

## Questions for AEA Section 1 – Constructing a Concise Argument

**June  
2006**

1. (a) For  $|y| < 1$ , write down the binomial series expansion of  $(1 - y)^{-2}$  in ascending powers of  $y$  up to and including the term in  $y^3$ . (1)

(b) Hence, or otherwise, show that

$$1 + \frac{2x}{1+x} + \frac{3x^2}{(1+x)^2} + \dots + \frac{rx^{r-1}}{(1+x)^{r-1}} + \dots$$

can be written in the form  $(a + x)^n$ . Write down the values of the integers  $a$  and  $n$ . (4)

(c) Find the set of values of  $x$  for which the series in part (b) is convergent. (3)

**July  
2005**

1. A point  $P$  lies on the curve with equation

$$x^2 + y^2 - 6x + 8y = 24.$$

Find the greatest and least possible values of the length  $OP$ , where  $O$  is the origin. (6)

**June  
2003**

6. (a) Show that

$$\sqrt{2 + \sqrt{3}} - \sqrt{2 - \sqrt{3}} = \sqrt{2}.$$

(3)

(b) Hence prove that

$$\log_{\frac{1}{8}} \left( \sqrt{2 + \sqrt{3}} - \sqrt{2 - \sqrt{3}} \right) = -\frac{1}{6}.$$

(3)

(c) Find all possible pairs of integers  $a$  and  $n$  such that

$$\log_{\frac{1}{n}} \left( \sqrt{a + \sqrt{15}} - \sqrt{a - \sqrt{15}} \right) = -\frac{1}{2}.$$

(13)