

Errors highlighted in the chief examiners' reports in recent years for this topic.

- When asked for the gradient of a line connecting two points, students waste time by calculating the equation of the line.
- Choosing the inefficient method for finding the equation of a circle. For example, given the centre of a circle (a,b) and three points lying on the circle, algebraic mistakes are made when using the formula $x^2 - 2fx + y^2 - 2gy + c = 0$ and the resulting simultaneous equations. Far more efficient would be to use $(x-a)^2 + (y-b)^2 = r^2$
- Substituting $x = 0$ rather than $y = 0$ to find the point(s) where a graph crosses the x -axis.
- Overlooking the possible application of the circle theorems in problems.
- When asked for the coordinates of a point P on the y -axis giving P=2 rather than P:(0,2)
- In general, students should always take care when substituting negative values of x into equations.

- When finding gradients using $\frac{x_1 - x_2}{y_1 - y_2}$ or $\frac{y_1 - y_2}{x_2 - x_1}$ instead of $\frac{y_1 - y_2}{x_1 - x_2}$

Many students forget to ensure that x_1 corresponds to y_1 and instead subtract the smaller x co-ordinate from the larger and the smaller y co-ordinate from the larger.

For example, the gradient of the line passing through the points (4, 7) and (8,5) is not $\frac{7-5}{8-4} = \frac{1}{2}$. It is $\frac{5-7}{8-4} = -\frac{1}{2}$.

Weaker students might like to get in to the habit of choosing to label the points in such a way that (x_1, y_1) is furthest to the left thus ensuring that the denominator $x_2 - x_1$ is positive.

It is easy to show, using algebra, that $\frac{y_2 - y_1}{x_2 - x_1}$ and $\frac{y_1 - y_2}{x_1 - x_2}$ are the same:

$$\frac{y_1 - y_2}{x_1 - x_2} = \frac{-(y_2 - y_1)}{-(x_2 - x_1)} = \frac{y_2 - y_1}{x_2 - x_1}$$

In a similar vein, what does the following show about the line connecting the points $(a, ma + c)$ and $(b, mb + c)$?

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{(mb + c) - (ma + c)}{b - a} = \frac{mb - ma}{b - a} = \frac{m(b - a)}{b - a} = m$$