Function graphs: Lines and parabolas*

A glimpse into what researchers say:

- Common errors[2] with quadratic graphs (parabola) include:
  - The constant coefficient c in the general form ax^2+bx+c does not affect the vertex of the graph.
  - The parameter a,b or even c in the general form ax^2+bx+c is the 'slope' of the parabola.
  - A tangent line on any arbitrary point of the graph of a quadratic function has a the same slope.
- Researchers have different views on how the use of dynamic geometry software (e.g., Geogebra[1], Cabri[2] or Sketchpad[3]) improve students' understanding of function graphs: some results do not suggest significant improvement[1,2] and some have shown positive overall impact[3] of students' learning of graph functions.

A glimpse into what practitioners say:

- The use of graphing calculators may lead to potential issues and misunderstandings surrounding students' knowledge of how to sketch functions by hand[4]. This may become particularly troublesome if students choose to continue their mathematics studies onto undergraduate level.
- Some students may experience difficulties using the 'window' function on a graphical calculator. By zooming in and zooming out they can change the way the graph is viewed[5].

Some problems you can try with your class …

1. The line L passes through the points $(0,7)$ and $(3,19)$. Work out the equation of the line L.
2. Find a quadratic function the graph of which intersects the *x*-axis at the point 2 and 3.
3. The equations of four lines are given below, which lines go through the point $(2,9)$?

   $y=4x+1$ $\quad y+2x=8$ $\quad y=9-2x$ $\quad y-3x=3$

Some key definitions / concepts for GCSE students:

1. A straight line can be written in the form $y=mx+c$, where m is the gradient and c is the y-intercept.
2. If two straight lines are perpendicular then their gradients will multiply together to give -1.
3. Two straight lines are parallel if they have the same gradient.

[1] Ocal, M.F. (2017) Asymptote misconception on graphing functions: Does graphing software resolve it? *Malaysian Online Journal of Educational Technology, 5(1),* 21-33.
[2] Koklu, O. and Topcu, A. (2012) Effect of Cabri-assisted instruction on secondary school students' misconceptions about graphs of quadratic functions. *International Journal of Mathematical Education in Science and Technology, 43(8),* 999-1011.
[3] Eu, L.K. (2013) Impact of Geometer's Sketchpad on students' achievement in graph functions. *Malaysian Online Journal of Educational Technology, 1(2),* 19-32.
[4] Brakes, B. (2000) Graphs of real functions. *Mathematics in School, 29(5),* 32-35.
[5] Brown, J. (2004) A difficult function. *Australian Mathematics Teacher, 60(2),* 6-11

*** Resources selected and summarised by Rebecca Potiphar. Let us know whether they are useful and how we can improve them at @mathtask or email Irene Biza at i.biza@uea.ac.uk**