Problem of the Week: Week 1 (Summer1): Year 8: Graphs: linear and quadratic

- Interpret mathematical relationships both algebraically and graphically
- Use linear and quadratic graphs to estimate values of y for given values of x and vice versa
- Find approximate solutions to contextual problems from given graphs for a variety of functions

Please find 2 problems below

Problem 1:

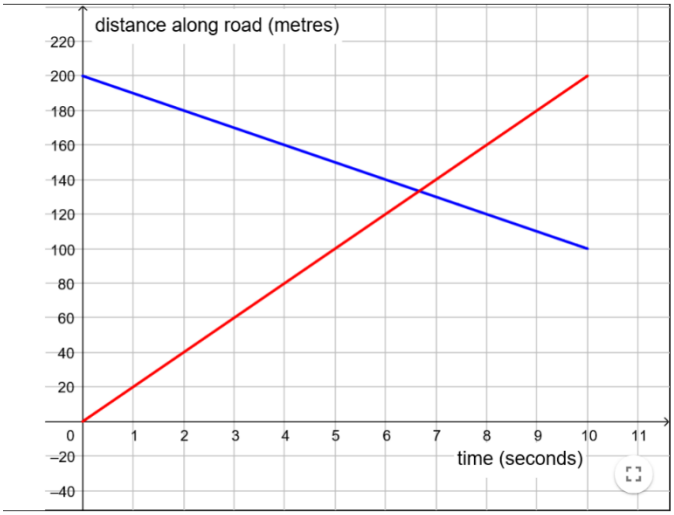
Explore real life graphs

Each graph below shows the journey of two vehicles

What is the same and different between these two graphs?

Possible solutions:

- *The cars are travelling in the same direction*
- *The cars are travelling in opposite directions*
- *The cars are travelling at constant speed*



Could we have a graph that has a horizontal line?

A vertical line?

Write a short paragraph to explain what is happening in each graph

Draw your own graph and explain what is happening

Axes and square paper can be found below

Possible solutions:

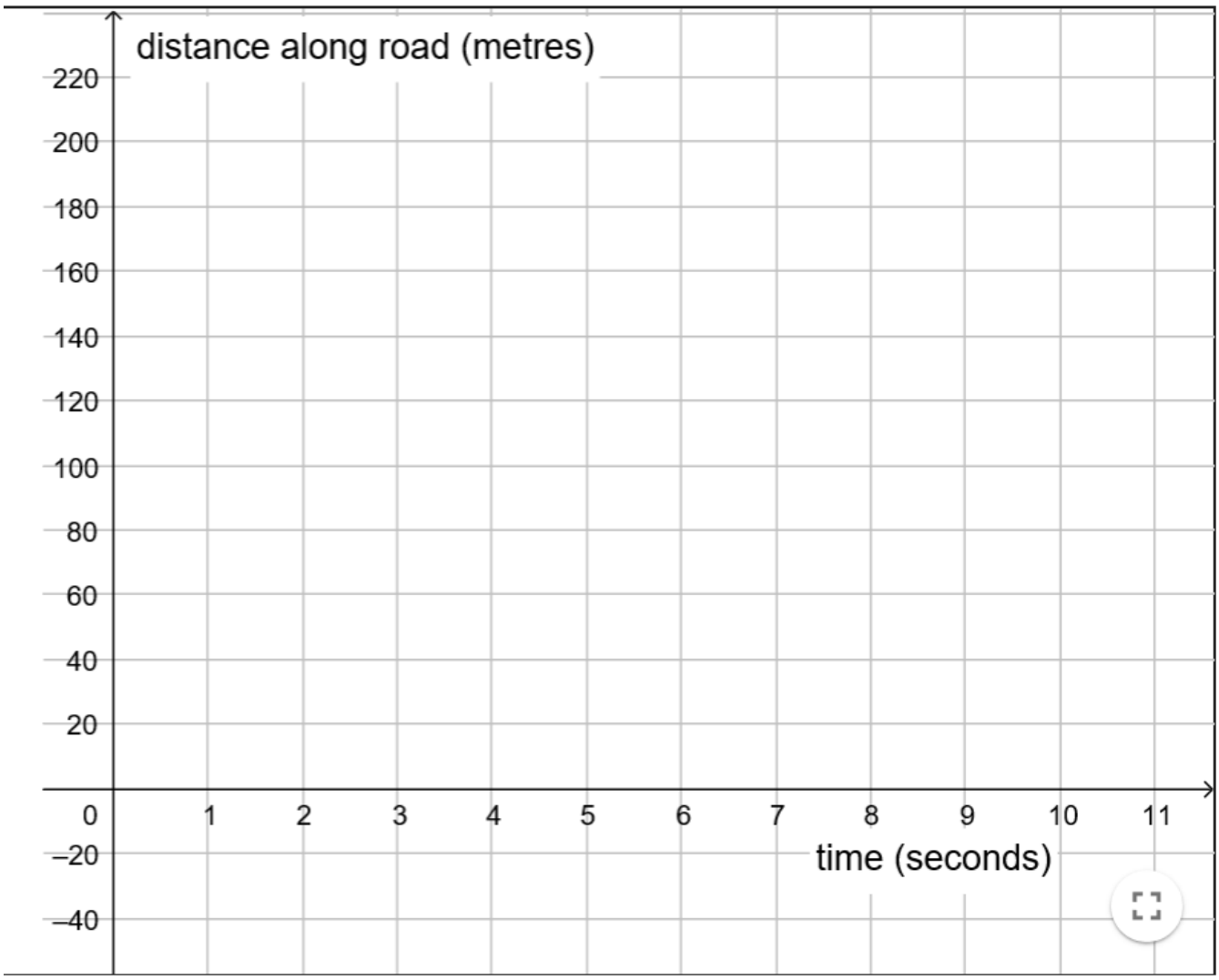
- *A horizontal line would mean that the vehicle is stationary as it remains the same distance from the start point for a period of time*
- *It is not possible to have a vertical line*

Graph 1:

The red vehicle starts at home and travels at a constant speed, after 4 seconds it overtakes the blue vehicle. The blue vehicle starts 40m in front of the red vehicle and travels at a constant speed, both vehicles travel for 10 seconds. The blue vehicle travels 100m in this time, the red vehicle travels 200m in this time. When the vehicles stop the red vehicle is 60m on front of the blue vehicle.

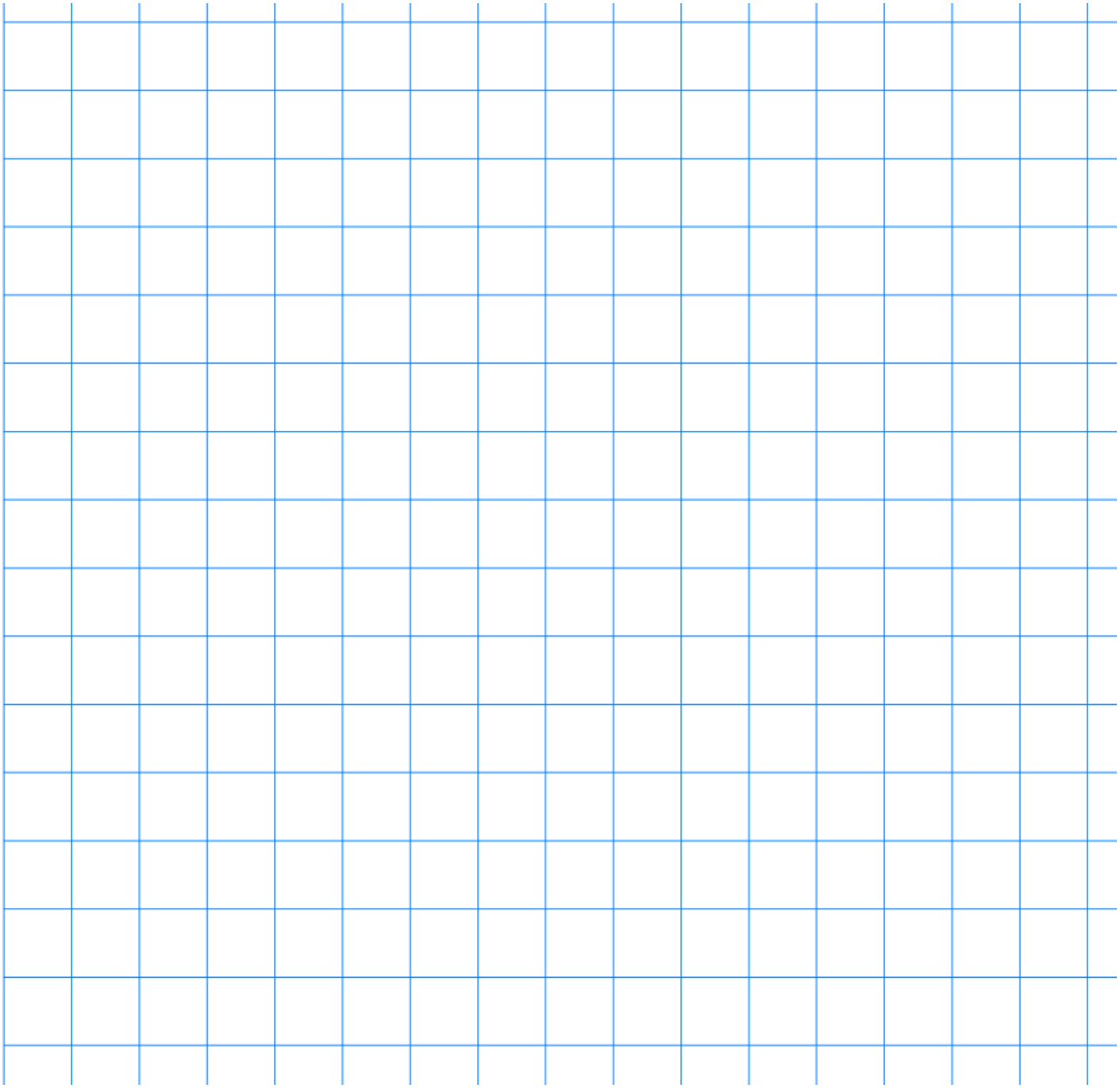
Graph 2:

The red vehicle starts from home and travels at a constant speed, it stops after 10 seconds. After approximately 6.6 seconds the blue vehicle passes it. The blue vehicle starts 200m away from the red car and is travelling in the opposite direction. It is travelling at a constant speed. The blue vehicle travels 100m and the red vehicle travels 200m during their journeys.



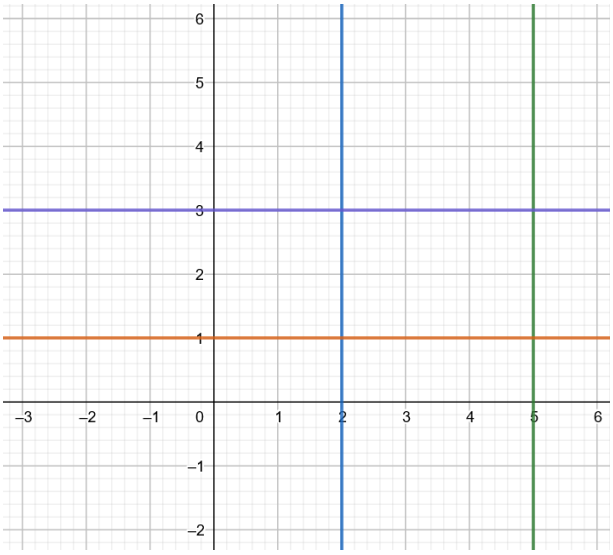
You can explore this further with:

- https://www.geogebra.org/m/AjWXqFVM



Problem 2:

Write down the equations of four lines which will form a rectangle when they cross….a bit like this…. (graph paper below to help with this, or use geogebra is free, https://www.geogebra.org/graphing)



There are many solutions to this, the solutions shown in the graph here are:

x=2, x=5, y=1 and y=3

Can you make another rectangle that is bigger / smaller than your first one?

Now investigate:

Can you make a square? What are the equations of the lines?
Can you make a different square, that is bigger / smaller than the first one?
What do you notice?

Possible solutions are:
X=2, x=5, y=1, y=4

Smaller:
X=-1, x=-2, y=-1, y=-2

Bigger:
X=-2, x=-7, y=3, y=8

The difference between the two x values and the difference between the two y values are the same.

What other quadrilaterals can you make?
What are the equations of the lines you have used?
What do you notice?

Possible solutions are:
Rhombus, parallelogram, trapezium, kite

Rhombus:
Y=2x-6, y=2x+1, y=-2x+1, y=-2x+8
Parallelogram:
X=2, x=7, y=x+1, y=x-4
Trapezium (right angles trapezium):
X=2, x=7, y=8, y=x-4
Kite:
Y=2x-6, y=-2x+2, y=x+4, y=-x+8

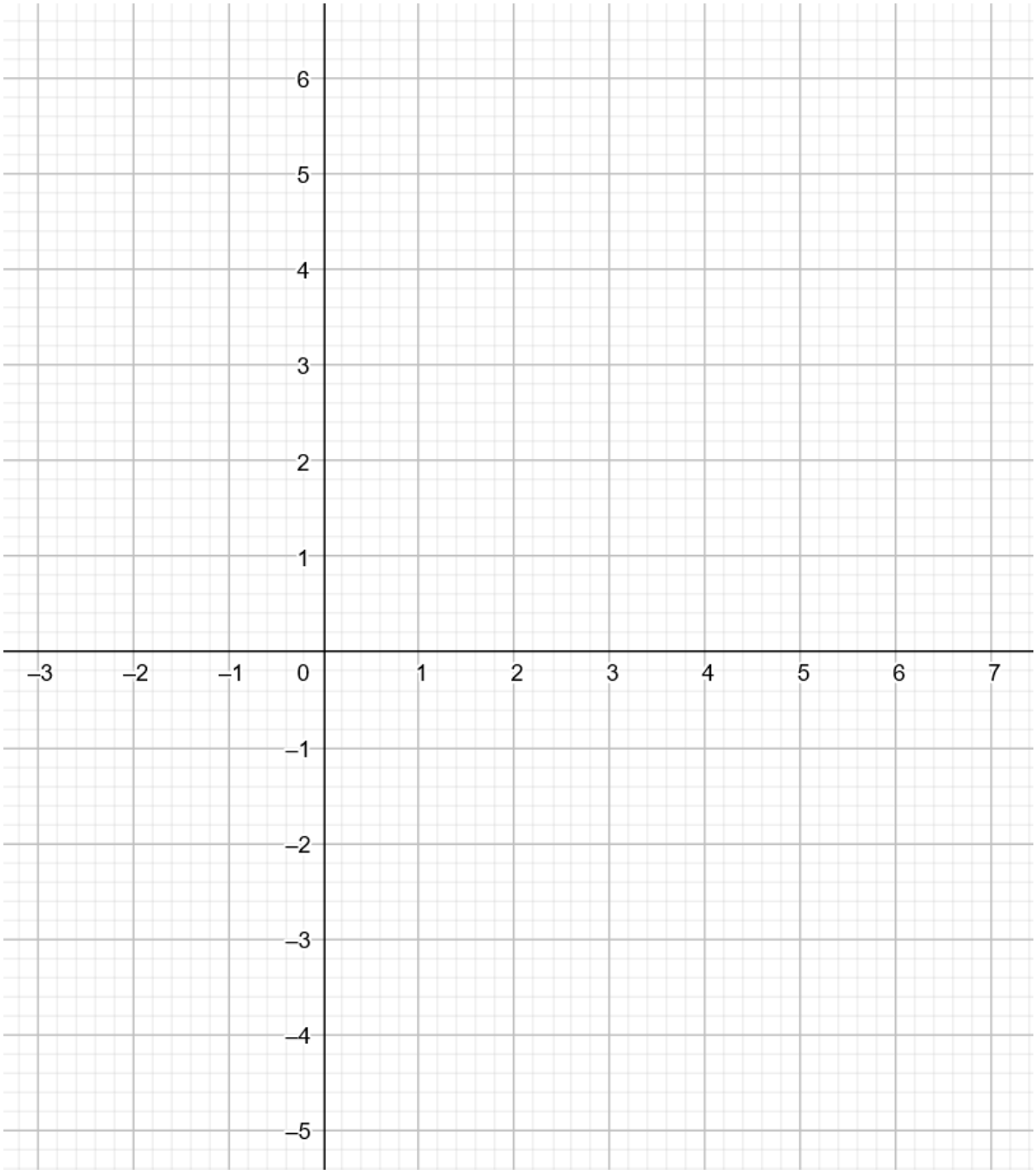
Comments could include reference to the gradients of lines and the parallel sides of shapes

What different polygons can you make using different straight lines?
What do you notice?

Possible solutions are:

- *Any irregular polygon*
- *Regular polygons can also be found, care needs to be given to ensure that all sides are equal. Remember the diagonal of a square is longer than a horizontal or vertical length*

For example:
Y=2, y=8, y=2x+5, y=-2x+5, y=2x-5, y=-2x+15 produce a hexagon but all the sides are not equal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