Non-linear Simultaneous Equations

- These can only be solved by substitution, or transitivity.

- Rearrange the linear equation so that it is in terms of one variable.

- Substitute the value into the non-linear equation

- Solve as normal.

- $x = 17 - 4y$
- $x^2 + y^2 = 34$

- Already done

- $(17 - 4y)^2 + y^2 = 34$

- See next page.

Non-Linear Simultaneous Equations

- $(17 - 4y)^2 + y^2 = 34$
- $\Leftrightarrow (17 - 4y)(17 - 4y) + y^2 = 34$
- $\Leftrightarrow 17(17 - 4y) - 4y(17 - 4y) + y^2 = 34$
- $\Leftrightarrow 289 - 68y - 68y + 16y^2 + y^2 - 34 = 0$
- $\Leftrightarrow 255 - 136y + 17y^2 = 0$
- $\Leftrightarrow y^2 - 8y + 15 = 0$
- $\Leftrightarrow y^2 - 3y - 5y + 15 = 0$
- $\Leftrightarrow y(y - 3) - 5(y - 3) = 0$
- $\Leftrightarrow (y - 3)(y - 5) = 0$
- $\Leftrightarrow y = 3, \ or \ 5$

Non-linear Simultaneous Equations

- Using $x = 17 - 4y$, find the corresponding values of x.
- If $y = 3$, $x = 17 - 4(3) = 17 - 12 = 5$
- If $y = 5$, $x = 17 - 4(5) = 17 - 20 = -3$

Non-linear Simultaneous Equations

- Ex7.6, p164
- Q1, 7, 14, 17

- Video about solving quadratics, and non-linear equations on my channel (OpenLCSolutions). 2013 Sample Ordinary Level, Paper 1, Question 4.

Non-linear Simultaneous Equations Q1

- ① $x = 5 - y$
- ② $x^2 + y^2 = 17$

- ② $(5 - y)^2 + y^2 = 17$
- $\Leftrightarrow 5(5 - y) - y(5 - y) + y^2 = 17$
- $\Leftrightarrow 25 - 5y - 5y + y^2 + y^2 - 17 = 0$
- $\Leftrightarrow 2y^2 - 10y + 8 = 0$
- $\Leftrightarrow y^2 - 5y + 4 = 0$

Non-linear Simultaneous Equations Q1

- (From previous page)
- $y^2 - 5y + 4 = 0$
- $\Leftrightarrow y^2 - 4y - y + 4 = 0$
- $\Leftrightarrow y(y - 4) - 1(y - 4) = 0$
- $\Leftrightarrow (y - 4)(y - 1) = 0$

- $Case\ 1: y - 4 = 0 \Leftrightarrow y = 4$
- $x = 5 - y = 5 - 4 = 1$

- $Case\ 2: y - 1 = 0 \Leftrightarrow y = 1$
- $x = 5 - y = 5 - 1 = 4$