

## How to tackle STEP questions (3 pages; 13/8/16)

### (1) Standard Approaches

#### (i) Creating equations

- create letters
- use definitions and theorems

#### (ii) Case by case

**Example 1:** Case 1:  $x > 0$  etc

**Example 2:** Case 1:  $n$  is even etc

#### (iii) Reformulating the problem

**Example 1:** To sketch the cubic  $y = x^3 + 2x^2 + x + 3$ , rewrite as  
 $y = x(x^2 + 2x + 1) + 3$

**Example 2:** Making a substitution, in order to simplify an integration.

**Example 3:** To find the min./max. value of  $y = \frac{f(x)}{g(x)}$ , consider what values of  $k$  give repeated roots of  $\frac{f(x)}{g(x)} = k$ , if it produces a quadratic equation.

#### (iv) Experimenting

- draw a diagram
- consider a concrete example
- look for any symmetry
- consider extreme cases
- consider a simpler version of the problem (eg experiment with a simple function such as  $y = x^2$ )
- find a systematic way of listing the possibilities, and then of counting the items in the list

## (2) Using a previous part of the question

(i) Using the actual result established in the previous part; possibly after some rearrangement or substitution.

(ii) Applying the same method, but to a harder case, or without the benefit of a 'show that' result. Some modification of the method might be needed.

## (3) Using information given in the question

(i) Information mentioned explicitly

**Example** "... where  $c \neq 0$ ": division by  $c$  may be involved

(ii) Observation of material in the question

- To get a feel for the theme of the question

- For any clues or ideas

**Example:** Part (i) involves  $2^{2x-x^2}$ ; part (iii) involves  $2^{-(x-c)^2}$ , suggesting that completing the square may help in (i)

## (4) General Tips

(i) Try things that look useful and are quick to do (ie you can quickly establish whether they are leading anywhere).

(ii) Don't do anything that is too obscure: the correct approach, once found, is usually relatively 'simple'.

(iii) Look out for refinements that need to be taken into account (eg to avoid division by zero)

(iv) Having thought of a method, briefly consider whether there is a quicker alternative, or whether the method can be improved on.

(v) Re-read the question at critical points:

(a) When about to embark on a solution.

(b) If the solution is not going well.

(c) When you think you've finished the solution (in case there is a supplementary task).