

## 6.4 Homework

*Any solution based entirely on graphical  
or numerical methods is not acceptable*

*Marks Available : 32*

### Question 1

*A-Level Paper 1 Examination question from June 2018, Q8*

The depth of water,  $D$  metres, in a harbour on a particular day is modelled by

$$D = 5 + 2 \sin (30t)^\circ \quad 0 \leq t \leq 24$$

where  $t$  is the number of hours after midnight.

A boat enters the harbour at 6.30 am and it takes 2 hours to load its cargo. The boat requires the depth of water to be at least 3.8 metres before it can leave the harbour.

- ( a ) Find the depth of the water in the harbour when the boat enters the harbour.

[ 1 mark ]

- ( b ) Find, to the nearest minute, the earliest time the boat can leave the harbour.

[ 4 marks ]

**Question 2**

*A-Level Paper 2 Examination question from June 2018, Q12 (a) edited*

Prove that

$$1 - \cos 2\theta \equiv \tan \theta \sin 2\theta \quad \theta \neq \frac{(2n + 1) 180^\circ}{2}, n \in \mathbb{Z}$$

[ 3 marks ]

**Question 3**

*A-Level C3 Examination question from June 2017, Q9*

(a) Prove that

$$\sin 2x - \tan x \equiv \tan x \cos 2x \quad x \neq (2n + 1)90^\circ, n \in \mathbb{Z}$$

[ 4 marks ]

(b) Given that  $x \neq 90^\circ$  and  $x \neq 270^\circ$  solve for  $0 \leq x < 360^\circ$

$$\sin 2x - \tan x = 3 \tan x \sin x$$

Give your answers in degrees to one decimal place where appropriate

[ 5 marks ]

**Question 4**

*A-Level Paper 1 Examination question from June 2019, Q6*

( a ) Solve, for  $-180^\circ \leq \theta \leq 180^\circ$ , the equation

$$5 \sin 2\theta = 9 \tan \theta$$

giving your answers, where necessary, to one decimal place.

[ 6 marks ]

( b ) Deduce the smallest positive solution to the equation

$$5 \sin ( 2x - 50^\circ ) = 9 \tan ( x - 25^\circ )$$

[ 2 marks ]

**Question 5**

A-Level Paper 2 Examination question from June 2019, Q12

(a) Prove,  $\frac{\cos 3\theta}{\sin \theta} + \frac{\sin 3\theta}{\cos \theta} \equiv 2 \cot 2\theta$   $\theta \neq (90n)^\circ, n \in \mathbb{Z}$

[ 4 marks ]

(b) Hence solve, for  $90^\circ < \theta < 180^\circ$ , the equation

$$\frac{\cos 3\theta}{\sin \theta} + \frac{\sin 3\theta}{\cos \theta} = 4$$

giving any solutions to one decimal place

[ 3 marks ]

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