

This white-pages test has problems 1 – 13. Take a moment to make sure you have them all.

MATH 144 students must do problems 1 – 9.

No Calculators Allowed; No Reference Materials; Just You and Your Pencil and Eraser.

- 1 Quickly fill in the table with the exact values of the trigonometric functions for the given clock-face angles:

Hour	θ rad	$\sin(\theta)$	$\cos(\theta)$	$\tan(\theta)$
3 PM				
2 PM				
1:30 PM				
1 PM				
12 noon				

- 2 State the famous *Laws of Logarithms*:

- 3 Let $Q = -\frac{3}{2} + \frac{\sqrt{3}}{2}i$. Make two Argand-Wessel diagrams: one showing Q with its modulus and argument, the other showing the same information for Q^4 .

- 4 Find all the fourth roots of the complex number Q^4 from problem 3. Leave your answers in trigonometric form.

- 5 Give a proof, which “flows” from one side to the other, of the identity

$$\frac{\sin(u + v)}{\cos(u) \cos(v)} = \tan(u) + \tan(v)$$

- 6 Give a proof, which “flows” from one side to the other, of the identity

$$\frac{\sin(x)}{\cos(x) - \sin(x)} - \frac{\cos(x)}{\cos(x) + \sin(x)} + 1 = \tan(2x)$$

7 Let $\theta = \arccos\left(\frac{7}{9}\right)$. Show steps in computing the following:

(a) $\sin(\theta) = \underline{\hspace{2cm}}$

(b) $\cos(\theta) = \underline{\hspace{2cm}}$

(c) $\tan(\theta) = \underline{\hspace{2cm}}$

8 Let $\theta = \arccos\left(-\frac{7}{9}\right)$. Compute the following:

(a) $\sin(\theta) = \underline{\hspace{2cm}}$

(b) $\cos(\theta) = \underline{\hspace{2cm}}$

(c) $\tan(\theta) = \underline{\hspace{2cm}}$

Explain briefly.

- 9 (a) Make a rough graph of the arccosine function. Label salient features with coordinates or equations.

- (b) Make a rough graph of the function $Q(x) = 8 \arccos\left(\frac{x}{3}\right)$. Label salient features with coordinates or equations.

- 10 Compute the doubling time of the value of a single amount deposited in an account paying 24%, compounded monthly.

11 Suppose that we have 320 pounds of exponentially-decaying mystery isotope \mathcal{X} at noon, and then at 3 PM we have only 80 pounds. Find a growth law for $\mathcal{A}(t)$, the amount (in pounds) of \mathcal{X} at a time t hours after noon. What is the half-life of \mathcal{X} ?

12 Solve for x : $6^{3x+2} = e^5$.

13 Solve for x : $\ln(x + 1) + \ln(x - 2) = \ln(x - 3)$.