

MINISTRY OF EDUCATION, SINGAPORE

in collaboration with

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

General Certificate of Education Advanced Level

Higher 2

MATHEMATICS

Paper 2

SPECIMEN PAPER

9758/02

For Examination from 2017

3 hours

1 (i) The function f is defined as follows:

$$f: x \rightarrow 3 \cos x - 2 \sin x, x \in \mathbb{R}, -\pi \leq x \leq \pi$$

Write $f(x)$ as $R \cos(x + \alpha)$, where R and α are constants to be found. Hence, or otherwise, find the range of f and sketch the curve. [4]

(ii) The function g is defined as follows:

$$g: x \rightarrow 3 \cos x - 2 \sin x, x \in \mathbb{R}, -a \leq x \leq b.$$

Given that the function g^{-1} exists, write down the largest value of b . Find $g^{-1}(x)$. [3]

i). $f(x) = 3 \cos x - 2 \sin x$

Let $R \cos(x + \alpha) = 3 \cos x - 2 \sin x$

$$R \cos x \cos \alpha - R \sin x \sin \alpha = 3 \cos x - 2 \sin x$$

By Comparing Coefficients :

$$R \cos \alpha = 3 \quad \text{--- (1)}$$

$$R \sin \alpha = 2 \quad \text{--- (2)}$$

$$\frac{(1)}{(2)} : \tan \alpha = \frac{2}{3}$$

$$\alpha = \tan^{-1} \frac{2}{3} = 0.588 \text{ radian.}$$

$$(1)^2 + (2)^2 : R^2 \cos^2 \alpha + R^2 \sin^2 \alpha = 3^2 + 2^2$$

$$\therefore R^2 = 13$$

$$\therefore R = \sqrt{13}$$

Hence, $f(x) = \sqrt{13} \cos(x + 0.588)$

The method works
for those who do
not remember
their R-formulae



ii). from the above graph,

$$b = \pi - 0.588$$

$$\text{Let } y = \sqrt{13} \cos(x + 0.588)$$

$$\cos^{-1} \left(\frac{y}{\sqrt{13}} \right) = x + 0.588$$

$$\therefore x = -0.588 + \cos^{-1} \left(\frac{y}{\sqrt{13}} \right)$$

$$g^{-1}(x) = -0.588 + \cos^{-1} \left(\frac{x}{\sqrt{13}} \right), -\sqrt{13} \leq x \leq \sqrt{13}$$

**Note that the above is for demonstration. Full working doesn't put this result.

2007 A Level Math Solutions Paper 2

**J. Michael Spector, M. David Merrill, Jan
Elen, M. J. Bishop**

2007 A Level Math Solutions Paper 2:

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