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Trigonometry

Basics Reinforcement



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Instructions

- Write down and submit intermediate steps along with your final answer.
- If the final result is too complex to compute, give the expression. e.g. C_{100}^{50} is acceptable.
- Problems are not necessarily ordered based on their difficulty levels.
- Always ask yourself what makes this problem a good practice?
- Read through the reference solution even if you can solve the problem for additional information which may help you to solve this type of problems.

Legends

2

- 1 Tips, additional information etc
- Important theorem, conclusion to remember.
 - Addition questions for further study.

My Comments and Notes

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Practice 1

Convert between radian and degree measures:

(i)	30°	(v)	120°	(viii)	$\frac{\pi}{6}$
(ii)	45°	(vi)	270°		3π
(iii)	60°	()		(ix)	$-\frac{3\pi}{5}$
(iv)	90°	(vii)	$-\frac{\pi}{4}$	(x)	2π

Practice 2

Complete the following table:

	0°	30°	45°	60°	90°	120°	150°	270°	360°	540°
\sin										
cos										
tan										

Practice 3

Which of the following equations always hold?

- (i) $\sin^2 \theta + \cos^2 \theta = 1$ (ii) $\tan \theta = \cos \theta / \sin \theta$ (iii) $\sin(-\theta) = \sin \theta$ (v) $\sin(\frac{\pi}{2} - \theta) = \cos \theta$ (vi) $\sin(\frac{\pi}{2} + \theta) = -\cos \theta$
- (iv) $\cos(\pi \theta) = \cos \theta$ (vii) $1 + \tan^2 \theta = \frac{1}{\cos^2 \theta}$

Practice 4

What are the ranges of the *sin*, *cos*, and *tan* function, respectively?

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Practice 5

When θ increases from 0 to $\frac{\pi}{2}$, determine whether each statement below is true or not:

- (i) the value of $\sin \theta$ increases
- (ii) the value of $\cos \theta$ increases
- (iii) the value of $\tan \theta$ increases

Practice 6

When $\frac{\pi}{4} < \theta < \frac{\pi}{2}$, which of the following statement holds?

- (i) $\sin\theta > \cos\theta > \tan\theta$
- (ii) $\cos\theta > \tan\theta > \sin\theta$
- (iii) $\tan \theta > \sin \theta > \cos \theta$
- (iv) $\sin \theta > \tan \theta > \cos \theta$

Practice 7

Let x be a real number and $0 \le x \le \frac{\pi}{2}$, explain why the following inequality holds and when the equality sign holds:

 $\sin x \leq x \leq \tan x$

Practice 8

Find all angles $\theta \in [0, 2\pi)$ such that $\sin \theta = \frac{1}{2}$. Express your answer in radian.

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Practice 9 Find all angles θ such that $\sin \theta = \frac{1}{2}$. Express your answer in radian.	
Practice 10 Find all angles θ such that $\sin \theta \leq \frac{1}{2}$. Express your answer in radian.	

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Answer Keys

Practice 1:

(i)	$30^\circ = \frac{\pi}{6}$	(v)	$120^\circ = \frac{2\pi}{3}$	(viii)	$\frac{\pi}{6} = 30^{\circ}$
(ii)	$45^{\circ} = \frac{\pi}{4}$	(;)	3π	<i>(</i> •)	3π 1000
(iii)	$60^{\circ} = \frac{\pi}{3}$	(V1)	$270 = \frac{1}{2}$	(1X)	$-\frac{1}{5} = 108^{\circ}$
(iv)	$90^\circ = \frac{\pi}{2}$	(vii)	$-\frac{\pi}{4} = -45^{\circ}$	(x)	$2\pi = 360^{\circ}$

Practice 2:

	0°	30°	45°	60°	90°	120°	150°	270°	360°	540°
sin	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	-1	0	0
sin	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$	0	1	-1
tan	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	$+\infty$	$-\sqrt{3}$	$-\frac{\sqrt{3}}{3}$	$-\infty$	0	0

Practice 3:

(i)	TRUE	(v)	TRUE
(ii)	FALSE	(TDUE
(iii)	FALSE	(VI)	INUL
(iv)	FALSE	(vii)	TRUE

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Practice 4: $[-1, 1], [-1, 1], (-\infty, +\infty)$

Practice 5:

- (i) True
- (ii) False
- (iii) True

Practice 6: (iii)

Practice 7:



 $\theta = \frac{\pi}{6}, \qquad \frac{5\pi}{6}$

The equality holds when x = 0.

Practice 8:

Practice 9:

 $\theta = 2k\pi + \frac{\pi}{6}, \qquad 2k\pi + \frac{5\pi}{6} \qquad \text{where } k \text{ is an integer, or}$ $\theta = k\pi + (-1)^k \cdot \frac{\pi}{6} \qquad \text{where } k \text{ is an integer.}$

Practice 10:

$$\theta \in [2k\pi, (2k+\frac{1}{6})\pi] \cup [2k\pi + \frac{5\pi}{6}, (2k+2)\pi], \text{ where } k \in \mathbb{Z}, \text{ or } \theta \in [(2k-\frac{7}{6})\pi, (2k+\frac{1}{6})\pi], \text{ where } k \in \mathbb{Z}$$



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