MHF 4U Name_____ Date_____

Quiz: Angular Velocity and Radian Measure

Instructions: Write complete solutions in the space provided. Total _____/26

1. Complete the table.

___/ 3

Degree	Radian Measure In terms of π	Radian Measure (round to nearest hundredth)
$450°$	$\frac{5\pi}{2}$	7.85 rad
108°	$\frac{3\pi}{5}$	1.88 rad
134.1°	$\frac{149}{200}\pi$	2.34 radians

2.

___/ 4

For $\theta = -\frac{13}{5}\pi$, find the co-terminal angle equivalent to θ in radian measure.	Given $\sec\theta = -1.59$, and $\tan\theta > 0$, find the standard angle and related angle, where $\theta = [0, 2]$	Given $\theta = \frac{-4\pi}{7}$, state the principal angle in degrees.
$\theta = -\frac{13\pi}{5} + 2\pi = -\frac{3\pi}{5}$ or keep adding 2π to get angle	$\cos\theta = -\frac{1}{1.59}$ $\cos\theta = 0.6289$ $\theta = 2.25$ rad (this is in Quad 2) but $\tan\theta > 0$ $\alpha = 0.89$ rad $\therefore \theta = \pi + 0.89$ $= 4.03$ rad	$\theta = -\frac{4\pi}{7} + 2\pi = \frac{10\pi}{7}$ $\therefore \theta = 257.1°$

3. Express each as a function of its co-related acute angle and evaluate using exact form.

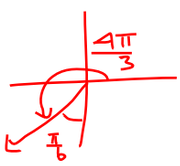
___/ 2

(a) $\sin\left(\frac{4\pi}{3}\right)$

$= \sin\left(\frac{3\pi}{2} - \frac{\pi}{6}\right)$

$= -\cos\frac{\pi}{6}$

$= -\frac{\sqrt{3}}{2}$



(b) $\cos(-135°)$

$= \cos(135°)$

$= -\cos(90° + 45)$

$= -\sin 45°$

$= -\frac{\sqrt{2}}{2}$

since $\cos(-\theta) = \cos\theta$

4. Evaluate each of the following using related angles and the exact values of the special angles. Simplify and rationalize where appropriate.

___/ 6

(a) $\sin\frac{5\pi}{4} - \cos\frac{11\pi}{6}\csc\frac{\pi}{3}$

$= -\sin\frac{\pi}{4} - \left(\cos\frac{\pi}{6}\right)$ over $\sin\pi/3$

$= -\frac{\sqrt{2}}{2} - \frac{\frac{\sqrt{3}}{2}}{\frac{\sqrt{3}}{2}}$

$= -\frac{\sqrt{2}}{2} - 1$

(b) $\dfrac{\sec\frac{\pi}{4}\cos\frac{2\pi}{3}}{\tan\frac{\pi}{6}\csc\frac{3\pi}{4}}$

$= \dfrac{(\sqrt{2})\left(-\cos\frac{\pi}{3}\right)}{\frac{1}{\sqrt{3}}\left(\csc\frac{\pi}{4}\right)}$

$= \dfrac{(\sqrt{2})\left(-\frac{1}{2}\right)}{\left(\frac{1}{\sqrt{3}}\right)\left(\frac{\sqrt{2}}{1}\right)}$

$= -\frac{1}{2} \times \frac{\sqrt{3}}{1}$

$= -\frac{\sqrt{3}}{2}$

5. A wheel turns with an angular velocity of 15 rad /s.

___/ 3

a. What is the rotational frequency in revolutions per minute of this wheel?

$\omega = \frac{15\text{ rad}}{1\text{ sec}} = \frac{15\text{ rad}}{1\text{ sec}} \times \frac{60\text{ sec}}{2\pi\text{ rad}} = 143.2$ rotations / min

b. How far will the wheel roll in 4 minutes if the radius of the wheel is 12 cm?

$\theta = \frac{a}{r}$

$\Rightarrow a = r\theta$

$= 12\left(\frac{15\text{ rad}}{1\text{ sec}}\right)(60\text{ sec}) \times 4$

$= 43200$ cm OR

$= 432$ m

The wheel will travel 43200 cm or 432 m in 4 minutes.

MHF 4U Name_____Date_____

6. A bicycle wheel has a diameter of 68 cm. If Andrew cycles 28 km/h to school, through what radian angle will his wheel turn in 1 sec?

__/ 4

$r = 34\text{ cm}$

$v = 28\text{ km/h}$

$v = \frac{28 \times 100000\text{ cm}}{3600\text{ sec}}$

$v = \frac{7000\text{ cm}}{9\text{ sec}}$

$v = \omega r$

$\Rightarrow \omega = \frac{v}{r}$

$= \frac{\frac{7000\text{ cm}}{9\text{ sec}}}{34\text{ cm}}$

$= \frac{22.88\text{ rad}}{1\text{ sec}}$

The angle at which the wheel rotates is 22.88 rad.

7. A satellite makes one complete revolution of the earth in 110 min. If the satellite is situated 300 km above the equator, find the satellite's speed in kilometer per second. Assume the earth's equatorial radius is 6400 km.

__/ 4

$r = 6700\text{ km}$

$\theta = 2\pi\text{ rad}$

$t = 110\text{ min}$

$= 6600\text{ sec}$

$v = \omega \cdot r$

$= \frac{\theta}{t} \cdot r$

$= \frac{2\pi\text{ rad}}{6600\text{ sec}} \cdot 6700\text{ km}$

$= 6.37\text{ km/sec}$

Satellite is traveling 6.37 km/s to make 1 revolution around the earth.