# 1.12 Complex numbers introduction

**1a.** *[6 marks]*

## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

(i)     



     ***A1A1***





**Note:**     Award first ***A1*** for correct binomial coefficients.

(ii)          ***M1***



     ***A1***

**Note:**     Previous line may be seen in (i)

equating imaginary terms     ***M1***

     ***AG***

(iii)     equating real terms

     ***A1***

***[6 marks]***

**1b.** *[4 marks]*

## Markscheme

     ***M1***

     ***A1***

     ***(M1)***

     ***A1***

**Note:**     Award ***M1A0*** if final answer is given in radians.

***[4 marks]***

**1c.** *[4 marks]*

## Markscheme

use of  **OR** the imaginary part of  is      ***(M1)***

     ***A1***

     ***M1***

**Note:**     Award ***M1*** for replacing .

     ***A1***

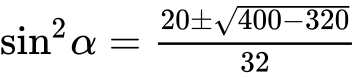
**Note:**     Award ***A1*** for any correct simplification.

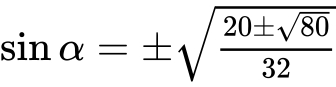
so      ***AG***

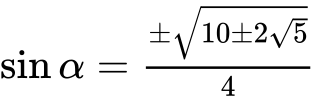
***[4 marks]***

**1d.** *[5 marks]*

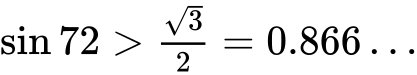
## Markscheme

     ***M1A1***

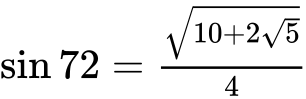


     ***A1***

**Note:**     Award ***A1*** regardless of signs. Accept equivalent forms with integral denominator, simplification may be seen later.

as ,  we have to take both positive signs (or equivalent argument)     ***R1***

**Note:**     Allow verification of correct signs with calculator if clearly stated

     ***A1***

***[5 marks]***

***Total [19 marks]***

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