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VCE Mathematical Methods ½
Circular Function II [4.2]
Test Solutions

23 Marks. 1 Minute Reading. 23 Minutes Writing.

Results:

Test Questions	____________ / 23

Section A: Test Questions (23 Marks)

Question 1 (3 marks)

State if the following statements are **true** or **false**.

Statement	**True**	**False**
a. Trigonometric equations without domain restriction have infinite solutions.	✓	
b. For tangent trigonometric equations, we can always write the answer using one general solution.	✓	
c. For sine trigonometric equations, we can never write the answer using only one general solution.		✓
d. The equation $\cos(x) = -\frac{1}{2}$ has the general solution $x = \frac{2\pi}{3} \pm 2n\pi$.		✓
e. The equation $\sin(x) - 2\cos^2(x) + 1 = 0$ can be written as $2\sin^2(x) + \sin(x) - 1 = 0$.	✓	
f. The general solution of the equation $\tan(2x) = 1$, where $x > 0$ is $x = \frac{\pi}{8} + \frac{n\pi}{2}$ for $n \in Z \cup \{0\}$.	✓	

Space for Personal Notes

Question 2 (5 marks)

Solve the following equations for x, over the stated domain.

a. $\tan(3x - \pi) = \sqrt{3}$, for $x \in [0, \pi]$. (2 marks)

```
In[14]:= Solve[Tan[3 x - Pi] == √3 && 0 ≤ x ≤ Pi]
```

Out[14]= $\left\{\left\{x \to \frac{\pi}{9}\right\}, \left\{x \to \frac{4\pi}{9}\right\}, \left\{x \to \frac{7\pi}{9}\right\}\right\}$

b. $2\cos\left(2x - \frac{\pi}{4}\right) - 1 = 0$, for $x \in [0, 2\pi]$. (3 marks)

```
In[13]:= Solve[2 Cos[2 x - Pi / 4] - 1 == 0 && 0 ≤ x ≤ 2 Pi]
```

Out[13]= $\left\{\left\{x \to \frac{7\pi}{24}\right\}, \left\{x \to \frac{23\pi}{24}\right\}, \left\{x \to \frac{31\pi}{24}\right\}, \left\{x \to \frac{47\pi}{24}\right\}\right\}$

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Question 3 (6 marks)

Solve the following equations for x:

a. $2\sin\left(2x+\frac{\pi}{3}\right)+1=0.$

In[12]:= `Solve[2 Sin[2 x + Pi / 3] + 1 == 0] // Expand`

Out[12]= $\left\{\left\{x \to \frac{5\pi}{12} - \pi c_1 \text{ if } c_1 \in \mathbb{Z}\right\}, \left\{x \to -\frac{\pi}{4} - \pi c_1 \text{ if } c_1 \in \mathbb{Z}\right\}\right\}$

b. $\sqrt{3}\tan\left(3x-\frac{\pi}{6}\right)+3=0.$

In[16]:= `Solve[`$\sqrt{3}$` Tan[3 x - Pi / 6] + 3 == 0] // Expand`

Out[16]= $\left\{\left\{x \to -\frac{\pi}{18} - \frac{\pi c_1}{3} \text{ if } c_1 \in \mathbb{Z}\right\}\right\}$

Question 4 (3 marks)

Solve the following equation for x:

$$2\cos\left(2x - \frac{\pi}{4}\right) = 1, \text{for } x \leq 0$$

In[18]:= **Solve[2 Cos[2 x - Pi / 4] == 1 && x ≤ 0] // Expand**

Out[18]= $\left\{\left\{x \to -\frac{\pi}{24} - \pi c_1 \text{ if } c_1 \in \mathbb{Z} \,\&\&\, c_1 \geq 0\right\}, \left\{x \to \frac{7\pi}{24} - \pi c_1 \text{ if } c_1 \in \mathbb{Z} \,\&\&\, c_1 \geq 1\right\}\right\}$

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Question 5 (6 marks)

Consider the function:

$$f(x) = 2\sin^2(2x) - \sin(2x) - 1$$

a. Solve $f(x) = 0$ for $x \in [0, \pi]$. (4 marks).

```
In[20]:= Solve[2 Sin[2 x]^2 - Sin[2 x] - 1 == 0 && 0 ≤ x ≤ Pi]
```

$$\text{Out[20]=} \left\{\left\{x \to \frac{\pi}{4}\right\}, \left\{x \to \frac{\pi}{4}\right\}, \left\{x \to \frac{7\pi}{12}\right\}, \left\{x \to \frac{11\pi}{12}\right\}\right\}$$

b. Hence, find a general solution to $f(x) = 0$. (2 marks)

$$\boxed{x = \frac{\pi}{4} + n\pi, \text{or } x = \frac{7\pi}{12} + n\pi \text{ or } x = \frac{11\pi}{12} + n\pi, \text{where } n \in Z}$$

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