USE OF THE TI-30 and the CASIO 260 CALCULATOR FOR RADIAN PROBLEMS

I. Finding Trigonometric Functions of Angles in Radians:

If there is a **"DEG"** button:

Whenever the **AC/ON** button is pressed, the calculator will be set to degree mode and "DEG" will appear on the display. In order to find a trigonometric function of an angle given in radians, the calculator should be set to radian mode. This is accomplished by pressing the **DRG** button ("RAD" will appear on the display.) (Should "GRAD" ever appear on the display, the calculator may be set to radian mode by pressing the **DRG** button twice.) Once the calculator is set to radian mode, the sine, cosine, or tangent of any value in radians may be obtained by first entering the value and then pressing the appropriate trigonometric function button.

If there is a **MODE** button: Press **MODE**, followed by **5** and proceed as described above. To return to degree, press **MODE 4.**

Example 1: Find the cos 1.5. First press the **DRG** button as necessary until "RAD" appears on the display. Then enter 1.5 and press the **COS** button. The calculator will give the desired approximation: .0707 (We will round our answers for all trigonometric functions to 4 decimal places.)

Example 2: Find tan (-4). Remember, if you have hit the **AC/ON** button instead of the **CE/C** button, the calculator has reverted to degree mode, and you must reset it to radian mode once again by pressing the **DRG** button. Then enter in turn: 4,+/-, **TAN**; and the calculator will display the answer: -1.1578. To clear the display but remain in radian mode, press the **CE/C** button.

Example 3: Find csc 2.25. With the calculator in radian mode, enter 2.25. Since there is no **CSC** button, you must use the trigonometric identity:

$\csc 2.25 = \dfrac{1}{\sin 2.25}$. Press the **SIN** button. The calculator now displays .7780732 as the approximation of sin 2.25. Finally, to obtain csc 2.25, press the **1/X** button getting us the answer: 1.2852.

Example 4: Find sec (-0.85). With the calculator in radian mode, enter .85,+/-, and **COS** to obtain .6599832 for cos (-0.85). Then press the **1/X** button (for the CASIO press **SHIFT and** the **1/X** button) to find sec (-0.85), the reciprocal of cos (-0.85). The result is 1.5152.

Example 5: Find cot (-10). (Answer is: -1.5424)

II. Finding Angles in Radians given the Value of a Trigonometric Function:

The procedure is to set the calculator to radian mode and enter the absolute value of the trigonometric function (since the calculator will provide only the reference angle.) Press the **INV** (or **2nd**) button (for the CASIO press the **SHIFT** button **and** the **INV** button) and finally the appropriate trigonometric function button; the calculator will display the approximation (in radians) of the correct reference angle, which we then will use to find the required angles. Note that we will round angles in radian measure to 2 decimal places.

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Example 6: Find all θ in radians such that $\sin\theta = .8866$. With the calculator in radian mode, enter .8866; then press the **INV** (or **2nd**) button and the **SIN** button. The number 1.0899418 displayed, which we round to 1.09, is the approximation of the reference angle for θ. Since $\sin\theta$ is positive in quadrants I and II, the values for θ between 0 and 2π are1.09 (quadrant I) and $\pi - 1.09 = 2.05$ (quadrant II). The general solution for θ (all θ for which $\sin\theta = .8866$) if desired, then could be written as $\theta = 1.09 + 2\pi k$ or $\theta = 2.05 + 2\pi k$, where k is any integer.

Example 7: Find θ, $0 \le \theta < 2\pi$, such that $\tan\theta = -2.508$. Enter 2.508 (not the negative), then press the **INV** (or **2nd**) and **TAN** buttons. The 1.19 displayed is the reference angle. (Did you make sure the calculator was in radian mode?) Since tangent is negative in quadrants II and IV, the answers are $\pi - 1.19 = 1.95$ and $2\pi - 1.19 = 5.09$ (Note: This second solution may not be written as "-1.19," which is coterminal but not between 0 and 2π).

Example 8: Find θ, $0 \le \theta < 2\pi$, such that $\sec\theta = 3$. Since there is no **SEC** button, you must work through cosine, the reciprocal of secant. Saying $\sec\theta = 3$ is the same as saying $\cos\theta = \frac{1}{3}$. Therefore, start by entering 3 and then press the **1/X** button. Since the value .3333333 displayed is the value for $\cos\theta$, press **INV** (or **2nd**) and then **COS**, getting 1.23 as the desired reference angle. Since secant, like cosine, is positive in quadrants I and IV, the answers are 1.23 and $2\pi - 1.23 = 5.05$

Example 9: Find θ, $0 \le \theta < 2\pi$, such that $\csc\theta = -4.044$. Recall that, if $\csc\theta = -4.044$, then $\sin\theta = \frac{1}{-4.044}$. Enter 4.044, press **1/X, INV (or 2nd), SIN**, to obtain the reference angle .25. Since cosecant, like sine, is negative in quadrants III and IV, the desired values are $.25 + \pi = 3.39$ and $2\pi - .25 = 6.03$

Example 10: Find θ such that $\sec\theta = -.8080$. If you proceed correctly in radian mode, entering .8080, then pressing **I/X, INV, (or 2nd), COS**, the calculator will display "E" for error. This means there is no θ for which $\sec\theta = .8080$. Why? (What is the range of the secant function?)

Before proceeding to the following exercises, be sure you understand why in examples 3,4,5, we found the trigonometric function first and then the reciprocal; whereas in examples 8,9,10, we took the reciprocal first and then the inverse trigonometric function.

Exercises	Answers:
Find:	
1) tan (-1.8)	1) 4.2863
2) csc (0.9)	2) 1.2766
3) θ, $0 \le \theta < 2\pi$, such that $\cos\theta = .9$	3) .45 and 5.83
4) θ, $0 \le \theta < 2\pi$, if $\cos\theta = .9$ and $\tan\theta < 0$	4) 5.83 (since $\tan\theta < 0$ eliminates the first quadrant angle .45)
5) cot (-2.1)	5) .58
6) θ, $0 \le \theta < 2\pi$ if $\csc\theta = .9$	6) no solution
7) θ, $0 \le \theta < 2\pi$ if $\tan\theta = -.62$	7) 2.59 and 5.73
8) θ, $\frac{3\pi}{2} \le \theta < 2\pi$, if $\cot\theta = -.95$	8) 5.47