Math 141 Name: _____

MIDTERM 3 – PART 1

(CHAPTER 4)
INTRODUCTION TO TRIGONOMETRY; MATH 141 – FALL 2024 – KUNIYUKI
150 POINTS TOTAL: 35 FOR PART 1, AND 115 FOR PART 2

Show all work, simplify as appropriate, and use "good form and procedure" (as in class).
Box in your final answers!
No notes or books allowed.

PART 1: USING SCIENTIFIC CALCULATORS (35 PTS.)

If you round off at intermediate steps, round off to at least five significant digits. Write units where appropriate in your final answers.

1) A central angle of a circle has measure 0.1 radians. It intercepts an arc of length 10 meters along the circle. What is the radius of the circle? (3 points)

2) Give the solutions for $\cos(\theta) = 0.4$, where $0 \le \theta < 2\pi$. Give your answers in **radians** and in solution set form, and round them off to the nearest thousandth of a radian (that is, to three decimal places). (4 points)

3) Give the solutions for $\sin(\theta) = -0.8$, where $0 \le \theta < 2\pi$. Give your answers in **radians** and in solution set form, and round them off to the nearest thousandth of a radian (that is, to three decimal places). (5 points)

4) Write $\tan\left(\sin^{-1}\left(\frac{x}{3}\right)\right)$, also written as $\tan\left(\arcsin\left(\frac{x}{3}\right)\right)$, as an equivalent algebraic expression, as in class. Assume x is in the domain of the expression. (7 points)

5) An airplane is flying at an altitude of 10,000 feet over a flat desert. In other words, its height from the ground is always 10,000 feet as far as we're concerned. It is flying on a line taking it directly over an observer. (16 points)

a) If the angle of elevation from the observer (specifically, the observer's shoes) to the plane is 53°, what is the distance from the observer to the plane? Round off your answer to the nearest foot. (8 points)

b) After some time has elapsed, the plane is now 12,000 feet away from the observer. The angle of elevation from the observer to the plane is no longer 53°, as it was in part a). Find the new angle of elevation. Round off your answer to the nearest tenth of a degree. (8 points)

Math 141 Name: _____

MIDTERM 3 – PART 2

(CHAPTER 4)
INTRODUCTION TO TRIGONOMETRY; MATH 141 – FALL 2024 – KUNIYUKI
150 POINTS TOTAL: 35 FOR PART 1, AND 115 FOR PART 2

Show all work, simplify as appropriate, and use "good form and procedure" (as in class).
Box in your final answers!
No notes or books allowed.

PART 2: NO CALCULATORS ALLOWED! (115 POINTS)

If you are asked to evaluate an expression that is undefined, write "und."

6) Fill out the table below. Rationalize denominators and simplify wherever appropriate. You do not have to show work. (28 points total)

θ	$\sin(\theta)$	$\cos(\theta)$	$\tan(\theta)$	$\csc(\theta)$
0				
$\frac{\pi}{6}$				
$\frac{\pi}{4}$				
$\frac{\pi}{3}$				
$\frac{\pi}{2}$				
xxx	xxxxxxxxxxx	xxxxxxxxxxx	xxxxxxxxxxx	xxxxxxxxxxx
$\frac{2\pi}{3}$				
$\frac{3\pi}{2}$				

7) Complete the Identities. Fill out the table below so that, for each row, the left side is equivalent to the right side, based on the type of identity (ID) given in the last column. (6 points total)

Left Side	**Right Side**	**Type of ID**
$\tan^2(\theta)+1$		Pythagorean ID
$1+\cot^2(\theta)$		Pythagorean ID
$\tan(-\theta)$		Even / Odd ID

8) Convert $\frac{4\pi}{9}$ radians into degrees. (3 points)

9) Assume θ is an angle measured in radians such that $\cos(\theta)=0.4$. (4 points)

a) What is $\cos(-\theta)$?

b) What is $\sin\left(\frac{\pi}{2}-\theta\right)$?

10) Evaluate $\sin\left(-\frac{13\pi}{6}\right)$. (4 points)

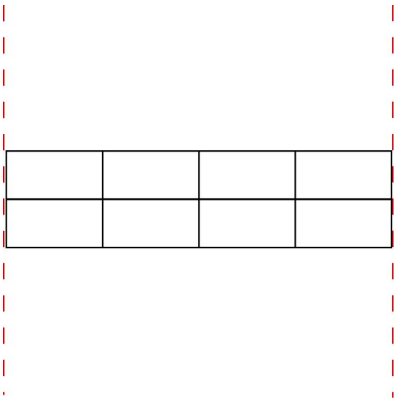
11) Evaluate $\sec\left(270^\circ\right)$. (2 points)

12) Fill out the table below. Use interval form (the form with parentheses and/or brackets) except where indicated. You do not have to show work. (24 points)

$f(x)$	Domain	Range
$\sin(x)$		
$\tan(x)$	Use set-builder form.	
$\sec(x)$	Use set-builder form.	
$\cot(x)$	Use set-builder form.	
$\cos^{-1}(x)$		
$\tan^{-1}(x)$		

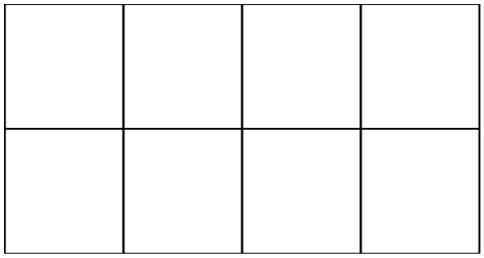
13) Graph one cycle of $y = -3\tan\left(2x\right)$.

Simplify and clearly label all key x- and y-coordinates next to each corresponding grid line. Superimpose the x- and y-axes. If you do not use the frame, make sure you provide all required information. (10 points)

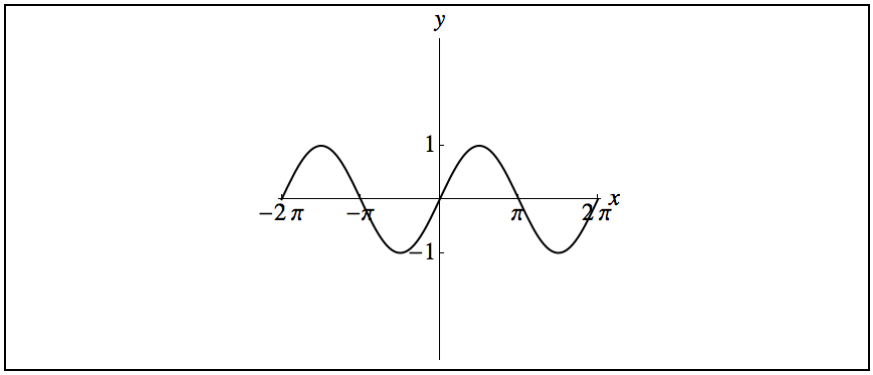


14) Graph one cycle of $y = 2\sin\left(3x - \frac{\pi}{2}\right) - 1$.

Simplify and clearly label all key x- and y-coordinates next to each corresponding grid line. Superimpose the x- and y-axes. If you do not use the frame, make sure you provide all required information. (16 points)



15) The graph of $y=\sin(x)$ appears in the box below. Graph two cycles of $y=\csc(x)$ in the box below by using the graph of $y=\sin(x)$ as a guide. Draw vertical asymptotes as dashed lines where appropriate. (5 points)



16) Consider the Unit Circle. Which one of the following is a true identity for all real values of θ? Box in one. (2 points)

a) $\sin(\pi-\theta)=\sin(\theta)$

b) $\sin(\pi-\theta)=-\sin(\theta)$

c) $\sin(\pi-\theta)=\cos(\theta)$

17) Evaluate $\arcsin\left(-\frac{1}{2}\right)$, also written as $\sin^{-1}\left(-\frac{1}{2}\right)$. (3 points)

18) Evaluate $\arccos\left(\cos\left(-\frac{\pi}{6}\right)\right)$, also written as $\cos^{-1}\left(\cos\left(-\frac{\pi}{6}\right)\right)$. (2 points)

19) Graph $y = \sin^{-1}(x)$, also known as $y = \arcsin(x)$. Draw in the x- and y-axes, and clearly indicate any endpoints and their corresponding coordinates. (6 points)