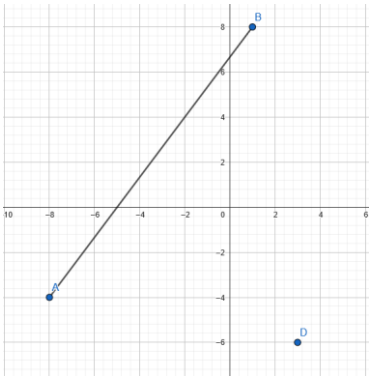
Lesson 1 – Revision?

1. Alfred works at ElvisCo., he earns \$100 per week. Suppose Alfred originally had \$20 in his bank account.
   a. Write the equation for the amount of money (\$$y$) Alfred will have in the form of $y = mx + c$, where m and c are constants and x represent the number of weeks which have passed. (e.g. when 1 week has passed, $x = 1$)
   b. When will Alfred have enough money to purchase Cities Skylines 2, his favorite video game, costing \$500. You may assume that Alfred receives money continuously throughout the period.
   c. When can Alfred buy Cities Skylines 2 if instead he was paid weekly. i.e. *he receives his weekly wage of \$100 every Sunday.*
   d. As it turns out Alfred found another site to buy his videogames from. On that site, videogames decrease in value at a constant rate. How much must the value of Cities Skylines 2 decrease over a week such that Alfred can purchase the game at exactly the end of the 4th week? Given the videogame is worth \$500 at $x = 0$.
2. In this question we will examine the path of a spaceship. All distances are measured in parsecs (pc), which you can treat as the space version of a meter.



   a. Our spaceship travels from Star Alpha (A = (-8,-4)) to Star BetaMinus (B = (1,8)). There is a black hole Delta located at D = (3,-6). Find the equation of the straight line passing through D, and perpendicular to AB. We denote this line as l_c.
   b. l_c intersects AB at C. Find the coordinates of C and hence find out when the spaceship reaches C, given that the spaceship travels at a constant speed of 2.5 pc every 10 years.
   c. A black hole, being very big and massive, attracts objects even from a far distance. In our case, Delta is able to exert "strong" gravitational forces when an object is less than 9 pc away from it. Will our spaceship experience a "strong" gravitational force due to Delta during its travel? *Hint: When is the spacecraft closest to Delta? Will there be any special geometrical properties of lines DS and AB at that point? (S is position of the spaceship)*

Throughout parts (b) and (c), you need to use the Pythagorean theorem (which I will definitely make sure to ask you about during the lesson)

3. Factorise the following polynomials:
   a. $6xy + 2y$
   b. $6xy + 2y - 3x^2 - x$
   c. $2x^2 - 7x - 4$
   d. $u^4 - 8u^3 + 15u^2$
4. Consider the polynomial

$$q(x) = x^3 - 5x^2 + 2x + 8$$

   a. Show that $x = -1$ is a solution to $q(x) = 0$
   b. We can rewrite $q(x)$ in the form of $q(x) = (x + 1)(ax^2 + bx + c)$, why can we multiply an arbitrary quadratic polynomial to (x+1) to represent $q(x)$. I.e. why is the second polynomial term a quadratic but not a linear/cubic (or others) term.
   c. Find a, b, and c. Then find all 3 solutions for $q(x) = 0$
   d. What happens to $q(x)$ as x tends to $\pm\infty$
   e. Sketch a graph of $q(x)$ without any further calculations. (and by sketch you don't need to get the values totally correct)