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VCE Mathematical Methods ½
Graphs of Circular Function [4.4]
Test Solutions

19 Marks. 1 Minute Reading. 19 Minutes Writing.

Results:

Test Questions	_____ / 19

Section A: Test Questions (19 Marks)

Question 1 (4 marks)

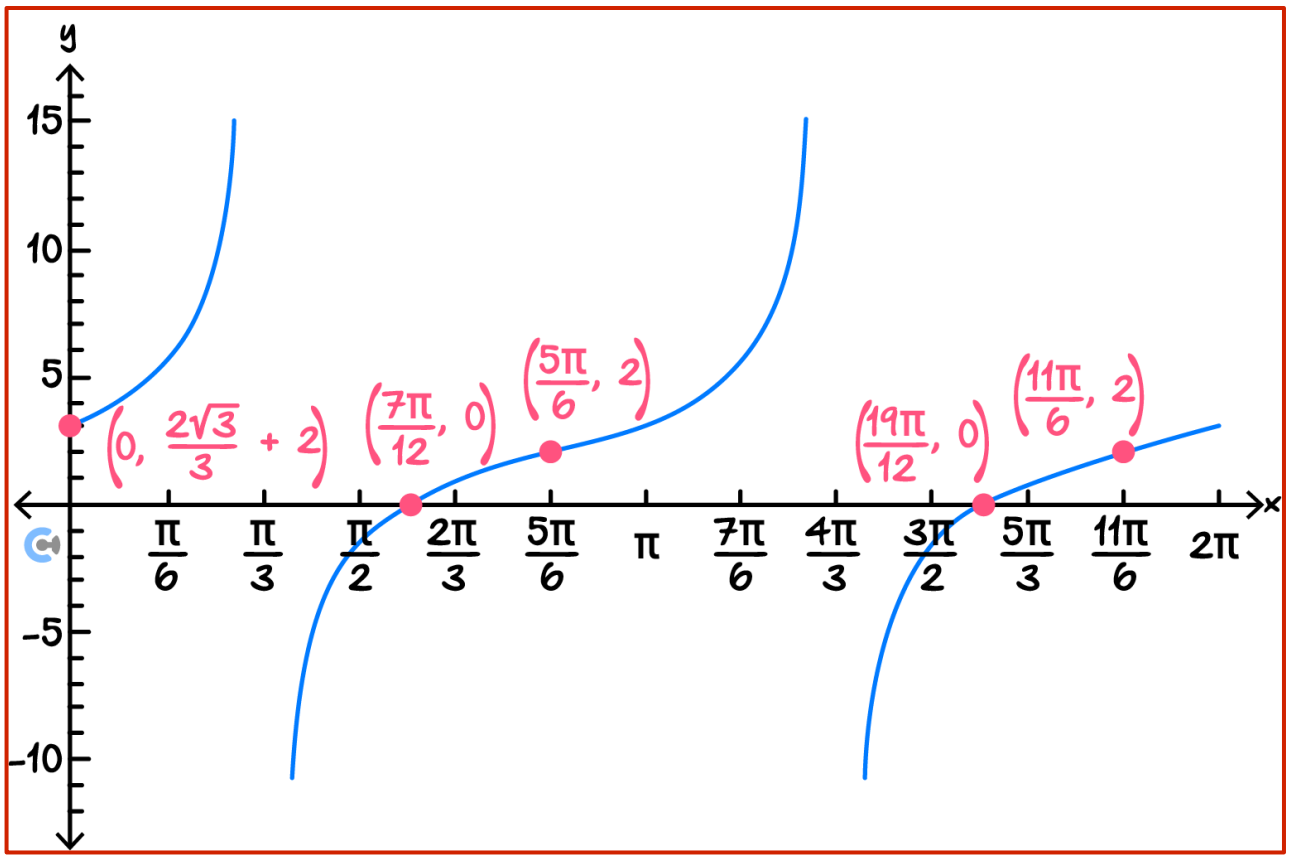
Tick whether the following statements are **true** or **false**.

Statement	True	False
a. To tackle horizontal translation for sin and cos graphs, we can start the period when the x value is equal to 0. We start when the angle $= 0$		✓
b. To tackle horizontal translation for tan graphs, we simply find the asymptote by equating the inside to $\frac{\pi}{2}$.	✓	
c. $\sin(x) \geq \frac{1}{2}$ for $\frac{1}{3}$ of its period.	✓	
d. The amplitude of $a\sin(x)$ where $a < 0$ is a.		✓
e. The graph of $y = \cos\left(x + \frac{3\pi}{2}\right)$ is the same as the graph of $y = \sin(x)$.	✓	
f. The asymptotes of the graph $y = \tan(2x)$ are $x = \frac{\pi}{4} + n\pi, n \in \mathbb{Z}$.		✓
g. The graph of $y = \sin(x) + \cos(x)$ has the same period as $y = \sin(x)$.	✓	
h. A function f has a maximum value of 5, a minimum value of -1 and it attains a maximum value when $x = \frac{5\pi}{6}$. f could have the rule $f(x) = -3\sin\left(2x - \frac{\pi}{6}\right) + 2$.	✓	

Space for Personal Notes

Question 2 (3 marks)

Sketch the graph of $f(x) = 2\tan\left(x + \frac{\pi}{6}\right) + 2$ for $x \in [0, 2\pi]$ on the axes below, labelling all asymptotes, intercepts and endpoints with their coordinates.



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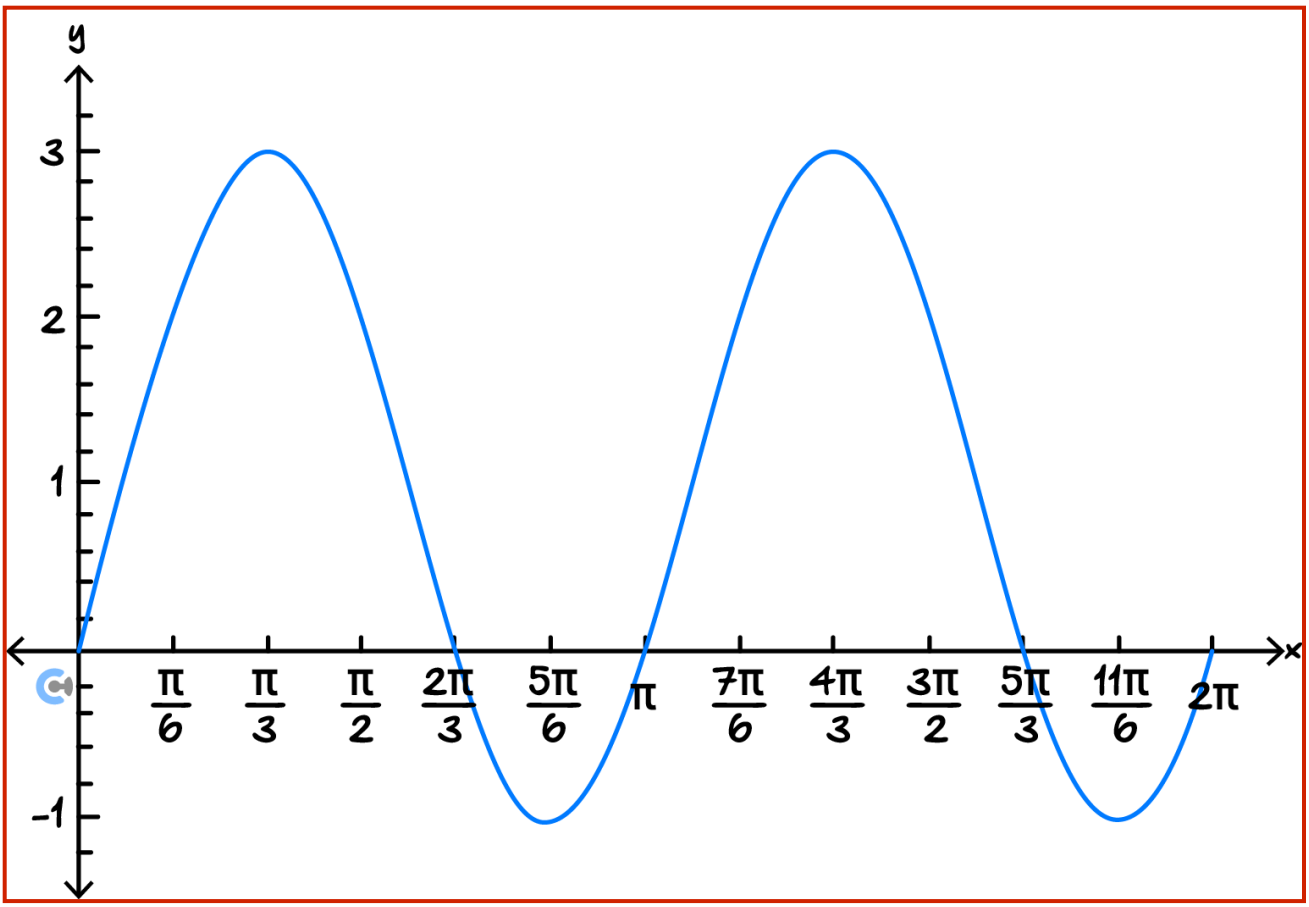
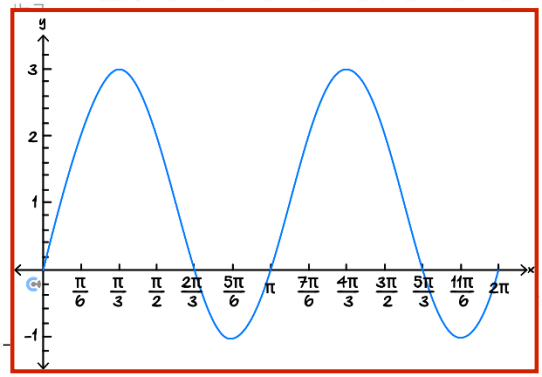
Question 3 (3 marks)

Sketch the graph of $f(x) = -2\cos\left(2x + \frac{\pi}{3}\right) + 1$ for $x \in [0, 2\pi]$ on the axes below, labelling all intercepts and endpoints with their coordinates.




```
Plot[-2 Cos[2 x + π / 3] + 1, {x, 0, 2 π},
 플롯      코사인
 Ticks → {{0, a, 2 a, 3 a, 4 a, 5 a, 6 a, 7 a, 8 a, 9 a, 10 a, 11 a, 12 a}, Automatic}]
                                                                          자동
```




```
Solve[-2 Cos[2 x + π / 3] + 1 == 0 && 0 ≤ x ≤ 2 Pi]
 풀이 함수   코사인                                  원주율
```

$$\left\{\{x \to 0\}, \left\{x \to \frac{2\pi}{3}\right\}, \{x \to \pi\}, \left\{x \to \frac{5\pi}{3}\right\}, \{x \to 2\pi\}\right\}$$

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Question 4 (9 marks)

The population of foxes in a certain forest varies according to the rule:

$$P(t) = 50 - 30\cos\left(\frac{\pi}{2}(t-2)\right)$$

where $P(t)$ is the number of foxes t years after 2024.

a. Find the period and amplitude of this function. (2 marks)

Period $= 4$ years and amplitude $= 30$.

b. Find the maximum and minimum number of foxes in the forest. (2 marks)

$Min = 20$
$Max = 80$

c. After how many months is the population of foxes a maximum in the first 5 years? (2 marks)

Solve $P(t) = 80$ over $[0, 5]$
$t = 0.7$. After 8.4 months.

Foxes are declared a vulnerable species if their population drops below 35.

d. Find the percentage of time when the foxes are declared as vulnerable species. (3 marks)

Solve $P(t) = 35$

$$t = \frac{4}{3}, \frac{8}{3}$$

By shape of graph below for $\frac{8}{3} - \frac{4}{3} = \frac{4}{3}$.
Period is 4. Thus

$$\frac{\frac{4}{3}}{4} = \frac{1}{3}$$

Thus percentage of time is

$$\frac{100}{3}\%$$

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