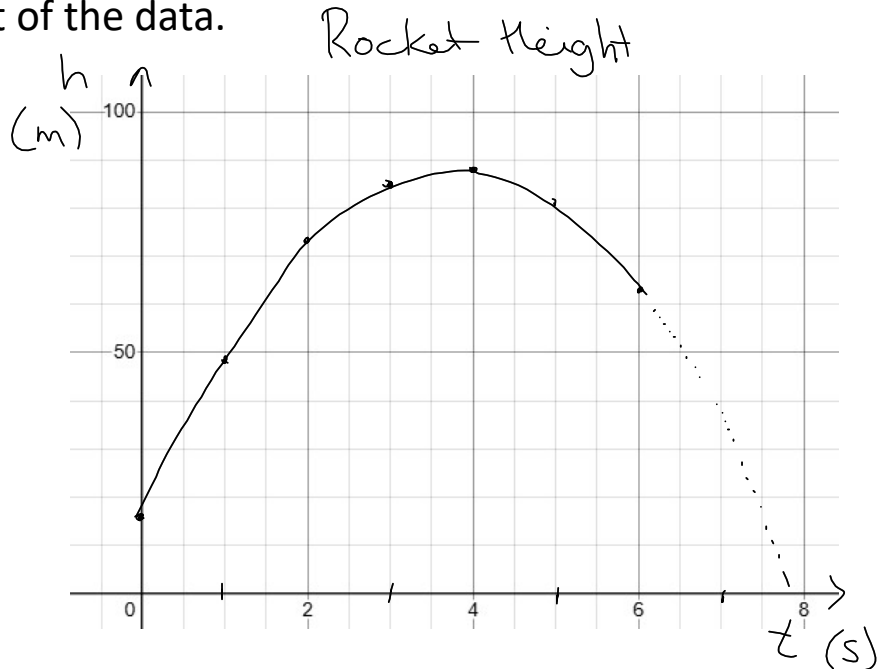
63 (See table)

Looking at the trend of first differences.

Ex 4: A toy rocket is launched straight up. The table shows its height, h , in metres above the ground after t seconds.

a) Create a scatter plot of the data.

Time	Height
0	16
1	49
2	72
3	85
4	88
5	81
6	64



b) Describe the relation.

Non-linear

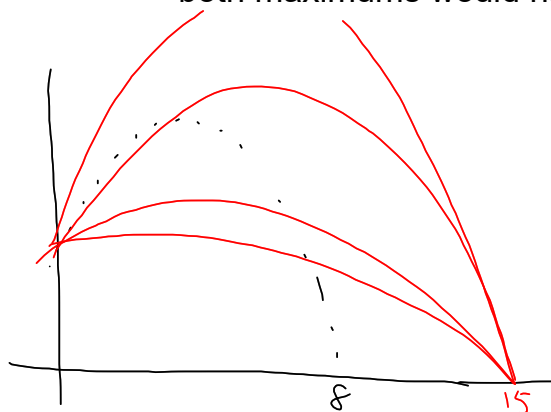
c) Draw a curve of best fit.

d) Use your model to predict the height of the rocket at 8 seconds.

Approximately 0 (Sitting on the ground?)

e) Describe how the graph would change if the rocket stayed in the air for 15 seconds.

- it would reach a higher maximum if it increased faster.
- it would reach a lower maximum if it increased slower.
- both maximums would happen at later times.

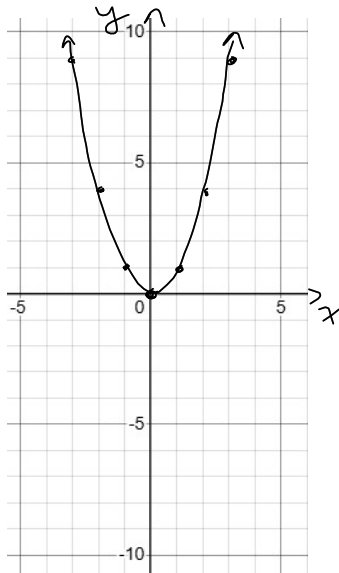


Graphs of Quadratic Relations

Ex 5: Complete the table of values and graph each relation.

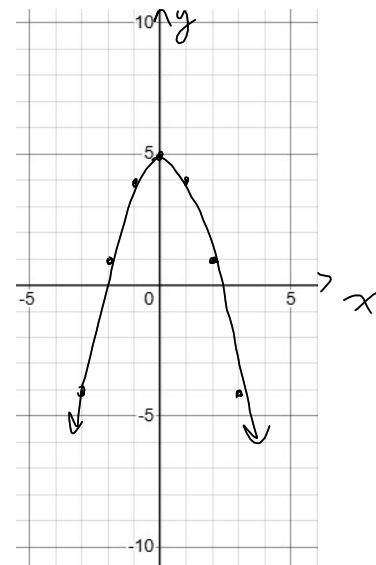
a) $y = x^2$

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9



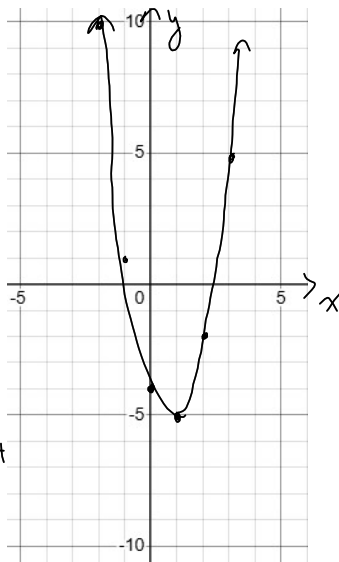
b) $y = 5 - x^2$

x	y
-3	-4
-2	1
-1	4
0	5
1	4
2	1
3	-4



c) $y = 2x^2 - 3x - 4$

x	y
-3	23
-2	10
-1	1
0	-4
1	-5
2	-2
3	5



Describe what these graphs have in common.

Parabolic in shape

These are the graphs of *Quadratic* relations.

The graph is called a

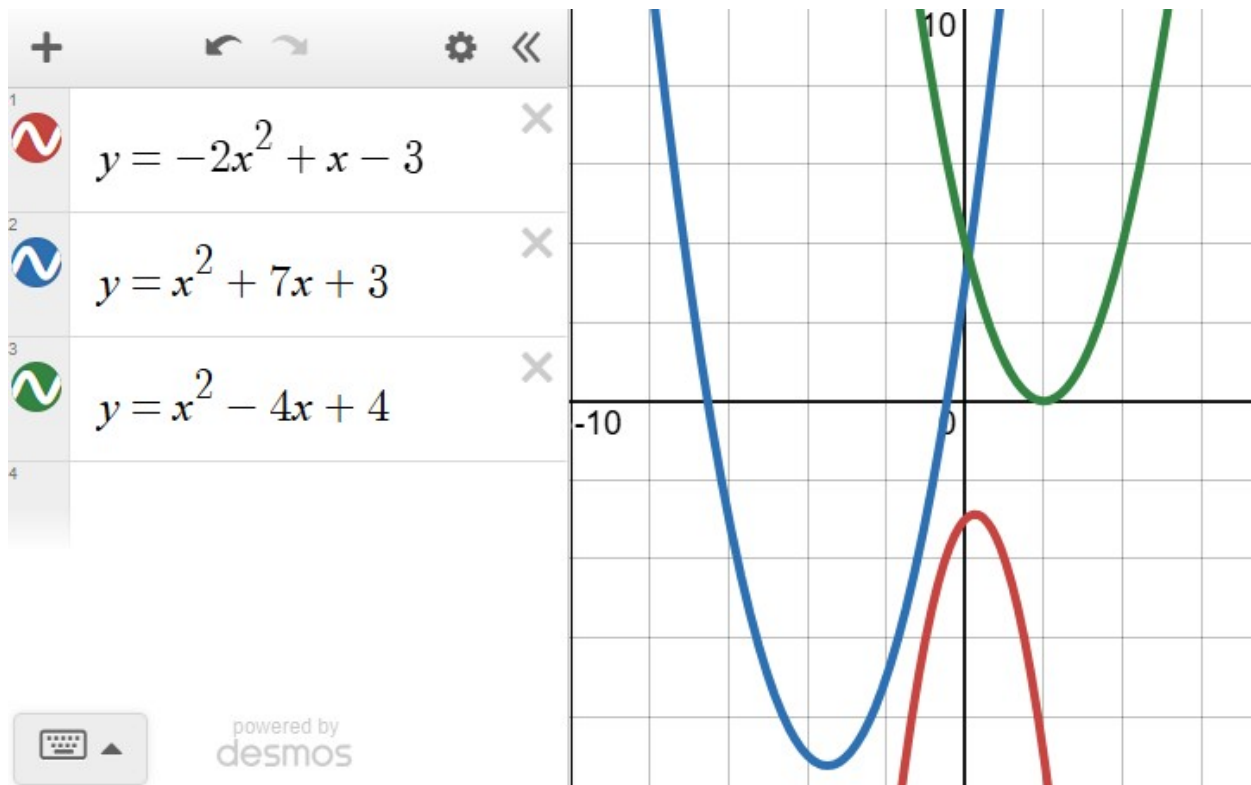
PARABOLA

$$2(1)^2 - 3(1) - 4 = 2 - 3 - 4 = -5$$

$$2(-3)^2 - 3(-3) - 4 = 18 + 9 - 4 = 23$$

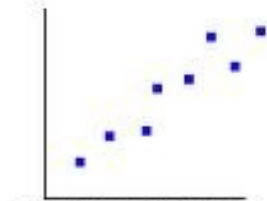
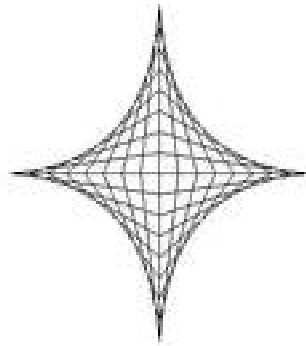
$$2(-1)^2 - 3(-1) - 4 = 2 + 3 - 4 = 1$$

Ex. 6 Use graphing technology to graph each of the following.

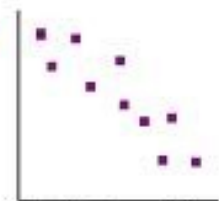


Homework

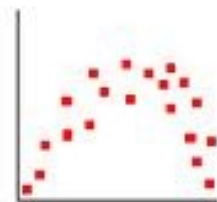
p. 166 #C1,2,3,5 p. 172 #3



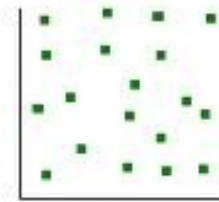
Positive linear relationship



Negative linear relationship



Non-linear relationship



No relationship